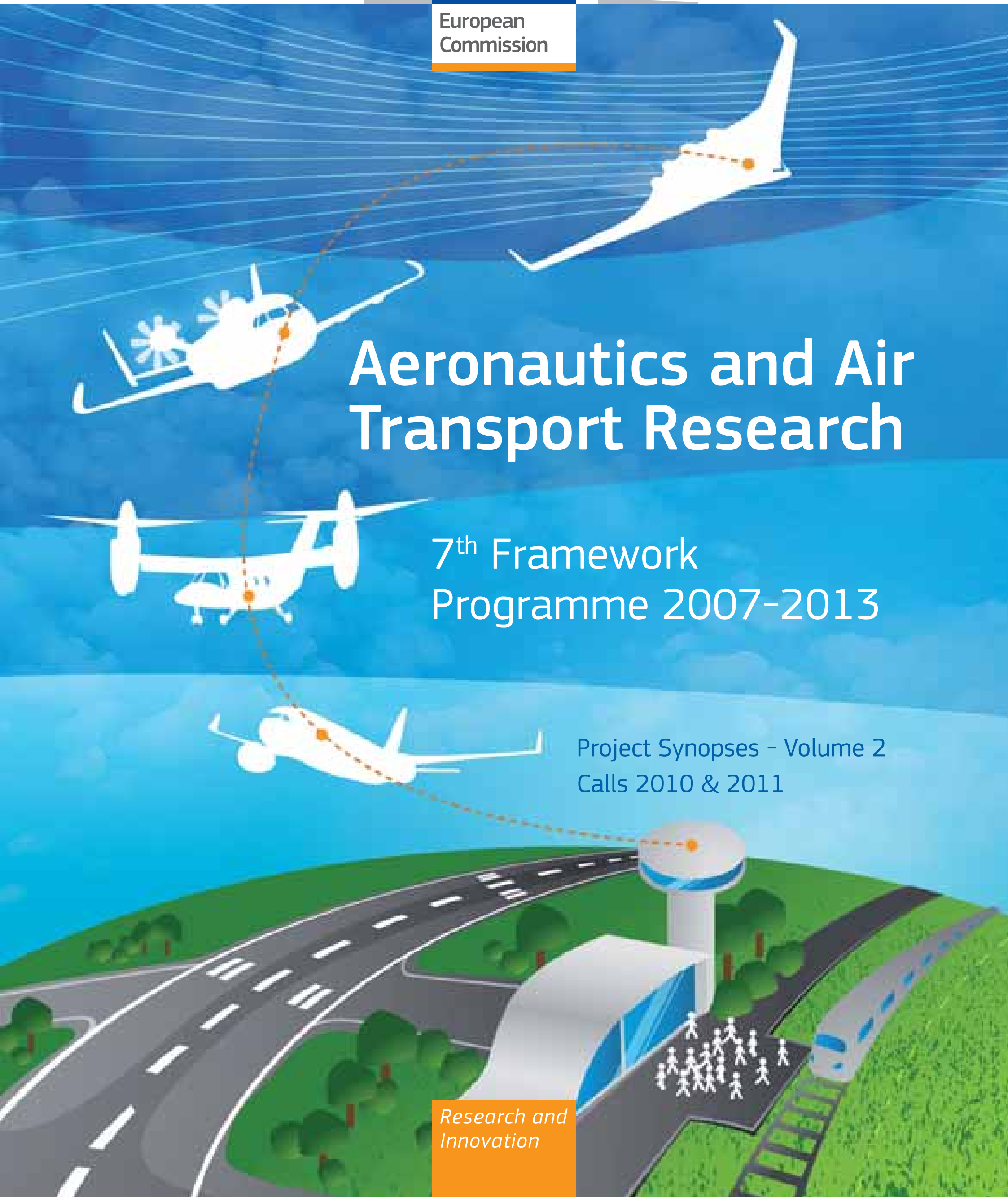
European Commission

Aeronautics and Air Transport Research

7th Framework Programme 2007-2013

Project Synopses – Volume 2

Calls 2010 & 2011



Research and Innovation

EUROPEAN COMMISSION

Directorate-General for Research and Innovation
Directorate H – Transport
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EUROPEAN COMMISSION

Aeronautics and Air Transport Research

7th Framework Programme 2007-2013

Project Synopses – Volume 2
Calls 2010 & 2011

2012

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

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Foreword

When I joined the European Commission in 2010, I was given responsibility for Research, Innovation and Science, a responsibility that in reality I share with all of you, researchers and innovators in industry, research centres, academia and with a wide range of research policy-makers.

Much has happened since my first day in the Commission. Globalisation is putting more and more pressure on the labour market, our social system, our way of living and on our environment. A long-lasting financial crisis is threatening our economy.

The European Commission reacted with a European strategy for smart, sustainable and inclusive growth called 'Europe 2020' [1] which is being implemented through seven flagship initiatives.

Research and innovation have a key role to play in this strategy and several of the flagship initiatives are important for the aviation community, including 'An industrial policy for the globalisation era', 'An agenda for new skills and jobs', 'Resource efficient Europe' and 'Youth on the Move'. However, my greatest interest lies in 'Innovation Union' [2], which I launched in October 2010. Innovation Union aims to improve the framework conditions for research and innovation in Europe so as to ensure that innovative ideas can be turned into products and services that create growth and jobs.

Since its launch, the Seventh Framework Programme for Research has continued to deliver results. In the field of Aeronautics and Air Transport, the calls for proposals in 2010 and 2011 selected 65 projects, which received EU funding of EUR 261 million. Most of these projects focus on reducing the impact of aircraft and air transport on the environment and on developing technologies to maintain and reinforce our competitiveness.

This book contains a short description of each of these projects. Together with the previously funded 83 projects in the first two FP7 calls for proposals in the field of Aeronautics and Air Transport in 2007 and 2008 (total EU funding of EUR 427 million) and with the work carried out in the large Joint Undertakings Clean Sky (EUR 800 million of EU funding) and SESAR (EUR 700 million of EU funding), it is clear that Europe continues to play a strategic role in the aviation sector.

In the last Aeronautics and Air Transport Work Programmes, the innovation dimension has received particular attention and is set to become increasingly important in the coming years. We are now preparing 'Horizon 2020', our new instrument for research and innovation at the European level. The aviation sector will have an important role to play in the 'Sustainable, safe and secure mobility' societal challenge. Together with Vice-President Kallas, who is responsible for Transport, I called on the aviation community to produce a new vision, 'Flightpath 2050' [3], and we are now supporting the development of a Strategic Research and Innovation Agenda that will help us to implement Horizon 2020.

The aviation community has been very responsive and proactive in the entire process and I would like to acknowledge all the work done by stakeholders to support us in developing our research and innovation policy. I look forward to the aviation sector's new Strategic Research and Innovation Agenda that will shape the contours of our future.

Máire Geoghegan-Quinn

[1] Europe 2020: A European strategy for smart, sustainable and inclusive growth, 2010.
[2] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Europe 2020 Flagship Initiative Innovation Union SEC(2010) 1161, 2010.
[3] Flightpath 2050, Europe's Vision for Aviation, Report of the High-Level Group on Aviation Research.

Contents of this volume

Since 1990, the European Union has been funding research in the field of Aeronautics and Air Transport (AAT). This second volume of the AAT research synopses describes those research projects which received funding in the 2010 and 2011 Calls for Proposals launched under the EU's Seventh Framework Programme.

For each project, you will find a short description of the state of the art, the objectives, the work planned during the project and the expected results. Contact details of the coordinator and the partnerships are also provided. We hope that this information will prove helpful to research policy-makers, project proposers who are looking to conduct an exhaustive survey of the state of the art, and to stakeholders within the research community who either want to identify ongoing research projects of interest to them or find potential partners for future collaborations.

The research projects are grouped according to the activities that structure the AAT Work Programme:

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.

Cross-Cutting Activities supporting research policy issues are described in the last section.

To contribute to these broad policy-based activities, research projects are targeting the following technical topics:

1) Flight Physics;

2) Aero-structures;

3) Propulsion;

4) Systems and Equipment;

5) Avionics;

6) Design Systems and Tools;

7) Production;

8) Maintenance;

9) Flight Management;

10) Airports;

11) Human Factors;

12) Noise and Vibration.

SEVENTH FRAMEWORK PROGRAMME

You will also find indexes by activities, technical topics, acronyms, instruments and partners. The contact details of the National Contact Points, whose role is to relay information about the Seventh Framework Programme in the European Union Member States, are also provided. Finally, the contact details of the project officers and assistants involved in project follow-up in the European Commission are provided.

The following pages give a quick overview of the results of the first four calls as a well as on the participation of SMEs.

The introduction to Volume 1, which presented the projects co-funded under the Calls for Proposals 2007 and 2008 (note that there was no call in 2009), contains an executive summary of the European Aeronautics and Air Transport system, the Seventh Framework Programme and its instruments. A brief description of the SESAR Joint Undertaking, which is developing a modern Air Traffic Management system contributing to the Single European Sky (www.sesarju.eu), and of the Clean Sky Joint Undertaking (www.cleansky.eu), which performs large-scale demonstrations mainly targeting the reduction of environmental impact, is also provided in the first volume. Thus, for these elements, the reader is referred to Volume 1 which can be downloaded from the Cordis website (cordis.europa.eu).

As the editor of this volume, and on behalf of all colleagues in the Aeronautics Unit, I wish you fruitful cooperation in the Seventh Framework Programme.

Rémy Dénos

European Commission

RESEARCH & INNOVATION

Table of contents

Overview of the results of the 4 first Calls for Proposals

There is a need to support both bottom-up and top-down approaches. Bottom-up approach allows flexibility for a wide range of projects however focussed on a reduced set of technologies (Collaborative Projects -Focussed Projects, CP-FP also referred to as Level 1). Top-down approach targets mainly the demonstration of an integrated set of technologies in a domain where the required level of maturity has been reached (Collaborative Projects -Integrated Projects, CP-IP also referred to as Level 2). The later involves larger resources and a wider range of partners per project. It is expected that over the Seventh Framework Programme, there will be a balance between the funds dedicated to large integrated projects and smaller focussed research projects. This is already broadly the case after 4 Calls (see Table 1). The Clean Sky Joint Undertaking mainly deals with higher Technology Readiness Level (TRL) than Level 2 projects by performing larger scale demonstrations.

Regarding Activities, Cost Efficiency received the largest attention (Table 1). This reflects the increasing competitive pressure that faces the European aeronautics industry and air transport system in a fast globalisation context. In particular, a number of Level 2 projects target Cost Efficiency addressing for example systems to support an extended virtual enterprise, scalable reconfigurable avionics or integrated design and testing tools for fuselage with composite materials. Level 1 Projects concentrate on modern, cost efficient and fast design tools and systems, on lean and time efficient manufacturing and production techniques, in particular associated to the increased use of composite materials.

Research projects contributing to the Greening of Air Transport come second in terms of EU-funding share. Level 1 projects mostly target the reduction of fuel consumption i.e. CO_2 through reduced drag, more efficient engines, lower levels of NO_x thanks to better engine combustors and lower aircraft noise. Level 2 projects are contributing to new engine architectures (e.g. open rotor) or an integrated approach to aircraft noise reduction. Overall, these projects bring a significant contribution towards reaching the ACARE goals (–50% CO_2 per passenger per kilometre, –80% NO_x emissions, –50% perceived noise in 2020 with reference to year 2000).

Under Customer Satisfaction and Safety, most of the projects are in the field of safety, which remains paramount in aviation. Projects address mainly systems and equipments for avionics, measurement systems for flight relevant data, better understanding of the ditching process but also investigate issues related to human factors.

It is to be noted that Pioneering, i.e. promising breakthrough technologies and concepts for the second half of the century has received significant attention in particular under the 2011 Call where Pioneering was the only activity opened to Level 1.

Time Efficiency is concentrated on aspects such as airport turnaround and the needed safe separation time between successive aircraft due to the wake vortices. A significant portion of the EU efforts on Time Efficiency is carried out in the SESAR Joint Undertaking, which targets the modernisation of the European Air Traffic Management System.

A small percentage of the funds (2.7%) finances actions to support the coordination of research, to support the participation of SMEs, the organisation of conferences as well a specific studies on, for example, weather hazards, attracting students to aeronautical careers, etc. In particular, in the last four Calls a significant effort was dedicated to international cooperation with Canada, China, Japan, Latin America, Russia, South Africa, Ukraine and the United States. In 2010, Coordinated Calls with Russia and China were also part of the Work Programme.

Table 1: Indicative repartition of the EC funds for the four first Calls per Instrument, Activity and Topic

	Nb	EC fund (M€)	Share of total fund	Average fund (M€)
CP-FP	100	354.9	51.1%	3.5
CP-IP	12	320.6	46.2%	26.7
CSA-SA	33	14	2%	0.42
CSA-CA	3	4.8	0.7%	1.6
TOTAL	**148**	**694.3**		

	Nb	EC fund (M€)	Share of total fund
1) Greening	31	198.3	28.6%
2)Time Efficiency	5	35.8	5.2%
3) Customer Satisfaction and Safety	17	71.8	10.3%
4) Cost Efficiency	40	287.5	41.4%
5) Protection of Aircraft and Passengers	4	26.9	3.9%
6) Pioneering	17	58.1	8.4%
7) Cross Cutting	34	15.9	2.3%
TOTAL	**148**	**694.3**	

(data include Calls FP7-AAT-2007-RTD-1, FP7-AAT-2008-RTD-1, FP7-AAT-2010-RTD-1, FP7-AAT-2010-RTD-CHINA, FP7-AAT-2010-RTD-RUSSIA and FP7-AAT-2011-RTD-1).

Participation of SMEs

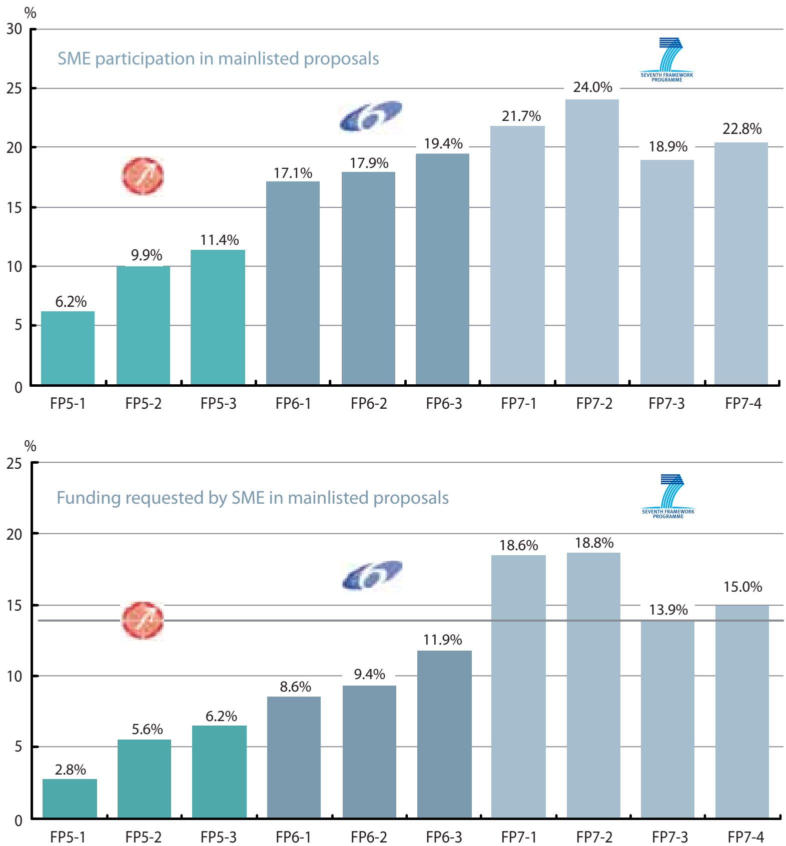
SME participation has increased significantly over the years (see Figure 1). The step in terms of EU funding between FP6 and FP7 is partially due to the change of funding rate – from 50% of eligible cost in FP6 to 75% in FP7. The change of participation observed in the 3rd and 4th Calls of FP7 coincides with the start of the Clean Sky Calls for proposal in which ~40% of the participants are SMEs.

A study performed by Aeroportal (an FP7 EU-funded Coordination and Support Action which was presented in FP7 AAT synopses vol 1), based on the two first Calls, concluded that SMEs tend to participate in only one project (78 % of the participation are from distinct SMEs) and mostly in Level 1 projects (59%).

Many SMEs (49%) are exclusively related to aeronautical product and services. A large share of SMEs (39%) have a unique know-how in specific processes or new technologies. Finally, less than 10% of SMEs provide management support. (Please note the percentages mentioned before belong to different classifications and cannot be added).

Also, the success rate of SMEs is lower compared to non-SMEs. It is partly explained because larger companies can allocate dedicated resources with a good knowledge in EU-funded research. This is not the case for SMEs and for this reason, the EU has provided support through 2 successive support actions: Aeroportal and SME-Aero-Power.

Figure 1 Evolution of SME participation: top graph number of Partners, bottom graph share of fund



Index by Activities

The Greening of Air Transport

Ensuring Customer Satisfaction and Safety

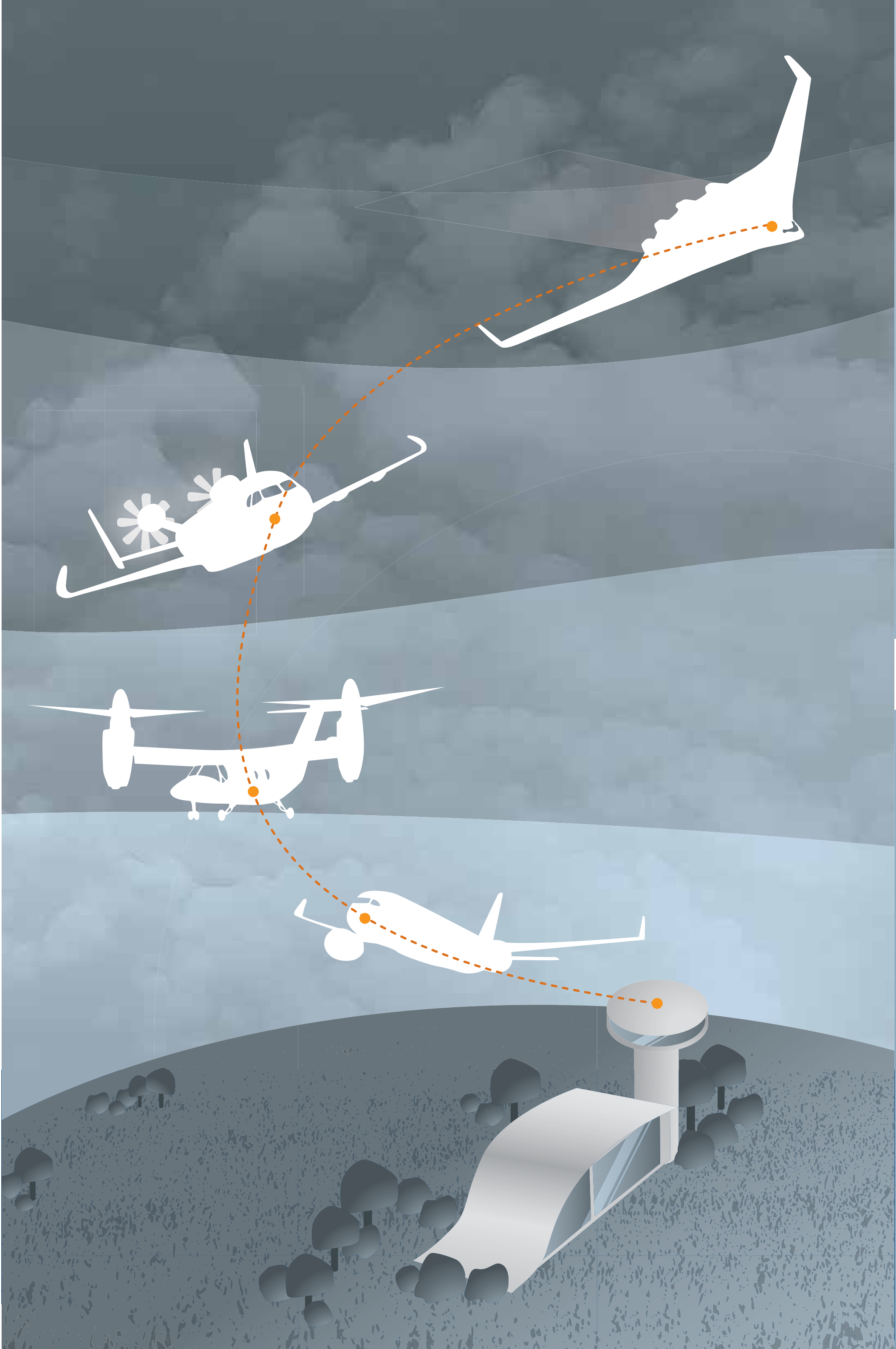
Improving Cost Efficiency

Pioneering the Air Transport of the Future

Cross Cutting Activities

Index by Technical Fields

Breakthrough and Novel Concepts



AEROMUCO

Aerodynamic Surfaces by Advanced Multifunctional Coatings

State of the Art – Background

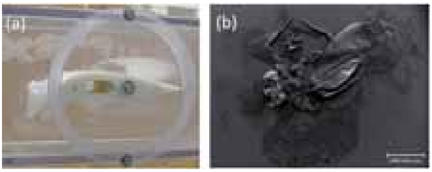
Laminar-flow technologies, including laminar-flow control, which relies on a mechanism such as suction to maintain laminar flow, has the potential to deliver significant improvements in fuel efficiency through the reduction of skin friction drag, which accounts for nearly 50% of the total drag on a civil jet transport aircraft during cruise. The potential rewards of laminar-flow technologies are considerable: a laminar-flow aircraft would have a greater range, lower direct operating costs and lower atmospheric emissions than the current turbulent designs.

The successful implementation of laminar flow (including laminar-flow control) is dependent on practical solutions being found for a number of technical and operational concerns. Foremost on this list is the requirement to maintain a clean aerodynamic surface as the physical contamination of the leading edge of such laminar-flow surfaces is a major concern.

The surfaces of the wings, fuselage and stabilisers of an aircraft are subjected to high-speed air fluxes, which can contain sand, drops of water, insects and ice crystals. Therefore, the main challenge is the production of erosion-resistant coatings with additional functionalities such as anti-contamination and anti-icing.

Objectives

The main objective of the AEROMUCO project is to develop and evaluate a number of alternative – and highly innovative – active and passive multifunctional surface-protection systems for the future generation of aircraft. This will lead to a significant improvement in fuel efficiency and a reduction in CO_2 and NO_x emissions.



(a) Testing of icing; (b) Insect contamination test with Drosophila Melanogaster

Two technological routes to achieve this goal will be explored:
- to reduce energy consumption for in-flight de-icing through the development of coatings that exploit the use of new-generation low-energy-consuming, active de-icing systems;
- to develop durable and effective active and passive surface-protection systems that will facilitate and maintain laminar boundary layers on aerodynamic surfaces. These coatings will reduce insect adhesion through novel, low-surface-energy concepts and remove insect residue through photoactive/enzymatic activity on nanotextured coatings.

AEROMUCO will develop multifunctional coatings with both anti-contamination and anti-icing properties, which will also protect the aircraft's skin from erosion. These novel coatings will be customised to the requirements of the location on the wing (e.g. leading-edge contamination avoidance, upper-surface runback ice prevention).

Description of Work

Two technological routes will be explored:
- reduce the energy consumption for in-flight de-icing by developing coatings that exploit the use of a new generation of low-energy-consuming, active de-icing systems;
- enable and support the generation of laminar-flow boundary layers on aerodynamic surfaces by sustainable and effective active and passive surface-protection systems. These will:
- reduce insect adhesion through novel low-surface energy coatings;
- remove insect residue through photoactive/enzymatic activity of nanotextured coatings.

The development will be based on two concepts:
- the utilisation of current well-known polymer matrixes (such as polyurethane films typically used for exterior applications on aircraft) will help to avoid extended development cycles and provide a demonstration of emerging products, as well as accelerating the development of coating technology, in compliance with the EU's *Solvent Emission Directive*;
- new hybrid materials (e.g. generated by sol-gel technology) and multilayered hard coatings will be developed as a second-generation source for functional coatings. In this way, AEROMUCO will contribute to highly innovative and flexible coating development.

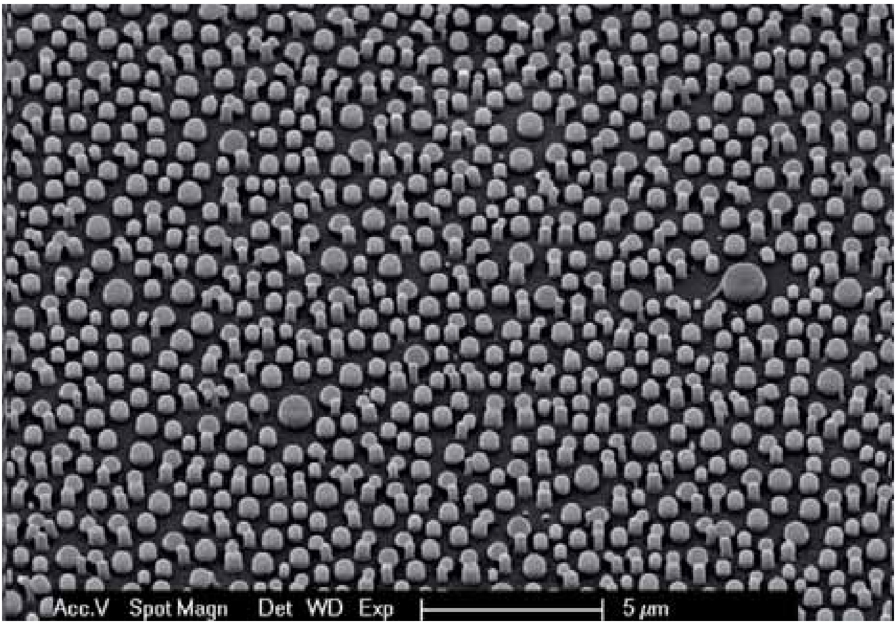
A comprehensive set of unique tests will be performed, including ice-build-up tests, comparative rain-erosion tests, abrasion tests, and an assessment of enzyme processes.

Expected Results

The multi-disciplinary approach will yield technological improvements beyond the state of the art through a structured, innovative research strategy.

The major impact of AEROMUCO will be on the conservation of fuel by making air transport more economic through the use of laminar-flow measures. These efficient anti-ice coatings will lead to the potential employment of lightweight devices (electric) for active de-icing, thus reducing energy consumption. By means of new innovative coatings, considerable savings of fuel can be realised, thus contributing to the desired reduction in CO_2. Maintaining laminar flow conditions during flight, by avoiding contamination and ice-formation, has the potential to decrease CO_2 emissions in aviation by an estimated 7-10%.

Ice formation and insect contamination are not only a problem for the aerospace industry; there is also the automotive industry, signalling devices, railway systems, buildings, wind-energy conversion plants, solar panels and many others. Advanced anti-icing solutions developed for aircraft applications will create opportunities for products in these other areas and therefore greatly improve the options available to customers. Competitiveness of European industry on the global market will be increased, thus creating additional benefits for European citizens and society alike.



Example of structured polyurethane coating

Acronym:	AEROMUCO	
Name of proposal:	Aerodynamic Surfaces by Advanced Multifunctional Coatings	
Grant Agreement:	266029	
Instrument:	CP – FP	
Total cost:	5 769 133€	
EU contribution:	3 772 261€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.01.2011	
Ending date:	31.12.2013	
Duration:	36 months	
Technical domain:	Aerostructures and Materials	
Website:	http://www.aeromuco.eu/	
Coordinator:	Mr Dominik Raps EADS Deutschland GmbH Willy-Messerschmitt-Strasse DE 85521 Ottobrunn	
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Partners:	Alenia Aermacchi S.p.A.	IT
	Dassault Aviation SA	FR
	Saab Aktiebolag	SE
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	Dublin Institute of Technology	IE
	CSEM – Centre Suisse d'Electronique et de Microtechnique SA – Recherche et Développement	CH
	Hef R&D SAS	FR
	University of Limerick	IE
	Photon et Polymers	FR
	Università degli Studi di Padova	IT
	University of Food Technologies	BG

DAEDALOS

Dynamics in Aircraft Engineering Design and Analysis for Light Optimised Structures

State of the Art – Background

The current design practice considers the load envelope, by which each aircraft section is sized, as being statically applied, even when the loads are dynamic. This is the case, for example, with the landing impact that induces dynamic loads on the fuselage, but also with gust loads on the wings and tailplanes.

In addition, the models commonly used assume that the stringer/frame/skin assemblies do not absorb any energy, and that the load acting at a certain location is propagated along the aircraft without attenuation arising from structural damping.

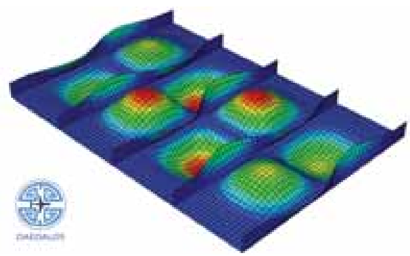
This common approach does not consider two main parameters: time, i.e. the propagation behaviour along the structure of the loading forces, mainly related to the frequency content of the input load and the characteristic frequencies of the structure, and damping, i.e. the capability of the structure itself to damp the loading waves' amplitudes, starting from the zone closest to the load introduction point and propagating away from it.

Furthermore, because an aircraft structure is thin-walled and slender, it is prone to local buckling. The buckling analysis is commonly performed by assuming that the sizing load is statically applied, while it is well recognised that under certain loading conditions the dynamic buckling capacity of a structural element can be significantly higher than the static buckling load.

Objectives

The primary objective of the DAEDALOS project is to investigate the dynamic effects on the actual loads acting on civil aircraft. In this way an improved definition of the sizing loads can be obtained for the structural components, considering in particular the effects of dynamic buckling, material damping and mechanical hysteresis.

The specific objectives can be summarised as follows:
- determine more realistic loads that act along an aircraft structure;
- establish a basis for reducing pseudo-static loads to be used for sizing aircraft structures, as well as for internal force redistribution;
- define a structural concept and a design philosophy that is capable of improving the dynamic response;
- consider the effects of dynamic buckling, material damping and mechanical hysteresis during aircraft service;
- develop technologies in experimentation and simulation for the identification of damping characteristics related to material and structural components, and numerical methods to include material and geometrical non-linearities with an acceptable computation cost;
- update the current design philosophy leading to a structural weight reduction.



Buckling mode of a vertical tail panel

Description of Work

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

WP1 manages all the project activities, and disseminates and exploits the results and knowledge.

WP2 prepares the ground for the theoretical and experimental research activity to be performed in WP3 and WP4. WP2 focuses on the generation of a reference aircraft configuration that can be used to critically review the definition of sizing loads for a civil aircraft, define the models to be adopted for the different stages of analysis, and identify the typical time history loads related to landing and gust loads.

WP3 investigates the particular loading phenomena that may cause (unwanted) conservatism, and translates these results into design variables that can be applied to the current design process. The main targets of WP3 are the comparison of the results between static and dynamic sizing loads, and the definition of new structural concepts able to absorb dynamic loads.

In WP4, structural tests are performed. WP4 experimentally evaluates the material damping, the structural damping properties and the effects of dynamic buckling for typical aircraft components.

WP5 defines a new procedure for the definition of loads to be used during aircraft design, to quantify the potential weight saving of structural components due to the overloading effect of static loads, and to develop new design guidelines.

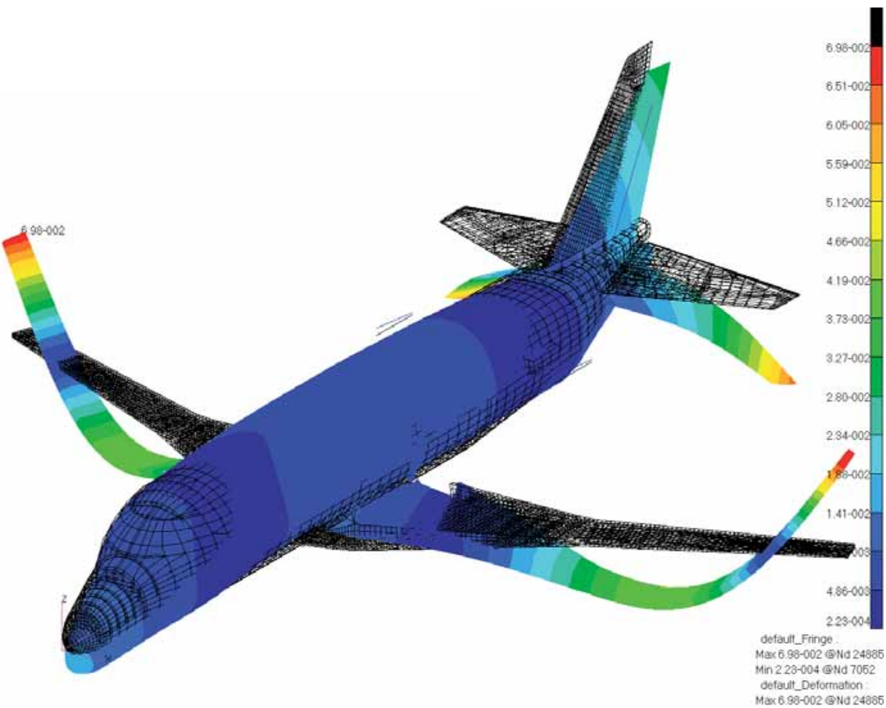
Expected Results

European transport policy and the European aircraft industry demand safer and greener aircraft transport systems, as well as reduced development and operating costs, by 20% and 50% in the short and long term, respectively.

The DAEDALOS project contributes to these aims by means of an innovative design approach for aerospace structures that considers dynamic effects. Although aircraft are, in most cases, subjected to highly dynamic loads, today's design and certification procedures are mainly based on static loading.

This project is expected to be a relevant step towards the structural design methodology for the new generation of European aircraft. In particular, the main expected results are the definition of sizing dynamic loads for structural components of civil aircrafts, the quantification of the potential weight saving due to the overloading effect of static loads, and the development of new design guidelines, which take into account dynamic effects.

Finally, DAEDALOS is a project where people from different national and cultural backgrounds work in teams and represent a reminder of the talent that Europe can mobilise. The content of the project will advance the education standard of European aerospace engineers.



Mode shape of the DAEDALOS reference aircraft

Acronym:	DAEDALOS
Name of proposal:	Dynamics in Aircraft Engineering Design and Analysis for Light Optimised Structures
Grant Agreement:	266411
Instrument:	CP – FP
Total cost:	5 857 183€
EU contribution:	3 962 468€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.11.2010
Ending date:	31.10.2013
Duration:	36 months
Technical domain:	Aerostructures and Materials
Website:	http://www.daedalos-fp7.eu
Coordinator:	Prof. Chiara Bisagni Politecnico di Milano Via La Masa 34 IT 20156 Milan
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	VUT – Vysoke Uceni Technicke v Brne	CZ
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	FOI – Totalforsvarets Forskningsinstitut	SE
	Israel Aerospace Industries Ltd.	IL
	Letov letecka vyroba s.r.o.	CZ
	Gottfried Wilhelm Leibniz Universitaet Hannover	DE
	RWTH – Rheinisch-Westfaelische Technische Hochschule Aachen	DE
	SMR Engineering & Development SA	CH
	Technion – Israel Institute of Technology	IL

ELECTRICAL

Novel Aeronautical Multifunctional Composite Structures with Bulk Electrical Conductivity and Self-sensing Capabilities

State of the Art – Background

Increasing the relative fraction of non-metallic composite components within aircraft has given rise to questions regarding the electrical conductivity. Electrical functions can be met by the use of improved enabling technologies. The inclusion of carbon nanotubes (CNTs) and related materials into the matrix has the potential for creating materials with multi-functional properties.

But some important issues must still be overcome in order to realise the exciting potential of nanomaterials for the applications considered (electrical continuity and sensing capabilities). When employing traditional manufacturing processes using particle-filled resins, two main problems arise: the increased viscosity of the resin and the filtration of nanoparticles, which leads to defective laminates.

Another important issue directly related to the increasing use of carbon-fibre-reinforced plastic (CFRP) is the lack of reliable methods for their quality control. Most non-destructive inspection (NDI) techniques present some important drawbacks, such as the need for highly specialised personnel. Alternatively, electrical resistance tomography (ERT) is a technique for imaging the subsurface electrical structure using conduction currents. Carbon fibre is inherently electrically conductive by nature, so fracturing the fibres would result in sharp changes in the electrical resistance of laminates.

Objectives

ELECTRICAL will exploit the properties of CNTs as polymeric resin doping to develop novel multifunctional composite structures with bulk electrical conductivity and self-sensing capabilities through the following activities:

- improve bulk electrical conductivity of aeronautical composite structures to meet requirements regarding static discharge, electrical bonding and grounding, interference shielding and current return through the structure;
- monitor and optimise the CFRP curing process by dielectric mapping. The dielectric sensor system will perform non-invasive measurements of the electrical properties in the sensor's vicinity;
- develop innovative CFRP structures with distributed or localised self-sensing capabilities for quality assurance;
- develop state-of-the-art fabrication technologies to convert nanofillers into engineered multifunctional preforms, prepregs, buckypapers, etc, for further use in CFRP structures;
- manufacture, characterise and test CFRP-based materials with multifunctional engineered nanostructures and bulk-doped resins. The most broadly used liquid-moulding technologies will be considered, including autoclave curing and associated prepreg development;
- manufacture and test representative panels for proof-of-concept of the materials and technologies developed;
- consider the health, environment and safety issues derived from CNT handling.

Description of Work

Firstly, this project will investigate and develop alternative emerging methods to manufacture nano-reinforced carbon-based composites compatible with current industrial manufacturing processes of composites. Polymer injection processes will constitute the main project's target, including RTM, RTI, LRI and their variants, although autoclave curing is to be considered as the reference process.

The following topics of research will be considered:

- incorporate nanofillers in dry carbon performs:
  - incorporate nanofillers in toughened thermoplastic fibres;
  - incorporate nanofillers in polymeric non-woven veils or films;
  - preform nano-reinforcements into thin mats with a well-controlled dispersion and porous structure, so called 'buckypaper';
  - incorporate nanofillers in injection resin;
- modify or develop new injection strategies:
  - tune the process parameters for traditional technologies;
  - two-step infiltration for RTM and LRI;
- alternatively, consider incorporating nano-reinforcements into carbon-fibre pre-pregs.

Secondly, the multi-functionality concept will be approached, which will consist of integrating three main functionalities:

- increase the electrical conductivity of CFRP laminates;
- monitor and optimise the CFRP curing process by dielectric mapping;
- develop quality assurance of the final component (delaminations, inclusions, etc.) by ERT.

Expected Results

This project will increase the competitiveness within an important group of European aeronautical companies, the aeronautic sector being one of the most innovative sectors with high R&D investments in Europe. Airbus currently leads by one generation with its CFRP fuselage in comparison with Brazilian, Canadian, Russian and Chinese manufacturers. With the work conducted within ELECTRICAL, this lead can be maintained.

The main expected outputs for potential exploitation are summarised as follows:

- an innovative solution for bulk electrical conductivity, with an important aircraft weight saving. This can be considered as the main outcome of the activity with potential applications in composite structures in different aeronautical products;
- an innovative solution for control of the manufacturing process (proper resin-curing status) and quality assurance of the final component (delaminations, inclusions, etc.), with important maintenance cost reductions;
- innovative CNT-engineered structures and CNT-doped resin formulations;
- an innovative solution for integrating nano-reinforcements in CFRP and out-of-autoclave manufacturing methods for composites.

Acronym:	ELECTRICAL
Name of proposal:	Novel Aeronautical Multifunctional Composite Structures with Bulk Electrical Conductivity and Self-sensing Capabilities
Grant Agreement:	265593
Instrument:	CP – FP
Total cost:	4 608 274€
EU contribution:	2 878 153€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.10.2010
Ending date:	30.09.2013
Duration:	36 months
Technical domain:	Aerostructures and Materials
Website:	http://www.electrical-project.eu
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	ACG – Advanced Composites Group Ltd	UK
	INASCO – Integrated Aerospace Sciences Corporation O.E.	GR
	Fundacja Partnerstwa Technologicznego Technology Partners	PL
	University of Patras	GR
	ADERA – Association pour le Développement de l'Enseignement et des Recherches auprès des universités, des centres de Recherche et des entreprises d'Aquitaine	FR
	Short Brothers PLC	UK
	Arkema France SA	FR

ENCOMB
Extended Non-Destructive Testing of Composite Bonds

State of the Art – Background

Adhesive bonding is the appropriate joining technology for the manufacture of lightweight aeronautic structures made from carbon-fibre reinforced plastics (CFRP).

Due to a lack of adequate quality assurance, adhesive bonding is not being applied to load-critical CFRP primary structures (e.g. fuselage structures). However, a quality assurance process for adhesively bonded CFRP primary structures that are not load critical is already in existence.

Bonded structures are inspected by means of conventional non-destructive testing (NDT) in order to detect defects like pores in the joint area. Supplied materials (adhesives, impregnated materials, etc.) and parameters of the manufacturing processes (surface treatment, curing, etc.) are also controlled. In addition, specimens that have been through the complete manufacturing cycle are tested by non-destructive and destructive methods to identify systematic process failures. The reliability of load-critical primary structures is crucial to the safety of the aircraft. The requirements with regard to quality assurance of manufacturing processes are therefore high.

The implementation of reliable adhesive bonding processes by advanced quality assurance would lead to an increased development of highly integrated structures with an optimum combination of advanced composite materials, thus minimising the amount of rivet-based assembly.

Objectives

The strength of the adhesive joint depends on the operational loads during aircraft operation, defects in the joint area and the physico-chemical properties of the interphase region.

Operational loads are considered in the structural design while defects can be detected by means of conventional NDT. The physico-chemical properties of the interphase region are mainly affected by the state of adhered surfaces, e.g. the degree of contamination and activation after surface pre-treatment.

Therefore, one objective of the ENCOMB project is the development and adaptation of methods for the characterisation of adhered surfaces before application of the adhesive. The second challenging goal is the development of techniques for evaluating the bonded components. This new field of testing is defined as extended NDT (ENDT).

The testing methods will be evaluated with regard to their suitability for application scenarios, which are important for the adhesive bonding of primary structures in the aeronautic industry. Also the techniques have to show a high level of suitability for measurements in the field of manufacturing, rework and (in-service) repair. They have to operate automatically with high reproducibility and with an adequate speed of measurements.

Description of Work

Firstly, the most important aeronautic application scenarios are identified, e.g. the effect of adhered surface contamination by a silicone-based release agent. Suitable test specimens are prepared and used for i) reference characterisation by means of analytical methods and mechanical testing, and ii) experimental characterisation by a variety of ENDT methods in order to evaluate their suitability for the selected measurement tasks.

ENDT methods from the field of spectroscopic technologies, e.g. infrared spectroscopy or laser-induced breakdown spectroscopy, and optical methods like laser scanning vibrometry, as well as active thermography and a wetting test (aerosol wetting technique), will be applied to characterise the state of adhered surfaces. In addition, sensor/fibre-based technologies like embedded optical fibre sensors or electrochemical impedance spectroscopy will be tested with regard to their suitability to monitor properties of adhered surfaces (and adhesives). For the characterisation of adhesive bonds, technologies, for example from the field of active thermography, using different excitation sources or optical coherence tomography will be applied. Elastic wave techniques, e.g. laser-excited ultrasonic techniques or nonlinear ultrasonic techniques, will also be investigated.

Expected Results

The selected analytical techniques will be evaluated for their detection capabilities and the most suitable will be further developed into quality assurance tools to be directly applied during aircraft manufacture. In detail, the expected results are:

- analytical technique(s) for characterising adhered surfaces;
- analytical technique(s) for the assessment of the quality of adhesive bonds;
- knowledge about the effect of different application scenarios on adhesion properties and the overall bond performance;
- quality assurance concept(s) for adhesive bonding of primary structures in aircraft manufacture and in-service environments.

The implementation of reliable adhesive bonding processes will lead to an increased use of lightweight composite materials for highly integrated structures. The expected weight savings for the fuselage airframe are up to 15%. These weight savings will have further effects on the size and weight of the engines. From the overall weight savings, significant reductions in fuel consumption and hence CO_2 emissions per passenger-kilometre will result.

Furthermore, the development of a robust and reliable adhesive bonding process reduces the scrap rates by decreasing the amount of rejected material. This in turn reduces waste pollution, which results in a more environmentally friendly manufacturing process within the European aircraft industry.

Acronym:	ENCOMB	
Name of proposal:	Extended Non-Destructive Testing of Composite Bonds	
Grant Agreement:	266226	
Instrument:	CP – FP	
Total cost:	5 766 785€	
EU contribution:	4 231 823€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.11.2010	
Ending date:	30.04.2014	
Duration:	42 months	
Technical domain:	Aerostructures and Materials	
Website:	http://www.encomb.eu	
Coordinator:	Dr. Michael Hoffmann	
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EC Officer:	Hugues Felix	
Partners:	Airbus Operations GmbH	DE
	University of Patras	GR
	EADS Deutschland GmbH	DE
	University of Bristol	UK
	Research Center for Non Destructive Testing GmbH	AT
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	Instytut Maszyn Przeplywowych – Polskiej Akademii Nauk	PL

Agilent Technologies	UK
EPFL – Ecole polytechnique fédérale de Lausanne	CH
ENEA – Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile	IT
CNRS – Centre National de la Recherche Scientifique	FR
EADS France SAS – European Aeronautic Defence and Space Company	FR
EASN Technology Innovation Services BVBA	BE

FACTOR

Full Aero-thermal Combustor-turbine Interaction Research

State of the Art – Background

To reduce fuel consumption and CO_2/NO_x emissions, modern turbo-machineries operate at high velocities and high temperature conditions. The lack of confidence in the prediction of combustor-turbine interaction leads to applying extra safety margins on component designs. Consequently, the understanding of combustor-turbine flow field interactions is mandatory to preserve high-pressure turbine (HPT) life and performance when optimising the design of new HPT and combustors (e.g. lean burn combustors).

Previous projects have investigated combustor technologies (INTELLECT and TIMECOP) and addressed the challenge of understanding the behaviour of hot flow structures in the HPT (TATEF2 and AITEB2). However, industrial experience demonstrates that the separate optimisation of the two modules does not necessarily ensure that the system in which they are embedded will also be optimum. This understanding is even more crucial to develop new combustion technologies where there is a lack of industrial experience.

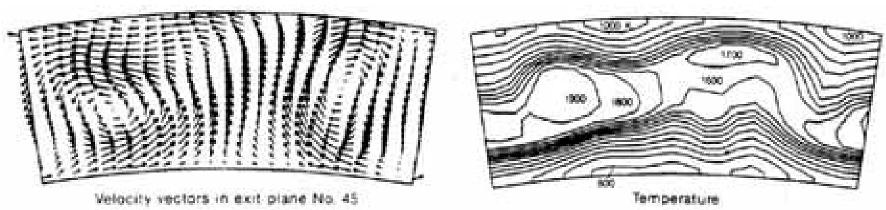
The link between the combustor and the turbine in an engine is very tight and all engine manufacturers are putting in much effort to master this interface; problems like extremely hot gases make this region difficult to investigate. This interface still requires many improvements as gas turbine designers are lacking the experimental data needed to optimise its design.

Objectives

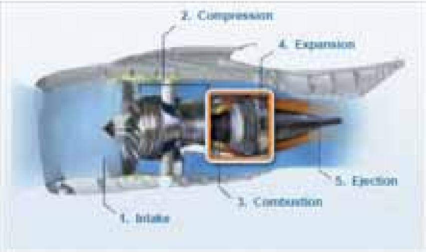
The main objective of FACTOR is to optimise the combustor-HPT interaction design. This will be achieved through a better understanding of the interaction between the coolant system, the transport and the mixing mechanisms to enable a specific fuel consumption (SFC) reduction of about 2%.

To get a detailed understanding of the combustor-HPT interactions, FACTOR will set up an experimental test infrastructure using the most advanced measurement techniques. These measurement techniques will be adapted to FACTOR-specific requirements and combined to ensure that an all-encompassing and comprehensive database of measurements is obtained, which respect the same boundary conditions exactly.

This unique test infrastructure will contain two complementary European turbine test rigs:
- A new continuous flow facility hosted by DLR (Deutsches Zentrum für Luft- und Raumfahrt). Fed by hot and cold air, this module will supply realistic flow field to the downstream HPT, thus enabling experimentalists to explore the aerodynamic and thermal interactions between combustor and turbine.
- A complementary blow-down turbine facility hosted by Oxford University (the Oxford Turbine Research Facility). This will be used to supplement the analysis of the DLR's continuous flow test rig.



Exit combustor temperature and flow field for a modern annular combustor with one row of dilution jets computationally shown by Shyy et al. (1989)



Turbomachine architecture showing the combustor-HPT interaction zone

Description of Work

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

WP1 aims at designing and manufacturing the components of the rig. Separate combustor and turbine concepts are studied, designed and then integrated together to ensure that mechanical, thermal and aerodynamic performances match the specifications.

WP2: The instrumentation is designed and manufactured. The new turbine test rig will be upgraded to ensure that the combustor/turbine modules and the necessary equipment and services are achieved.

WP3: The components will then be integrated within the whole test rig.

WP4 will focus on the measurements campaign. Aerodynamic and aero-thermal measurements will be performed to build the most comprehensive database, which includes:
- characterisation of the solid temperatures inside the HPT;
- measurements of wall heat flux;
- characterisation of the HPT aerodynamic performances under representative inlet flow conditions found in a real engine.

WP5 will assess the lean burn influences on low turning strut heat transfer in the Oxford Turbine Research Facility.

Experiments and computations will be synthesised in WP6 and the analysis of the generated computational fluid dynamics (CFD) data should lead to drawing up guidelines on modelling combustor-turbine interactions.

Expected Results

The test infrastructure outlined above will allow for the collection of data needed to:
- Improve the knowledge of aerothermal external flows. FACTOR will investigate the behaviour of a realistic combustor outlet/turbine inlet conditions in the HPT to better understand the interaction with the coolant system, transport and mixing mechanisms.
- Assess the reliability and performance in predicting the combustor-turbine interaction of conventional and advanced CFD techniques based on URANS, DES and LES.
- Develop more efficient low-cost turbines and reduce the specific fuel consumption (SFC) by 2%, the weight of the HPT by 1.5% and accordingly the engine cost by 3% compared to the results achieved in TATEF2 and AITEB2. This should also enable a reduction of CO_2 emissions by 1%.

More generally, FACTOR is targeting the understanding of combustor-turbine interactions that will lead to increasing thermal efficiency by optimising the coolant flows and reducing the risks of lean burn combustors integrating with turbine modules.

Improvements to testing and modelling capabilities will finally allow engine manufacturers to obtain more thermally efficient gas turbines. The FACTOR project test infrastructure will enable further research in combustor-turbine understanding and allow the study of state-of-the-art combustor concepts to be used in the next generation of aero-engines.

Acronym:	FACTOR	
Name of proposal:	Full Aero-thermal Combustor-turbine Interaction Research	
Grant Agreement:	265985	
Instrument:	CP – FP	
Total cost:	7 319 819€	
EU contribution:	4 893 945€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.12.2010	
Ending date:	30.11.2014	
Duration:	48 months	
Technical domain:	Propulsion	
Website:	http://www.factor-fp7.eu/	
Coordinator:	Mr Patrick Houel	
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Partners:	Avio S.p.A	IT
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	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	GDTech – Global Design Technology SA	BE
	ILA – Intelligent Laser Applications GmbH	DE
	Instytut Maszyn Przeplywowych – Polskiej Akademii Nauk	PL
	ITP – Industria de Turbo Propulsores SA	ES
	MTU Aero Engines GmbH	DE
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	Progesa s.r.l.	IT
	Rolls Royce Deutschland Ltd & Co KG	DE
	Rolls Royce plc	UK
	Siemens Industrial Turbomachinery AB	SE
	Turbomeca SA	FR
	University of Cambridge	UK
	Università degli Studi di Firenze	IT
	University of Oxford	UK
	Volvo Aero Corporation AB	SE
	VKI – von Karman Institute for Fluid Dynamics	BE
	Wytwornia Sprzetu Komunikacyjnego PZL – Rzeszow SA	PL
	ARTTIC	FR

FIRST

Fuel Injector Research for Sustainable Transport

State of the Art – Background

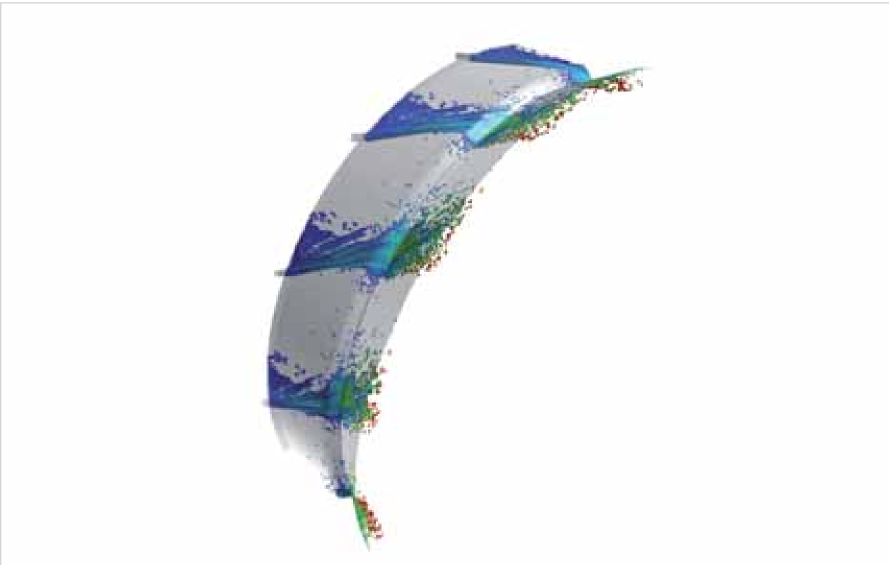
The environmental impact of aviation must be reduced to allow the sustainable growth of the aircraft engine sector to benefit European industry and society. This requires reductions in air transport's contribution to climate change at a global level and reductions in aircraft emissions at a local level, in order to reduce the risks to health and allow better management of energy usage. Aviation engine manufacturers have already reduced fuel consumption and pollutant emissions by over 50% in recent decades. However, step changes are still required to meet ACARE 2020 targets and deliver sustainable technology.

The impact of NO_x reduction technology has been eroded by increasingly demanding engine cycles improving fuel consumption. As the engine pressure ratio and turbine entry temperature increase, NO_x, smoke and particulate emissions also increase. Smoke and particulates, unlike NO_x, can be consumed within the combustor but the conditions which favour their oxidation promote the formation of NO_x.

Lean-burn combustion technology has been demonstrated outside the EU and has been shown to be capable of delivering the necessary step-change in environmental performance. To deliver lean-burn combustion to the market in a competitive, reliable, affordable and airworthy package, European industry needs to advance a number of enabling technologies to a higher level of readiness.

Objectives

The primary objectives of FIRST are to deliver a fuel spray atomisation predictive capability for gas-turbine injectors and an improved soot-modelling methodology for combustion computational fluid dynamics (CFD). Fuel spray atomisation models require an increase in capability to predict the fuel injector's spray properties, including spatial and temporal unsteadiness, based upon knowledge of the fuel injector geometry in combination with the fuel and air-flow boundary conditions.



LES modelling of a sector of an industrial prefilmer leading to fuel break-up and atomisation

In this project, work on numerical models of the atomisation process will include small-domain direct Navier-Stokes simulation, combustor geometry CFD and phenomenological models. Detailed atomisation and spray experimental measurements will also be performed using advanced state-of-the art diagnostics across a range of geometries to inform and validate both the physics-based and phenomenological-based modelling approaches.

The soot-modelling tasks in FIRST will deliver a more accurate methodology for predicting the soot emissions in combustion systems. This will be in the form of sub-model code to be embedded in CFD tools and a methodology for its implementation and use.

After development and validation of numerically intensive academic soot-modelling tools, the resulting modules will be incorporated into industrial codes in reduced form for exploitation.

Description of Work

FIRST is structured into six, interlinked work packages (WP) focused on project management, technical research, validation, integration and exploitation.

WP1 applies project management tools across all activities to enhance the project efficiency.

WP2 is involved in developing the methods for computationally simulating the spray and soot physics, largely at a fundamental level.

WP3 will perform experiments to validate the models developed. Appropriate data collected for model validation is fed into WP2 to inform, enhance and calibrate the modelling activity and understanding of the physics.

WP4 uses the detailed sub-models that have been developed in WP2 in research CFD codes and then tests these in the 3-D combustor and injector geometries to evaluate and demonstrate effectiveness. WP4 will also deliver the practices and techniques for employing the soot and spray-modelling tools, which are as important as the computational tools themselves.

WP5 will implement the spray and soot CFD tools developed in WP2-4 into the industrial CFD codes for commercial exploitation. These production CFD tools will then be used to predict the spray and emission performance of state-of-the-art low-emission combustion systems to enable their final exploitation.

The exploitation and dissemination of the project are the focus of WP6.

Expected Results

The impact of FIRST will be from the development of substantial and critical new tools for the optimisation of combustion systems for environmentally sustainable air transport. The capability to model fuel sprays and soot emissions in the gas turbine engine combustor will accelerate European industry's effort to achieve the ACARE 2020 goals of reducing NO_x, CO_2 and soot particulate emissions.

Experimental databases will be produced focusing on spray and soot at conditions relevant to gas-turbine combustors. These will improve the understanding of the underlying physics behind atomisation and soot production/consumption.

The prediction and measurement of fuel sprays will also be studied for a selection of alternative fuels to allow future fuels to be characterised and modelled effectively.

With this knowledge and understanding, FIRST will deliver a greatly improved CFD fuel spray and soot modelling capability with validation of the models against the experimental databases. From this improved capability an acceleration of the technology readiness level of lean-burn medium-to-large engines can be made, leading in the future to substantial reductions in aircraft emissions. Rich-burn applications on smaller engines will also benefit from reduced system-development times, leading to enhanced competitiveness in European aero-engine industries.

LES modelling of prefilmer flow leading to fuel break-up and atomisation

Acronym:	FIRST	
Name of proposal:	Fuel Injector Research for Sustainable Transport	
Grant Agreement:	265848	
Instrument:	CP – FP	
Total cost:	7 323 306€	
EU contribution:	4 999 959€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.12.2010	
Ending date:	30.11.2014	
Duration:	48 months	
Technical domain:	Propulsion	
Website:	http://www.first-fp7project.eu/	
Coordinator:	Dr Darren Luff Rolls Royce plc PO Box 31 UK DE24 8BJ Derby	
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	CERFACS – Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique	FR
	CNRS – Centre National de la Recherche Scientifique	FR
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	Enginsoft SpA	IT
	Imperial College of Science, Technology and Medicine	UK
	UPMC – Université Pierre et Marie Curie – Paris 6	FR
	KIT – Karlsruher Institut fuer Technologie	DE
	Loughborough University	UK
	MTU Aero Engines GmbH	DE
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	Rolls Royce Deutschland Ltd & Co KG	DE
	SNECMA – Société Nationale d'Étude et de Construction de Moteurs d'Aviation SA	FR
	Turbomeca SA	FR
	Università degli Studi di Bergamo	IT
	Università degli Studi di Firenze	IT
	ARTTIC	FR
	SCITEK Consultants Ltd	UK

HYSOP

Hybrid Silicide-based Lightweight Components for Turbine and Energy Applications

State of the Art – Background

The performances of aircraft engines (overall thrust, CO_2 and NO_x emissions, unburnt fuel, costs, etc.) are addressing technical as well as economic and environmental issues. These issues have been continuously tackeld by advanced engine architectures and cycle designs, novel combustor designs, optimised aerodynamics and new cooling concepts. But turbine material development has clearly made a crucial contribution to performance gains in turbo-machinery.

A substantial increase in the turbine materials' temperature capability would permit considerable performance enhancements, allowing either an increase of combustion temperature and/or a significant reduction of cooling air flows. High temperature (HT) materials are identified by the ACARE group as one major enabler in the medium and long term for most engine improvements.

As important is the need to reduce the overall weight of the aircraft, which can be achieved by lighter architectures (including engines), but the need for weight optimised technology is applicable to every component.

Material research thus appears as a major contributor to the development of clean efficient engines. Especially, materials like intermetallics and ceramics, exhibiting outstanding properties, can lead to significant benefits compared to the currently used Ni-based single crystal superalloys whose temperature limit is around 1100°C.

Objectives

Two of the most advanced lightweight candidate materials for HT turbine applications are Nb/Nb5Si3-based composites and Si3N4 ceramics. Both exhibit relatively low toughness and ductility, which is perceived as a hurdle to their introduction in aero-engines. The replacement of HT superalloys by monolithic Nb-Si alloys or Si3N4 ceramics for the most stressed aero-engine components, like high-pressure turbine blades, is not foreseen in the short or medium term. But modification of the design, e.g. by associating a judicious selection of superalloys with these new materials in a hybrid structure, would lead to viable turbine components able to withstand increased temperature service conditions. This implies that, in parallel, new coating systems that will protect, in particular, Nb-Si based materials from oxidation and corrosion attack have to be developed.

The objectives of the HYSOP project is to demonstrate that the design and manufacture of specific HT turbine components, by combining innovative manufacturing solutions (advanced powder metallurgy processes, design of hybrid structures) and optimisation of the material system (component + coating) will allow the progressive implementation in new greener turbo-engines of Nb-Si or Si3N4-based lightweight materials with a temperature capability increased by about 200°C.

Description of Work

HYSOP will target rotating and static HT turbine components exhibiting diverse criticality and geometric complexity levels, and submit them to various mechanical and thermal loadings. The main tasks are:

- to develop advanced net shape processing techniques suited to 'brittle' HT materials providing adequate microstructures for improved mechanical properties, i.e. powder metallurgical routes like direct laser fabrication, net-shape HiPing and powder injection moulding;
- to design and manufacture hybrid components in a 'core-skin' or 'additive' structure;
- to develop Si3N4/MoSi2 composites, as an improvement with respect to Si3N4 ceramics;
- to design oxidation resistant coatings for Nb-Si alloys based on expertise gained on the control of substrate/coating/environment interactions for both Nb-Si alloys and superalloys, supported by thermodynamic modelling;
- to apply top layers (environmental/thermal barrier coating, E/TBC) for environmental protection against water vapour and CMAS attack (molten silicate glass that deposit on the component during operation, originating from fine sand/ash particles ingested by the engine);

- to test the coating system in service-like isothermal and cyclic conditions at temperatures up to 1300°C;
- to converge the design/manufacturing and coating-E/TBC approaches in assessing the mechanical behaviour of bare and coated specimens.

Expected Results

The outcomes of the HYSOP project will be technological enablers that will demonstrate cost-effective net-shaping processes, adapted to the Nb-Si and Si3N4-MoSi2-based materials, which can be used to manufacture turbine components, and that efficient and fail-safe coatings can be designed and applied on Nb-Si-based alloys.

The project will further show that solutions for cost-effective net-shaping processes yielding controlled microstructures exhibiting the desired properties have been developed and that solutions for efficient coatings on Nb-Si based alloys have been achieved.

The main expected medium-term impacts, once these technologies are implemented, are an increase in turbine inlet temperature, a reduction of engine specific fuel consumption, a reduction of cooling airflow in hot section components, as well as weight savings of several tens of kilograms per engine.

The application of lightweight HT Nb-Si and Si3N4/MoSi2 materials is, of course, not limited to aero-engine turbines: stationary turbines and especially micro-turbines (power less than ~1 MW) can benefit from these new materials.

Acronym:	HYSOP	
Name of proposal:	Hybrid Silicide-based Lightweight Components for Turbine and Energy Applications	
Grant Agreement:	266214	
Instrument:	CP – FP	
Total cost:	5 896 249€	
EU contribution:	4 476 047€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.10.2010	
Ending date:	30.09.2014	
Duration:	48 months	
Technical domain:	Propulsion	
Website:	http://hysop.onera.fr/	
Coordinator:	Mr Stefan Drawin	
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EC Officer:	Michail Kyriakopoulos	
Partners:	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
	SNECMA – Société Nationale d'Étude et de Construction de Moteurs d'Aviation SA	FR
	TU Darmstadt – Technische Universitaet Darmstadt	DE
	University of Birmingham	UK
	Université Henri Poincare Nancy 1	FR
	CNRS – Centre National de la Recherche Scientifique	FR
	L-up SAS	FR

IMPACT-AE

Intelligent Design Methodologies for Low-pollutant Combustors for Aero-engines

State of the Art – Background

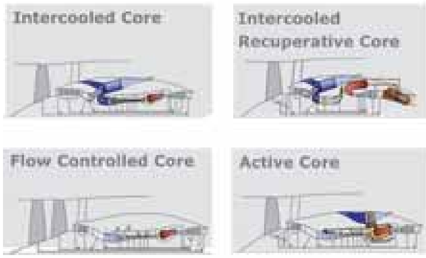
The expected annual growth rates of air traffic (about 3%) for the next two decades are only sustainable if the environmental footprint of aviation engines is minimised. Fuel burn (CO_2 emissions) as the predominant driver for aero-engine design optimisation over the last years has been accompanied by stringent NO_x and noise requirements. A successful new engine design needs a well-balanced consideration of these three parameters and their associated trade-offs. For that reason, advanced engine architectures, like geared turbofans, direct-drive turbofans with advanced cycles and open rotors, must be optimised within the triangular relationship between CO_2, noise and NO_x depending on the intended flight mission, the engine architecture and thermodynamic cycle.

This challenge requires advanced design methodologies for the combustor by implementing previous developments. This will enable an accurate design of novel combustor architectures within a new envelope of a new centreline engine design within a short turnaround time to find the optimal design with respect to all combustion requirements: emissions (NO_x, CO, UHC, soot), combustion efficiency, thermo-acoustic noise, operability, weight and costs.

Objectives

The objective is to develop and validate smart design systems for low NO_x, highly efficient aero-engine combustors. This will be achieved by:

- automation of the combustion aero-design process, including coupling different levels of combustor preliminary design tools, starting from 1-D combustor sizing models up to full 3-D-CFD simulations;
- improved parameterisation of the whole combustion system allowing scaling of the combustor module;
- increased accuracy of simulation tools through improved combustor wall cooling and NO_x models;
- design and experimental validation of new combustor cooling schemes suitable for low-emission combustion;
- generating improved combustor designs based on optimisation techniques and improved knowledge-based design rules for low-NO_x and high-combustion efficiency;



Future engine architectures

- establishing rapid prototype design processes to allow faster validation of new combustor designs;
- generation of comprehensive design rules for low-emission highly efficient combustion via detailed non-intrusive and intrusive measurements inside the combustors and multi-sector, and full annular combustor tests to validate the design methods.

The project directly supports the reduction of NO_x by 80% by 2020 through investigating innovative low-emission combustor concepts. It will optimise the NO_x versus combustion efficiency trade especially during low and part-power operations.

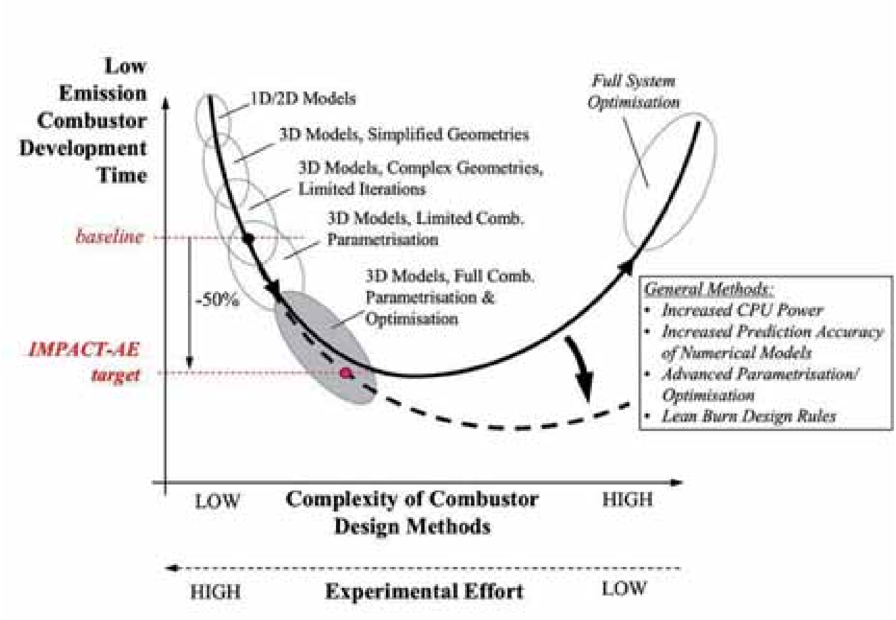
Description of Work

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

WP1 is focused on the development of intelligent combustor design methodologies for low-emission and high-efficiency combustors. This covers design methodologies for combustor liners, KBE methods, including parameterisation and optimisation of the combustion system, improvement of large eddy simulation-based emissions' predictive capability and generation of a more accurate NO_x prediction tool.

WP2 is focused on the reduction of the combustor air flow available for wall cooling, and the understanding of the interaction between heat-release zones and cooling flow that influences emission and combustion efficiency.

In WP3, advanced non-intrusive measurement techniques will be applied to assess the low-emission combustors developed in WP1 to generate clear design rules regarding optimised pilot/main flame interaction



Development towards a comprehensive combustor design methodology

during fuel-staged operation and flame/wall-cooling interaction. Additionally, understanding how fuel temperature affects spray and vaporisation will be improved via detailed measurements.

WP4 will provide a final demonstration of the design methodologies developed within WP1 and 2. The results will be used for the validation of a low-emission combustion system based on KBE design rules. Moreover, new combustor liner cooling systems will be evaluated during multi-sector test campaigns.

Expected Results

The expected key benefits are:
- 70% reduction versus CAEP/2 (Committee on Aviation Environmental Protection) standards for NO_x;
- reduction of combustor development time of up to 50% compared to the state-of-the-art aero-design processes;
- 25% improvement in CO emissions compared to best lean-burn technology currently developed;
- improvement in the prediction accuracy of the combustion design process;
- ability to perform combustion optimisation at different stages within the combustor development due to automated combustor aero-design processes;
- development of combustor design methods suitable for scale combustor geometries for future aero-engine architectures.

Acronym:	IMPACT-AE
Name of proposal:	Intelligent Design Methodologies for Low-pollutant Combustors for Aero-engines
Grant Agreement:	265586
Instrument:	CP – FP
Total cost:	7 411 859€
EU contribution:	4 899 175€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.11.2011
Ending date:	31.10.2015
Duration:	48 months
Technical domain:	Propulsion
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	Avio S.p.A	IT
	Turbomeca SA	FR
	MTU Aero Engines GmbH	DE
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	Université de Pau et des Pays de L'Adour	FR
	KIT – Karlsruher Institut fuer Technologie	DE
	UniBw – Universitaet der Bundeswehr Muenchen	DE
	Imperial College of Science, Technology and Medicine	UK
	University of Cambridge	UK
	Loughborough University	UK
	Università degli Studi di Firenze	IT
	Cambridge Flow Solutions Ltd	UK
	Avioprop Srl	IT
	INSA – Institut National des Sciences Appliquées de Rouen	FR
	ARTTIC	FR

LEMCOTEC

Low-emissions Core-engine Technologies

State of the Art – Background

After laying the foundations for turbo-fan engines with very high by-pass ratios (BPRs) of up to 15 in VITAL and open-rotor configurations with ultra-high BPRs of 45 to 50 in DREAM, the development of core-engine technology with overall pressure ratios (OPRs) beyond 50 (up to 70 and higher), remains the only way, to increase the engine efficiency further and expand the work commenced in NEWAC.

Some of the LEMCOTEC objectives will enable the engine industry to extend their design space beyond the overall pressure ratio of 50, which is the practical limit in the latest engines.

Other areas have already been researched by NEWAC and the technology will be driven further here for ultra-high pressure ratio core engines. These technologies will be validated at a higher readiness level of up to TRL 5 (component and/or system validation in a relevant environment) for ultra-high OPR core engines.

Objectives

The main objective of the LEMCOTEC project will be to improve core-engine thermal efficiency by increasing the overall pressure ratio (OPR) up to 70, which leads to a further reduction of CO_2. Since NO_x increases with OPR, combustion technologies have to be further developed to compensate for this effect and meet the ACARE targets for 2020. The major technical subjects to be addressed by this project are:

- Innovative compressors for the ultra-high pressure ratio cycles and associated thermal management technologies;
- Combustor-turbine interaction for higher turbine efficiency and ultra-high OPR cycles;
- Low NO_x combustion systems for ultra-high pressure ratio (UHPR) cycles;
- Advanced structures to enable high OPR engines and integration with heat exchangers;
- Reduced cooling requirements and stiffer structures for turbomachinery efficiency;
- HP/IP compressor stability control.

Most importantly, LEMCOTEC addresses the particular challenge in delivering these benefits simultaneously, hence contributing to the simultaneous attainment of the relevant ACARE targets described in the Strategic Research Agenda (SRA) and the Vision 2020.

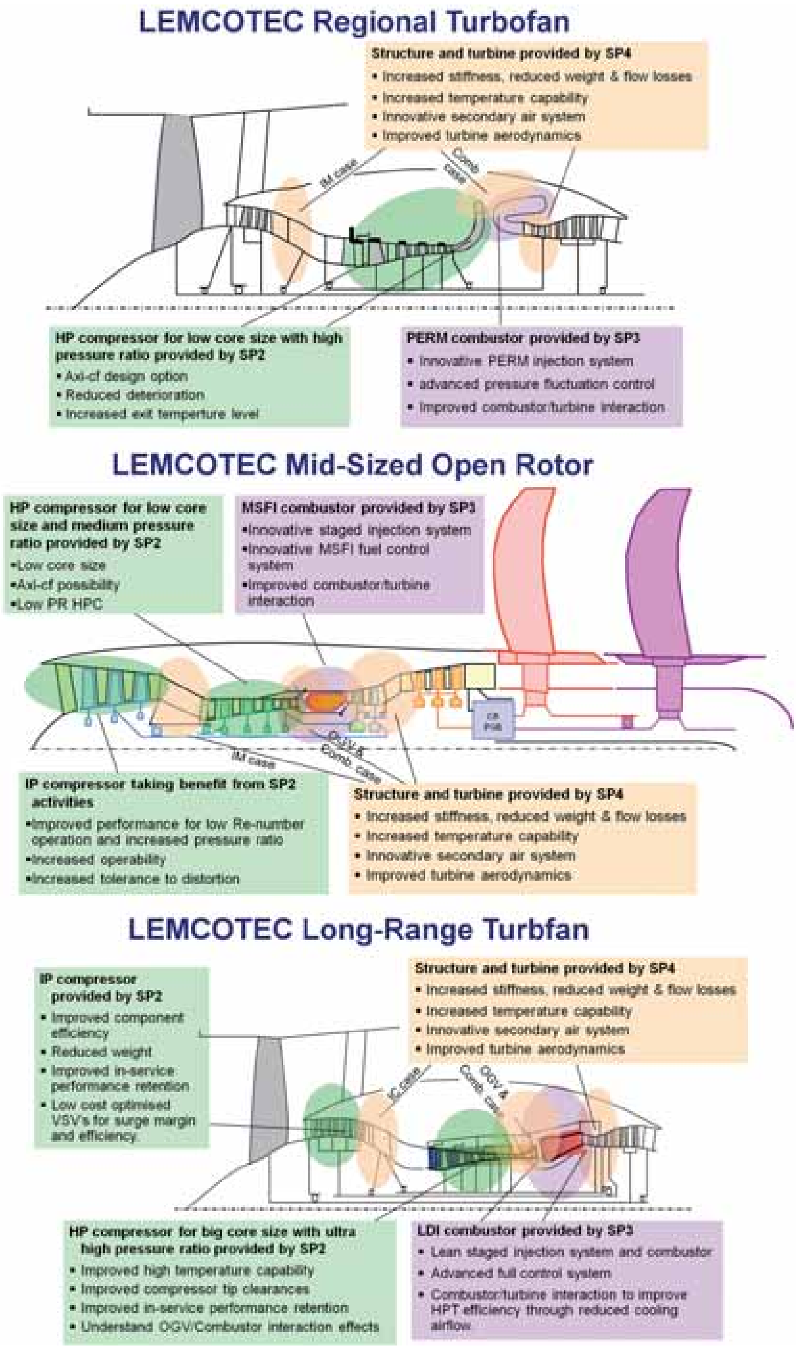
Description of Work

Innovative lean burn combustion technology adapted to ultra-high OPR compressors will be developed to achieve 65% to 70% NO_x reduction by developing lean staged injection systems and associated combustors, developing a fuel control system, and detailed investigations of flow and combustion processes inside the combustor and at the interface with the high-pressure turbine.

Innovative structures and thermal management techniques will be investigated to enable not only engine designs with 35% higher pressure ratio but also to reduce losses and weight to achieve a 1.5% lower fuel burn and a 3% core weight reduction compared to current engine cycles.

The resulting high temperatures will be dealt with by applying advanced materials with high and predictable strength at elevated temperatures and improved design to avoid subjecting highly loaded structures to excessively hot flows.

Core-engine characteristics and performance meeting aircraft and non-core-engine component requirements will be specified to monitor the progress of the research work. The overall consistency and scalability of the core engine component integration will be ensured by assessing the weight and environmental impact, and optimising the engine through integrated technology. A roadmap will be explored towards further emission reduction targets and possible 2030 to 2050 entry into service.



The LEMCOTEC engines

Expected Results

The work will aim at providing the European aero-engine manufacturing industry with improved capability to produce more environmentally friendly aero-engines.

Environmental impacts:
- CO_2 and fuel burn: these will be substantially reduced by improving the engine thermal cycle efficiency;
- NO_x emissions will be maintained at the level obtained in NEWAC for the flow controlled engine and the actively cooled engine;
- CO, UHC and smoke emissions can be reduced in parallel compared to in-service combustion systems, mainly due to the introduction of lean burn systems and increased combustion and turbine entry temperatures;
- Contrails: the emission of water-vapour will be reduced proportionally to the fuel-burn reduction, potentially leading to reduced contrail formation;
- Cirrus clouds: aerosols indirectly affect natural cirrus cloud formation by acting as ice nuclei long after emission and long distances away from flight routes. Reducing particulate emissions will lead to a reduced effect of aviation on cirrus cloud formation.

Propulsion system weight is intended to be kept constant with the ambition for further reductions. The higher OPR will lead to smaller core engine diameters, while stiffer structures are required. However, the combination of the ultra-high OPR core engines with ultra-high by-pass ratios LP systems can outweigh the weight benefits obtained.

Acronym:	LEMCOTEC	
Name of proposal:	Low-emissions Core-engine Technologies	
Grant Agreement:	283216	
Instrument:	CP – IP	
Total cost:	68 457 112€	
EU contribution:	39 980 815€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.10.2011	
Ending date:	30.09.2015	
Duration:	48 months	
Technical domain:	Propulsion	
Website:	http://www.lemcotec.eu	
Coordinator:	Dr Ralf von der Bank	
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Partners:	MTU Aero Engines GmbH	DE
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	Volvo Aero Corporation AB	SE
	Avio S.p.A	IT
	ITP – Industria de Turbo Propulsores SA	ES
	Prvni brnenska strojirna Velka Bites a.s.	CZ
	Turbomeca SA	FR
	Wytwornia Sprzetu Komunikacyjnego PZL – Rzeszow SA	PL
	ARTTIC	FR

ARISTOTELIO PANEPISTIMIO THESSALONIKIS	GR
ERGON Research di Lorenzo Tarchi ECSAS	IT
Bauhaus Luftfahrt e.V.	DE
University of Cambridge	UK
CERFACS – Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique	FR
Chalmers Tekniska Hoegskola AB	SE
CIAM – Central Institute of Aviation Motors	RU
CNRS – Centre National de la Recherche Scientifique	FR
Cranfield University	UK
CTA – Fundación Centro de Tecnologías Aeronáuticas	ES
DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
KIT – Karlsruher Institut fuer Technologie	DE
Loughborough University	UK
ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
PCA Engineers Ltd	UK
RWTH – Rheinisch-Westfaelische Technische Hochschule Aachen	DE
Braunschweig – Technische Universitaet Braunschweig	DE
TU Dresden – Technische Universitaet Dresden	DE
UPM – Universidad Politécnica de Madrid	ES
Università degli Studi di Firenze	IT
University of Oxford	UK
Universitaet Stuttgart	DE
VKI – von Karman Institute for Fluid Dynamics	BE
VZLU – Vyzkumny a Zkusebni Letecky Ustav A.S.	CZ

MARS

Manipulation of Reynolds Stress for Separation Control and Drag Reduction

State of the Art – Background

Drag reduction and separation control are directly related to more efficient air transportation and less harmful gas emissions into the environment. While the aerospace industry is striving to have more optimised designs, it is still a long way from the targets set out in A Vision for 2020 for 50% reduction in aircraft emissions. Separation control and drag reduction contribute directly towards this target and active flow control could play an important role in achieving it.

Active flow control provides an additional dimension for further improving aircraft performance, particularly at different operational points, such as at cruise, take-off and landing. After many decades of development, the highly optimised designs of aircraft make further large improvements difficult without a 'game-changing' technology, such as active flow control.

At cruise, approximately 50% of the total drag of a modern commercial aircraft is attributed to skin friction. The importance of improved separation control is less obvious unless the influence of aircraft mass on fuel burn is acknowledged. In fact the sensitivity of fuel burn to mass is greater than that to skin friction.

Objectives

The main objectives of MARS are:

- to control turbulent wall-bounded shear flow effectively from a more fundamental level by directly investigating the behaviour of Reynolds stresses and their response to the manipulation of the dynamic components of the flow;
- to conduct both experimental tests and computational simulations to extract reliable flow physics, including Reynolds stresses, for a number of active flow-control devices;
- to explore large-scale unsteadiness (unsteady jets, wakes and vortices) produced from the capability of these devices so as to provide effective control of the dynamic components, and hence the Reynolds stresses, within the shear layers associated with large-scale wakes and separations;
- to identify key strategies that enable efficient control of dynamic fluid structures within shear layers, and to design and optimise these devices for separation control (higher shear) and drag reduction (lower shear);
- to demonstrate the most promising device/devices at relevant scale, together with the ability to efficiently increase or decrease the Reynolds stresses;
- to investigate the application of this capability within an aircraft context;
- to foster further collaboration between European and Chinese researchers in the key technology area of flow control for the benefit of civil aircraft industries on both sides.

Description of Work

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

WP1: Management, data tools and communication, which is aimed at facilitating the daily work and reaching the objectives of the project. Due to the fact that the European and Chinese partners will need to interact and share information, this work package will also provide the required tools to ensure good communication and information sharing.

WP2: Experimental investigation of flow-control mechanisms, which will be devoted to understanding the involved concepts of the flow phenomena that affect drag and separation. This is one of the most important work packages because it will feed WP4 and WP5 with important information and data.

WP3: Numerical simulation of flow control, which will work in parallel with WP2 because it will obtain similar information, together with data to understand flow control mechanism from the point of view of numerical simulations.

WP4: Synthesis, understanding and design optimisation, which is split into two main tasks. The first one is devoted to understanding the control phenomena. The second task will take all the project data to produce an optimised design of the most promising devices.

WP5: Industrial demonstration and evaluation of the project.

Expected Results

An aircraft's operational cost is mainly intended to ensure cost efficiency by focusing on reducing the aircraft's direct operating cost. It is well known that one of the most important operating costs is fuel consumption, which is directly related to flight performance of the aircraft. Reducing drag and delaying flow separation result in efficient ways of reducing fuel consumption. In addition, there are also environmental benefits with reduced emissions and less external engine noise.

This project is focused on international co-operation with China and follows on from the work achieved in AeroChina2, which researched flow control. The aim is to promote an effective co-operation in an important field supporting aircraft design, i.e. computational simulation and flow-control experiments to discover effective means of flow-separation control and relevant drag reduction through an improved understanding of the effect of Reynolds stress.

To summarise, the potential impacts are:

- a basic understanding of the effects of various flow-control devices on Reynolds stress;
- ways of manipulating the turbulent Reynolds stress for effective flow control;
- identification of practical issues in aeronautical application;
- experimental and simulation flow-control data for future validation;
- enhancement of EU-China scientific collaboration in a key technological area.

Acronym:	MARS	
Name of proposal:	Manipulation of Reynolds Stress for Separation Control and Drag Reduction	
Grant Agreement:	266326	
Instrument:	CP – FP	
Total cost:	3 490 633€	
EU contribution:	1 498 673€	
Call:	FP7-AAT-2010-RTD-CHINA	
Starting date:	01.10.2010	
Ending date:	30.09.2013	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.cimne.com/mars	
Coordinator:	Ms Anna Font Jornet	
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	Airbus Operations SL	ES
	FOI – Totalforsvarets Forskningsinstitut	SE
	Alenia Aeronautica S.p.A.	IT
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	CNRS – Centre National de la Recherche Scientifique	FR
	Dassault Aviation SA	FR
	NUMECA – Numerical Mechanics Applications International SA	BE
	University of Manchester	UK
	INRIA – Institut National de Recherche en Informatique et en Automatique	FR
	EADS UK Ltd.	UK
	NUAA – Nanjing University of Aeronautics and Astronautics	CN
	Tsinghua University	CN
	Northwestern Polytechnical University	CN

Peking University	CN
BHU – BeiHang University	CN
Zhejiang University	CN
CAE – Chinese Aeronautical Establishment	CN

MERLIN

Development of Aero-engine Component Manufacture using Laser-additive Manufacturing

State of the Art – Background

The first laser-additive rapid manufacturing process emerged in 1987 in the form of stereo-lithography which produced parts in layers by selectively photo-polymerising a vat of liquid monomer. A metallic powder variant of this concept followed about six years later and has resulted in creating new opportunities for additive manufacture of complex metallic part manufacture, surface treatment and component repair. Although extensively used for prototyping, the direct application of this concept in manufacturing is growing, but currently limited for reasons including low productivity, repeatability and inferior material properties.

Two additive manufacturing technologies are being developed within the MERLIN project: laser metal deposition (LMD) and selective laser melting (SLM).

SLM is a laser powder-bed concept using a scanned laser spot on a bed of powder, locally fusing the powder, layer by layer, in a pre-determined pattern. LMD makes use of a laser to process material to build up self-supporting 3-D structures and for the cladding of conformal surfaces.

Laser techniques provide low heat input, low dilution, accurate and small feature creation, and good surface finish, which cannot be delivered by electron beam and arc-based additive techniques.

Objectives

The concept of MERLIN is to reduce the environmental impact of air transport using additive manufacturing (AM) techniques in the manufacture of civil aero-engines. Techniques will be developed that allow environmental benefits, including close to 100% material utilisation. All of these factors will drastically reduce emissions across the lifecycle of the parts. There will also be added in-service benefits due to the enhanced functionality available from additively manufactured parts. Lighter in weight and with an improved part performance, these techniques will result in reduced manufacturing costs, fuel consumption and emissions. MERLIN will seek to develop the state-of-the-art by producing higher performance additive manufactured parts in a more productive, consistent, measurable, environmentally friendly and cost-effective way.

Description of Work

The current accuracy of the SLM technique ranges between 50 to 250µm, with a productivity of 3 to 7 cm^3 of powder fused per hour.

LMD-p is a process variant by which powder is used to form a layer of material. LMD-w is another process variant by which a wire filament is introduced into the melt pool. Current LMD-p technology is capable of building walled features as small/thin as 200-300µm, at a productivity of up to 10 cm^3 of powder per hour. Conversely, LMD-w technology has much higher productivity but at the expense of resolution and a reduced choice of materials (minimum wall thickness approximately 4-5mm).

The work is split into eight work packages, each of which has its own objectives, milestones and deliverables.

Level 1 component demonstrators will be produced, assessed and tested as part of the MERLIN deliverables with the selected results disseminated both within the consortium and externally as part of the exploitation and dissemination plan agreed between all the partners.

The partners have identified the following areas where a progression of the state-of-the-art is needed to take advantage of AM:
- productivity increase;
- design or topology optimisation;
- powder recycling validation;
- in-process non-destructive testing (NDT) development;
- in-process geometrical validation;
- high-specification material process development.

Expected Results

Impacts will include the development of high-value, disruptive AM technologies that are capable of step changes in performance. AM will significantly reduce waste in an industry where materials require massive amounts of energy and toxic chemicals, in-process toxic chemical usage will be massively reduced, and emissions will drop because of the reduced amount of material involved. The application of topological optimisation techniques to redesign parts for function rather than manufacture will reduce the amount of material involved, and enhance performance.

The recycling of material not consumed in powder LMD and SLM processes will maximise raw material utilisation.

Distortion modelling development will enable parts of the correct geometry to be manufactured without additional tooling because the process creates the part as a net or near net shape. Residual stresses will be minimised.

The development of novel NDT processes will improve the measurement of material consistency.

Geometrical validation using 3-D scanning systems will evaluate the geometrical tolerance of the parts generated. MERLIN will also develop a closed 'in-process' measurement and control loop, preventing 'distortion runaway', thus stabilising AM processing.

The processing of high-specification, crack-susceptible materials needed for the aero-engines of the future will be developed.

Acronym:	MERLIN	
Name of proposal:	Development of Aero-engine Component Manufacture using Laser-additive Manufacturing	
Grant Agreement:	266271	
Instrument:	CP – FP	
Total cost:	7 122 571€	
EU contribution:	4 886 561€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.01.2011	
Ending date:	31.12.2014	
Duration:	48 months	
Technical domain:	Design Tools and Production	
Website:	http://www.merlin-project.eu/home/index.jsp	
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	ITP – Industria de Turbo Propulsores SA	ES
	MTU Aero Engines GmbH	DE
	LPW Technology Ltd	UK
	Turbomeca SA	FR
	Volvo Aero Corporation AB	SE
	Twi Ltd	UK
	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
	ARMINES – Association pour la Recherche et le Développement des Méthodes et Processus Industriels	FR
	Asociación Centro Tecnológico en Tecnologías de Unión Lortek	ES
	BCT Steuerungs- und DV-Systeme GmbH	DE
	Högskolan Väst	SE
	FRC – Frederick Research Center	CY

NINHA

Noise Impact of Aircraft with Novel Engine Configurations in Mid-to-High Altitude Operations

State of the Art – Background

The introduction of aircraft with advanced counter-rotating open rotor (CROR) engine power plants will contribute significantly to the reduction of fuel burn and gaseous emissions. In the 1980s, prototypes of the first generation of open rotor engines were developed and tested. One of the findings was that the noise generated by these engines, even in the en-route flight phase, was significant, thus hazarding public acceptance. Since then significant effort has been dedicated to improving the CROR aero-acoustic design; the new generation of CROR engines currently envisaged will be much quieter than its predecessors.

The NINHA project will assess whether noise issues away from airports (i.e. during high-altitude operations) might potentially hinder the introduction of this new generation of power plant. To date, the International Civil Aviation Organisation's (ICAO) Committee for Aviation Environmental Protection (CAEP) and aviation stakeholders have primarily been concerned with aviation noise around airports. The means for assessing en-route noise are not standardised and the ability to predict en-route noise is quite limited. NINHA will address this limitation.

Objectives

The NINHA project will determine the level and impact of the en-route noise of open rotor power plants and hence assess the viability of these new engine concepts.

The NINHA objectives are:

- to assess the near-field noise characteristics of the CROR propulsion system in climb, cruise and descent operating conditions using wind-tunnel test data acquired in other research programmes;
- to develop methods for extrapolating the near-field wind-tunnel noise levels to the far-field, using advanced computational methods;
- to adapt and validate computational methods suitable for modelling long-distance propagation through simulated realistic layered atmospheres with support of noise measurements to be acquired from flight tests of a large turboprop airplane operated at different altitudes;
- to assess the ground noise impact of future CROR-powered aircraft with reference to existing turbofan and turboprop configurations when operating away from airports, considering various levels of ambient noise, including areas of very low background noise;
- to evaluate the most influential parameters on en-route noise impact;
- to develop and disseminate to regulating bodies both data and assessment methodologies that are necessary for the development of en-route noise standards in the event that the assessed impact justifies consideration of such standards.

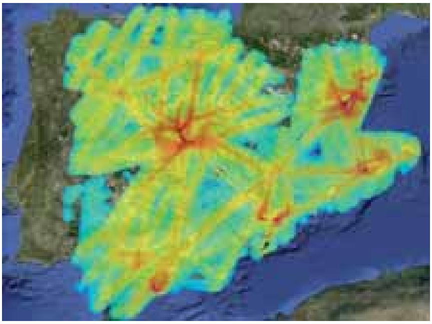
Description of Work

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

WP1 adapts existing PE and ray-tracing computation methods for modelling long-distance sound propagation through simulated realistic layered atmospheres. These methods will be validated with data obtained from dedicated flight tests with an A400M. An engineering model for long-distance atmospheric sound propagation will be developed.

WP2 exploits a large experimental database of near-field CROR noise, obtained in earlier research projects. Since significant uncertainty still exists in extrapolating from high-speed wind-tunnel data to the far-field, WP2 will extrapolate the near-field noise to the far-field with different methodologies and parallel approaches on data from different wind-tunnels. The ray-tracing method and the engineering model from WP1 will be implemented in the SOPRANO aircraft noise prediction platform.

A model is developed in WP3 to assess the noise impact of aircraft en-route. Real air traffic data will be obtained for various areas in Europe. This database will be extended with heavy turboprops by means of dedicated measurements. Together with the predicted en-route noise levels of CROR aircraft from WP2, the noise impact will be derived for various fleet compositions. A set of recommendations will contribute to the ICAO/CAEP discussion on potential en-route noise regulations related to CROR.



En-route noise map of Spain

Expected Results

Relatively little research has been conducted on en-route aircraft noise since the 1990s. To address this shortfall, NINHA will quantify the potential community annoyance with en-route noise generated by aircraft, in particular open rotors, and discover whether the levels of en-route noise for CRORs are acceptable (their acoustic signatures are different from existing engines since they contain prominent low-frequency tonal energy spectra that are less attenuated by the atmosphere).

NINHA will deliver numerical methods on atmospheric propagation that are better calibrated, more reliable, more efficient and accurate, and with less constraint in terms of computation time and costs. Previous measurement campaigns were insufficient, so NINHA will include comprehensive measurements from a flight test of an A400M aircraft to calibrate the long-distance propagation methods.

If en-route noise is demonstrated to be a potential problem, technical discussions will be continued beyond Europe to get an international consensus on the understanding of en-route noise and its annoyance impact. This could result in new standards and certification processes.

Exploiting the developed tools and existing model-scale data on various open-rotor designs, NINHA will deliver answers to the questions concerning en-route noise that are required by aviation stakeholders.

Acronym:	NINHA
Name of proposal:	Noise Impact of Aircraft with Novel Engine Configurations in Mid-to-High Altitude Operations
Grant Agreement:	266046
Instrument:	CP – FP
Total cost:	2 909 922€
EU contribution:	1 924 780€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.10.2010
Ending date:	30.09.2013
Duration:	36 months
Technical domain:	Noise and Vibration
Website:	http://www.ninha-project.eu
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Partners:	Airbus Operations SAS	FR
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	FOI – Totalforsvarets Forskningsinstitut	SE
	University of Southampton	UK
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	Rolls Royce plc	UK
	SNECMA – Société Nationale d'Étude et de Construction de Moteurs d'Aviation SA	FR

RECEPT

Receptivity and amplitude-based transition prediction

State of the Art – Background

One of major issues in lowering the emissions caused by air transport is the reduction of aircraft drag. It is well known that optimising a configuration for minimum fuel burn is more beneficial than optimising other operating costs. The design of an efficient aircraft requires maximum utilisation of the physical limitations. To do that, accurate computational tools should be developed that allow a reduction in the current large safety margins caused by low-fidelity prediction methods.

Understanding the origins of turbulent flow remains an important challenge in fluid mechanics. Transition to turbulence in boundary layers, like those developing on an aircraft wing, is due to the growth of unstable disturbances, which finally break down to turbulence.

The most frequently used transition prediction method in aeronautics is the so-called eN method. The idea of this approach is simply that transition occurs when the amplitude of the perturbations (compared to the location where they first start to grow) has been amplified by a factor equal to eN, independent of the actual magnitude of the initial disturbances. The value of the parameter N is defined through empirical relations, but no calibration of the value of the parameter N has been found that works satisfactorily. The main issue is the lack of linkage to the perturbation level in the incoming flow and the surface quality.

Objectives

Using transition-prediction methods developed over the last 50 years, the initial linear amplification and the nonlinear stage of growth of these perturbations can both now be accurately estimated. However, accurate initial conditions for the amplified waves need to be provided in order to correctly predict the onset of transition. Thus, the key element for a successful

Direct numerical simulation of cross-flow transition on a swept wing transition prediction method is accurate estimation of the initial amplitude of the perturbations. This requires quantitative knowledge about the entrainment process of ambient disturbances into the boundary layer, i.e. the receptivity process.

RECEPT aims at developing the next-generation transition-prediction methods by adopting an amplitude-based method. The present work will both remove the need for empirical relations and calibration of the wind tunnels, and render possible accurate prediction of the onset of transition, with consequences on flight performance, both under wind tunnel and, more importantly, free-flight conditions.

Description of Work

The method will consist of the following steps:

1. Estimation of the disturbance level and spectrum in the wind-tunnel and in free-flight;
2. Receptivity calculations giving the initial amplitudes of the most unstable disturbances;
3. Non-linear stability calculations to estimate the transition location based on the finite amplitude of the disturbances.

The planned work includes both numerical and experimental investigations. Experiments are devoted to investigations of receptivity of three-dimensional boundary-layer flows to external vortical perturbations. Experiments will be performed in a quiet wind tunnel with controlled external perturbations and surface roughness quality.

Numerical approaches will be used to replicate the physics approached experimentally. Methods and numerical tools with different ranges of complexity and approximation levels will be used to attack the problem. Direct numerical simulation will also be employed to provide specific detailed information.

The development of a suggested amplitude-based transition prediction method is based on the idea of taking into account the initial amplitude of disturbances obtained from receptivity computations.

The new receptivity and transition prediction tools obtained here will be applied to geometries and flow parameters for realistic cases. The effects of 3-D flow will also be investigated.

Expected Results

Incorporating substantially more physics into the transition prediction methods can be expected to generate a leap in performance and reliability. It is therefore foreseen that proposed research activities within RECEPT will result in more accurate and reliable tools for transition prediction, which will increase the capability of designing aircraft with natural laminar wings. It will also contribute towards improved modelling of the effects of laminar-flow control devices, thus moving a step closer towards the design of more advanced flow-control devices. As a result, this project will contribute to achieving the objectives for technology readiness so as to reduce fuel consumption and hence CO_2 and NO_x emissions.

Acronym:	RECEPT	
Name of proposal:	Receptivity and amplitude-based transition prediction	
Grant Agreement:	265094	
Instrument:	CP – FP	
Total cost:	3 624 036€	
EU contribution:	2 684 688€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.02.2011	
Ending date:	31.07.2014	
Duration:	42 months	
Technical domain:	Flight Physics	
Website:	http://www.mech.kth.se/recept	
Coordinator:	Prof. Ardeshir Hanifi	
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EC Officer:	Dietrich Knoerzer	
Partners:	Università degli Studi di Genova	IT
	Università degli Studi di Salerno	IT
	Universitaet Stuttgart	DE
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	FOI – Totalforsvarets Forskningsinstitut	SE
	SA Khristianovich Institute of Theoretical and Applied Mechanics of Siberian Branch of Russian Academy of Science – ITAM of SB RAS	RU
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	Airbus Operations GmbH	DE
	Piaggio Aero Industries S.p.A.	IT
	Saab Aktiebolag	SE

TEAM_PLAY

Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis

State of the Art – Background

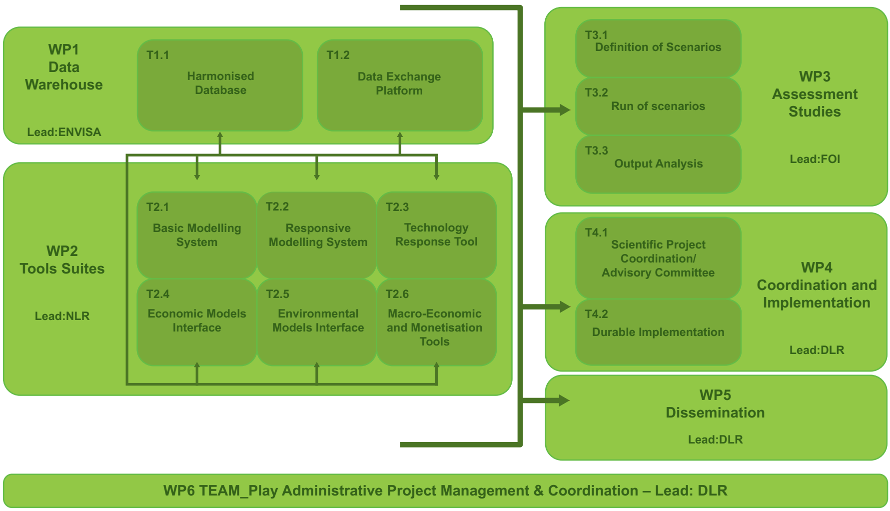
A large set of policy issues in the fields of aviation and environment is discussed in the Committee on Aviation Environmental Protection (CAEP) of the International Civil Aviation Organisation (ICAO) as well as at European level. Currently, the most urgent requirements are the capability of modelling noise, NO_x stringencies and greenhouse gases in relation to the Kyoto protocol, as well as related agreements, and their respective effects. Careful analysis of the complex interdependencies between air transport activities and environmental or economic effects is needed for the assessment of policies and guidance at a political level.

Thus, integrated modelling capabilities have to be enhanced. In the USA, this modelling capability is currently being developed in a multi-million dollar project based upon criteria, assumptions and points of view primarily set by the USA.

Objectives

The objective of TEAM_Play is to enhance the European modelling capabilities required for policy assessment. These capabilities will be strengthened by creating a common infrastructure allowing for connections between existing European models (noise and gas emissions, and the economic and environmental impacts of the air transport sector).

TEAM_Play will create a modelling framework to combine and advance European modelling capabilities in order to support the European perspective in the international policy arena.



Description of Work

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

The common infrastructure outlined above is addressed in WP1 by linking the models to a data warehouse in which all required modelling input and output data are stored.

WP2 covers the development of model interfaces which will enable the models to be connected. In addition, an economic impact assessment will be conducted.

In WP3, assessment studies using the TEAM_Play tool suite will be carried out.

The dissemination will be carried out in WP4 and a concept for the durable implementation beyond the Seventh Framework Programme funding will also be developed.

Expected Results

A structure plan for the data exchange platform has already been developed, together with data concepts for existing information, including airport and aircraft/ engine databases.

Initial interim versions of the Basic Modelling System, and specifications for the Responsive Modelling System and the technology response tool have been completed, along with the interface specifications for the noise, third-party risk, greenhouse gas emissions and climate response tools.

A macro-economic analysis model and an energy module are currently also being worked on.

Acronym:	TEAM_PLAY	
Name of proposal:	Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis	
Grant Agreement:	266465	
Instrument:	CP – FP	
Total cost:	5 280 324€	
EU contribution:	3 867 496€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.12.2010	
Ending date:	30.11.2012	
Duration:	24 months	
Technical domain:	Design Tools and Production	
Website:	http://www.teamplay-project.eu	
Coordinator:	Dr Sven Maertens	
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	Envisa SAS	FR
	FOI – Totalforsvarets Forskningsinstitut	SE
	Manchester Metropolitan University	UK
	AEA Technology plc.	UK
	Anotec Consulting SL	ES
	Ingenieurbuero Janicke	DE

CERC – Cambridge Environmental Research Consultants Ltd	UK
COMOTI – Institutul National de Cercetare-Dezvoltare Turbomotoare	RO
SNECMA – Société Nationale d'Étude et de Construction de Moteurs d'Aviation SA	FR
Airbus Operations SAS	FR
Rolls Royce plc	UK
University of Cambridge	UK
ENAC – Ecole Nationale de l'Aviation Civile	FR
Taks B.V.	NL
National Aviation University	UA
Limited Skies	UK

X-NOISE EV

Aviation Noise Research Network and Coordination

State of the Art – Background

X-NOISE EV, through its network structure and comprehensive work plan addresses the noise challenges faced by aviation. As such, it is significantly contributing to the objectives of reducing aircraft noise by 10 dB per operation as set by the ACARE Vision2020, while addressing key factors associated with airport noise issues.

Through a new phase of consolidation and development, X-NOISE EV (for EVolution) is aimed at pursuing the activities of the former Aircraft Exterior Noise Research Network (X-NOISE). The basic concept behind the project is set on three pillars, each involving a dedicated set of coordination and networking activities:

- strategic domain: definition and assessment of research strategies;
- dissemination domain: dissemination and communication activities;
- integration of research community: development of a research community network.

Objectives

To support the three-pillar approach, the project will address the following objectives:

- evaluate project results on aviation noise and assess their contribution to the state of the art;
- formulate low-noise operations, and improve understanding and modelling of the impact of aircraft noise in the community, including environmental interdependencies; this will be achieved through the development of common strategies with national activities and the identification of priorities and key topics for future projects aimed at noise reduction at source;
- ensure dissemination and exploitation of research findings, including technical information aimed at regulatory bodies and policy-making agencies;
- contribute to an improved integration of the European Aircraft Noise Research Community through a network of national focal points that cover all countries with a technical interest in aviation noise;
- identify potential reinforcement of future project partnerships through extended international networking and dedicated processes to foster new collaborations and promote novel ideas.

Description of Work

The project is divided into work packages (WP):

- strategic domain: WP1 and 2;
- dissemination domain: WP3 and 4
- integration of the research community: WP5.

More specifically, WP1 deals with the definition and assessment of research strategies aimed at reducing noise at source. The emerging issue of general aviation noise is also investigated.

WP2 elaborates the strategy for the technical areas concerned with a balanced approach and impacts (noise abatement procedures, annoyance, etc.).

WP3 focuses on scientific exchanges within the technical community. A publications database will also be kept online and regularly maintained. Closer links will be developed with international conferences to promote the presentation of EU project achievements by way of dedicated sessions.

WP4 coordinates the project activities associated with communication and knowledge management.

WP5 addresses transverse activities aimed at a better integration of the aviation noise research community. A national network will provide local organisations with better information and exchange capabilities, for the consideration of contributions to EU projects and national initiatives. Co-operation with associated regions outside the EU will be promoted.

WP6 handles the project outreach effort: i.e. the establishment of network committees and the organisation of international co-operation seminars.

Expected Results

The following achievements are expected from the three project aspects:

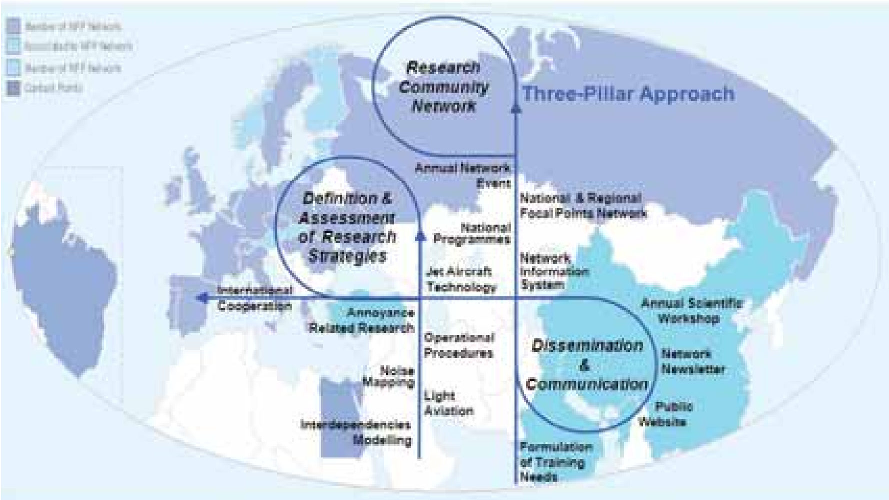
Strategic domain:

- gap analysis and recommendations on research priorities concerning technology solutions, noise abatement procedures, annoyance-related research, noise mapping techniques and interdependency modelling;

- established methodologies to support ACARE's noise goal assessments;
- recommended approach for coordinating the European interdependencies modelling framework;
- recommendations for international co-operation in the balanced approach and impacts area.

Dissemination domain:
- annual scientific workshops;
- periodic network newsletter;
- detailed public website;
- contribution to the International Civil Aviation Organisation's noise technology review;
- recommendations on how to address training needs.

Integration of research community:
- national workshops and active exchanges for all countries involved in the National Focal Points network;
- regional workshops for South America, the Mediterranean and the Balkans;
- annual full network meeting;
- calls to contribute to the innovation bank.



Scope of European Aviation Noise Research Network activities

Acronym:	X-NOISE EV
Name of proposal:	Aviation Noise Research Network and Coordination
Grant Agreement:	265943
Instrument:	CSA – CA
Total cost:	2 227 745€
EU contribution:	1 997 976€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.12.2010
Ending date:	30.11.2014
Duration:	48 months
Technical domain:	Noise and Vibration
Website:	http://www.xnoise.eu

Coordinator: Dr Dominique Collin
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Manchester Metropolitan University	UK
Airbus Operations SAS	FR
DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
To70 B.V.	NL
GFIC SARL	FR
University of Southampton	UK
Alenia Aeronautica S.p.A.	IT
Creo Dynamics AB	SE
TsAGI – Federal State Unitary Enterprise – Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
FFT – Free Field Technologies SA	BE
ILOT – Instytut Lotnictwa	PL
COMOTI – Institutul National de Cercetare-Dezvoltare Turbomotoare	RO
EPFL – Ecole polytechnique fédérale de Lausanne	CH
INASCO – Integrated Aerospace Sciences Corporation O.E.	GR
Safran Engineering Services	FR
Budapesti Muszaki Es Gazdasagtudomanyi Egyetem	HU
CVUT v Praze – Ceske Vysoke Uceni Technicke v Praze	CZ
VGTU – Vilniaus Gedimino Technikos Universitetas	LT
TCD – Provost Fellows & Scholars of the College of the Holy and Undivided Trinity of Queen Elizabeth Near Dublin	IE
IST – Instituto Superior Técnico	PT
National Aviation University	UA
Ain Shams University, Faculty of Engineering	EG
Universidade Federal de Santa Catarina	BR

AIRCRAFTFIRE

Fire-risk Assessment and Increase of Passenger Survivability

State of the Art – Background

Safety aboard aircraft is one of the main preoccupations of aircraft manufacturers and airline companies. For 20 years, the fire threat in aeronautics has decreased, but more efforts are still necessary to reduce the incident/accident rate and increase passenger and crew survivability. The fire impact must be re-evaluated for the new generation of aircraft (A350 or B-787 types) by considering the increased use of composite materials for hull, wing and structure, thermal heat-release during fire, and the growth of the electrical power required by electronics and avionics equipment.

The aeronautic regulations, based on results of standard tests applied on the aircraft materials, cannot provide a complete answer to the fire threat evaluation and its consequences. Despite previous Sixth Framework Programme studies, progress depends essentially on determining the composites flammability and burning properties required to predict the fire threat and enhance fire prevention and protection. The AircraftFire approach is for a better knowledge, by experiments and numerical modelling, of the main fire origins, the development of individual and global events involved during aeronautical fires, and the efficiency of the fire management and passenger evacuation.

Objectives

AircraftFire addresses important questions:

- Do composites aboard the aircraft induce more fire threat;
- Does the fire growth velocity increase to engulf the entire cabin;
- Does the time of flashover, which generally marks the end of the survivability of passengers within the cabin, change.

The objective of AircraftFire is to highlight contributions to reduce the impact of in-flight (cabin or engine fires) or post-crash fires on the survivability of passengers in the new generation of aircraft. The need for additional knowledge will be achieved by academic research in partnership with aeronautical stakeholders.

The project will identify the new fire hazards, determine the key flammability and burning properties of materials for fuselage, wing and structure skins, thermo-acoustic insulation, cabin panel materials, cabling, ducting, carpet and seats, propose new solutions to aircraft manufacturers, and evaluate the efficiency of present regulations and protocols. It will introduce innovations in passive fire prevention and protection, including efficient detection and extinguishing systems to allow a safe landing and evacuation. The project will use the key material flammability properties, together with experimental aeronautical fire scenarios, for the numerical simulation of possible fires and of passenger evacuation.

Description of Work

The project is built on five scientific and technical work packages (WP).

WP1: fire threat analysis. It provides a database analysis of aircraft incident/accident caused by fire or causing fire. Major generic fire scenarios are investigated and the composites used in new-generation aircraft are selected.

WP2: fire prevention. It provides the critical information for the flammability and toxicity properties required to compare the performance of new composite materials with previously used materials where most incident data is available.

WP3: fire protection. Fire conditions and smoke generation are considered in fire configurations representative of real scenarios using and validating the property data determined in WP2. New advanced sensors will be capable of avoiding false alarms due to dust or cargo condensation.

WP4: fire growth and evacuation modelling. This identifies the weak and strong points of fire safety aboard the aircraft where the fuel load corresponding to the composites can be greater than the kerosene output power. The simulations should optimise procedures both during the aircraft design and crew training.

WP5: results. The results and findings will be transferred to the aircraft designers and aviation authorities to provide decision support for the choice of materials based on their mechanical, flammability, burning and toxicity properties.

Expected Results

AircraftFire will:
- evaluate the new fire threat induced by the massive use of composites in aeronautics;
- provide flammability, toxicity and burning properties of the materials required for modelling;
- evaluate the efficiency of new multi-criteria fire detectors and suppression systems to fight fires and reduce false alarms;
- provide a numerical tool for predicting fire growth and passenger evacuation.

The experimental and numerical approach of AircraftFire will provide aircraft designers and manufacturers and airline companies with the knowledge and tools to reduce the fire threat to the passenger survivability during in-flight or post-crash fires.

Acronym:	AIRCRAFTFIRE	
Name of proposal:	Fire-risk Assessment and Increase of Passenger Survivability	
Grant Agreement:	265612	
Instrument:	CP – FP	
Total cost:	4 200 557€	
EU contribution:	3 220 690€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.01.2011	
Ending date:	31.12.2013	
Duration:	36 months	
Technical domain:	Systems and Equipment	
Website:	http://www.aircraftfire.eu	
Coordinator:	Dr Jean-Michel Most	
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Partners:	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
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	EADS Deutschland GmbH	DE
	CAA – Civil Aviation Authority	UK
	Haskoli Islands	IS
	University of Greenwich	UK
	University of Ulster	UK
	INSA – Institut National des Sciences Appliquées de Rouen	FR
	University of Patras	GR
	TU Delft – Technische Universiteit Delft	NL
	University of Edinburgh	UK

ARISTOTEL

Aircraft and Rotorcraft Pilot Couplings – Tools and Techniques for Alleviation and Detection

State of the Art – Background

Aircraft and rotorcraft pilot couplings (A/RPC) are aircraft oscillations originating from adverse couplings between the pilot and the aircraft. These can range in severity from benign to catastrophic: benign A/RPC affect the operational effectiveness of a mission, degrading the aircraft's handling qualities; catastrophic A/RPC result in the loss of the aircraft and the lives of those on board.

Known as pilot-induced (PIO)/pilot-assisted oscillations (PAO) until 1995, A/RPC have always been an area of concern for engineers. PIO occur when the pilot inadvertently applies control inputs that are essentially in the wrong direction or have a significant phase lag with respect to the vehicle response. PAO are higher frequency aircraft oscillations related to the pilot's involuntary bio-mechanical control inputs.

It is clear these days that the pilot is not at fault and that it is the rapid advance in the field of flight control systems (FCS) that has increased the sensitivity of the pilot-vehicle system to appear as unfavourable A/RPC events. Also, rotorcraft pilot coupling (RPC) seem significantly more problematic for safety than aircraft pilot coupling (APC) because their particular characteristics and missions make them more prone to adverse couplings than aircraft.

Objectives

The main goal is to design the tools and methods capable of preventing and detecting A/RPC at their onset. Six key problems related to A/RPC analysis were identified:

1. How to determine whether a particular event is an A/RPC when analysing aircraft oscillatory behaviour.
2. The pilot models used during A/RPC analysis need improving. There is a shortage of both quantitative pilot behavioural models and understanding of all the possible interactions between the FCS and the pilot.
3. Current rotorcraft modelling for RPC analysis is rather limited to the particular case analysed and does not consider other interactions existing between aerodynamics, structures and other control systems.

Simulators used in ARISTOTEL

4. There have been numerous attempts to define design criteria that will result in an aircraft that is free of RPC tendencies. Many of these criteria started as handling quality criteria or focused upon highly augmented fast-jet military aircraft. Despite these efforts, A/RPC events have stubbornly refused to go away. Highly augmented rotorcraft are becoming more prevalent and the supposition is that the propensity of RPC event encounters will increase.
5. Current simulator and flight tests do not possess the proper practices to unmask the A/RPC signature.
6. There is no coherent design guide or simulator guideline available to the designer for unmasking A/RPC.

Description of Work

A/RPC phenomena have been divided into two groups based on the characteristic frequency range of such phenomena, i.e. rigid body and aero-elastic A/RPC. Rigid body A/RPC are oscillations in the bandwidth up to 1 Hz for aircraft and 3.5Hz for rotorcraft. Aero-elastic A/RPC are oscillations in the bandwidth 2-8Hz. It is thought that a parallel rigid body/aero-elastic approach may enhance the understanding of A/RPC phenomena in the critical range of 1-3.5 Hz where many accidents have been observed. The project is divided into five technical work packages (WP).

WP1 provides the necessary background for the definition and understanding of A/RPC events of both existing and future aircraft/rotorcraft configurations.

WP2: Rigid body modelling and predictions and aeroelastic modelling and predictions (WP3) are organised as a parallel stream of study. The aim is to advance the state-of-the-art for A/RPC prediction by simulating, predicting and validating A/RPC events for the entire spectrum of critical frequencies of pilot/vehicle interactions (usually between 1-10Hz).

WP4 performs simulator tests triggering the A/RPC and measurements of the bio-dynamic pilot behaviour in four simulator facilities that are available to the consortium.

WP5 provides the designer with guidelines as to how to model and unmask such phenomena in the simulator.

Expected Results

The results of the project will be:
- advanced vehicle-pilot-FCS simulation models for both rigid body and aeroservoelastic A/RPC analysis;
- A/RPC design guidelines and criteria;
- protocols and guidelines for A/RPC flight simulator training.

The training protocols in the simulator for A/RPC will also be developed with regard to:
- the types of simulated flight tasks that training organisations should perform to demonstrate A/RPC events to pilots;
- piloting techniques that will avoid A/RPC events occurring during flight;
- how to identify that an A/RPC event is in progress;
- the recommended techniques for dealing with an A/RPC event once it is identified.

All these results will be useable by the aerospace industry in the design process for improving flight safety. Since the project is not focused on specific types of aircraft or specific designs, many of the working documents and expected outcomes will be made available to the public.

Acronym:	ARISTOTEL
Name of proposal:	Aircraft and Rotorcraft Pilot Couplings – Tools and Techniques for Alleviation and Detection
Grant Agreement:	266073
Instrument:	CP – FP
Total cost:	3 843 228€
EU contribution:	3 003 652€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.10.2010
Ending date:	30.09.2013
Duration:	36 months
Technical domain:	Avionics, Human Factors and Airports
Website:	http://www.aristotel.progressima.eu/
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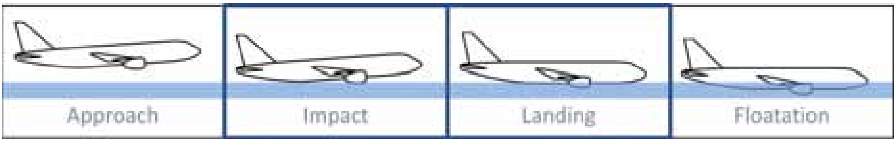
	Politecnico di Milano	IT
	Università degli Studi Roma Tre	IT
	University of Liverpool	UK
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	SC STRAERO SA	RO
	TsAGI – Federal State Unitary Enterprise – Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
	EURICE – European Research and Project Office GmbH	DE

SMAES
Smart Aircraft in Emergency Situations



Phases of aircraft ditching

State of the Art – Background

The certification requirements for ditching safely are primarily devoted to minimising the risks for immediate injuries and providing fair chances for the occupants to evacuate.

The ditching process can be categorised into four phases: approach, impact, landing and floatation (see figure). The flotation phase is crucial for the evacuation of occupants, and is influenced by aspects of the initial three phases. The approach phase provides the initial altitude and speed. The subsequent impact and landing phases are primarily influenced by the high forward velocity, yielding severe hydrodynamic loads on the aircraft, with effects such as cavitation, ventilation and suction significantly influencing the dynamic response. The high forward velocity and related effects pose a severe challenge to computational modelling of the hydrodynamic loads, as well as experimental validation where effects such as cavitation are not seen in model scale tests.

Today's drive towards greener, safer, and lower cost aircraft requires manufacturers to consider innovative solutions and new structural concepts. A consequence is that empirical methods, traditionally used to design and substantiate aircraft with respect to emergency situations, become obsolete. New methodologies and predictive numerical tools are then necessary to mitigate safety and economical risks with innovative designs.

Objectives

The overall objective of the SMAES project is to develop a set of simulation tools that will permit cost-effective design and entry-into-service of aircraft able to protect its occupants in emergency situations, specifically ditching. These tools will allow manufacturers to:
- improve models to reduce test costs;
- reduce calculation and design costs;
- increase innovation towards safer, lighter and lower cost structures;
- anticipate future substantiation requirements.

The aeronautics design community requires a set of simulation tools for ditching that are appropriate for use at the different stages of the design and certification process. Of special interest is the behaviour of future composite structures compared to classic metallic ones, as the use of composites may lead to structures that respond differently to ditching loads. In support of this, SMAES will improve the existing simulation tools so that they are capable of more accurately handling the complex behaviour of the fluid and fluid-structure interaction in the water impact analysis problem.

Description of Work

SMAES is divided into three technical work packages (WP).

WP2 concentrates on numerical methods for modelling relevant water behaviour. The main purpose here is to extend existing simulation tools for fluid behaviour to allow the effective calculation of fluid loads on an aircraft structure during ditching.

WP3 concentrates on structural behaviour including coupled fluid-structure response. It is divided into three main tasks. The first task involves the structural models where the requirement is to include non-linear transient structural response to water impact within large-scale structural models. In the second task the structural models will be coupled with the fluid models from WP2. The outcome of this task will be the validated methodologies to perform fluid structure coupled with aircraft ditching simulations, which is the main objective of the project. In the final task, two industrially-led test cases will be used to evaluate and demonstrate the capability to model innovative structural components under ditching loads.

WP4 provides experimental data to support WP2 and 3 where existing data is inadequate or non-existent. A guided impact facility will be developed to provide water impact experimental data for impact velocities in excess of 30 m/s with a low impact angle. WP4 will also provide experimental data required for the two WP3 industrial demonstrations.

Expected Results

The specific results of the SMAES project will be:

- a set of validated and demonstrated modelling techniques for the ditching analysis. From semi-analytical methods allowing cost-effective calculation of global loads through to detailed methods suitable for prediction of the local loads on a deforming structure;
- an improved understanding of the complex physical phenomena occurring during aircraft ditching;
- new experimental data, extending the range of conditions covered by current published data.

The overall outcome of the SMAES project will be advanced simulation tools to support aircraft development from pre-project phase to certification. These will contribute to improved aircraft safety by providing designers with the tools to understand and optimise the ditching response. They will also contribute to the reduction in aircraft development costs by allowing innovation and enhanced optimisation of aircraft structures, and by reducing the test duration and costs related to safety validation.

Acronym:	SMAES	
Name of proposal:	Smart Aircraft in Emergency Situations	
Grant Agreement:	266172	
Instrument:	CP – FP	
Total cost:	5 732 492€	
EU contribution:	3 828 125€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.02.2011	
Ending date:	31.01.2014	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.smaes.eu/	
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EC Officer:	Michail Kyriakopoulos	
Partners:	TU Dresden – Technische Universitaet Dresden	DE
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	EADS – Construcciones Aeronauticas SA	ES
	Airbus Operations GmbH	DE
	Alenia Aeronautica S.p.A.	IT
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	INSEAN – Istituto Nazionale per Studi ed Esperienze di Architettura Navale	IT
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR

ESI Group SA	FR
Altair Engineering France SARL	FR
University of East Anglia	UK
University of Patras	GR
CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
TUHH – Technische Universitaet Hamburg-Harburg	DE

SVETLANA

Safety (and maintenance) Improvement through Automated Flight-data Analysis

State of the Art – Background

The SVETLANA project is an EU-Russia co-operation in the field of aviation safety and maintenance improvement. The project is aimed at improving the capabilities of flight-data monitoring programs for civil aviation.

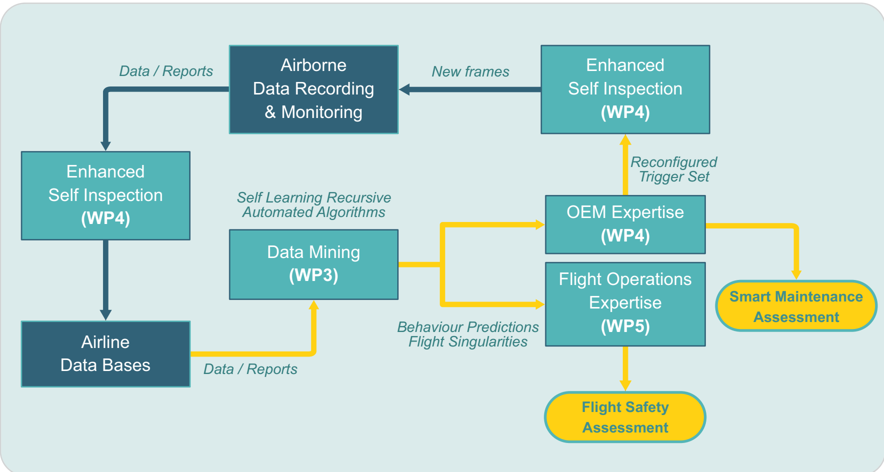
The aviation industry is continuously challenged to improve the aviation safety record even further. An important instrument in this field is expected to be the introduction of new advances in flight-data monitoring programs.

Over recent years, the volume of recorded flight data has increased so significantly that analysis tools are challenged to keep up. Although the flight-data monitoring (FDM) systems of today allow operators to gain a good understanding of their flight operation, the full potential of the available data can often not be released due to limitations in analysis capacity. Deeper analysis of each flight has shown that there is a) a need for an important amount of expert involvement, b) a lack of analysis standards and c) that current practice uses predefined analysis models.

Objectives

In response to these challenges, the SVETLANA project has been initiated with the following objectives:

- to improve flight safety: SVETLANA will design an automated and standardised flight-data management cycle that is capable of routinely processing large amounts of data from various sources in order to improve flight safety evaluation.
- to improve maintenance support: The customisation of the FDM cycle anticipates additional benefits to support smart maintenance processes; airline operations and maintenance departments will be informed about a potentially unsafe situation and how to detect it.
- to analyse more flight data to a more extensive level: This will lead to the reduction of expert involvement by qualifying the singularities detected automatically (and not preselected by experts). As a result, human intervention will be used only to validate critical decisions for flight safety and maintenance enhancements.
- to provide feedback to inform stakeholders and improve FDM processes: SVETLANA will refine the search of singularities that have not been selected for immediate risk mitigation. The most appropriate



Overall process of the SVETLANA project

parameters for monitoring will be selected and, when possible, confirming the event.
- to update the FDM process to enhance flight-data analysis: This is a very innovative approach as it develops the FDM process to be able to adapt to new trends.

Description of Work

The SVETLANA concept is based on a two-step methodology: a highly automated flight-data analysis phase, followed by a short expert assessment when abnormalities are detected.

The first phase of analysis will use intelligent algorithms with self-learning capabilities that are able to analyse all available flight data and at a deeper level. SVETLANA will use automated flight-data processing tools based on advanced algorithms for knowledge extraction from the data. These algorithms will be designed to identify fault signatures and predict abnormal behaviour.

SVETLANA will also be designed to include a feedback loop that aims at detecting future events more efficiently. The closed loop approach will update the FDM process on the basis of previous findings from the flight-data analysis.

By using a higher frequency, the time taken for feedback to reach the relevant stakeholders will be shorter. The concept of SVETLANA will be designed to be adaptable to the existing FDM systems by providing a modular architecture to introduce the new flight-data processing capabilities. With this approach, the technology can be implemented with a minimum of additional investment in training and integration. This innovation aims at providing new standards to the FDM process, with a complete and systematic data processing that allows 100% analysis of all flight data.

Expected Results

The architecture and all contributing software components can be used to implement a distributed flight-data analysis system, open to a variety of data processing and standard compliance between Europe and Russia.

In addition, the data sources are expected to be linked to stakeholder systems in order to integrate contextual information, e.g. weather conditions, flight plans, in-house safety management systems, etc.

SVETLANA will allow significantly more flight data to be processed with the same or even less effort than before.

The SVETLANA process will allow other programs to be introduced that will improve flight operations on the basis of flight-data analysis. The potential areas where advanced flight-data analysis might bring economical viable improvements are expected to be fuel consumption optimisation, training programme updates, training programme assessments, updating existing flight operations with additional indications on flight safety, etc. By introducing these results, significant gains are expected in the field of flight safety but also in the area of maintenance-related data processing.

By providing a proposal for the introduction of standards, the implementation of SVETLANA will ease flight-data analysis and enable a comparison of results between peer groups of operators, something not currently possible.

Acronym:	SVETLANA	
Name of proposal:	Safety (and maintenance) Improvement through Automated Flight-data Analysis	
Grant Agreement:	265940	
Instrument:	CP – FP	
Total cost:	3 920 503€	
EU contribution:	1 299 517€	
Call:	FP7-AAT-2010-RTD-RUSSIA	
Starting date:	01.08.2010	
Ending date:	30.09.2012	
Duration:	26 months	
Technical domain:	Design Tools and Production	
Website:	http://www.svetlanaproject.eu/	
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Partners:	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Lancaster University	UK
	UAC – United Aircraft Corporation JSC	RU
	JSC Concern Avionica	RU
	Federal State Unitary Enterprise – Institute of Aircraft Equipment	RU
	Alma Consulting Group SAS	FR

ACTUATION2015

Modular Electro Mechanical Actuators for ACARE 2020 Aircraft and Helicopters

State of the Art – Background

The all-electric aircraft is a major target for the next generation of aircraft and helicopters to lower consumption of non-propulsive power and thus fuel burn. Compared to hydraulic and pneumatic systems, electrical actuators only need to be powered when they are used and the power supply is subject to fewer losses and is lighter to distribute.

The all-electric aircraft is consequently a key means to achieve ACARE 2020 objectives at the systems level if the current technological, economical and reliability barriers (i.e. electronics) can be resolved.

A key challenge in this process, which will be addressed in this project, is to make electromechanical actuators (EMAs) available. These are made of standardised modules and can replace or eliminate costly-to-maintain, heavy and energy-consuming hydraulic circuits and actuators. This technology can be adopted providing such EMAs will address the current airframer requirements with regard to cost and weight.

Objectives

The objective of ACTUATION 2015 is to develop and validate a common set of standardised, modular and scalable EMA modules that address cost, reliability and weight requirements from the airframers.

These EMA modules will enable:
- a reduction of the overall life cycle costing (LCC) (development, acquisition, certification, maintenance, operation);
- an improvement of the reliability and the quality;
- a reduction of the overall system weight;
- increased safety margins.

ACTUATION 2015 will innovate through:
- modularity: move from custom-made actuators to actuators made from standard off-the-shelf modules by using a standardised design process and a common validation method and tools;
- module sharing: design electric actuation functions as part of a global aircraft electrical architecture rather than single and independent functions sharing modules, support redundancy and save weight-addressing actuation functions at an aircraft level rather than at an equipment level;
- standardisation: identify and specify a set of EMA building blocks (modules) that can be standardised and thereby facilitate multiple sources of module supply, and lower EMA certification and acquisition costs.

The project will also improve the technology readiness up to level 5 (TRL 5) while preparing qualification and standardisation material.

Description of Work

The project will gather detailed airframer requirements, specify a set of standard modules and develop module and EMA prototypes for assessment at component and actuator level through rig tests and the virtual validation of modules. In parallel, a unified EMA design process supported by standard methods and tools will also be developed.

The project will address a large range of aircraft families, including business, regional and large commercial aircraft as well as helicopters, and systems, including primary and secondary flight controls for lift, the main landing gear, doors and thrust reversers.

There will be two approaches:
- top-down, using the airframer partners' expertise for the definition, specification, standardisation, architecture optimisation and validation of modules and EMAs;
- bottom-up, developing innovative and improved technologies necessary to achieve cost, reliability and weight targets, via new materials, anti-corrosion and lubrication techniques, system health monitoring, motor design and power management.

The validation and verification activities will take into account the needs and architectural differences in the aircraft and helicopter applications. They will be performed through physical and virtual prototypes including linear and rotary EMAs for primary flight control, nose wheel steering, main landing gear and secondary flight control.

Expected Results

ACTUATION 2015 will deliver the following:
- standards and modular EMA products, tools and methods that are ready to use with the outputs of the CLEAN SKY System for green operation (SGO), making the necessary technology available to develop the all-electric aircraft;

- new mature actuation technologies (TRL 5):
  - improved sensor technologies;
  - new control and power management techniques;
  - standardised and enhanced health and usage monitoring;
  - mechatronic solutions applicable to aircraft environmental conditions;
- common standards and shop-replaceable units or line-replaceable units;
- commonality and scalability in the qualification process, providing credit for certification:
  - qualification methods;
  - database of component technologies and processes.

This will result in the creation of standardised modular hardware families, interfaces and software environments enabling the development and production of modular EMA technologies.

ACTUATION 2015 will enable the market development of EMA and the implementation of the all-electrical aircraft with a faster design, lower LCC, improved reliability and lower weight, thereby addressing the needs for more affordable and greener transports. The first priority is to target the next generation of short-range aircraft, a market of tens of thousands of aircraft that represents close to 500 000 jobs in Europe.

Acronym:	ACTUATION2015	
Name of proposal:	Modular Electro Mechanical Actuators for ACARE 2020 Aircraft and Helicopters	
Grant Agreement:	284915	
Instrument:	CP – IP	
Total cost:	34 799 852€	
EU contribution:	20 225 884€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.11.2011	
Ending date:	31.10.2014	
Duration:	36 months	
Technical domain:	Systems and Equipment	
Website:	http://www.actuation2015.eu	
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	Airbus Operations Ltd	UK
	Airbus Operations SAS	FR
	Alenia SIA S.p.A.	IT
	ARTTIC	FR
	BAE Systems (Operations) Ltd	UK
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	Centre d'Etudes et de Recherches pour les Techniques Industrielles Appliquées SA	FR
	CISSOID S.A.	BE
	Clemessy SA	FR
	CEN – Comité Européen de Normalisation	BE
	CESA – Compañía Española de Sistemas Aeronáuticos	ES

Crompton Technology Group Ltd	UK
DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
EADS Deutschland GmbH	DE
Euro Heat Pipes SA	BE
Eurocopter Deutschland GmbH	DE
Fokker Landing Gear BV	NL
Fundación Tecnalia Research & Innovation	ES
Fundación Tekniker	ES
Goodrich Actuation Systems Ltd	UK
Goodrich Control Systems Private Unlimited Company	UK
Harmonic Drive AG	DE
Hispano-Suiza SA	FR
Hottinger Baldwin Messtechnik GmbH	DE
INSA – Institut National des Sciences Appliquées de Toulouse Insat	FR
Liebherr-Aerospace Lindenberg GmbH	DE
MTA SZTAKI – Magyar Tudomanyos Akademia Szamitastechnikai es Automatizalasi Kutato Intezet	HU
Meggitt (Sensorex) SAS	FR
Messier-Bugatti SA	FR
Messier-Dowty Ltd	UK
Microsemi Power Module Products SAS	FR
Naturen Industrial Informatics and Trading Ltd.	HU
Navarra de Componentes Electrónicos SA	ES
ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
Paragon Anonymh Etaireia Meleton Erevnas Kai Emporiou Proigmenhs Texnologias	GR
Piaggio Aero Industries S.p.A.	IT
Politecnico di Torino	IT
Ratier Figeac	FR
Rollvis SA	CH
Saab Aktiebolag	SE
Sagem Défense Sécurité	FR
Sagentia Group Ltd	UK
SENER Ingenieria y Sistemas SA	ES
SKF Aerospace France	FR
NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
TUHH – Technische Universitaet Hamburg-Harburg	DE
TUM – Technische Universitaet Muenchen	DE
Thales Avionics Electrical Motors SAS	FR
University of Nottingham	UK
Umbra Cuscinetti S.p.A.	IT
UNIS a.s.	CZ
University of Newcastle upon Tyne	UK
Piher Sensors and Controls SA	ES

AFDAR
Advanced Flow Diagnostics for Aeronautical Research

State of the Art – Background

The need for radical improvements in the efficiency and reliability of air transportation has been clearly identified in Europe.

Supporting the ambitions of European aeronautics to play a prime role in shaping the future of aviation means that breakthroughs in technological innovation and developments are required which involve upstream research.

The safer, greener and smarter aircraft that meet the targets to cut fuel consumption, reduce greenhouse gas and acoustic noise are yet to be designed and built. This will require diagnostic tools that are able to deliver more detailed and reliable information on the physical mechanisms at the basis of propulsion and aerodynamic performance.

Most analyses are based on steady-state conditions. Unsteady or transient phenomena, like flow separation, aero-acoustic noise and combustion instabilities, require a new generation of experimental techniques that are able to visualise and understand these phenomena before they are introduced in computer-based simulations for system optimisation.

Image-based laser measurements, in particular particle image velocimetry (PIV), are able to detect these phenomena. The last decade has seen their introduction for tests at industrial scale, showing a great potential to describe the details of flow behaviour. The challenge here is the development of novel and more effective configurations.

Objectives

AFDAR aims at a number of breakthroughs in experimental methods. The objectives are driven by the fact that, currently, measurement techniques based on the 'light-sheet' concept are mostly possible at a low-repetition rate, over a two-dimensional domain and with limited spatial resolution.

The main focus is on volume-resolving (3-D) measurements that are based on the recently introduced tomographic reconstruction technique. This will make the 'data interpretation' less important when analysing three-dimensional configurations (e.g. wing-tip vortices, turbulent separation).

The introduction in an industrial environment of diode-pumped lasers and CMOS sensors has the potential to shift the measurement temporal resolution by three orders of magnitude and enable time-resolved measurements of unsteady flow effects. This type of system could revolutionise the way in which current experiments are performed and also dramatically reduce the testing time.

Long-range microscopy could enable measurements at unprecedented spatial resolution to unveil the details of the flow in proximity to the wall. Its feasibility at industrial scale will be investigated.

The combination of PIV and temperature measurements for combustion is a further objective of the project, along with their feasibility in an industrial environment.

Description of Work

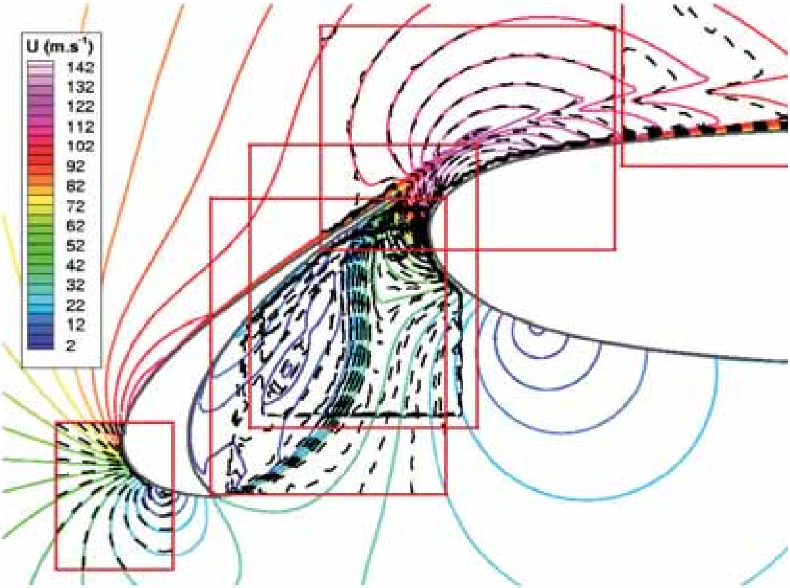
The project comprises four technical work packages (WP).

WP2 is devoted to the general assessment of 3-D measurements by tomographic PIV. Similar to medical tomography, but thousands of times faster, the tomographic system must capture the position and velocity of particle tracers within a few microseconds. The expected outcome is an objective definition of the system performance and practical criteria to design an experiment in a wind tunnel test campaign.

WP3 includes the investigation of kilohertz PIV and long-range micro-PIV. The work concentrates on how to extract the most information from data sequences acquired at high speed. This should determine the spatial resolution and accuracy of micro-PIV systems when operating at a distance comparable to that of the test section in industrial wind tunnels.

WP4 focuses on combustion diagnostics with laser-induced fluorescence (LIF) and laser-induced incandescence (LII) for the detection of soot formation in flames. The work package also includes a feasibility study on the combination of several measurement principles for the simultaneous measurement of the velocity field and the density or pressure field generated at the tips of helicopter blades.

In the final work package several experiments are performed on configurations of industrial relevance.



Comparison of PIV measurements and computer simulations on a multi-element airfoil. The experiments were conducted within the EUROPIV2 project.

Expected Results

The result will be a general-purpose platform for experimental diagnostics offering a substantial increase in productivity and, most importantly, an enlarged envelope of operations.

Validated high-quality data and robust measurement procedures will be delivered to support cutting-edge system optimisation, in particular when unsteady aerodynamic phenomena are expected, such as in the case of a large separation at landing in a high-lift configuration.

The result of the experiments will be highly suited to form a database for validation of computational fluid dynamics with unprecedented data related to transition, unsteady effects including fluid-structure interactions (flutter) and aero-acoustics.

AFDAR will contribute to the 'greening of air transport' by providing the necessary tools to visualise aerodynamic phenomena as yet only modelled. The 'awareness' of the flow physics is the basis for understanding system behaviour. This is needed to build confidence in the design of more innovative and daring concepts and break through the conventional design scheme.

The consortium will act as the group of reference for the development and assessment of PIV and other activities that include worldwide comparisons of the measurement algorithms undertaken in the project. AFDAR will contribute towards consolidating the leading role of European research in this area.

Acronym:	AFDAR	
Name of proposal:	Advanced Flow Diagnostics for Aeronautical Research	
Grant Agreement:	265695	
Instrument:	CP – FP	
Total cost:	4 018 236€	
EU contribution:	2 660 000€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.11.2010	
Ending date:	31.10.2013	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.afdar.eu	
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EC Officer:	Marco Brusati	
Partners:	CNRS – Centre National de la Recherche Scientifique	FR
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	LaVision GmbH	DE
	UniBw – Universitaet der Bundeswehr Muenchen	DE
	Università degli Studi di Napoli Federico II	IT
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	VKI – von Karman Institute for Fluid Dynamics	BE
	Monash University	AU
	Kutateladze Institute of Thermophysics – Siberian Branch of the Russian Academy of Sciences – IT SB RAS	RU

AIM²

Advanced In-flight Measurement Techniques 2

State of the Art – Background

Flight testing new or modified aircraft is a necessary part of the design process and provides the final validation for the full-scale aircraft design. Flight-test certification is a critical phase because all the trials proving compliance with specifications and regulations must be completed in the shortest possible time, whilst maintaining high-quality standards in the certification process. Usually heavy instrumentation is installed to validate the predicted behaviour of the aircraft and also to detect unforeseen problems so that any modifications can be done quickly.

Optical measurement techniques can minimise the installation work and reduce the testing time as they are able to capture a huge amount of parameters within a short timeframe. AIM – Advanced In-flight Measurement Techniques, the preceding project, proved the principal feasibility of applying modern optical measurement techniques used in industrial wind tunnels to flight testing. It presented possibilities of measuring wing and rotor deformation, surface pressure distribution, heat distribution and flow velocity fields in a non-intrusive way and with minimal sensor set-up. AIM also identified major challenges that had to be dealt with before these advanced optical measurement techniques could progress from the research and development stage and become state-of-the-art measurement techniques for industrial use.

Objectives

This follow-up project, AIM², intends to further develop these measurement techniques so that they can be easily and routinely applied to in-flight testing with industrial demands. Whereas AIM proved the principal feasibility of using modern optical wind tunnel measurement techniques for in-flight measurements, AIM² focuses on developing reliable and easy-to-use dedicated measurement systems, and defines design and application rules for these new in-flight measurement techniques.

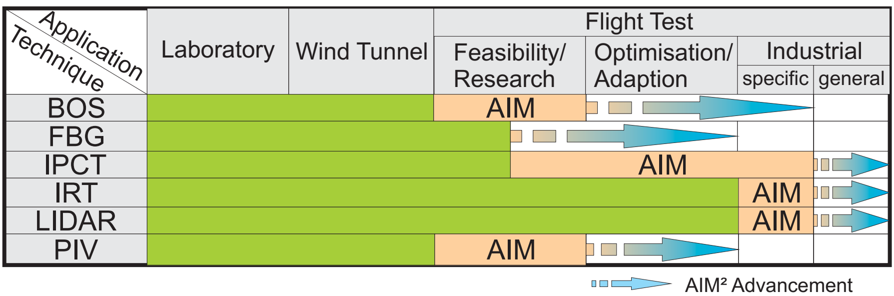
The prime objective is to enable aerospace industries to use such mobile measurement systems to reduce testing time and costs. Furthermore, design and application rules for the measurement techniques will be defined and the knowledge on how to apply these modern techniques effectively will be provided to interested parties from industry, research organisations, universities, training facilities and the authorities via publications, conferences, the project website and dedicated workshops.

Description of Work

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

WP1 covers project management.

WP2 focuses on deformation measurements on wings and control surfaces, and mainly deals with the



Development of advanced measurement techniques and expected progress within AIM² improvement of Image Pattern Correlation Technique (IPCT) and marker-based optical deformation techniques for measuring wing and control surface deformations in flight.

WP3 is devoted to improving IPCT and marker-based techniques for propeller deformation measurements, resulting in a Quantitative Visualization Technique (QVT) setup for 360° propeller deformation measurements.

WP4 expedites the improvement of a Fiber Bragg Grating (FBG) for surface pressure measurements and the development of unsteady IRT for transition and shock detection. In a step-by-step approach, both techniques are first developed in the laboratory; afterwards research flight tests with FBG and unsteady Infrared Thermography (IRT) will take place.

WP5 further enhances the optical measurement methods Particle Image Velocimetry (PIV) and Background Oriented Schlieren (BOS) for in-flight flow field measurements, and improves airspeed measurements based on Light Detection and Ranging (LIDAR) methods. In a stepwise approach, laboratory-level measurement set-ups will be transferred and adapted to different aircraft types and industrial applications.

WP 6 reviews the tested techniques, as well as creating useful tools and guides for an easy application of these techniques by non-experienced users.

Expected Results

AIM² intends to further develop advanced in-flight measurement techniques for industrial application, for example optical deformation measurement of wings or propeller blades, image-based flow-field measurements. Furthermore, it will deal with the creation of an application matrix and a toolbox for the measurement techniques developed in the project. The application matrix and the toolbox will be promoted during a flight-test workshop and will be utilised during several industrial measurement tasks. Parts of the final task report will constitute an easy-to-use guide for non-experienced users to apply optical measurement techniques to flight tests.

Acronym:	AIM²
Name of proposal:	Advanced In-flight Measurement Techniques 2
Grant Agreement:	266107
Instrument:	CP – FP
Total cost:	5 120 454€
EU contribution:	3 754 447€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.10.2010
Ending date:	31.03.2014
Duration:	42 months
Technical domain:	Design Tools and Production
Website:	http://aim2.dlr.de
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Partners:	Airbus Operations SAS	FR
	Avia Propeller s.r.o.	CZ
	Cranfield University	UK
	Evektor Spol. s.r.o.	CZ
	State Educational Institution of the Higher Vocational Education Moscow Power Engineering Institute (Technical University)	RU
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	Piaggio Aero Industries S.p.A.	IT
	Politechnika Rzeszowska Im Ignacego Lukasiewicza PRz	PL

ALASCA
Advanced Lattice Structures for Composite Airframes

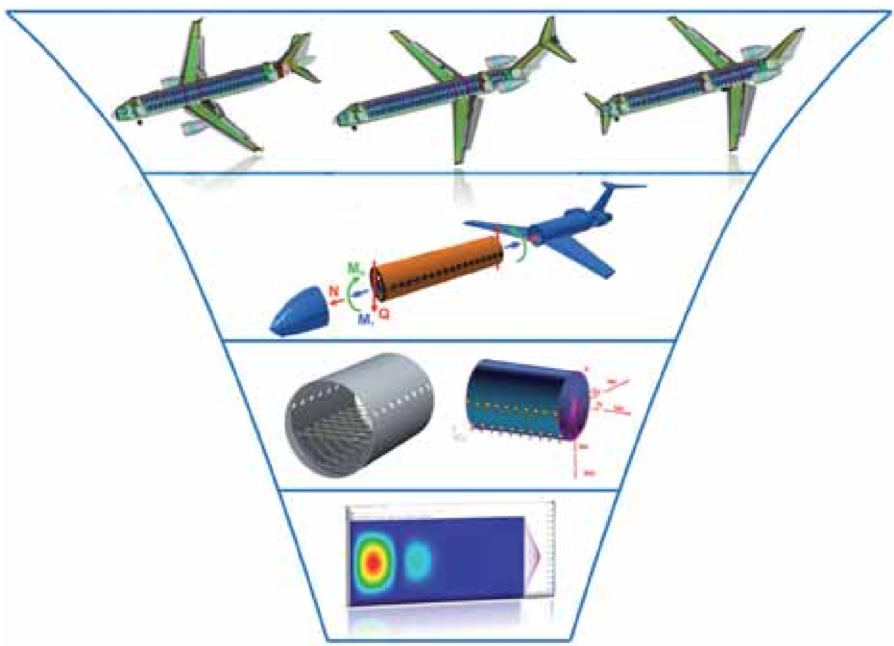
State of the Art – Background

Environmental and economic issues force future aircraft designs to maximise efficiency with respect to weight and cost in order to keep air transport competitive and safe. As metal designs reach a high degree of weight and cost efficiency, further potential for improvement can be seen, especially with extremely lightweight yet very strong and stiff fibre-reinforced composites. However, these materials demand a sophisticated layout, design and manufacture in order to fully exploit their immense potential and so be significantly advantageous when compared to metal designs.

To efficiently use the carbon-fibre-reinforced plastic (CFRP) available today, new design principles and technological concepts have to be developed. The use of highly integrated structures where the fibres are aligned with the load will maximise the mechanical properties of the design. Composite lattice filament-wound tubular structures are designed in this way, specifically for composite applications. They are a highly integral framework of geodesic ribs in circumferential, helical and axial directions. These structures have been successfully applied for years in Russian rocket technology due to their excellent strength and stiffness-to-weight ratio. Additionally, the new concepts also aim at reduced fastening, while satisfying stringent in-service requirements like reparability and robustness.

Objectives

ALaSCA focuses on the development of manufacturing optimised lattice fuselage structures, which maximise weight and cost reductions while fulfilling fundamental aspects of airworthiness. The approach of this project is to perform a comprehensive investigation into possible composite aircraft fuselage designs by taking



The project's workflow, from aircraft configuration to lattice-element analysis the beneficial geodesic design, which is well-proven in space technology, as its basis.

The main objectives of this research programme are:
- to achieve maximum weight and cost reductions through the use of lattice designs in fuselage structures;
- to develop optimised-lattice-design manufacture that satisfies airworthiness requirements;
- to verify airworthiness through manufacturing and testing of representative lattice components.

Description of Work

Since structural requirements and boundary conditions in rocket technology are quite different from those for aircraft fuselage design, the scope of this project covers design, sizing, manufacturing and testing of lattice structures.

The objectives will be achieved when solutions to the following issues are found in terms of layout, design, sizing, manufacturing and testing:
- identify pro-lattice aircraft configurations that achieve maximum weight and cost savings; also investigate potential industrial applications (evaluation on the basis of an A320);
- develop pro-lattice fuselage structure designs that fulfil specified airworthiness requirements;
- examine lattice fuselage-specific aircraft components, such as cut-outs, floor grid integration and fuselage interface;
- examine lattice elements under loading, such as internal pressures or impacts, with respect to service requirements;
- review and evaluate the developed concepts, apply the results and define the required future research activities.

Expected Results

ALaSCA, which offers a novel airframe design-concept, will directly impact European and Russian aeronautical development needs by achieving the following:
- pro-composite design leads to the exploitation of composite material and therefore to a weight saving of 25% when compared to the traditional fuselage structure;
- increasing safety through a damage-tolerant design;
- highly automated manufacturing that yields a high output and greatly reduced costs;
- the interaction of pro-composite design using geodesic technology, design of aircraft concepts and manufacturing resulting in efficient pro-composite-driven novel aircraft configurations based on geodesic fuselage structure.

ALaSCA strengthens the collaboration between leading European and Russian research centres, universities and the aeronautical industry.

Acronym:	ALASCA
Name of proposal:	Advanced Lattice Structures for Composite Airframes
Grant Agreement:	265881
Instrument:	CP – FP
Total cost:	3 431 752€
EU contribution:	1 350 260€
Call:	FP7-AAT-2010-RTD-RUSSIA
Starting date:	01.12.2010
Ending date:	30.11.2013
Duration:	36 months
Technical domain:	Aerostructures and Materials

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	The Central Research Institute for Special Machinery (CRISM)	RU
	Delft University of Technology (TU Delft)	NL
	SMR S.A. Engineering & Development	CH
	Airbus Operations SAS	FR
	European Aeronautic Defence and Space Company – Innovation Works (EADS-IW)	DE
	University of Leeds	UK
	The Educational Scientific and Experimental Centre of Moscow Institute of Physics and Technology (ESEC of MIPT)	RU
	Mendeleev University of Chemical Technology of Russia (MUCTR)	RU
	JSC Scientific and Production Enterprise Radar-mms (Radar)	RU
	Research Engineering Centre (NIK – Samara)	RU

CERFAC

Cost-effective Reinforcement of Fastener Areas in Composites

State of the Art – Background

The CERFAC project addresses many challenges faced in the growing use of composite structures, mainly the transfer of loads between composite parts through innovative designs for joining and assembly.

Today a rapid growth in composite applications for fuselage, wing and other structures (A380 28% and Boeing 787 50% content) has been achieved due to their superior 'specific' mechanical properties that allow weight and associated fuel consumption and pollution reductions. However, the substitution of metals with composites has presented formidable challenges to realise lighter, stiffer and stronger, damage-tolerant structures that are cost-efficient with regard to development, manufacturing, inspection or even operating costs.

A major design problem of composite is efficient joining systems for high performance aero-structures. Due to the large number of such interfaces in aircraft, a solution to these problems would be highly advantageous in terms of weight and cost reductions. It can be stated that current design practices result in non-optimal jointing systems that are poor in terms of weight penalties and cost efficiency. Consequently, composite designs are often rejected in favour of traditional metallic concepts.

Objectives

CERFAC's objectives are to increase the strength-to-cost ratio and damage tolerance of fastened areas in composites without weight, thickness and stiffness penalties, to reduce the number of fasteners (10% to 100% reduction) and the local thickening of fastener areas, and to minimise the manufacturing and assembly costs (20% reduction).

Technically, it will focus on the following:
- provide a catalogue of reinforcement solutions at the location of fastener holes (rivet holes, bolt holes) or edges leading to lighter, stronger and more damage-tolerant designs;
- introduce innovative and efficient joining concepts combining some of the investigated reinforcement solutions, thus supporting representative target applications.

These applications are:
- application 1: generic straps for assembling thin-walled structures (so-called butt straps or butt joints);
- application 2: final assembly of fuselage shells or barrels. During assembly, splices are generally used (adding significant weight), as well as a large amount of rivets (that increase the costs). The aims here are:
  - to lower the number of rivets used in butt joints and introduce new geometrical concepts of profiles;
  - to join the large components together with specific multifunctional profiles.
- application 3: transfer concentrated loads through thicker laminates or thickened zones of thin-walled parts.

Description of Work

Three levels of work distribution are used in the project in order to optimise its organisation and make sure that specific topics are supervised by the most appropriate partner:
- work packages (transversal activities);
- target applications (the driving force of the project);
- reinforcement solutions (specific developments).

Moreover, three essential tools of the project will be introduced:
- A manufacturing matrix which summarises all the manufacturing routes involved in the project, from the provision of materials to the delivery of samples, from E to B level.
- A test matrix that gathers all the information on the mechanical testing of specimen at different levels (from E to B).
- A technical sheet for each target application.

The work packages (WP) are defined in such a way as to follow a classical part-development procedure, from specification and requirement (WP1) to final assessment (WP5). Design, sizing and analysis phases (WP2) are followed by manufacturing (WP3) then testing of samples and parts (WP4) at different scales of the building-block approach.

Expected Results

CERFAC addresses the ACARE 2020 objectives that refer to the joining structures at the location of fastener areas:

- minimise the thickness increase in the fastener area – propose local strengthening mechanisms to achieve a decrease in material and labour costs;
- minimise the production-flow constraints to achieve decreases in tooling and labour cost;
- avoid material heterogeneity (e.g. in terms of stiffness, bearing, thermal behaviour) to achieve extra strength;
- display more tolerant failure behaviour, less abrupt, more progressive, with increased residual load-carrying capability after initial damage (i.e. more reliable structures);
- present complex profiles with 3-D reinforcement to achieve more damage tolerant, reliable structures);
- minimise the need and number of fasteners (fasteners for composite structures are very expensive).

This project will have an environmental positive impact, as well as an economic one. The use of carbon fibre reinforced plastic (CFRP) structures for airframe structures brings immediate weight savings if the parts can, indeed, be joined with confidence, thus reducing the aircraft fuel consumption with a direct impact on the environment.

CERFAC also makes safety (damage tolerance, strength) and cost efficiency (material, manufacturing and assembly costs, inspection costs) priorities to achieve more affordable air-transportation.

Acronym:	CERFAC	
Name of proposal:	Cost-effective Reinforcement of Fastener Areas in Composites	
Grant Agreement:	266026	
Instrument:	CP – FP	
Total cost:	6 739 059€	
EU contribution:	4 581 215€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.10.2010	
Ending date:	31.03.2014	
Duration:	42 months	
Technical domain:	Aerostructures and Materials	
Website:	http://www.cerfac-project.eu	
Coordinator:	Dr Janos Vajda	
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EC Officer:	Hugues Felix	
Partners:	SABCA – Société Anonyme Belge de Constructions Aéronautiques	BE
	VZLU – Vyzkumny a Zkusebni Letecky Ustav A.S.	CZ
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	EADS Deutschland GmbH	DE
	Eurocopter Deutschland GmbH	DE
	Universitaet Stuttgart	DE
	Dassault Aviation SA	FR
	EADS France SAS – European Aeronautic Defence and Space Company	FR
	University of Patras	GR

KTH – Kungliga Tekniska Hoegskolan	SE
NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
FHNW – Fachhochschule Nordwestschweiz	CH
ZHAW – Zurcher Hochschule fur Angewandte Wissenschaften	CH
Biteam AB	SE

COLTS

Casting of Large Ti Structures

State of the Art – Background

COLTS is aimed at dramatically improving the quality of large cast components for the aerospace industry in order to provide lower cost components with reproducible properties at the level required by the aerospace industry. Titanium (Ti) is currently very widely used in the aerospace industry and its use is increasing with the growing use of composite structures in airframes. This is due to the strong resistance of Ti alloys against galvanic corrosion when in contact with composite panels. The most commonly used route for the manufacture of aerospace components is thermomechanical processing. This is very expensive but the quality and reliability of the product and the enormous database built up gives this route a commercial advantage over powder processing and casting. Casting is potentially the most cost-effective process for producing a large volume of components, but the mechanical properties of cast components are at the lower end of all process routes and the scatter in properties is large; in the case of Ti alloys there are difficulties which make the production of cast products more difficult than for other metals and alloys.

In China, a large number of medium-sized components are currently manufactured using centrifugal casting, but the development of a commercially viable process, for components of the size envisaged in COLTS, has not yet been achieved.

Objectives

The COLTS project is aimed at developing and demonstrating improved centrifugal and gravity-investment casting of large, thin walled Ti alloy castings which eliminate the defects that are present in current large castings. Cost reductions will be achieved by improving the properties of cast products, by reducing the scatter in properties and by increasing the yield of the process. The production, including commercialisation of the large castings envisaged in this project, would mark an important step forward for the producers of castings and for end-users.

Description of Work

The casting of Ti alloys is extremely difficult for two linked reasons; firstly, molten Ti alloys are extremely reactive and melting them in a refractory crucible results in oxygen pick-up and consequent degradation of properties. Secondly, because of this reactivity, Ti alloys must be melted in cold wall crucibles – these crucibles have water-cooled copper walls which form a thin skull of solid Ti alloy, thus protecting the melt from contamination.

For large components such as aero-engine casings, the current route is gravity-casting into a static mould. Such cast components commonly have a large number of casting defects so that the casting is rejected or has to be weld-repaired, thus compromising the mechanical properties.

The work to be carried out in COLTS will focus on the production of large investment castings of Ti6Al4V. The components targeted are for both airframe and engines, and for applications in space.

The project will develop casting technologies, together with welding technology for the cast Ti structures. High strength wax and wax patterns required for investment casting will also be developed. Examples of the wax patterns produced are shown in figures 1 and 2.

Comprehensive assessments of the microstructure and properties of cast materials and components will be carried out and computer modelling for mould filling and welding will be developed.

Expected Results

The underlying technologies developed as part of COLTS are:

- the development of a strong wax and reproducible investment casting processes – centrifugal casting and gravity casting – to achieve dimensional control for casting of large components;
- the generation of a comprehensive database of the mechanical properties of Ti6Al4V for these cast components;
- the development of modelling which can accurately predict and control gravity and centrifugal casting so that mould filling, microstructure, mechanical properties and the size and distribution of pores can be accurately predicted;
- the development of welding techniques, backed up by modelling, to join castings and to allow castings to be repaired;
- the production of selected demonstrator components for application in airframes and aero-engines and in satellites.

The most significant potential impacts to end-users will be the reduction in weight, caused by improving the properties of cast Ti6Al4V components and narrowing the scatter band of these properties, and reduced costs in the manufacture of large components through a reduction in the quantity of materials and the improved fly-to-buy ratio associated with reduced machining.

COLTS will lead to strengthening the link between European and Chinese industry and between European and Chinese research and technology partners.

Acronym:	COLTS	
Name of proposal:	Casting of Large Ti Structures	
Grant Agreement:	265697	
Instrument:	CP – FP	
Total cost:	3 731 564€	
EU contribution:	1 500 000€	
Call:	FP7-AAT-2010-RTD-CHINA	
Starting date:	01.10.2010	
Ending date:	30.09.2013	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.birmingham.ac.uk/research/activity/irc-materials-processing/themes/colts/index.aspx	
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Partners:	Airbus Operations SAS	FR
	European Space Agency	FR
	Calcom ESI SA	CH
	Ingeniería Aeronáutica INGENIA-AIE	ES
	EADS France SAS	FR
	Chinese Aeronautical Establishment	CN
	Huazhong University of Science and Technology	CN
	Institute of Metal Research, Chinese Academy of Sciences	CN
	Tsinghua University	CN

DOTNAC

Development and Optimisation of THz NDT on Aeronautic Composite Multi-layered Structures

State of the Art – Background

Composite materials containing aramid fibres, glass fibres, carbon fibres, polyurethane foam and others, used in specific structures such as honeycomb and sandwich structures, are recognised for their high strength-to-weight ratios, and have found use as structural components in demanding applications, e.g. aircraft. To support the high standards of composite-part construction and repair, new non-destructive techniques (NDT) are necessary to improve the efficacy of composite part inspection. Recently there has been a significant interest in the potential of terahertz (THz) detection. There are two major factors contributing to this interest:

1. terahertz radiation is readily transmitted through most non-metallic and non-polarised media;
2. THz radiation is non-ionising and poses no health risk to the system's operator. By taking advantage of these unique radiation properties, THz imaging can be used for NDT purposes.

Since the use of X-ray includes strict handling procedures, due to its danger to human exposure, and ultrasound NDT can lack precision, the possibility to detect deep into the structure can be achieved with THz remote sensing.

Due to the rapidly increasing use of composites, especially in critical parts, almost every industry that fabricates and/or maintains composite structures can benefit, in terms of both cost savings and part integrity.

Objectives

The main goal of the DOTNAC project is to develop a fast, high-resolution, non-invasive and non-contact inspection system for assessing aeronautic composite parts during production.

To achieve this overall goal, several underlying objectives will be set and consequently achieved:
- the assessment of aeronautic relevant composite materials and occurring defects;
- the creation of two fast, non-mechanical THz imaging systems (one using pulsed signals and optical-fibre coupling, the other one continuous wave signals and electrical cable coupling);
- the building of a 3-D scanning system enabling the THz imaging systems with associated command, control and data processing software;
- the final integration of the two THz systems (separately) and the 3-D scanner will allow the DOTNAC project maximum liberty of movement to scan the object under inspection, and the according optimisation of two complementary signal processing and imaging software.

To finally achieve the main goal, the above developed hard- and software will be integrated and optimised, the THz NDT tool will be used to view the initially defined composite materials and structures, and the results will be compared with well-developed NDT systems using ultrasound waves (UT), infrared thermography (IRT), X-rays (RT), and optical shear interferometry.

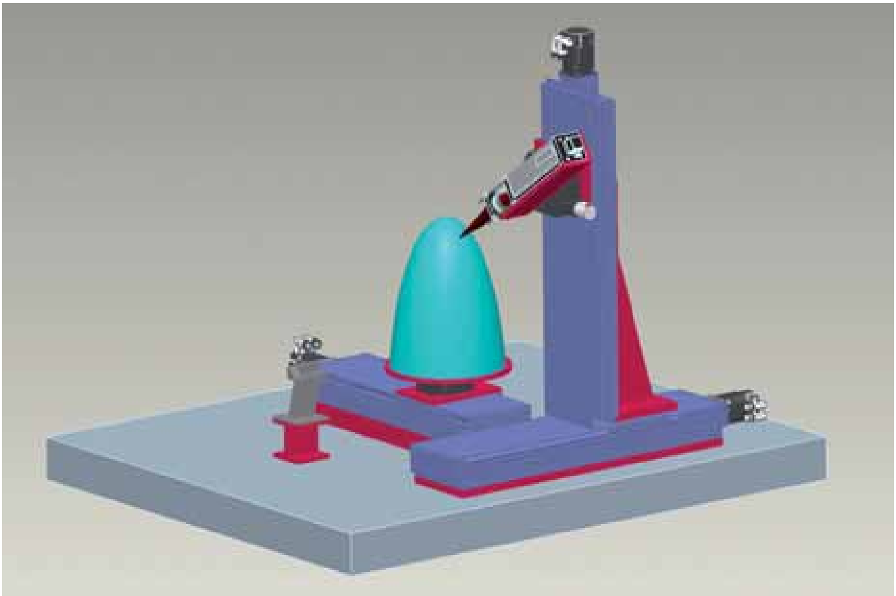
Description of Work

The overall strategy of DOTNAC can be defined as a logical and constructive build-up of sub parts that can partly run in parallel and partly sequentially. The work is divided into seven work packages (WP).

The first step in this process is the knowledge acquisition of the end-user's NDT requirements and the assessment of aeronautic-relevant composite materials and occurring defects (WP1). From this point on five processes can work more or less in parallel.

Starting with the THz hardware research (WP2 and 3), a first process will concentrate on the development of a pulsed THz system using fibre coupling and a second one on a multi-frequency FMCW THz system using electrical cable coupling. System integration tasks will start incorporating a three-dimensional scanning stage with its accompanying command control and processing software.

Simultaneously, WP4 and 5 will concentrate on an appropriate software development to optimise the signal acquisition, and to perform adequate image processing that will maximally automate and facilitate the image interpretation. From this point, the evalua-



Preview of the expected THz system configuration

tion and validation phase of the developed NDT tool can start (WP6 and 7).

By comparing these measurements with the results from UT, RT, IRT, shearography and acoustic tapping on the same samples, the THz-NDT tool can be validated and valorised with respect to the established methods.

Expected Results

Two fully integrated systems will be created:

- an integrated (hardware-software) and optimised THz imaging system using pulsed signals and optical fibre coupling;
- an integrated (hardware-software) and optimised THz imaging system using continuous wave signals and electrical cable coupling.

The planned measurement campaign will allow the full assessment of the performances of the two developed THz NDT tools with regard to aeronautic composite parts, knowledge which is non-existent at this moment.

For the broader expected impact, the aims of the project meet the high-technology nature of the transport industry, making research and innovation crucial to its further development, thus improving European competitiveness.

Finally, the world market for NDT equipment is witnessing growth, promoted by the recovery in the economies of developed countries, as well as the demand from developing markets. Focus on R&D in newer digital-driven NDT modalities and the translation of these into value-delivering solutions are expected to be paramount in ensuring the success of NDT equipment vendors in the market.

Acronym:	DOTNAC
Name of proposal:	Development and Optimisation of THz NDT on Aeronautic Composite Multi-layered Structures
Grant Agreement:	266320
Instrument:	CP – FP
Total cost:	4 505 167€
EU contribution:	3 302 783€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.09.2010
Ending date:	31.08.2013
Duration:	36 months
Technical domain:	Design Tools and Production
Website:	http://www.dotnac-project.eu

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Partners:	Verhaert New Products & Services NV	BE
	Innov Support	BE
	TU Kaiserslautern – Technische Universitaet Kaiserslautern	DE
	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
	CNRS – Centre National de la Recherche Scientifique	FR
	CTA – Fundación Centro de Tecnologías Aeronáuticas	ES
	LGAI Technological Center SA	ES
	CIMNE – Centre Internacional de Metodes Numerics en Enginyeria	ES
	Israel Aerospace Industries Ltd.	IL

ESPOSA

Efficient Systems and Propulsion for Small Aircraft

State of the Art – Background

Further development of general aviation is substantially limited by the availability of modern certified propulsion units and reliable aircraft systems. Any kind of aircraft or rotorcraft configuration will now require an efficient and environmentally acceptable propulsion unit.

There is a very limited choice of turboprop and turboshaft engines currently available in the power range below 1000 kW. There are engines with appropriate electronics but their purchase price is too high for the general aviation market to use them on a commercial scale. Affordable certified turbine propulsion in small power ranges for two to five-passenger aircraft hardly exists.

There is a trend to replace piston engines with turbines for various reasons, for example AVGAS 100 fuel unavailability, mass and weight reduction, longer time between maintenance, better passenger comfort or simply a lack of spare parts for older types of piston engines.

There is also a growing retrofit market where old types of turbine engines on currently operating aircraft are replaced by modern propulsion units. The replacement of single piston engines on light helicopters with two light turbines can significantly increase their operational potential. However, light helicopters with a single engine are not allowed to land in cities and therefore cannot be used as an aero-taxi.

Objectives

The ESPOSA project is orientated on turbine-engine technologies tailored for a small aircraft up to 19 seats (under CS-23/FAR23) that is operated on scheduled and non-scheduled flights. Generally there is a worldwide growing need for efficient and environmentally friendly gas-turbine engines with a thermodynamic power range from 180 kW up to 1.0 MW. These categories of propulsion units are used to power small turboprop aircraft, light helicopters, transport utility aircraft and regional commuters.

The ESPOSA project will develop and integrate novel design and manufacture technologies for a range of small gas-turbine engines. It will also deal with engine-related systems which contribute to the overall propulsion unit efficiency, safety and pilot workload reduction. Through the newly developed design tools and methodologies for the engine/aircraft integration, the project will also contribute to the improved readiness for new turbine engines installed in aircraft.

Categories of propulsion units and their possible application

Validation levels

Description of Work

The project is divided into two managerial and seven technical sub-projects (SP), which are structured into 30 work packages that are sorted by thematic areas.

SP1 starts the technical activities by defining the airframe's and engine producer's requirements.

SP2 and SP3 comprise performance improvements in key engine components, and their improved manufacture in terms of costs and quality.

SP4 is dedicated to novel modern electronic engine control based on off-the-shelf products, pioneering the engine health monitoring for small engines and providing advanced, more electric solutions for fuel-control systems.

SP5 integrates the project's achievements in the form of two engine demonstrators.

The activities of SP6 include extensive validation on the test rigs. The most appropriate technologies according to value/cost benefits will be selected and integrated into functional complexes and further evaluated on the engine test beds. The functionality of certain project outcomes will also be demonstrated and validated in flight conditions. SP6 also addresses problematic design areas connected with turboprop/shaft gas-turbine engine installation into an airframe structure, including the use of composite materials.

SP7 validates not only installation technologies developed in SP6 but also selected engines in flying conditions on test beds.

Expected Results

The ESPOSA project plans to deliver better gas-turbine engine affordability and a 10-14% reduction in direct operating costs through the development of advanced concepts for key engine components, lean manufacture technologies and modern engine systems, thus improving overall engine efficiency and maintainability.

The project will also deliver new or adjusted simulation and design tools and methodologies for engine integration into aircraft. The enhanced simulation capability straightens the aircraft design and saves developmental costs.

The research work comprises performance improvements of key engine components and their improved manufacture in terms of costs and quality.

New engines will be backed by novel modern electronic engine control based on off-the-shelf products, pioneering the engine health monitoring for small engines and providing new, more electric solutions for fuel and propeller control systems.

Acronym:	ESPOSA	
Name of proposal:	Efficient Systems and Propulsion for Small Aircraft	
Grant Agreement:	284859	
Instrument:	CP – IP	
Total cost:	37 710 538€	
EU contribution:	24 999 800€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.10.2011	
Ending date:	30.09.2015	
Duration:	48 months	
Technical domain:	Propulsion	
Website:	http://www.esposa-project.eu	
Coordinator:	Mr Zdenek Palát Prvni brnenska strojirna Velka Bites a.s. Vlkovska CZ 59512 Velká Bíteš	
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EC Officer:	Eric Lecomte	
Partners:	Zaporozhye Machine-Building Design Bureau Progress State Enterprise named after Academician A.G. Ivchenko	UA
	Avio S.p.A	IT
	ULB – Université Libre de Bruxelles	BE
	Motor Sich JSC	UA
	Wytwornia Sprzetu Komunikacyjnego PZL – Rzeszow SA	PL
	Honeywell International s.r.o.	CZ
	TUSAS Motor Sanayi AS	TR
	UNIS a.s.	CZ
	Zollern GmbH & Co. KG	DE
	ATARD Savunma ve Havacilik Sanayi Ileri Teknoloji Uygulamalari Arastirma ve Gelistirme A.S.	TR
	MERL – Materials Engineering Research Laboratory Ltd	UK
	Sysgo AG	DE
	Jihostroj a.s.	CZ
	Piaggio Aero Industries S.p.A.	IT
	Zaklady Lotnicze Marganski & Myslowski Sp zoo	PL

Grob Aircraft AG	DE
Evektor Spol. s.r.o.	CZ
Winner Scs	BE
Fundación Tecnalia Research & Innovation	ES
CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
ILOT – Instytut Lotnictwa	PL
VZLU – Vyzkumny a Zkusebni Letecky Ustav A.S.	CZ
CENAERO – Centre de Recherche en Aeronautique Asbl	BE
INCAS – Institutul National de Cercetari Aerospatiale Elie Carafoli SA	RO
NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
CIAM – Central Institute of Aviation Motors	RU
COMOTI – Institutul National de Cercetare-Dezvoltare Turbomotoare	RO
VTT – Technical Research Centre of Finland (Teknologian Tutkimuskeskus)	FI
Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
TU Delft – Technische Universiteit Delft	NL
TUM – Technische Universitaet Muenchen	DE
Politechnika Warszawska	PL
Budapesti Muszaki Es Gazdasagtudomanyi Egyetem	HU
VUT – Vysoke Uceni Technicke v Brne	CZ
TUKE – Technical University Kosice	SK
Politechnika Rzeszowska Im Ignacego Lukasiewicza PRz	PL
TOBB ETU – Ekonomi ve Teknoloji Universitesi	TR
Università degli Studi di Padova	IT

IDIHOM

Industrialisation of High-order Methods – A Top-down Approach

State of the Art – Background

Computational fluid dynamics (CFD) has become a key technology for the development of new products in the aeronautical industry. Numerical simulation based on high-fidelity non-linear methods can offer significant benefits, both to verify a design in off-design situations and to provide physical knowledge and results for all flight regimes where linear methods fail.

However, despite the progress made in CFD, it is well known that high-fidelity software tools are not yet fully exploited in industrial design environments. With the increased complexity of computed geometries and flows, it becomes obvious that improvements to the numerical methods solving the governing flow equations with respect to accuracy and cost-efficiency is of utmost importance.

High-order methods offer the possibility to achieve a fast reduction of approximation errors with only a moderate increase in the number of unknowns. Compared to second-order methods (p=1) currently used in industry, the high-order methods allow more accurate predictions or, in case of the same accuracy, faster simulations. Previous research projects (e.g. the EU project ADIGMA) have demonstrated the great potential of high-order methods for aeronautical problems. However, despite the significant progress made over the last years, many achievements are still far from industrial use.

Objectives

In order to realise the full potential of adaptive higher-order methods, further concentrated effort with respect to industrialisation is required. Particular research areas to be addressed are efficient and robust solution algorithms and meshing approaches for turbulent flow problems relevant for the aeronautical industry.

The goal of the IDIHIM project is to take a major step forwards towards the industrialisation of the next generation of CFD tools for advanced applications in aeronautics with significant improvements in accuracy and efficiency.

The main scientific objectives are to advance current high-order methods and to apply them to complex industrial flows, to demonstrate capabilities of high-order approaches in solving industrially relevant and challenging applications, to demonstrate the applicability of high-order methods to multidisciplinary topics such as aero-acoustics (noise reduction) and aero-elastics (reduced aircraft weight, improved aircraft safety), to advance the Technology Readiness Level (TLR) of these innovative methods from about 3 to 5, and to facilitate collaboration between academia, research organisations and the different industries, such as airframe, turbo-engines, helicopters, ground transportation and the EU CleanSky project.

Description of Work

IDIHOM follows a top-down approach. Scientific activities and improvement of methods are driven by a set of challenging and underlying test cases, which are going to be used for verification and assessment of high-order methods. The complete set of a high-order framework, including mesh generation and adaptation, discretisation strategies and solution methods, convergence acceleration, parallelisation as well as visualisation for post processing, will be advanced to fulfil the industrial requirements.

Based on the experience and outcome of the previous EU project ADIGMA, the focus will be on dedicated improvements and extensions of selected high-order solvers, namely the Discontinous Galerkin (DG) and the Continuous Residual Based (CRB) methods. When assessing the newly developed methods, the business test cases proposed by industry will be considered top priority. The test-case suite addresses steady and unsteady turbulent flows, covering external and internal aerodynamics as well as aero-elastic and aero-acoustic applications. So-called underlying test cases are identified for rapid verification of the enhanced methods. For these less complex problems, high-order results are expected at mid-term allowing, if necessary, an adjustment of activities for the second part of the project.

Expected Results

IDIHOM is aiming at scientific results and methods that are novel in an industrial environment and which contribute to a real breakthrough in CFD for complex real-life turbulent flows. Thus IDIHOM will provide an essential and indispensable building block to fully exploit the potential of numerical simulation as the major source for determination of data required to drive the aerodynamic design process. The industrialisation of innovative high-order methods will either contribute to considerably reduced simulation time for a given numerical accuracy or provide the means to enhance numerical accuracy with only a moderate increase in computational effort and time. Evidently, efficient high-order methods gain the potential to explore new aerodynamic designs out of reach for today's design methodology. Precise and efficient CFD solutions – fulfilling the needs of multidisciplinary simulations as in aero-elastic and aero-acoustic applications – are the key enablers to reach the ACARE Vision 2020 orientated design goals. IDIHOM is an important cornerstone to support the competitiveness of both the European research community and European aircraft manufacturers.

As an added value, the developed algorithms and solution methodologies will not be limited to aeronautical applications but can also be exploited for flow simulation in general.

Acronym:	IDIHOM	
Name of proposal:	Industrialisation of High-order Methods – A Top-down Approach	
Grant Agreement:	265780	
Instrument:	CP – FP	
Total cost:	5 659 942€	
EU contribution:	4 166 569€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.10.2010	
Ending date:	30.09.2013	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.idihom.de	
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Partners:	Dassault Aviation SA	FR
	EADS Deutschland GmbH	DE
	CENAERO – Centre de Recherche en Aeronautique Asbl	BE
	NUMECA – Numerical Mechanics Applications International SA	BE
	Aircraft Research Association Ltd	UK
	FOI – Totalforsvarets Forskningsinstitut	SE
	INRIA – Institut National de Recherche en Informatique et en Automatique	FR
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	TsAGI – Federal State Unitary Enterprise – Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU

VKI – von Karman Institute for Fluid Dynamics	BE
Arts Association	FR
Imperial College of Science, Technology and Medicine	UK
Università degli Studi di Bergamo	IT
Università degli Studi di Brescia	IT
Universitaet Stuttgart	DE
PUT – Poznan University of Technology	PL
Politechnika Warszawska	PL
LIU – Linköpings Universitet	SE
UCL – Université Catholique de Louvain	BE

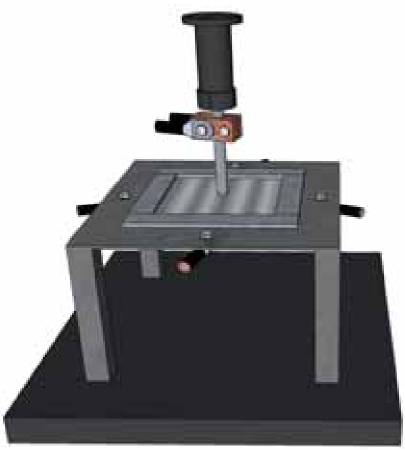
INMA

Innovative Manufacturing of Complex Ti Sheet Aeronautical Components

State of the Art – Background

The pylons, nacelles and the engine itself are sub-assemblies where many sheet components made of titanium and its alloys are concentrated. Examples include pylon fairings, fan blades, exhaust ducts and air collectors. The growing use of composite structures is increasing the content of complex titanium sheet components in other airframe areas due to galvanic compatibility with the carbon fibres. The number of complex titanium sheet components seems likely to progressively increase in order to reduce weight and thus contribute to the ACARE objectives of decreasing fuel consumption and consequent CO_2 emissions, as well as reducing NO_x emissions and noise levels.

Currently, different forming technologies are used by the aeronautic industry to produce complex components from titanium. The technology used for each application depends on the complexity of the targeted shape, as well as on material considerations. However, all these production technologies are cost intensive and involve long lead times, mostly because they require specific tooling. Limitations in component size and frequent manual reworking associated with these technologies also negatively affect the production costs and lead times. Furthermore, they are not based on environmentally friendly principles because of the high fly-to-buy ratios and significant energy consumptions that are usually involved.



Set-up concept for hot AISF

Objectives

Within this context, the INMA project aims at developing an intelligent knowledge-based and flexible manufacturing technology for titanium shaping. This will lead to reducing recurrent aircraft development costs incurred by the fabrication of complex titanium-sheet aeronautical components with a minimal environmental impact. Hence, the existing non-flexible and cost-inefficient titanium forming process chain will be transformed into a rapid, agile and green one.

The brand new technology relies on the use of asymmetric incremental sheet forming (AISF), a non-conventional forming process where a punch tool applies a localised and progressive plastic deformation to the blank while it describes a numerically controlled path.

Description of Work

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

WP1 aims to generate a solid and structured experimental database about machine parameters, tool specifications, tool paths and any other process parameter for cold and hot AISF of titanium.

WP2 aims to implement finite element (FE) models of the AISF process that provide force, thickness, strain and geometry predictions. As in WP1, FE modelling activities consider both cold and hot forming operations, as well as up-scaling issues.

WP3 will define specific tests and criteria to obtain material forming limits under AISF. Work also includes material testing and characterisation after being deformed using AISF.

WP4 aims to model material spring-back under AISF using knowledge-based techniques, such as data mining, knowledge discovery in data or artificial intelligence algorithms. The spring-back predictions will be used to correct the tool path and so avoid shape deviations from the design geometry.

WP5 analyses the heating methods and procedures for hot AISF of titanium at a minimum energy cost and consumption. Ease of integration of the equipment into the process, safety or equipment acquisition costs will also be considered.

WP6 addresses the demonstration activities by applying the project developments to fabricate two realistic demonstrator components and then validating them through an overall assessment.

Expected Results

The AISF technology to be developed by the project will provide:

- A cost reduction of forming operations. This is because the AISF-based technology will not require the use of specific tooling, which increases production costs due to the small-to-medium size of the components. It is estimated that with the new technology, tooling costs will decrease by 20%.
- A reduction in time-to-market for new products. Knowledge-based modelling will assist the design of the forming operations and will also eliminate the need for specific tooling. This will contribute to a decrease in the lead time of a new component by approximately 10%.
- A more environmentally friendly production route, which considers a lean management of energy to deform titanium alloys with low workability at room temperature, leading to a decrease in component weight due to the improved properties of materials being deformed incrementally.

Acronym:	INMA	
Name of proposal:	Innovative Manufacturing of Complex Ti Sheet Aeronautical Components	
Grant Agreement:	266208	
Instrument:	CP – FP	
Total cost:	3 989 736€	
EU contribution:	2 890 076€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.09.2010	
Ending date:	28.02.2014	
Duration:	42 months	
Technical domain:	Design Tools and Production	
Website:	http://www.inmaproject.eu	
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	VZLU – Vyzkumny a Zkusebni Letecky Ustav A.S.	CZ
	University of Patras	GR
	Airbus Operations SAS	FR
	Twi Ltd	UK
	RWTH – Rheinisch-Westfaelische Technische Hochschule Aachen	DE
	Wytwornia Sprzetu Komunikacyjnego PZL – Rzeszow SA	PL
	University of Liverpool	UK
	EASN Technology Innovation Services BVBA	BE

MASCA

Managing System Change in Aviation

State of the Art – Background

Within the aviation industry, the need for sustainable change is becoming more and more imperative. This is due to a number of factors ranging from structural and technological to commercial. Also, change management, mentoring, leadership skills and other 'soft' skills are not adequately distributed throughout the aviation industry. The training of personnel is mainly focused on the operational layer within organisations with the aim of reducing error and enhancing safety at the point where it is most likely to occur. However, safety risk, for example, is known to be a systemic phenomenon and not contained within the cockpit or hangar. Change is being imposed on the industry from a number of sources and the need for change management skills and capability within organisations is increasing.

Objectives

The main object of MASCA is to develop and deliver a structure to manage the acquisition and retention of skills and knowledge concerning organisational processes for managing change in the entire air transport system. Different stakeholders in a common operational system (airlines, airports, maintenance companies, etc.) will come together to change the shared operational system to deliver a better service. The project takes an action research approach with a primary focus on the transfer of change management capability into the organisations that are responsible for, and involved in, change. Thus the work programme is organised around two complementary objectives:

- the development of a system to support the development and deployment of an integrated change management capability, or change management system (CMS);
- the deployment and evaluation of the CMS in selected change management initiatives, both simulated and actual.

Description of Work

MASCA is divided into eight work packages (WP).

WP1 covers project management.

WP2 researches the requirements for change that will be the subject of the interventions by using a process-modelling and analysis framework.

WP3 transforms these requirements into a design specification. The model represents the dynamics of organisational change and the information support system.

WP4 defines the implementation context that has to be supported by the other CMS elements – simulation, information support, and learning, training and mentoring (LTM). Evaluation tools and methods are developed and customised. The qualification and accreditation framework is developed.

WP5 develops the management implementation of CMS. Simulation workshops are run; appropriate information support is put in place; and the LTM programme is initiated and run to prepare the involved personnel.

WP6 supports the partners' intervention initiatives through a management process; this includes continued monitoring of the information support to the change initiatives and active mentoring of the change agents. Concurrent and post-intervention evaluation measures are taken.

WP7 manages the revision of the integrated CMS components: the simulation; the information support system; the LTM system; the qualification and accreditation system is completed; the evaluation methodologies are standardised.

Expected Results

A failure in change management and the new technology initiatives necessary to achieve their objectives are a major expense for the aviation industry, significantly hampering the reduction of operating costs.

The project will improve the effectiveness of change management and maximise operating cost reductions, thus enabling these to be passed on in reduced travel charges.

MASCA will deliver a structure to manage the acquisition and retention of skills and knowledge through education, training and mentoring, and through the management and support of competence and capability in organisations across the entire air transport system – design and manufacture, airline operations, maintenance and airport operation.

The project will develop an integrated change management capability that supports the individual, the team, the organisation and the aviation system. It will deploy and evaluate change management in selected CMS initiatives, both simulated and actual.

Acronym:	MASCA	
Name of proposal:	Managing System Change in Aviation	
Grant Agreement:	266423	
Instrument:	CP – FP	
Total cost:	3 019 713€	
EU contribution:	2 120 562€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.12.2010	
Ending date:	30.11.2013	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
Website:	http://masca-project.eu/	
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	Scandinavian Airlines System SAS Consortium	SE
	KTH – Kungliga Tekniska Hoegskolan	SE
	Kite Solutions s.n.c. di Dunne Catherine e.C.	IT
	Swedavia AB	SE
	Thales Avionics SA	FR

PRIMAE
Packaging of Future Integrated Modular Electronics

State of the Art – Background

Early avionics were produced as a federated architecture, in which each aircraft function was implemented using dedicated bespoke hardware and software. As the number of functions being transferred to avionics increased, the federated architecture grew in size and complexity. Thus the aircraft of the 1980s contained a large number of 'black boxes' of dissimilar sizes based on different technologies.

Dating back to the 1950s, the ARINC 404 and then the ARINC 600 packaging standards, which are still used in federated architectures today, have defined the air transport radio and modular component unit form factors for line-replaceable electronics units in aircraft.

Cost constraints have led to a revolutionary step being taken away from the federated architectures and towards the integrated modular avionics (IMA) concept. This replaces the numerous separate and dissimilar black boxes with fewer common modules, referred to as 'resources' in the IMA context.

Apart from these modular avionic concepts, which are limited in number and proprietary, the majority of electronic equipment continues to use the ARINC 600. With regard to the new requirements of IMA2G, a certain number of limitations have appeared in the use of the present ARINC 600 standard, which impose a radical change (cost effectiveness, cooling versatility, increase of modularity, connectors, etc.).

Objectives

The project will address the main areas that may be the source of future problems (thermal aspects, mechanical aspects, etc.) without forgetting all the other constraints (noise, toxicity, costs, etc.) necessary to ensure a consistent and efficient product for all the phases of the aircraft development and operations.

The prime objective of PRIMAE is to develop the packaging of future onboard avionics and electronics equipment by replacing the 35-year-old ARINC 600 packaging standard with a new standard that is adapted to the evolution of the technologies and new aircraft programme constraints (weight, volume, cost, etc.).

The project will fully complement other current Seventh Framework projects on the same topic by answering the physical embodiment and integration aspects.

This concept, once harmonised among the European stakeholders participating in this project, will be proposed as the future standard for the next generation of large and regional aircraft, initially through the European standardisation bodies, then at international level.

Description of Work

The PRIMAE concept approach is modular integrated packaging (MIP), which offers the same standard in the form of a mechanical packaging toolbox able to support the following functional modules: high power, low power, input/output intensive, high emissive.

The aim is to harmonise and merge a set of building blocks in a single housing packaging. The MIP standard will be sufficiently versatile to support different combinations and types of line-replaceable modules. The work is divided into six work packages (WP).

The baseline requirements and specifications of aircraft packaging architecture will be established in WP1. On the basis of these and the state of the art, new advanced technologies will be investigated in WP3, which will cover the following main topics: thermal analysis; lightweight/mechanical analysis; electromagnetic capability (EMC) shielding and power supply architectures; connectors.

Three designs, in reference to the various functional needs and environmental constraints, will be defined in WP2. Each of these proposed designs will be developed at a demonstration level in WP4, in order to assess/verify their performance. The demonstrator test phase (WP5) will evaluate the thermomechanical and electrical/EMC shielding performance of the proposed packaging designs.

WP6 contains the project management and also the pre-standardisation and synthesis activities.

Expected Results

PRIMAE is expected to yield the following results:
- definition and evaluation of new cooling techniques;
- evaluation of weight benefits resulting from the use of composite material;
- new power supply and EMC concept;
- definition of a new family of connectors.

The concept, once harmonised among the main European players participating in this project, will be proposed as a standard for the future generation of large and regional aircraft, and helicopters. The reduction in aircraft development cost using the open standard of PRIMAE will allow the following:
- the development of low-cost equipment by equipment suppliers using mass market components;
- the development of low-cost systems by system suppliers, which comprise several blades with maximum reusability of test-bench infrastructure;
- better customisation of the architectures by airframes and so minimise the penalties of weigh/volume and cost compared to the ARINC 600.

Acronym:	PRIMAE	
Name of proposal:	Packaging of Future Integrated Modular Electronics	
Grant Agreement:	265413	
Instrument:	CP – FP	
Total cost:	6 338 307€	
EU contribution:	3 766 448€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.11.2010	
Ending date:	30.04.2014	
Duration:	42 months	
Technical domain:	Avionics, Human Factors and Airports	
Website:	http://www.primae.org	
Coordinator:	Mr Claude Sarno	
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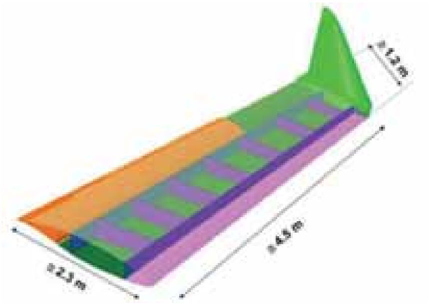
	Diehl Aerospace GmbH	DE
	Kontron Modular Computers SAS	FR
	Università degli Studi di Padova	IT
	INSA – Institut National des Sciences Appliquees de Lyon	FR
	Institute of Thermal Physics of the Ural Branch of the Russian Academy of Science	RU
	Aalto-Korkeakoulusaatio	FI
	Dutch Thermoplastic Components BV	NL
	Tyco Electronics UK Ltd	UK
	Radiall	FR
	VZLU – Vyzkumny a Zkusebni Letecky Ustav A.S.	CZ

DAU Ges.M.B.H. & Co. KG.	AT
ATM Przedsiebiorstwo Produkcyjne Sp. z o.o.	PL
EMCCons Dr Rasek GmbH & Co KG	DE
LATelec	FR
Celestica Valencia SA	ES
BAE Systems (Operations) Ltd	UK

SARISTU
Smart Intelligent Aircraft Structures



State of the Art – Background

Out of the wealth of smart intelligent aircraft structure concepts, SARISTU will focus on three.

Conformal airfoil morphing describes a structural concept that enables the discontinuity-free distortion of airfoil geometries with the objective of providing a flight-state optimised airfoil. Here, leading and trailing-edge devices are considered. The key bottlenecks experienced so far with conformal morphing camber change are mainly related to the insufficient durability of potential skin and aerodynamic gap-filler materials, together with operational considerations, which require integrating further systems into the morphing surfaces.

Structural health monitoring (SHM) describes the utilisation of systems that enable a structure-inherent self-assessment. This encompasses both the detection and assessment of damages. Evidently, the installation of additional systems in the structure is a major cost driver, which greatly reduces the economic feasibility, particular during the early phase of an aircraft's life. Currently this is a key obstacle to the further extension of SHM.

The rapid increase in the availability of nanoparticles has led to a strong interest in key individual aerospace applications. Of particular interest are damage tolerance and electrical isotropy improvements. However, large-part manufacturing is currently a major obstacle.

Objectives

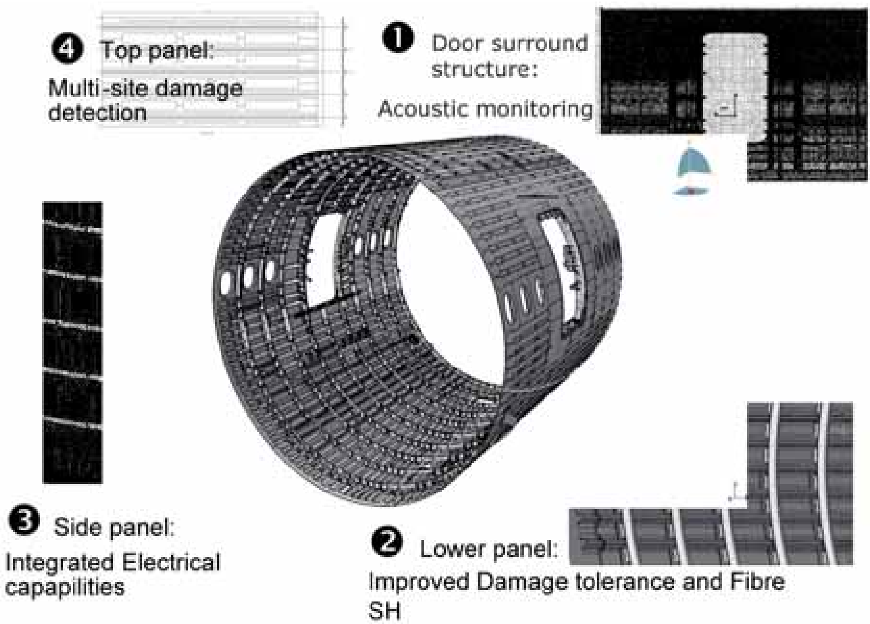
SARISTU focuses on the cost reduction of air travel through a variety of individual applications and in combination.

- A combination of different conformal morphing concepts in a laminar wing is intended to further improve the performance and hence reduce drag (<6%). This will have beneficial side effects with respect to aircraft noise (<6dB(A)) during take-off and landing.
- By facilitating the system integration early in the manufacturing chain, the costs are expected to come down to a level where SHM system integration becomes a feasible concept to enable in-service inspection cost reductions of up to 1%.
- The incorporation of carbon nanotubes into aeronautical resins will enable weight savings of up to 3% when compared to the unmodified skin, stringer and frame system, while a combination of technologies is expected to decrease the installation cost of the electrical structure network by up to 15%.

Description of Work

SARISTU has ten application scenarios investigating the following:

- a conformal morphing leading-edge device tackling areas such as the integration of lightning strike protection;
- the integration of trailing-edge devices for cruise optimisation and the integration of independent shape-monitoring methods;
- wingtip active trailing-edge devices for load alleviation and integration with a view to minimised maintenance;
- the structural integration of fibre-optic monitoring devices for a multitude of applications such as SHM, strain and shape assessment;
- the integration of guided wave ultrasonic monitoring for rapid damage detection and assessment;
- pitch-catch ultrasonic monitoring for the same purpose on typical fuselage structures;
- ultrasonic and fibre-optic techniques to enable the full monitoring for multi-site damage detection and assessment;
- passive SHM techniques focusing on damage-indicating coatings;
- the manufacturing challenges associated with nanoparticle-reinforced structures to improve their damage tolerance and damage behaviour;
- the use of nanoparticles and co-cured metal to integrate electrical capabilities into structures from carbon fibre reinforced plastics.



A full-scale outer wing for wind tunnel and structural testing will be realised and a range of representative, full-scale panels representing a typical fuselage structure will be manufactured.

Expected Results

With respect to conformal morphing, SARISTU expects to enable the consideration of aerodynamic gap fillers and load-bearing conformal morphing materials in future aircraft designs. When combined, the different morphing concepts are expected to result in the aforementioned objectives. Most importantly, the integration of critical elements, such as lightning strike protection, de-icing, bird-strike protection and independent shape assessment, fills key gaps in today's ability to seriously consider conformal morphing devices for integration into passenger aircraft.

With respect to SHM, load monitoring for improved health estimation is expected to reduce structural inspection-related costs by up to 1%, while rapid damage detection and assessment through acoustic and optical means are expected to reduce unscheduled structural inspection costs even further. Furthermore, the integration of different SHM techniques shall, for the first time, enable the monitoring for impact-induced damages on an entire panel, even if multiple damages occur.

With the weight reduction achieved by improving the damage behaviour, and hence an important sizing criterion of aircraft structures, significant cost savings are expected to be possible with respect to electrical functionality integration due to the complexity of these systems in aircraft currently in production and in development.

Acronym:	SARISTU	
Name of proposal:	Smart Intelligent Aircraft Structures	
Grant Agreement:	284562	
Instrument:	CP – IP	
Total cost:	50 950 852€	
EU contribution:	32 434 311€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.09.2011	
Ending date:	31.08.2015	
Duration:	48 months	
Technical domain:	Aerostructures and Materials	
Coordinator:	Mr Piet Wölcken Airbus Operations GmbH Kreetslag 10 DE 21129 Hamburg	
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	Airbus Operations SAS	FR
	Airbus Operations Ltd	UK
	Alenia Aermacchi S.p.A.	IT
	Aernnova Engineering Solutions Ibérica SA	ES
	Alenia Aeronautica S.p.A.	IT
	ATARD Savunma ve Havacilik Sanayi Ileri Teknoloji Uygulamalari Arastirma ve Gelistirme A.S.	TR
	Short Brothers PLC	UK
	Catalyse SARL	FR
	CENAERO – Centre de Recherche en Aeronautique Asbl	BE
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	Critical Materials Lda	PT
	CNRS – Centre National de la Recherche Scientifique	FR
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	EADS Deutschland GmbH	DE
	EADS France SAS – European Aeronautic Defence and Space Company	FR
	EADS UK Ltd.	UK
	EASN Technology Innovation Services BVBA	BE
	FACC AG – Fischer Advanced Composite Components AG	AT
	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
	FIDAMC – Fundación para la Investigación, Desarrollo y Aplicación de Materiales Compuestos	ES
	GKN Aerospace Services Ltd	UK
	Hellenic Aerospace Industry SA	GR

Yacht Teccon Engineering GmbH & Co. KG	DE
Israel Aerospace Industries Ltd.	IL
Imperial College of Science, Technology and Medicine	UK
INASCO – Integrated Aerospace Sciences Corporation O.E.	EL
Westcam Fertigungstechnik GmbH	AT
Innowattech Ltd	IL
INVENT Innovative Verbundwerkstofferealisation und Vermarktung Neuertechnologien GmbH	DE
KUL – Katholieke Universiteit Leuven	BE
Kok & Van Engelen Composite Structures BV	NL
Latécoère	FR
Mare Engineering S.p.A.	IT
Nanocyl SA	BE
Nastech Srl – Novel Aerospace Technologies	IT
NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
Politecnico di Milano	IT
Politecnico di Torino	IT
Redam Srl	IT
RWTH – Rheinisch-Westfaelische Technische Hochschule Aachen	DE
Saab Aktiebolag	SE
SABCA – Société Anonyme Belge de Constructions Aéronautiques	BE
Samtech SA	BE
SEGULA Aéronautique SAS	FR
Swerea SICOMP AB	SE
Sonaca SA – Société Nationale de Construction Aérospatiale	BE
TUSAS – Turk Havacilik ve Uzay Sanayii AS	TR
Tel Aviv University	IL
Technobis Fibre Technologies BV	NL
Fundación Tecnalia Research & Innovation	ES
Fundacja Partnerstwa Technologicznego Technology Partners	PL
TsAGI – Federal State Unitary Enterprise – Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
Universidade de Aveiro	PT
Alma Mater Studiorum – Università di Bologna	IT
Università degli Studi di Napoli Federico II	IT
University of Patras	GR
VZLU – Vyzkumny a Zkusebni Letecky Ustav A.S.	CZ
Universitaet Siegen	DE
Universitaet Stuttgart	DE
Universiteit Twente	NL
UPM – Universidad Politécnica de Madrid	ES
University of Pretoria	ZA

WASIS

Composite Fuselage Section Wafer-design Approach for Increasing Safety in Worst-case Situations and Minimising Joints

State of the Art – Background

Aeronautics is a key asset for the future of Europe, but the industry is currently facing the challenge of making aircraft 'more affordable, safer, cleaner and quieter', while at the same time accounting for demand that is likely to triple over the next 20 years.

WASIS aims to rise to this challenge by developing a composite fuselage structure based on the lattice-stiffening concept. The lattice approach allows composites to obtain more efficient mechanical behaviour, reduce weight and optimise structure performance, which will be proved by comparative simulations against other approaches. This will be combined with specially designed semi-loop and micro-pin joining elements to enable innovative non-regular lattice-structure manufacturing, save aircraft weight, and avoid fuselage section weakening caused by cutting reinforcement fibres.

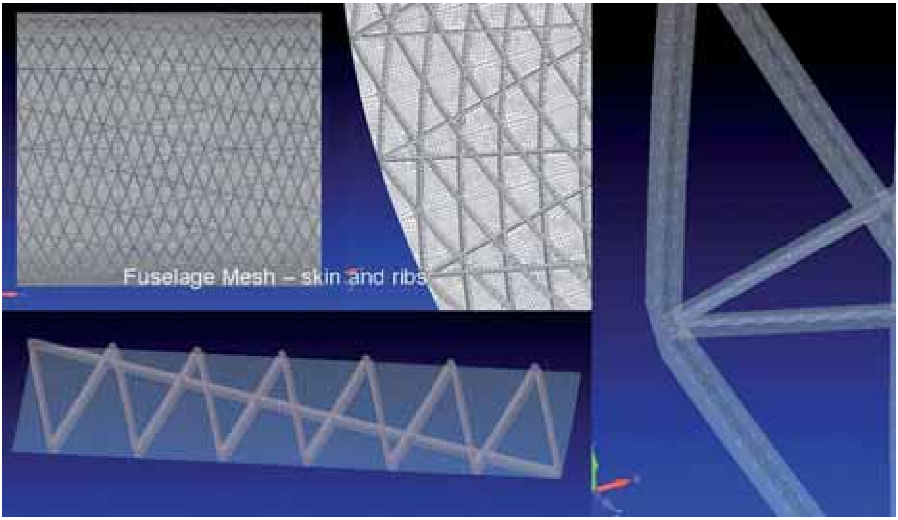
Furthermore, the structure will also be developed to better withstand worst-case scenario loadings; safety will be assessed by adopting simulation and virtual testing from the very first design stages.

The project's overall concept is focused on simultaneously meeting environmental demands with rising safety standards, coupled with design and manufacturing cost-efficiency improvements.

Objectives

The main objective of this project is the development of a composite fuselage structure based on the lattice stiffening concept, which will optimise geometrical and mass properties of transition zones of fuselage structural joints.

Moreover, the developed lattice structure will be further improved to produce a composite fuselage section with openings (doors, illuminators, bays, lids, etc.) in one single manufacturing process, thus minimising the required cutting operations. As a result, only the fuselage skin fibres will be cut, while the lattice ribs will remain continuous. Specially designed joining ele-



Scheme of a lattice-structured fuselage

ments will be used for innovative non-regular lattice structure manufacturing and so reduce aircraft weight, avoid weaker fuselage sections, prevent wastage of expensive composite material, and decrease manufacturing time and costs.

Developed innovative fuselage section design will be merged with high-productive filament winding technology to reduce manufacturing costs and time. Virtual testing will reduce the number of prototypes required, thus saving additional material and manufacturing costs.

WASIS will also address the structure's safety, so that the developed fuselage structure can better withstand accidental loads in various scenarios.

Description of Work

WASIS will design a whole wafer aircraft fuselage section using only composite materials and base this design on real operation-load scenarios. This design will also include new joining elements based on micro pins integrated into the winding jig, which will target the development of new solutions for jointing high-loaded elements and manufacturing openings without having to cut fibres in post-manufacturing operations.

By making use of modern simulation techniques, this design will be compared to conventional existing structures to optimise its mechanical and functional performance. A numerical modelling of previously defined impact loadings will also allow assessing the wafer structure's performance and safety in worst-case scenarios, developing recommendations for further design improvement.

Manufacturability of the joints and the material will be studied through non-standard parameter tests. Fibre placement will be used to manufacture panels of the structure; then manufacturing using filament winding will be set up. Special tooling will be designed to fully automate a complex manufacturing process: the skin, ribs and embedded joining elements must be manufactured together to form a one-piece fuselage. Small-scale prototypes will be manufactured and tested to prove the different innovative aspects of the project and to validate simulation models.

Expected Results

WASIS will contribute to the generation of knowledge on lattice structures in Europe by combining the benefits shown in the past with the structural benefits and advantages of composite materials. The project will develop an innovative structural concept that will reduce weight significantly with an automated manufacturing process that will also optimise and minimise joints. With this advantageous structure, WASIS aims to contribute to the emissions and noise reductions goals envisaged for 2020.

The use of specially designed joints during the section manufacturing will allow for openings in the structure that do not require the fibres to be cut, which implies material-efficient manufacturing, and reduced material costs and energy costs associated with their processing.

Furthermore, the manufacturing of prototypes and their testing will prove the technological advancement of the developed structure and its more innovative characteristics, such as the automated manufacturing, the specially designed joints to join the fuselage composite structure to other appliances (such as attachment frames) and the manufactured openings, produced without cutting fibres. With a building block approach, tests will be carried out to prove the structural concept under several load conditions, resulting in the expected impacts.

Acronym:	WASIS
Name of proposal:	Composite Fuselage Section Wafer-design Approach for Increasing Safety in Worst-case Situations and Minimising Joints
Grant Agreement:	265549
Instrument:	CP – FP
Total cost:	4 185 129€
EU contribution:	3 239 763€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.01.2011
Ending date:	30.06.2014
Duration:	42 months
Technical domain:	Aerostructures and Materials
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Partners:	KhAI – National Aerospace University Kharkiv Aviation Institute named by N Zukovskiy	UA
	University of Patras	GR
	CirComp GmbH	DE
	Instituto de Engenharia Mecânica e Gestão Industrial	PT
	MERL – Materials Engineering Research Laboratory Ltd	UK
	Netcomposites Ltd	UK
	AOES Group BV – Advanced Operations and Engineering Services Group BV	NL
	CEN – Comité Européen de Normalisation	BE
	Piaggio Aero Industries S.p.A.	IT
	IVW – Institut fuer Verbundwerkstoffe GmbH	DE
	COMAT Composite Materials GmbH	DE

2050AP

The 2050+ Airport

State of the Art – Background

The airport plays a vital role in the air transport system (ATS). It is a complex environment where coordinated, time-critical actions between all stakeholders are needed to carry out smooth and punctual operations.

The Advisory Council for Aeronautics Research in Europe (ACARE) provides in its document, A *Vision for 2020*, the vision for the future European air transport system. According to this report, the imperatives for such a vision are 'more affordable, safer, cleaner and quieter', reflecting the need to combine cost-effectiveness with uncompromising adherence to safety and environmental objectives.

As a result, ACARE contracted the 'out-of-the-box' project, which focused on a number of radical changes and resulted in six promising ideas, covering alternative propulsion, global ATS, the cruiser/feeder type of long-range transport, ground assisted take-off and landing, personal air travel and advanced systems for airports.

The airport of the future will have to meet different objectives in the areas of environment, costs and performance, amongst others. The key to securing these objectives will be investment in research and technology, in order to be able to meet the constantly rising demands of the market, as well as the needs of the aeronautical community.

Objectives

2050AP explores new airport concepts that apply radical and novel solutions to support the future development of airports.

The project will develop three different airport concepts. These three concepts address time efficiency, costs and the environment, and each concept will focus strongly on one theme which it will use as its leading objective. This means that there are three targets:
- to be climate neutral;
- to deliver a maximum of ten minutes aircraft turnaround time;
- a 90% reduction in cost compared to current operations.

Even if these aims are over-ambitious target values, they represent where the present concept of airport deployment is most weak.

The objectives of the three concepts are:
- climate-neutral airport concept to make the airport self-sufficient with regard to its energy needs, to operate in a climate-neutral way and to limit noise exposure to built-up areas surrounding the airport;
- time-efficient airport concept to maximise value through efficient and effective air transport operations;
- low-cost, affordable airport concept to create an airport with extremely low operating costs.

These concepts show how a future airport could look and its expected level of performance, including the interface between aircraft and the ground, and how the application of new principles to the airport layout can better integrate future intermodal connections.

Description of Work

The project activities comprise:
- building a methodology for airport concept development, which makes trade-offs by setting the focus on rating the concepts' designs based on a high-level value theory; it assesses the different stakeholder relations and interests, and provides a high-level set of objectives and attributes.
- delivery of three airport concepts by capturing different ideas, mainly through workshops and brainstorming sessions; this in turn will create an initial version of the concept according to the methodology, which will be further refined by the validation activities.
- partial validation of these concepts will increase the maturity level of the concepts and enable performance assessments to be done; the validation activities assess the feasibility of each solution, further refining the concept; any issue detected during validation will be used for concept refinement; this will ensure the coherence of the maturity level achieved by each concept.

Finally, the project collects the conclusions of the work performed, including:
- an evaluation of the methodology;
- the validation techniques used;
- a set of reasoned recommendations that will enable the community to focus the future research effort on those areas that are considered more promising for the preparation of airports in 2050 and beyond.

Expected Results

The major outcomes of 2050AP will be the new, highly innovative airport concepts: the climate-neutral, time-efficient and low-cost affordable airport.

The main impact expected from the project comes from the identification of new operational concepts and their associated technologies, which will establish a new innovative interface between flying and ground vehicles, and which will support the related passenger operations. The concepts will also pay special attention to passenger flows and intermodal connections in view of operations in 2050.

2050AP will fill a gap in European research on innovative pioneering airport research and continues the work started by ACARE and the out-of-the-box project. It will redesign the current fundamental airport processes to make a step change and combine different possible solutions into several new concepts.

Finally, the project will contribute to the aeronautics and air transport research and technological development by providing three airport concepts that have the potential to implement solutions to address long-term objectives.

2050AP is expected to be the basis for future research by establishing itself as a reference on innovative airport research, and its results will comprise validated and well-assessed ideas for deploying in the airports of the future.

Acronym:	2050AP	
Name of proposal:	The 2050+ Airport	
Grant Agreement:	284529	
Instrument:	CP – FP	
Total cost:	2 678 340€	
EU contribution:	2 077 829€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.09.2011	
Ending date:	28.02.2014	
Duration:	30 months	
Technical domain:	Breakthrough and Novel Concepts	
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Partners:	TU Delft – Technische Universiteit Delft	NL
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	CRIDA – Centro de Referencia Investigacion Desarrollo e Innovacion ATM, A.I.E.	ES
	Slot Consulting Ltd	HU
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	UPM – Universidad Politécnica de Madrid	ES
	Jarzemskis ir ekspertai UAB	LT

4DCO-GC

4-Dimension Contracts – Guidance and Control

State of the Art – Background

Today, the Air Transport System (ATS) is far from being a fully developed system close to perfection.

Ambitious objectives have been defined in the ACARE Vision 2020, together with metrics to assess their level of achievement: the future ATS will definitely have to be more time-efficient and highly customer-orientated, keeping costs low while being environmentally friendly, safe and secure. This system has to be validated and proven whatever the evolution of traffic will be.

Regarding this ATS evolution, the SESAR consortium has now given a comprehensive description of the implementations to be performed up to 2020; the short to medium-term ATS should not be dramatically different from what it is today for obvious continuity considerations.

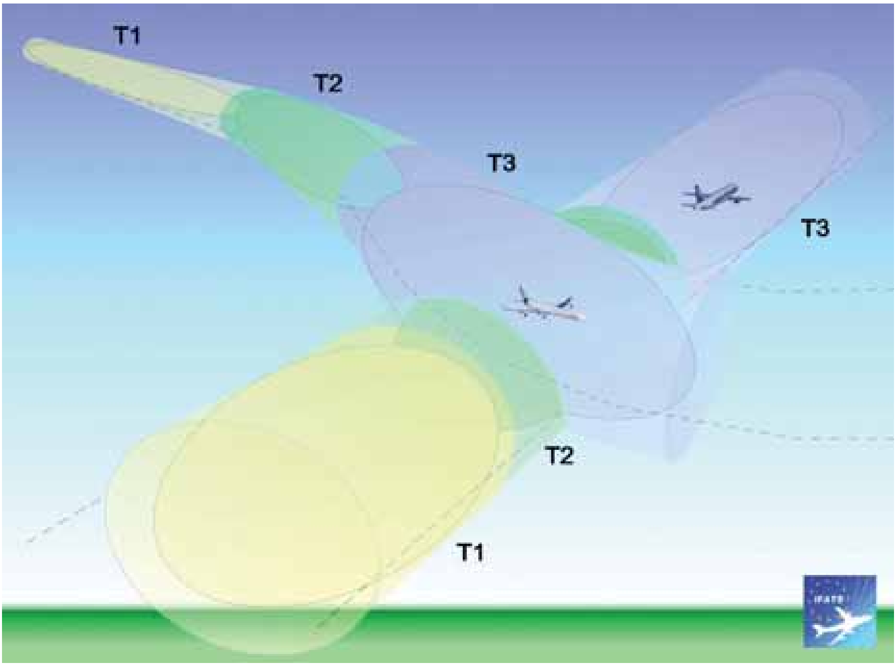
Looking further ahead, the need to really pioneer the future allows for much more freedom and flexibility in devising new ATS concepts – yet at the expense of much more uncertainty.

Regarding the automation of the ATS, one possible conclusion is that current technologies and computer science knowledge are not ready to really fulfil the needs for predicting 4-D trajectories, due to the difficulty of planning international traffic.

In this perspective, the central objective of the 4DCo-GC project is to address the aircraft's 4-D guidance and control principle.

Objectives

SESAR is recognised as the impetus needed to federate resources, mobilise investments and synchronise the plans and actions of the different players within the ATM community.



Use of the space and time dimensions for traffic separation: the 4D contract concept (developped in the frame of the FP6 IFATS project)

Regarding the longer term vision, for 2040 and beyond, and encompassing both air and ground segment sub-systems, the human workforce and technologies, the 4DCo-GC project's scientific and technological objectives are:

- to define and model 4-D contract concepts;
- to develop the algorithms, processes and functions necessary to construct the 4-D contracts;
- to define and develop a global tool architecture aimed at demonstrating and analysing the main operating functions of the 4-D contract concepts, including the role of the human;
- to qualify and quantify various possible options of the 4-D contact concepts for the control and guidance of aircraft;
- to perform a real-time assessment of the 4-D contract concept of operations using a simulator;
- to derive, from the qualification and quantification work, recommendations for future 4-D system development and performance standards.

Broadly speaking, the 4DCo-GC project goal is to make the 4-D contract concept a reality.

Description of Work

Periods dedicated to the study of technological components and the development of their numerical models necessary for the implementation of 4-D contracts will alternate with periods dedicated to the assessment of these components and their mutual interactions through the usage of a simulator integrating the developed models.

A functional analysis of 4-D contracts will first be done, encompassing the current aircraft flight deck and air traffic control equipment, as well as potential future solutions. This analysis will be followed by the development of simulator-orientated models of technical components dedicated to the management of 4-D contracts. They will be used for simulation in order to quantify the operational benefits of 4-D contracts. The measurement of performance will be realised against the fulfilment of the ACARE objectives and will encompass both the evaluation of the system as well as the evaluation of individually developed technology components.

A first workshop will present the results of the simulation campaign to an external audience. Feedback from this will be collected so as to improve the definition and modelling of the various simulation components.

A second workshop, including a new simulation campaign, will be held at the end of the project, which should enable the validation of the 4-D contract concept. It will also be used for dissemination.

Expected Results

The main result of the 4DCo-GC project is an analysis of the viability of the 4-D contract concept, from a technical perspective: ground-based 4-D contract management and airborne capabilities to the assigned 4-D contracts. To this end, a global networked simulation of all the relevant ATS elements will be performed. The results of this simulation will be used for identifying the potential advantages and disadvantages of the 4-D contract concept and derive recommendations for the future evolution of the European ATS.

These recommendations will, of course, be formulated in close coordination with SESAR. This work should show the way for implementing trajectory-based operations and point out the main practical problems that could be encountered, so proposing dedicated required research programmes (e.g. environmental impact, aircraft performance, etc.).

Acronym:	4DCO-GC	
Name of proposal:	4-Dimension Contracts – Guidance and Control	
Grant Agreement:	266296	
Instrument:	CP – FP	
Total cost:	5 472 611€	
EU contribution:	3 947 280€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.11.2010	
Ending date:	31.10.2013	
Duration:	36 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.4dcogc-project.org/	
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	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	ENAC – Ecole Nationale de l'Aviation Civile	FR
	Erdyn Consultants	FR
	Israel Aerospace Industries Ltd.	IL
	Monitor Soft	RU
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Technion – Israel Institute of Technology	IL
	Thales Communications SA	FR
	TsAGI – Federal State Unitary Enterprise – Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
	University of Patras	GR

AHEAD
Advanced Hybrid Engines for Aircraft Development

State of the Art – Background

Future demands on air transport systems dictate that aircraft should be less polluting, less noisy and more fuel efficient. As new environmental and efficiency targets for 2050 will be even more demanding, there is an urgent need to come up with breakthrough technologies to meet the stringent demands of future aviation.

In order to meet these demands, innovation is required on all fronts. Innovation in aircraft calls for new aircraft types. The blended wing body (BWB) configuration seems to be the most promising concept. Also, in the long term, alternative fuels like biofuels, liquefied natural gas (LNG) and hydrogen will replace the traditional jet fuel.

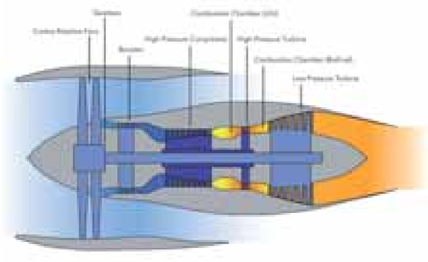
Even though the BWB aircraft concept is promising, it alone cannot meet future challenges without substantial improvements in the propulsion system. The requirements from an engine for futuristic aircraft configurations are envisioned as follows:

- low emissions
- low noise
- lower installation penalty
- boundary layer ingestion (BLI). The aircraft-engine integration for such configurations presents unique challenges and requires that the engine is buried within the nacelle. The nacelle and the engine are then required to ingest the boundary layer that is developed over the aircraft surface.
- multiple fuels. In the latter part of this century, non-carbon based fuels will become more popular.

Objectives

The hybrid engine proposed in AHEAD is a novel propulsion system with a different architecture (see Figure 1). This engine uses several unique technologies: shrouded contra-rotating fans, bleed cooling and a dual hybrid combustion system (using hydrogen and biofuel under flameless conditions to reduce CO_2 and NO_x emission respectively).

The proposed hybrid engine will constitute a leap forward in terms of environmental friendliness, using advanced multiple fuels and enabling the design of fuel-efficient BWB aircraft configurations (see Figure 2). The efficiency of BWB aircraft will be enhanced significantly due to embedded hybrid engines using BLI.



Schematic of the hybrid engine layout

AHEAD aims to establish the feasibility of the proposed hybrid engine configuration and will demonstrate that the concept will substantially lower engine emissions, installation drag and noise. The BWB configuration, along with the proposed hybrid engine concept, should be a breakthrough in civil aviation. The project will also evaluate the effect of liquid hydrogen (LH2) storage on BWB aircraft and its integration with embedded hybrid engines and the environmental gains achieved.

Special attention will directed to evaluate the effect of H_2O emission on the environment.

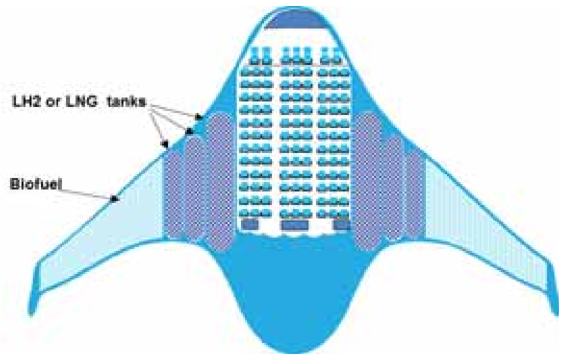
Description of Work

AHEAD is organized into four work packages (WP). These will study, design and develop methods/technologies required for engine development and integration programmes of the proposed hybrid engine for future BWB aircraft configuration.

The first work package will focus on the hybrid engine architecture and its performance modelling and optimisation. WP1 will also look into the effect of LH2 tanks on the BWB aircraft and the effect of BLI on such a configuration.

WP2 will focus on developing the novel twin combustion system for the hybrid engine as well as lab-scale testing at atmospheric pressure and simulations with advanced computational fluid dynamic (CFD) techniques.

WP3 will evaluate the effect of the hybrid propulsion system on the environment and climate, especially in view of the increased H_2O emission and reduced CO_2,



A futuristic BWB aircraft layout with LH2 tanks and biofuels

CO & NO_x emissions. WP3 will also incorporate and integrate the results and findings of all the previous work packages into the hybrid engine concept.

WP4 will deal with all the project management and address the dissemination aspects.

Expected Results

The project aims to assess the feasibility of proposed hybrid engine configuration and to analyse the performance and emissions of the proposed hybrid engine. It is anticipated that the BWB configuration, combined with the hybrid engine concept, will provide the much-required breakthrough in civil aviation. The project will also evaluate the effect of LH2 storage on BWB aircraft and its integration with embedded hybrid engines and the environmental gains achieved. Special attention will be directed to evaluate the effect of increased H_2O emissions in the engine exhaust on the environment.

The expected benefits from the hybrid engines are 60% reduction in CO_2 and NO_x, 5-10% reduction in fuel consumption, reduced lifetime of contrail formation and embedded configuration enabling significant noise reduction.

The AHEAD project should achieve the following:
- conceptual design of a multi-fuel hybrid engine concept;
- quantification of the reduction in CO_2 and NO_x emissions from hybrid engines;
- climate assessment for future aero-engine concepts in terms of aviation-induced global radiative forcing and associated temperature changes.
- development of a strategy for the evolution of future aircraft propulsion systems that can meet the ambitious goals of ACARE beyond 2050.

Acronym:	AHEAD
Name of proposal:	Advanced Hybrid Engines for Aircraft Development
Grant Agreement:	284636
Instrument:	CP – FP
Total cost:	2 990 508€
EU contribution:	2 153 668€
Call:	FP7-AAT-2011-RTD-1
Starting date:	01.10.2011
Ending date:	30.09.2014
Duration:	36 months
Technical domain:	Breakthrough and Novel Concepts
Website:	http://www.ahead-euproject.eu

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DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
Technion – Israel Institute of Technology	IL
Ad Cuenta BV	NL

ATLLAS II

Aero-thermodynamic Loads on Lightweight Advanced Structures II

State of the Art – Background

The ATLLAS-I project evaluated several lightweight materials which can withstand the high temperatures and heat fluxes typical for high-speed flights above Mach 3. At these high speeds, the classical materials used for airframes and propulsion units are no longer feasible and need to be replaced by high-temperature-resistant, lightweight materials, with active cooling for some parts.

ATLLAS-II is a logical continuation to the experience and technology developed in the ATLLAS-I project.

The previous study concluded that the optimal cruising Mach number is around Mach 5 to 6. The detailed design and feasibility study performed aimed for a globally optimised vehicle with respect to aerodynamic, propulsive, structural and thermal layout but nevertheless complying with restrictions imposed by emissions regulations and sonic boom mitigation. The validated tools developed previously, together with the lessons learnt, will allow the consortium to further address and improve the multi-disciplinary design process.

Meanwhile a reliable high-temperature and lightweight material database has been established upon which the consortium can now rely for the vehicle design process.

Objectives

The driver to set the requirements for the material manufacturing, processing and testing is a Mach 5-6 vehicle. This means a fully integrated, multi-disciplinary vehicle design, trade-off and optimisation is a major objective. The additional points to be addressed are:

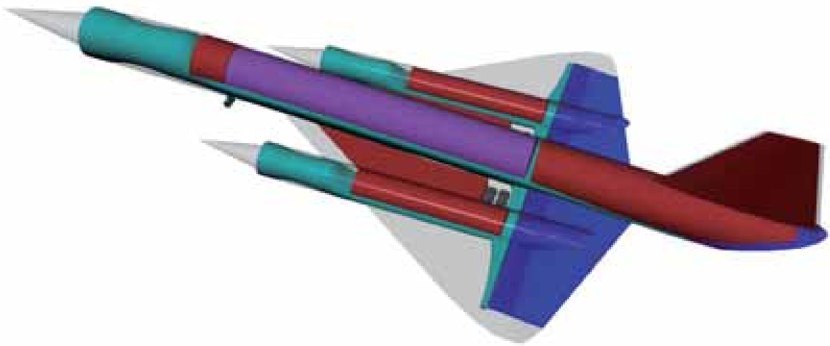
a. Integrated aerodynamic and propulsive flow-path layout

The objective is to derive the optimum cruise Mach number by balancing thermal constraints with the noted increase in cruise efficiency at higher speeds. In addition, sonic boom constraints will have an impact on the global layout.

b. Conceptual structural and thermal design

Hypersonic vehicles are exposed to temperatures that are beyond the limits of classical aircraft materials. New materials and composite structures suitable for high temperature applications need to be tested and involved during the design process. Besides aerothermal loads, unsteady loadings on the structure and control surfaces need to be assessed.

c. Environmental restrictions on the design process



Conceptual layout of a high-speed transport vehicle

Sonic boom prediction for the studied vehicles in ATLLAS-I revealed a potential to alleviate the impact by increasing the rise time. This encouraging path will be embedded into the above-mentioned design along with acceptable exhaust emissions.

Description of Work

Apart from a detailed optimisation of a high-speed transport vehicle concept, the implementation of advanced lightweight and high-temperature metallic and non-metallic materials will be justified by testing:

a. Durability and integration technologies for aero-frame materials

Both metallic (titanium matrix composites, TMCs, and nickel-based hollow sphere stackings) and non-metallic materials (ultra-high temperature ceramics, UHTCs, and ceramic matrix composites, CMCs) are considered for the structure.

b. Durability and integration technologies for combustor materials

The high thermally-loaded walls of the propulsion units require particular material development.

c. Integration and testing of (un)cooled injectors

UHTCs appear very promising as uncooled fuel injectors used within air-breathing propulsion units.

Work related to the environmental impact will not only assess the cruise-induced sonic boom. The acceleration from subsonic speed ($M < 1.0$) to cruise speed ($M = 5$ to 6) also leads to a sonic boom amplification whereas atmospheric turbulence is known to strongly modify the shock fronts of the sonic boom. Both effects have never been evaluated before for a hypersonic configuration.

Emission goals set by the European Commission could be achieved by using alternative fuels, such as methane or a CH_4/H_2-mix.

Expected Results

The integration of the different subsystems, each optimised individually with preset restrictions, into a single vehicle system design does not necessarily ensure a globally optimised vehicle. Due to the complexity of interdisciplinary interaction, numerically steered improvement and multi-disciplinary optimisation tools will result in a viable high-speed vehicle around Mach 5 in terms of fuel consumption, range potential, structural layout and a limited environmental impact.

A unique material database is available from ATLLAS-I which lists thermo-mechanical properties as useful engineering correlations up to temperature of 1800 K. The characterisation of the material's durability is a priority in the present experiments, together with their oxidisation behaviour or resistance to fatigue and fracture mechanisms. Apart from this extension, this material database will be further extended by additional materials such as CMC, UHTC, MMC and high-temperature alloys.

Acronym:	ATLLAS II	
Name of proposal:	Aero-thermodynamic Loads on Lightweight Advanced Structures II	
Grant Agreement:	263913	
Instrument:	CP – FP	
Total cost:	6 535 368€	
EU contribution:	4 750 000€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.05.2011	
Ending date:	30.04.2015	
Duration:	48 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.esa.int/techresources/atllas_II	
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Partners:	EADS Deutschland GmbH	DE
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	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	FOI – Totalforsvarets Forskningsinstitut	SE
	Alta Spa	IT
	GDL – Gas Dynamics Ltd	UK
	Sjöland & Thyselius Aerodynamics Research Center AB	SE
	TISICS Ltd	UK
	University of Southampton	UK
	Universitaet Stuttgart	DE
	UPMC – Université Pierre et Marie Curie – Paris 6	FR

CHATT

Cryogenic Hypersonic Advanced Tank Technologies

State of the Art – Background

In the future, particularly in hypersonic systems, new propellants will be used for aviation, such as liquid hydrogen, liquid methane and possibly liquid oxygen. Current Seventh Framework Programme-funded studies in Europe, such as FAST20XX, ATLLAS or LAPCAT, investigate advanced vehicles using these fuels for passenger transport, for example the SpaceLiner or Lapcat A2 and some of their constituent materials and associated propulsion challenges. The question of cryogenic propellant storage inside an airliner – although of critical importance but by far not yet mastered – has not been addressed until now in comparable detail.

The need for more detailed investigations on liquid hydrogen or methane tanks in future airliners is not only urgent in hypersonic aviation, but is also essential for environmental reasons in subsonic aviation.

The propellant tank technologies are critical for vehicle operation, cost and safety. Also the extent to which the technological issues can be solved has an important impact on the trade-off and choice of future propellants, in particular between liquid hydrogen and liquid methane.

New materials and design concepts are required, such as fibre composites, in order to reduce the tank weight and to increase the structural performance.

Objectives

One of the core objectives of this proposal is to investigate carbon fibre reinforced plastic (CFRP) cryogenic pressure tanks. Composite pressure vessels have an excellent potential for lightweight design, because the fibre architecture can be manufactured to allow all the dominating loads to be transferred along the reinforcement fibres.

All advanced cryogenic tank technologies to be investigated within CHATT are driven by system demands of future hypersonic passenger configurations. All cryotank technologies should eventually be assessed by the system requirements.

The research carried out here will increase the knowledge within Europe, with advancement from a pure material science level to a practical cryogenic tank demonstrator level. This project will take the first steps towards a common European development of future aerospace reusable lightweight composite cryogenic CFRP tanks. The fundamental building blocks in the tank design will be experimentally demonstrated within this project. Not only will the advantages and disadvantages of using liner/linerless tank designs be investigated within the project, but also issues relating to the realisation of more complex geometrical tank shapes.

Description of Work

Four different subscale CFRP-tanks are planned to be designed, manufactured, and tested under mechanical and thermal loads within the scope of the project.

Propellant management is imperative to achieve reliable and efficient vehicle operation. This is the third pillar of the study and covers tank pressurisation, fuel location/retention, and sloshing in horizontal tanks.

The study will therefore focus on establishing engineering models for sloshing verified by numerical calculations and experiments. These models will then be applied to flight control simulations of the reference vehicle concepts, allowing an evaluation of their overall feasibility.

In the past, metal-based heat-exchangers have shown, in particular, safety deficiencies resulting from leaks. In winged systems with potentially more complex propellant movements, which can lead to rapid tank pressure variations, powerful pressurisation systems might be required. Two different types of ceramic gas generators will therefore be looked at in CHATT.

Expected Results

Progress beyond the state-of-the-art in present TRL vs.envisaged TRL:

Flight control development sloshing case	12/3
Aero-elastic modelling of tanks	23
Tank preliminary design model	25
Tank system engineering methods	35
Liner design	34
Tank design with liner	34
Cryogenic dry-wounded carbon fibre pressure vessel	24
Tank design without liner	34
Tank design with complex shape	34
Testing and health monitoring	45
Tank insulation (aerogels)	23
High-order methods for sloshing simulation	25
Sloshing tests and modelling	24
CMC heat exchanger technologies	13
Cryogenic Rankine cycle	24

Acronym: CHATT
Name of proposal: Cryogenic Hypersonic Advanced Tank Technologies
Grant Agreement: 285117
Instrument: CP – FP
Total cost: 4 237 230€
EU contribution: 3 225 681€
Call: FP7-AAT-2011-RTD-1
Starting date: 01.01.2012
Ending date: 30.06.2015
Duration: 42 months
Technical domain: Breakthrough and Novel Concepts
Website: http://www.chatt.aero

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CENAERO – Centre de Recherche en Aeronautique Asbl	BE
GDL – Gas Dynamics Ltd	UK
ALE – Advanced Lightweight Engineering BV	NL

GABRIEL

Integrated Ground and Onboard System for Support of the Aircraft's Safe Take-off and Landing

State of the Art – Background

Air transport systems have to continually reduce the environmental impact of aviation and increase its efficiency. In *A Vision for 2020*, the stakeholders in the aeronautical industry agreed that future air transport must ensure customer satisfaction, whilst also being greener, safer, more secure and more time/cost-effective.

After reducing fuel consumption and thus the environmental load, a reduction in aircraft weight could be the best method to make future air transport even more effective and environmentally friendly.

Considerable weight reduction needs radically new solutions. For this the European Commission has funded a special 'out of the box' project that summarises a series of revolutionary new ideas. One of them is using ground power for assisting aircraft take-off and landing. After analysing numerous potential methods, GABRIEL focused on magnetic levitation. The core components of the proposed concept cover a ground-based accelerator/decelerator magnetic levitation rail system, a sledge to ease landings, and a section at the end of the rails to 'launch' the aircraft and so facilitate the initial climb.

Generally, maglev (magnetic levitation technology) is a well developed, green and safe technology applied to fast trains. However, its application to aircraft acceleration and deceleration requires extensive basic theoretical and practical investigations.

Objectives

The primary objective is to assess whether the concept behind GABRIEL is feasible, safe and cost-effective. In view of this, the project's aims are:

- to select the most appropriate maglev technology;
- to assess the impact on the aircraft through a. weight reduction, b. developing methods to assess the required aircraft thrust, c. designing an optimal aircraft control to perform landings on the sledge;
- to evaluate the impact on the airport by a. proposing an airport configuration for the concept, b. assessing the impact on the capacity;
- to assess the environmental and operational benefits (fuel consumption, emissions, noise);
- to investigate safety and the potential problems in emergency situations.

Description of Work

GABRIEL deals with the development of an unconventional, revolutionary new concept that calls for a specific out-of-the-box approach by using innovation and system-engineering theories. This project is characterised by the design of the operational concept and its theoretical background, validated by a practical investigation.

The general method is a classical approach for the development of new, innovative systems based on four steps:

1. Concept exploration and analysis: The idea is to state the problems to be solved by the GABRIEL concept. Subsequently, given a specific technology, the partners will explore various possible new solutions enabling take-off and landing with the assistance of a ground-powered system. The most promising option is selected.

2. Concept development: Having defined the operational concept, this part of the project focuses on the design of the concept based on different tools. Once the design is fixed, basic system performances are calculated.

3. Concept validation: The consortium will aim at both showing the validity of the GABRIEL concept through simulations and validating some hypotheses through an experimental phase.

4. Impact assessment: This step includes the safety, security, environmental impact issues, cost efficiency and system integration aspects.

Expected Results

GABRIEL develops a revolutionary operational concept using a ground-based power system with magnetic levitation technology to assist the aircraft's take-off and landing. Most importantly, the project will provide:

- the operational concept of using magnetic levitation technology to assist aircraft take-off and landing (including the selection of the most appropriate magnetic levitation method);
- the design of the air-borne and ground-based system elements;
- a validation of the concept with a small-scaled aircraft and a maglev track;
- the assessment of the concept's impact on, for example, safety, security, the environment, cost-effectiveness, airport capacity and public acceptance.

Acronym:	GABRIEL	
Name of proposal:	Integrated Ground and Onboard System for Support of the Aircraft's Safe Take-off and Landing	
Grant Agreement:	284884	
Instrument:	CP – FP	
Total cost:	3 293 492€	
EU contribution:	2 583 299€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.09.2011	
Ending date:	31.08.2014	
Duration:	36 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.gabriel-project.eu/	
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	TU Delft – Technische Universiteit Delft	NL
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	RWTH – Rheinisch-Westfaelische Technische Hochschule Aachen	DE
	Rogg Dietrich	DE
	Ad Cuenta BV	NL
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Politechnika Rzeszowska Im Ignacego Lukasiewicza PRz	PL
	Politechnika Wroclawska	PL
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	Università degli Studi di Salerno	IT

MAAT
Multibody Advanced Airship for Transport

State of the Art – Background

The free movement of people and goods is one of the fundamental freedoms fully granted by EU Member States to European citizens. At the same time, Europe's transport policy continues to be affected by a serious imbalance between the adoption of different modes of transport, the absence of systemic vectors and an efficient European coordination platform.

The MAAT concept evolved from an earlier project, PSICHE (Photovoltaic Stratospheric Isle for Conversion in Hydrogen as Energy Vector). PSICHE is a discoid stratospheric platform. It was conceived as a high-altitude isle (up to an altitude of 16 km) and has the same behaviour as a balloon. The buoyancy is provided by a set of ballonets, which are maintained in continuous thermodynamic equilibrium by pressure and the atmosphere's local density. The electric energy, produced by the photovoltaic roof, can be used for hovering position maintenance and for the production of electrolytic hydrogen and oxygen, which can be stored in a gaseous and/or liquid state. A feeder, MAM (mobile autonomous module), is designed to take the hydrogen and oxygen down to the Earth's surface and take water for the hydrolysis up to the platform.

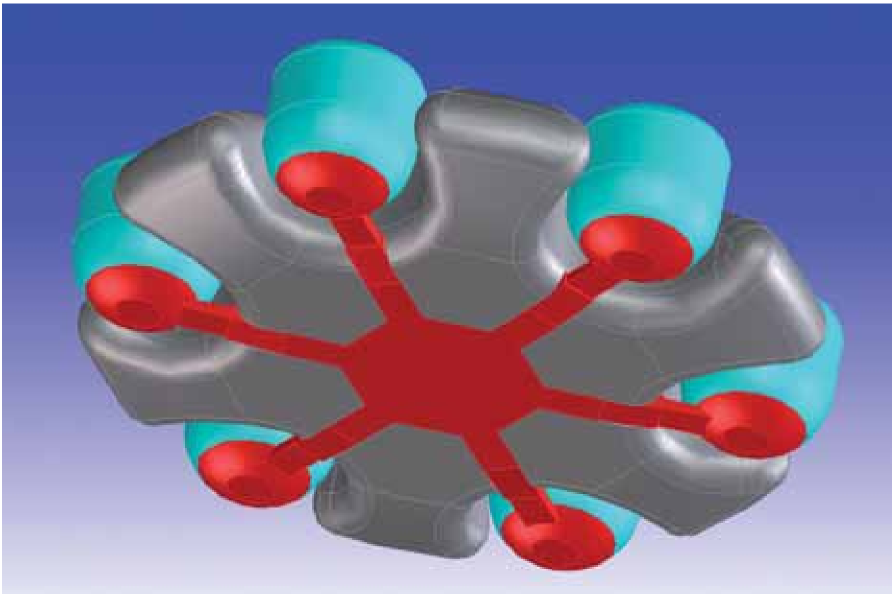
On the basis of evaluations carried out for the PSICHE Project, the MAAT dimensions are assumed to be about 70 m in height and 350 m in diameter.

Objectives

The MAAT project aims at designing a novel discoid airship or cruiser, which has the ability to make very long, non-stop-flights at economical altitudes and cruise speeds. Feeder ships carry people and goods to and from the cruiser during its travels.

The overall transport system is composed of two elements:

- PTAH (photovoltaic transport aerial high altitude system) is the central hexagonal airship cruiser which looks like the corolla of a flower;
- ATENs (aerial transport elevator networks) or feeder ships, which connect to the PTAH and look like hexagonal petals.



A six-feeder configuration of the MAAT System

The ATENs have a higher service ceiling than the PTAH in full service due to the buoyancy force and the airship's vertical take off and landing system. They rise to the cruiser interception altitude and descend to the ground using the buoyancy control system. They can also move horizontally due to the electric propulsion fed by the electric energy produced by the photovoltaic modules. The horizontal and vertical movement allows the feeders to approach and join the PTAH while their propulsive system contributes to a horizontal displacement of the MAAT system.

This distinctive feature and the possibility of silent landing and take-off operations allow the design of an innovative airship hub airport (AHA). The feeders carry people and goods from the AHA hubs, distributed around the world, to the cruiser and back.

Description of Work

The project has to define the shapes of both the cruiser and feeder, together with the general guidelines for safe hydrogen deployment as buoyant gas, minimising the overall risk of explosion and fire. The ATENs has to join on to the PTAH cruiser rigidly so that they constitute a multi-body modular cruiser.

Logistical deployment of the system is also under analysis and will be studied.

The attention is focused on the system architecture and optimisation of different possible solutions. Different architectures will be compared in terms of functionality, energy needs, controllability and ease of management, including the analysis of the flight attitude of the system.

A novel airship concept for feeder has been defined. Optimised for both vertical and short-range horizontal movements, this concept can be defined as a variable volume airship, which is more similar to an aerostatic balloon than a traditional airship. Different airship concepts have been taken into account and analysed in depth to permit these features to have a minimum structural weight.

Expected Results

The main expected result of the MAAT project is testing the feasibility of the MAAT cruiser/feeder system.

Other expected results are:
- identify and design the best type of propulsion for the PTAH, starting with the available electric energy supplied by the photovoltaic modules;
- study the different ways of approaching, and joining and release between the ATENs and PTAH;
- identify and design the joining modality between the ATENs and PTAH;
- design the best procedure for docking operations;
- obtain the maximum safety level both for passengers and goods;
- achieve the correct size for the propulsive system of the PTAH and ATENs;
- study the different architectures of PTAH and ATENs, so that PTAH is optimised for aerodynamic performances given specified dimensions and an operative mission;
- set up a demonstrator of the system on a 1:10 scale; the demonstrator has to prove the feasibility of all the systems, subsystems and operations;
- test the capability of PTAH to remain airborne for long periods without interruption.

Acronym:	MAAT
Name of proposal:	Multibody Advanced Airship for Transport
Grant Agreement:	285602
Instrument:	CP – FP
Total cost:	5 092 000€
EU contribution:	3 767 000€
Call:	FP7-AAT-2011-RTD-1
Starting date:	01.09.2011
Ending date:	31.08.2014
Duration:	36 months
Technical domain:	Breakthrough and Novel Concepts
Website:	http://www.eumaat.info/ ; http://www.projectmaat.org/

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	Engys Ltd	UK
	University of Lincoln	UK
	Alma Mater Studiorum – Università di Bologna	IT
	EDL SA	UY
	Aero Sekur S.p.A.	IT
	VUB – Vrije Universiteit Brussel	BE
	Politecnico di Torino	IT

MYCOPTER
Enabling Technologies for Personal Air-transport Systems

State of the Art – Background

The volume of road transportation continues to increase and the implied financial and environmental impact fuels public concern. Individual drivers spend considerable time in congested urban agglomerations or highly frequented highways, which leads to significant losses to the European economy.

The EC-funded study Out of the box suggests a personal air transport system (PATS) as a radical solution to congestion and as an alternative to current transport systems. A PATS would use personal aerial vehicles (PAVs) to bridge the gap between relatively slow cars in a road-based door-to-door system and an air transport system that provides fast and longer journeys to specific locations.

Previous projects related to PAVs have focused on the design of the vehicle itself. However, the surrounding issues, such as the concept of operations, business models and target users, have not been comprehensively considered. This is a necessary requirement for PATS to be operated commercially.

Objectives

The myCopter project approaches the development of PATS by investigating the technologies that are needed to enable the operational infrastructure required for the use of PAVs on a large scale.

Three key research areas are addressed. First, the interaction between the pilot and a vehicle will be investigated, including the level of training that will be required to fly a PAV effectively. Even though it is likely that a PAV will be autonomous to a high degree, the pilot will be expected to interact with the vehicle.

Second, the technologies for PAV automation will be assessed. This research will focus on algorithms for guidance and navigation through cluttered environments, for choosing safe landing positions, for collision avoidance, and for formation flying to facilitate smooth traffic flow.

Finally, the socio-economic impact of PATS will be examined. Questions surrounding the expectations of potential users and how the public would react to and interact with such a system will be addressed.

The following objectives will be pursued:

1. develop an operational concept for a PATS;
2. investigate and test technologies that support the envisaged concept of operations;
3. demonstrate several of the key technologies;
4. examine the potential wider social and technological impact if a PATS were to become reality.

Description of Work

The interaction of humans with PAVs should be as intuitive as possible. The myCopter project will introduce novel concepts for the interaction between human and the vehicle. The benefits of, for example, synthetic vision displays and haptic feedback will be evaluated in motion simulators. Furthermore, non-pilots will be used to develop a better understanding of the training requirements for 3-D PAV flying. Training for emergency situations will also be assessed.

Current automation algorithms focus on beacons and inertial navigation systems. In urban environments, this approach is hampered by things like intermittent GPS signal loss and GPS reflection on buildings. This project will introduce vision-based localisation and navigation as a complementary source of information. These algorithms will be used to develop vision-aided automatic take-off and landing. Additionally, alternatives to centralised air traffic control will be explored, leading to collision avoidance techniques and global traffic control strategies

The success of PATS depends not only on the relevant technological aspects but also on demand patterns, expectations, perceptions and attitudes of relevant actors, and many more factors. These factors will be investigated through a screening of the socio-technological environment and interviews with potential PAV users, relevant stakeholders and regulatory bodies.

Expected Results

The human-machine interface concepts and automation technologies developed here can form the basis for a PATS. The testing will be done with an experimental helicopter that is equipped with many sensors, reconfigurable pilot controls and displays. At the end of the project, selected technologies will be validated in piloted evaluations in flight.

The explorations of the socio-economic environment performed in the project will result in design criteria for autonomous control, collision avoidance and traffic management. Also, interviews with target groups for PAVs will provide an overview of the requirements for a PATS in terms of, for example, safety and efficiency. Finally, strategies will be developed for the integration of PAVs in the current transport system.

In the longer term, the development of a PATS could reduce congestion and result in spending less time in traffic by using a more flexible approach to personal transportation. This is supported by developing the necessary technologies for safe and efficient individual air travel. In turn, this approach could lead to increased flexibility in urban planning. On the shorter term, results from the project can be used to facilitate developments in general aviation.

This project integrates social investigations and technological advancements that are necessary to move public transportation into the third dimension.

Acronym:	MYCOPTER	
Name of proposal:	Enabling Technologies for Personal Air-transport Systems	
Grant Agreement:	266470	
Instrument:	CP – FP	
Total cost:	4 496 419€	
EU contribution:	3 424 534€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.01.2011	
Ending date:	31.12.2014	
Duration:	48 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.mycopter.eu	
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	Karlsruher Institut für Technologie	DE
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE

NOVEMOR

Novel Air Vehicle Configurations: From Fluttering Wings to Morphing Flight

State of the Art – Background

Air transport is becoming increasingly more accessible to a greater number of people, within and outside Europe, and for both leisure and business. This is evidenced by the fact that last year the European air transport system moved more than 1 billion passengers and 14 million metric tonnes of freight through its airports, whilst handling more than 12 million movements over the same period. In air transport terms, this implies a doubling of traffic about every 16 years.

It is evident that environmental requirements, such as noise impact and emissions, will play a dominant role in future transport aircraft development and become a driving force for aircraft design. The adoption of this kind of global requirement has two main consequences: firstly, the greening level becomes one of the criteria for which a new aircraft has to be judged or selected; and secondly, the aircraft configuration itself must be defined to fulfil the greening requirements.

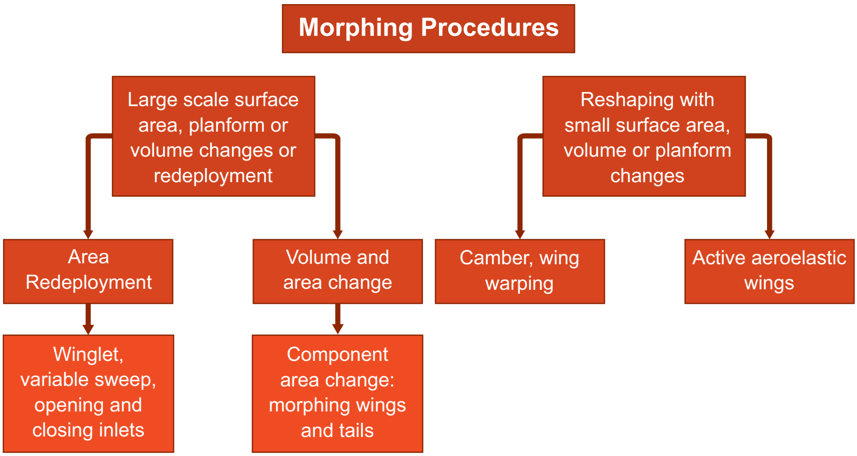
Research topics and technologies to be developed during the NOVEMOR project will guarantee significant progress beyond the state of the art by using modelling capabilities integrated into simulation and multidisciplinary design optimisation numerical tools, which will allow the use of adaptive and morphing technologies from the beginning of the design process.

Objectives

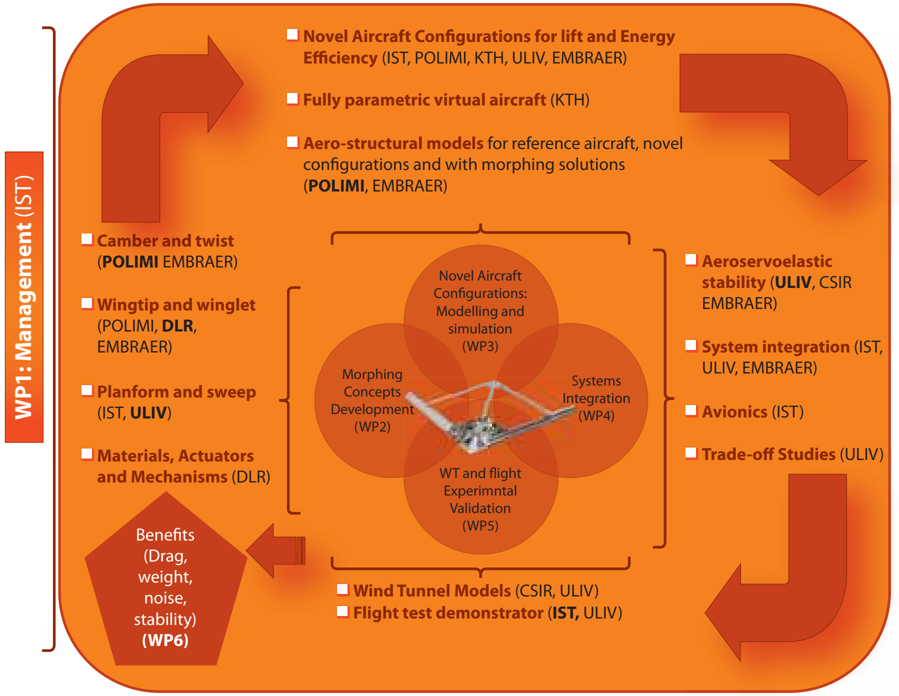
The aim of the NOVEMOR research project is to investigate novel air vehicle configurations with new lifting concepts and morphing wing solutions to enable cost-effective air transportation. The design and development of the proposed solutions will be an integral part of the aircraft's conceptual design, rather than just as an add-on later in the design cycle, thus enabling innovative aircraft designs to be made through the use of morphing structure technologies. Such concepts will enable improved aircraft efficiencies and aerodynamic performance, reduced structural loads and lighter weight structures.

The project will focus on the following primary objectives:

- design and evaluate a new aircraft concept that includes structural, aerodynamic and aero-elastic scaling simulations and analysis, and multidisciplinary design optimisation (MDO) techniques;
- propose morphing wing solutions (span and camber strategies and wing-tip devices) to enhance lift capabilities and manoeuvring;



Morphing strategies



Overall project implementation plan

- design, test and evaluate novel configurations, and some of the more promising adaptive/morphing concepts and mechanisms as part of a conceptual design environment, which are capable of augmenting performance characteristics in terms of drag reduction, load reduction, and weight and noise impact reduction.

Description of Work

The project will be focused on the following methods and approaches:

1. Study novel aircraft configurations equipped with morphing devices to augment lift and increase manoeuvrability, resulting in reduced operational costs.
2. Design and evaluate a new aircraft configuration based on the joined-wing concept.
3. Develop an aero-elastic scaling approach to experimentally flight test and evaluate the aero-elastic characteristics of the novel aircraft.
4. Validate the models and the design framework in wind tunnels and by flight testing the physical models.
5. Evaluate the benefits of these new morphing concepts in terms of lift increase and reduced operational costs.
6. Extend the already available aerodynamic and aero-elastic tools so as to be able to investigate slow and fast changes in the aircraft's state in terms of stability boundaries and resulting loads.
7. Use MDO tools to perform trade-off studies in order to optimise the complete system composed of aircraft plus morphing devices/surfaces.
8. Compare the proposed solutions with a conventional reference aircraft with due consideration to the energy balance between the conventional and the new proposed solutions.

Expected Results

The following outcomes are expected from NOVEMOR:

- Modelling capabilities integrated into simulation and MDO numerical tools will allow the use of adaptive and morphing technologies from the beginning of the design process, rather than considering their possible use later in the design cycle.
- Novel configurations and morphing concepts to be developed in this project show promise in delivering substantial capabilities to aircraft design.
- Within the consortium there are a number of unique wind tunnel models and facilities available, including a transonic wind-tunnel capability, which will allow, for the first time, a small-scale project to test different concepts in parallel and to substantiate the obtained measurements by means of cross-testing reference models. The transonic testing capabilities provide much added value to the outcome of the project in order to enable realistic tests of the proposed morphing concepts.
- The development of a wind-tunnel test to measure time-dependent pressure distributions typical of those associated with rapid wing geometry morphing. This effort would define the test article, instrumentation and data to provide a standard for future analytical unsteady aerodynamic predictions. Candidate models are variable camber and twist, variable planform and sweep, and morphing wingtips and winglets.

Acronym:	NOVEMOR	
Name of proposal:	Novel Air Vehicle Configurations: From Fluttering Wings to Morphing Flight	
Grant Agreement:	285395	
Instrument:	CP – FP	
Total cost:	2 568 150€	
EU contribution:	1 915 458€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.09.2011	
Ending date:	31.08.2014	
Duration:	36 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.novemor.eu	
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	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	CSIR – Council for Scientific and Industrial Research	ZA
	Embraer SA	BR

ORINOCO

Co-operation with Russia in the Field of Advanced EngIne Noise Control based on Plasma Actuators

State of the Art – Background

The increasing noise restrictions around airports are a challenging problem for aircraft and engine manufacturers. By 2020, the ACARE agenda requires a reduction in external noise of 10 EPNdB per operation of fixed-wing aircraft. For many years, the efforts in research and development have resulted in significant reduction in the sound pressure level radiated by aircrafts engines actually in service, especially for jet noise, which remains the main source of noise at take-off.

After the introduction of the high by-pass ratio engine, which contributed to both an improved aerodynamic efficiency and a substantial noise reduction, jet noise reduction has been treated by using passive devices such as chevrons or mixers, which enhance the mixing in the shear layers to reduce jet noise, but unfortunately decrease the engine performance during cruise.

Therefore, to reach ambitious noise reduction goals without thrust penalty, it is necessary to implement new ideas, based on active devices that can be switched off during cruise. The micro-jet actuator was one of the first implemented solutions, with reductions comparable with chevrons. However, air supply for theses devices has to be taken from the engine at a point when maximum thrust is needed. Another solution is to use plasma actuators system that can be easily configured in any spatial form near the nozzle orifice.

Objectives

The ORINOCO project objective is to achieve advanced engine noise control based on plasma actuators. Plasma technologies were initially developed for flow control and their first applications for jet noise reduction were confronted with technical aspects that had nothing to do with acoustics. This use of plasma actuators is a novel concept that requires fundamental approaches to understand the interacting mechanisms with the main jet and the resulting radiated sound.

To achieve the final goal of evaluating plasma actuator concepts for jet noise reduction, several points have been identified, including theoretical, numerical and experimental investigations:

- develop and enhance plasma actuator technologies dedicated to jet noise reduction;
- investigate instability wave concepts for jet noise;
- formulate a noise control strategy;
- implement jet noise control based on plasma actuators.

Jet noise reduction is a major goal for the aeronautical industry, and plasma technology presents a promising solution. However, the concept needs to prove its potential. As a result of the fundamental work performed during the first stages of the project, aero-acoustic tests will be carried out in wind tunnel facilities. The experimental results will be analysed to evaluate the potential of plasma actuators concepts for jet noise reduction.

Description of Work

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

The plasma actuators will be developed and improved in WP1 with the support of theoretical considerations, numerical simulations and experimental tests in the laboratory. Control strategies will be investigated to define the best means of acting on the flow in order to reduce the jet noise. Finally, linear and non-linear feedback control laws will be developed in preparation for the assessment.

Dielectric barrier discharge from IVTAN in the wind tunnel facilities at TsAGI

The instability wave is the physical mechanism exploited by some plasma actuators concepts in ORINOCO. WP2 deals with the physics of instability wave concepts to define its parameters in the vicinity of the nozzle and the characteristics of actuators to generate anti-phase waves.

WP3 assesses the various control concepts developed in the project. The test campaigns will be carried out on an isothermal single jet at small scale, with aerodynamic and acoustic measurements (near and far field). With the support of the conclusions of WP2 about instability wave concept physics, the actuators developed in WP1 will be tested and different configurations of implementations will be investigated.

In WP4, a synthesis of the acoustic performance of each plasma actuator concept for jet noise reduction will be achieved. Specifications for the extension of these concepts to full scale will be carried out.

Expected Results

By addressing the fundamental aspects, ORINOCO will contribute towards enhancing the knowledge on the physics for jet noise reduction. Previous research on chevrons and micro-jets have shown that the precise ways these devices impact the sound sources are not fully understood, which renders the full-scale optimisation very difficult. Thanks to analytical and experimental studies, ORINOCO will focus on the coupling mechanisms, which will lead to the definition of control strategies.

Several plasma actuator concepts are considered: dielectric barrier discharge, corona discharge, plasma actuator and other variants. The choice of these types of actuators is representative of the possible interaction mechanisms with the jet, wide or discrete, and the activities performed in the project will result in the optimisation of these techniques for jet noise reduction. Most of these concepts will be evaluated in anechoic test facilities to assess their efficiency, providing much information on noise control-based plasma actuators, which has not been done before.

ORINOCO is one of the first projects to be co-funded by the European Commission and the Ministry of Industry and Trade in the Russian Federation. The main actors of plasma technologies and aero-acoustics in Europe and Russia are involved in the project, which will help reinforce the co-operation between these countries.

Acronym:	ORINOCO
Name of proposal:	Co-operation with Russia in the Field of Advanced EngIne Noise Control based on Plasma Actuators
Grant Agreement:	266103
Instrument:	CP – FP
Total cost:	3 218 250€
EU contribution:	1 349 921€
Call:	FP7-AAT-2010-RTD-RUSSIA
Starting date:	01.08.2010
Ending date:	31.01.2014
Duration:	42 months
Technical domain:	Breakthrough and Novel Concepts
Website:	http://www.orinoco-project.org/
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	A.M. Prokhorov General Physics Institute of Russian Academy of Sciences – GPI – RAS	RU
	JIHT RAS – Institution of the Russian Academy of Sciences Joint Institute for High Temperatures	RU
	CNRS – Centre National de la Recherche Scientifique	FR
	ECL – Ecole Centrale de Lyon	FR
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	State Research Centre of Russian Federation Troitsk Institute for Innovation and Fusion Research	RU
	Università degli Studi Roma Tre	IT
	Erdyn Consultants	FR

RECREATE

Research on a Cruiser-enabled Air Transport Environment

State of the Art – Background

RECREATE investigates the introduction and airworthiness of cruiser-feeder operations for civil aircraft as to whether they are a promising, pioneering idea for the air transport of the future.

Air-to-air refuelling operations are an example of this concept. The soundness of the proposed cruiser-feeder operations concept is convincingly exemplified by air-to-air refuelling (AAR). AAR has long since been formulated and described in peer-reviewed publications as a concept for greening air transport with respect to fuel burn and CO_2 emissions. The publication resulting from the Greener by design study in the UK is well known. Studies by Bennington, Visser and Nangia show the economic benefits offered by an improvement in range and an increase in payload, including a reduction in fuel burned. An important observation is the direct proportionality of CO_2 emissions with fuel burn and weight. This reduction potential has been shown to be large by any standard.

Objectives

The main objective of the RECREATE project is to demonstrate on a preliminary design level that the cruiser-feeder concept can be shown to comply with airworthiness requirements for civil aircraft. A generic and non-process-orientated definition of airworthiness is: the ability of an aircraft or other airborne equipment or system to operate without significant hazard to aircrew, ground crew, passengers (where relevant) or to the general public over which such airborne systems are flown.

The subsequent scientific and technological objectives are:

- to substantiate through a collaborative research effort on a pre-design level that viable and acceptable concepts exist for cruiser-feeder operations;
- to identify and qualify, through a collaborative effort, the necessary procedures and steps and required facilities to assure airworthiness of cruiser-feeder operations;
- to confirm through collaborative research that the reported benefits of cruiser-feeder operations are consistent with the refined analysis and high-fidelity simulation.

Description of Work

Progress beyond the state-of-the-art will be achieved by answering these crucial questions:

1. Which procedures and steps need to be taken and which facilities are necessary to comply with airworthiness requirements for cruiser-feeder operations with passengers on board? Which ones are required for nuclear propulsion as suggested by the authors of the out-of-the-box studies?
2. Can viable and acceptable concepts for cruiser-feeder operations be substantiated, even when passengers need to be transferred between cruiser and feeder?
3. Are the reported benefits of cruiser-feeder operations consistent with the results of the refined analysis and the high fidelity simulation?

Airworthy operational concepts for cruiser-feeder operations are determined and studied. The benefits in terms of reduced CO_2 emissions are derived and quantified. A conceptual and preliminary design study of the aircraft required will be made, as well as automatic flight control concepts necessary to reduce the workload of the pilots and concepts to transfer passengers, supplies and waste.

Finally, flight simulations will be conducted to investigate the cruiser-feeder operations concept. The impact of the work carried out here will be generated by disseminating the results to the general public, to advisory groups and policy-makers, and to the aeronautical sciences community.

Expected Results

A viable and acceptable airworthy operational concept can be pursued through the known process of conceptual, preliminary and detailed design in aerospace engineering. State-of-the-art airworthy passenger aircraft designs could be taken as a baseline for comparison, and new cruiser and feeder aircraft configurations will be defined.

It is anticipated that the cruiser and feeder aircraft dock while both airplanes are supporting their weight by means of their own wings. When fixed together they will form a single multi-surface aircraft. Hence critical in cruiser-feeder operations is the very advanced device that will enable docking and the transfer of passengers, supplies and waste. From an airworthiness point of view, this device is a third airborne part: the aerial transfer boom system (ATBS).

Automated flight control algorithms and technology will progress as a requirement to increase the safety level of cruiser-feeder operation manoeuvres. New knowledge will be generated regarding environmental, operational and economic benefits, and regarding human factors of cruiser-feeder operations.

Airworthy nuclear propulsion is potentially offering a step change beyond the state-of-the-art, although the consortium realises that such a concept might remain unacceptable in society for many years to come.

Acronym:	RECREATE	
Name of proposal:	Research on a Cruiser-enabled Air Transport Environment	
Grant Agreement:	284741	
Instrument:	CP – FP	
Total cost:	3 704 586€	
EU contribution:	2 909 225€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.08.2011	
Ending date:	31.01.2015	
Duration:	42 months	
Technical domain:	Breakthrough and Novel Concepts	
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Partners:	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	FOI – Totalforsvarets Forskningsinstitut	SE
	TUM – Technische Universitaet Muenchen	DE
	TU Delft – Technische Universiteit Delft	NL
	Queen's University of Belfast	UK
	ZHAW – Zurcher Hochschule fur Angewandte Wissenschaften	CH
	Dr Rajendar Kumar Nangia	UK
	NRG – Nuclear Research and Consultancy Group	NL

SOLAR-JET

Solar Chemical Reactor Demonstration and Optimisation for Long-term Availability of Renewable Jet Fuel

State of the Art – Background

The future of aviation will be shaped by a growing mobility demand, limited fossil energy resources and the need for climate protection.

Today, the aviation sector is very dependent on fossil fuels, which are ideal energy carriers due to their high-energy density and convenient handling and storage properties. The most significant challenge for the future of aviation is therefore the substitution of fossil fuels or the aircraft's power system to implement entirely renewable carbon-neutral energy carriers and power systems in aviation.

Suitability, sustainability and scalability serve as major criteria for the evaluation of different alternative fuels. 'Drop-in' alternative fuels rank high in suitability because they do not require a re-design of the aircraft fuel system or changes in the infrastructure for implementation. The scalability criterion addresses the technical feedstock potential, the processing potential and challenges in high-volume logistics. Selected alternative fuels are compared in Table 1. Solar fuels show high potential in all three criteria, representing a promising path towards reducing the carbon footprint within aviation. Among the possible paths to produce solar drop-in fuels, thermochemistry offers a viable way with theoretical efficiencies surpassing those of the biomass fuel paths.

Schematic of solar reactor for the two-step thermochemical production of syngas (carbon monoxide and hydrogen, a precursor for solar jet fuel) from carbon dioxide, water and concentrated sunlight (Chueh, W. C., Science 2010, 330 (6012), 1797-1801.)

Objectives

The technological potential of SOLAR-JET fuel is investigated both theoretically and experimentally using the ceria-based thermochemical cycle.

Starting with an existing reactor that has been used in previous experiments, a computer model will be devised to allow the design of an optimised reactor. Both the existing and the optimised reactors will produce syngas (hydrogen and carbon monoxide) from water, carbon dioxide and concentrated sunlight in a solar research facility. Experimental results will serve as a base for the validation of the model, which can be further used for estimating the scaled-up potential.

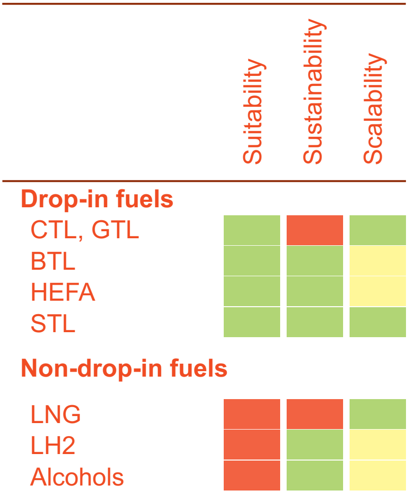
An analysis of the ceria cycle and of all further steps in the conversion process will be performed for a quantitative and comprehensive comparison of SOLAR-JET fuel with other alternative fuels, using fossil fuel as a reference.

The synthesis of experimental and theoretical results will allow the identification of criticalities and maturity gaps in the production chain. Furthermore, an economic feasibility analysis will be performed to understand the perspectives of implementing SOLAR-JET fuel as a potential substitute for fossil kerosene.

Description of Work

The work is organised into four technical work packages (WP).

WP1 deals with the development of quantitative measures (metrics) that allow the comparison of various fuel technologies to assess the potential of SOLAR-JET fuel in comparison with other alternative fuel sources and fossil kerosene. This quantitative assessment framework will then be applied to various fuel options and also to fuel requirements in order to obtain comprehensible, transparent and objective figures of merit.



Main benefits and limitations of alternative fuels for aviation. The colour code indicates a qualitative aptitude of a fuel option in a 2050 timeframe. CTL/GTL/BTL: coal/gas/biomass-to-liquid; HEFA: hydroprocessed esthers and fatty acids; STL: sunlight-to-liquid; LNG: liquid natural gas; LH2: liquid hydrogen.

In WP2, synthesis gas is produced from CO_2 and H_2O via a two-step solar thermochemical cycle based on non-stoichiometric ceria redox reactions. Experimental results obtained with the existing, non-optimised solar reactor will be used to validate a reactor model, which will be utilised to design an optimised reactor geometry and determine optimal operating conditions. A new solar chemical reactor for the production of syngas will be fabricated.

In WP3 the chemical composition of the produced syngas is analysed and a small amount of SPK will be produced via a Fischer-Tropsch micro-reactor to prove the concept.

WP4 works on integrating the theoretical and experimental results into a clear and transparent representation of the potential impact on and advancement of the future alternative fuel technology and economics for aviation.

Expected Results

The first significant achievement will be the synthesis of solar kerosene from syngas, produced in a solar research facility in Switzerland. The syngas will be converted to solar kerosene in the Netherlands as a first proof of concept of this technology.

Using the experience gained with the existing reactor and computational fluid dynamic modelling of the heat and mass transfer, coupled with chemical reactions inside the reactor, an enhanced reactor design is proposed that will allow the more efficient production of solar syngas, the precursor for processing solar jet fuel. The modelling will also show the potential of the process for scaled-up operations to an industrial level.

A theoretical analysis of the process and the evaluation in a comprehensive assessment framework will show the inherent characteristics and advantages of the thermochemical ceria cycle as compared to other alternative fuels and fossil kerosene.

The synthesis of the theoretical and experimental results, combined with an overall fuel production path analysis, will provide information on the technological and economic potential of the ceria cycle and the solar fuel production chain that need to be addressed in order to make full use of this technology potential.

The outcomes of SOLAR-JET would propel Europe to the forefront in efforts to produce renewable aviation fuels.

Acronym:	SOLAR-JET
Name of proposal:	Solar Chemical Reactor Demonstration and Optimisation for Long-term Availability of Renewable Jet Fuel
Grant Agreement:	285098
Instrument:	CP – FP
Total cost:	3 123 950€
EU contribution:	2 173 548€
Call:	FP7-AAT-2011-RTD-1
Starting date:	01.06.2011
Ending date:	31.05.2015
Duration:	48 months
Technical domain:	Breakthrough and Novel Concepts
Website:	http://www.solar-jet.eu/
Coordinator:	Mr Andreas Sizmann Bauhaus Luftfahrt e.V. Lyonel-Feininger-Straße DE 80807 Munich
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EC Officer:	Christiane Bruynooghe

Partners:	ETH – Eidgenössische Technische Hochschule Zürich	CH
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	Shell Global Solutions International B.V.	NL
	ARTTIC	FR

VR-HYPERSPACE

The innovative use of virtual and mixed reality to increase human comfort by changing the perception of self and space

State of the Art – Background

During the last few decades, the growth of air traffic has been immense, even though it has faced many challenges, for example security attacks, environmental issues, oil prices and the financial crisis. However it is expected that this key strategic sector for the European economy will continue to grow, with forecasts predicting a potential demand for 25 000 new passenger and freight aircraft between 2008 and 2028.

To truly address the future interior space for passengers in 2050 and beyond, including the impact on passenger comfort, there is a need to consider how to open up the space through the innovative use of display and movement-tracking technologies. The interior of the air cabin will need to fit increasing numbers of passengers in a confined space that may not even have windows.

Passengers are likely to travel more frequently, further, faster and even into outer space. Therefore a solution that considers how to improve comfort through extending and enhancing a person's perceptual and cognitive experience is more likely to provide the step-change required.

Objectives

VR-HYPERSPACE aims to carry out fundamental research and development that will provide positive illusions to enable passenger to feel that they are in an extended or alternative space and feeling comfortable. This will be achieved through the following objectives:
- Passenger 2050 and beyond: understand the requirements of future passengers in terms of the activities they are likely to want to do to support business and social mobility;
- Comfort and self representation: investigate the relationship between a person and their virtual representation so as to explore whether changing a person's virtual self to appear more comfortable can change a person's perceived level of comfort and physiological state;
- Comfort and perception of space: investigate whether we can change a person's perception of volume and provide the illusion of a more spacious cabin by altering visual cues;

MPS cyber motion simulator that is used for scientific research in motion perception, flight training, simulating aviation and driving experiences

- Comfort and perception of others and their environment: investigate new functionalities to improve levels of comfort through enabling the passenger to personalise their space and interact with others;
- Evaluation of current and future technological approaches: develop and apply innovative evaluation approaches to test emerging and future breakthrough technological concepts;
- Research roadmap: provide a roadmap showing the steps required to develop current and future immersive technologies.

Description of Work

The VR-HYPERSPACE concept utilises three fundamental ideas.

1. Self perception: evidence suggests that it is possible for people to have a sense of embodiment in an entirely virtual body, where they have the illusion that this is their body (ownership) and that they have control over it (agency). Such body transformations can result in the perception of changed levels of comfort, and even physiological changes.

2. Space perception: evidence also strongly suggests that the passenger's sense of the surrounding space can be changed through virtual reality, thus overcoming the likely cramped and constrained conditions of air passengers in the future. Current

methods to do this include altering visual cues and subsequently measuring human behaviour and perception in controlled experiments.

3. Others and the environment: the use of virtual environments will be explored. These present an in-flight environment to passengers that is more or less decoupled from the actual situation of being on board an aircraft, ranging from an enhanced cabin (e.g. with transparent seats and virtual windows), to an environment completely unrelated to an aircraft, (e.g. some alternate reality). Representations of other passengers, or indeed people not on board but sharing the same virtual environment, will enable communication and interaction for business or social activities.

Expected Results

VR-HYPERSPACE presents a profoundly new approach to the issue of aircraft passenger comfort for the second half of this century. The project employs recently emerging results from cognitive neuroscience and virtual reality, which show that it is surprisingly easy to give people the illusion of substantial changes in their body – regarding appearance, posture, movement and even structure. These ideas will be applied to generate a sense of comfort in passengers, and to enable them to transform their sense of place to situations away from the aircraft, to more desirable alternate realities, including realities from everyday life. VR-HYPERSPACE will provide the necessary step-changes required to design the future interior cabin of 2050 and beyond.

Acronym:	VR-HYPERSPACE	
Name of proposal:	The innovative use of virtual and mixed reality to increase human comfort by changing the perception of self and space	
Grant Agreement:	285681	
Instrument:	CP – FP	
Total cost:	4 592 294€	
EU contribution:	3 424 849€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.10.2011	
Ending date:	30.09.2014	
Duration:	36 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.vr-hyperspace.eu	
Coordinator:	Ms Mirabelle D'Cruz	
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EC Officer:	Christiane Bruynooghe	
Partners:	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V	DE
	VTT – Technical Research Centre of Finland (Teknologian Tutkimuskeskus)	FI
	BUW – Bauhaus-Universitaet Weimar	DE
	EADS Deutschland GmbH	DE
	Institute of Communication and Computer Systems	EL
	UB – Universitat de Barcelona	ES
	Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V.	DE
	Thales Alenia Space Italia S.p.A.	IT

AERA-PRO

Aeronautics and Air Transport European Research Agenda – Promotion

State of the Art – Background

The European Commission published its *Vision 2020* report in 2001. The document detailed a vision for air transport for 2020, and advised the set-up of a standing body: the Advisory Council for Aeronautics Research in Europe (ACARE).

The dissemination campaigns of the Strategic Research Agenda (SRA) Vol.1 and Vol.2 have echoed all over the world, and the dissemination of the next Strategic Research and Innovation Agenda (SRIA), which is the objective of this project, is set to continue these efforts towards the vision beyond 2020 for the benefit of European citizens.

Over the last ten years, substantial progress has been made in research. Supported by the actions of the European Commission, research is performed throughout Europe and the co-operation in joint research and technology development in Europe has increased at a greater pace than would have been thought possible in 2000.

With this new SRIA, Europe wants to remain at the forefront of innovation.

Objectives

Flightpath 2050 , Europe's vision for Aviation beyond 2020 was published in March 2011 at the Aerodays conference.

The development of a Strategic Research and Innovation Agenda (SRIA) based on this vision is now taking place through the involvement and consultation of major aeronautics and air transport stakeholders with the support of the EC-funded FP7 project NEARS (New European Aviation Research Strategy).

The SRIA will outline the main threads of technical, operational and strategic actions to achieve the fulfilment of the vision, and will be released during Summer 2012.

Aera-Pro will provide the opportunity to raise the profile of this research-intensive sector by orchestrating a dissemination campaign matching the expectations of transforming the strategic research and innovation agenda into a well known reference document for all aeronautics and air transport stakeholders and beyond.

The objective is therefore to cover, as extensively as possible, the European Member States and countries associated to the EU Framework Programme, to promote the image of European research in this sector on a global scale and use the very best communication means to address audiences that are usually more difficult to reach.

Tailoring a dissemination campaign around the new agenda to maximise its impact is therefore contributing to this overarching objective.

Description of Work

AERA-Pro is made up of five work packages (WP) to create the dissemination campaign.

WP1 will encompass all the management activities of the project.

WP2 will develop the communication strategy and communication plan to define and monitor the progress of the consistent approach to communication and dissemination. A communication group made up of communication experts from the air transport stakeholders will be created to provide advice to the project team on the approach and the particular need to tailor it to communicate better with the identified target audiences.

WP3 will deal with the development of the communication supporting tools: website layout and implementation, research agenda printing, leaflets, banners and video editing.

WP4 is dedicated to the organisation of the nine conferences, which are scheduled to take place all over Europe.

WP5 will cover the continuous assessment of the activities performed during the project to evaluate the level of maturity gained for the audiences reached, and the anticipated level of uptake of the research agenda in the organisational strategies.

This project is dedicated to ensure that the new SRIA rapidly becomes an indispensable instrument to make progress in terms of research and technology development, close coordination and co-operation, as well as integration in research and technology development in Europe.

Expected Results

AERA-Pro will push back the frontiers of the number of organisations already aware of the strategic work performed at the aeronautics and air transport level inside and outside the boundaries of the sector itself.

The SRIA will be the main vehicle around which the communication will take place. Dedicated supporting tools will be developed to ensure that the largest number of people will know more about it through its website, conferences, events organised in the Member States, webinars and leaflets. A dedicated team of 'champions' from the sector itself will also be put together to act as key-note speakers in the different events and to play the role of ambassadors in the various Member States visited. Nine conferences are planned for a total audience of 1 800 attendees.

The new agenda will be the focus for future aeronautics and air transport research, on the European level, as well as for national and industrial programmes. This will ensure that, in times of unpredicted challenges and limited resources, the mobility needs of European citizens are satisfied safely and more sustainably, and that Europe continues to maintain its leading position in a technology sector of strategic and commercial importance and political prestige.

Acronym:	AERA-PRO	
Name of proposal:	Aeronautics and Air Transport European Research Agenda – Promotion	
Grant Agreement:	284875	
Instrument:	CSA – SA	
Total cost:	343 535€	
EU contribution:	300 359€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.01.2012	
Ending date:	31.03.2013	
Duration:	15 months	
Website:	http://www.aera-pro-project.eu	
Coordinator:	Ms Patricia Pelfrene	
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EC Officer:	Rémy Dénos	
Partners:	Minerva Consulting & Communication	BE
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE

AERODAYS2011

Innovation for Sustainable Aviation in a Global Environment

State of the Art – Background

The sixth European Aeronautics Days, entitled 'Innovation for sustainable aviation in a global environment', took place from 30 March to 1 April 2011 in Madrid, following on from previous successful events that took place in Brussels (1991), Naples (1993), Toulouse (1997), Hamburg (2001) and Vienna (2006). The event brought together aeronautics stakeholders, ministries, agencies and R&D centres from all over Europe and further afield to network, present their latest research results and discuss common future R&D projects.

Organised by CDTI (Centre for the Development of Industrial Technology in Spain) and the European Commission (Directorate-General for Research), Aerodays 2011 provided a perfect opportunity to present and disseminate information about EU-funded RTD results, fully in line with the EU goals of creating a Single European Sky, a European Research Area, and of finding innovative approaches to sustainable aviation in a global environment.

Objectives

The Aerodays 2011 seeked:

- to link the political messages of key stakeholders with the developments in aeronautics and air transport;
- to report on the latest advances in aeronautics worldwide;
- to encourage new partnerships in collaborative projects;
- to present technological achievements and ongoing research and technological development that is carried out under the EU's Framework Programmes, national and international research actions, and large-scale European technology initiatives (such as JTI Clean Sky, SESAR and Galileo);
- to present a forum for the review process of the Vision 2020 goals and the Aeronautics Strategic Research Agenda;
- to offer an opportunity to formulate a vision on the future of aeronautics, including the Eighth Framework Programme and a vision beyond 2020 with the publication of the Flightpath 2050 document.

Description of Work

AERODAYS main auditorium

The overall strategy of the project is based on four work packages (WP).

WP1: Project management. This work package frames the administrative and financial coordination, and provides all relevant reports to the European Commission.

WP2: Project preparation. This work package covers the specific selection of priority areas to be dealt with in the event, as well as the definition of its structure in great detail, invitations to speakers and attendees, hotel bookings, conference facilities, catering, media equipment and transport.

WP3: AERODAYS 2011: Innovation for sustainable aviation in a global environment conference. This work package mainly covers the conference. This consists of the coordination, management and organisation of the three-day event.

WP4: Communication and outreach. Adequate public relation material and a dedicated website for registration and news were produced for the conference. The event was published in CORDIS and on the main website of CDTI. In addition, a dissemination campaign of the event was prepared with European and Spanish research agencies and organisations in order to cope with the high interest levels and the number of people attending the event.

Expected Results

The main results of the conference are listed below.

- Up to 1 400 participants registered from Europe and overseas.
- Up to 56 parallel sessions involved more than 220 speakers from 26 countries and numerous international organisations and six plenary sessions with high-level speakers (EU Commissioners, members of Spanish ministries, etc.) from Europe and overseas were organised during the event.
- The event represented an excellent platform to launch Flightpath 2050: Europe's Vision for Aviation. This document sets the scene for the implementation of the new vision, the cornerstone for preparing the future roadmap for aeronautics and air transport.
- Special sessions and meetings on international cooperation, national activities, GARTEUR, JTI Clean Sky and SESAR, ERA-NET AIRTN2, the Support Action Cooperate-US, the European Aviation Research Partnership Group from the European Aviation Safety Agency, etc., were organised.
- The conference exhibition portrayed 20 EU research projects and another 20 companies and organisations committed to aviation.
- A contest for university students and children took place before the conference. During the event the students' projects were presented in different parallel sessions.
- Attractive side events and a social programme also took place, including technical visits to the main aeronautics facilities close to Madrid, an official dinner in the Thyssen-Bornemisza museum and visits to several aeronautics museums.

Acronym:	AERODAYS2011
Name of proposal:	Innovation for Sustainable Aviation in a Global Environment
Grant Agreement:	264602
Instrument:	CSA – SA
Total cost:	1 177 540€
EU contribution:	420 000€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.02.2010
Ending date:	30.09.2011
Duration:	20 months
Website:	http://www.aerodays2011.org
Coordinator:	Ms Eva Martinez CDTI – Centro para el Desarrollo Tecnológico Industrial Calle Cid 4 ES 28001 Madrid
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Fax:	+34 (0)915 815 584
EC Officer:	Dietrich Knoerzer

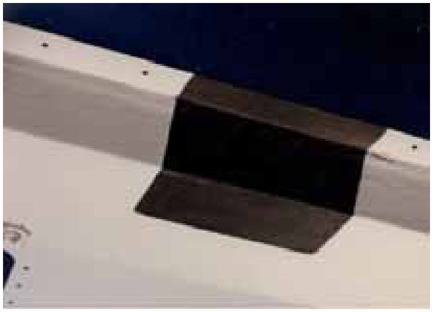
AEROPLAN

Composites Repairs and Monitoring and Validation – Dissemination of Innovations and Latest Achievements to key players of the aeronautical industry

State of the Art – Background

Current economic world conditions in many countries, both within and outside the EU, are forcing the operation of both passenger and cargo aircraft well beyond their original design life, as the cost for replacing older aircraft becomes disproportional to the capability for many airlines' long-term investment.

Most aircraft have been manufactured using aluminium alloys, which constitute the greatest percentage of their structure, while the use of composite materials, although increasing, is relatively limited. Even though repair techniques have been established by the manufacturers for the initial design life of the aircraft, it is well understood that there is an increasing need for innovative repair solutions, for both metallic and composite structures, to restore structural integrity or to reinforce areas prone to damage. This would reduce operating costs by providing easy and low-cost repair procedures, thus significantly extending the economic life of aircraft while guaranteeing airworthiness and the corresponding flight safety.



Airbus landing-gear door repair using a composite repair patch to the aluminium structure

Objectives

For the last ten years, the European Commission has funded research projects providing composite-based aircraft repair solutions, through the development of innovative elements that could assist in performing safer and more efficient repairs in a faster and more economical way. As these innovations have been developed as the main or the secondary target of a large number of upstream research projects, their combination and adaptation to the actual aeronautical composite repair requirements is still required, together with their organised and systematic promotion towards the key players of the aeronautical industry, in order to maximise the impact of results facilitated by investment or funding.

Following detailed dissemination and exploitation plans, it is evident that, due to the fragmentation of the research activities on the same topic (e.g. bonded composite repairs) in ten different projects, none of these projects was able to autonomously provide a global overview of advancements achieved in this field to the stakeholders of the aeronautical industry. This is the 'gap' which the AeroPlan project attempts to fill, by integrating all the produced technological advancements into a single support action, targeting directly all the key players of the aeronautical industry.

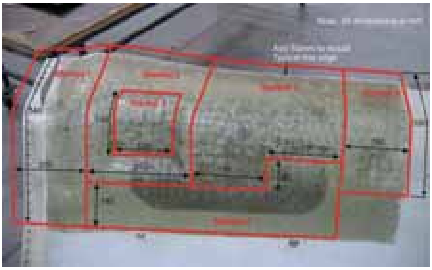
Description of Work

The overall strategy of the project allows for flexibility to cover the needs of the target group within the following work packages (WP).

WP1: Detailed definition of supporting activities. This is the 'navigator' of the project, providing the detailed orientation, content and focus of each instrument, according to the needs of the target groups, namely certification authorities, R&D and industrial target groups.

WP2: Preparatory activities. All the material required to support the disseminating activities will be processed according to the needs of the target groups and will then be exploited by the periodic dissemination activities and permanent supporting instruments.

WP3: Periodic dissemination activities (PDAs). These activities range from conferences, seminars and workshops of broader interest to short lecture series targeted to specific needs.



Extensive composite-to-composite repair using multi-zone heating technique

WP4: Permanent supporting instruments (PSI). These include the assembly of a composite repair advisory group and a web-based application. These instruments will not only address issues related to the existing target groups and the interaction among them (interconnection of industry to research, etc.), but will also attempt to enlarge the field of applications of the technology developed for composite repairs, through interaction with other areas of technology (e.g. energy generation, automotive and ship building, etc.).

Expected Results

AeroPlan will disseminate the innovations of recent European Commission-funded project innovation achievements relating to the rapid in-situ structural repair of airframes for in-service damaged aircraft, both ageing and, where appropriate, new. The innovations will include the inspection/monitoring of the airframe repair area to ensure integrity for continued safe operation. The aim is to support broad policy issues (i.e. reliable, rapid, cost-effective in-situ repairs of airframe structures) and technical/socio-economic topics (safety, aircraft availability, minimal disruption) that are important to the air transport sector.

The intended impact will be to ensure that all European airlines, certification authorities, airframe manufacturers, maintenance, repair and operations (MRO) organisations and aircraft inspection companies are made aware of the technological innovations resulting from the AeroPlan dissemination process at a minimum of middle-management level. It will inform and influence direct decision-makers in the airframe structure repair and monitoring business.

It is anticipated that the numbers of engineering, maintenance and managerial personnel that will be made aware of project results via the AeroPlan dissemination process will be in the order of 2 000 in the EU and a further estimated 3 000 similar personnel worldwide.

Acronym:	AEROPLAN
Name of proposal:	Composites Repairs and Monitoring and Validation – Dissemination of Innovations and Latest Achievements to key players of the aeronautical industry
Grant Agreement:	285089
Instrument:	CSA – SA
Total cost:	398 005€
EU contribution:	300 000€
Call:	FP7-AAT-2011-RTD-1
Starting date:	01.09.2011
Ending date:	31.08.2013
Duration:	24 months
Website:	http://aeroplanproject.eu
Coordinator:	Mr John Matwiejew
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EC Officer:	Ivan Konaktchiev

Partners:	NTUA – National Technical University of Athens	GR
	National Technical University of Athens	GR
	Laserzentrum Hannover e.V.	DE
	Fundación Tecnalia Research & Innovation	ES
	GMI Aero SAS	FR
	INASCO – Integrated Aerospace Sciences Corporation O.E.	GR
	Integrated Aerospace Sciences Corporation O.E.	GR
	EADS Deutschland GmbH	DE

CANNAPE

Canadian Networking Aeronautics Project for Europe

State of the Art – Background

The European Union and Canada enjoy a privileged partnership, which is marked by longstanding political, economic and development co-operation ties. This relationship with the EU represents Canada's most important trade and investment partner after the United States of America. Results of collaborative initiatives supported under the EU co-operation agreement have been recognised as not only significantly contributing to the enhancement of the international knowledge base and human-resource development, but also contributing to greater business competitiveness, world-class products and research achievements, for both Canadian and European stakeholders.

The challenge is to ensure that international S&T co-operation contributes effectively to stability, security and prosperity in the world (see the European Research Area's Green Paper, New Perspectives, published by the European Commission). It is acknowledged that in order for the EU to become more competitive and play a leading role at world level, it is necessary for it to strengthen its research co-operation so as to reap the full benefits of internationalised research, technology and development; to contribute to the production of global, public goods; and to further integrate itself with the worldwide research community.

Objectives

The objective of CANNAPE is to create a platform for enhancing aeronautics and air transport research and development co-operation between the EU and Canada.

The overall objectives are:
- to explore the potential for enhancing co-operation through further analysis (mapping of themes and topics) of aeronautics and air transport research and development (R&D) collaboration between the EU and Canada;
- to develop and enhance networks and partnerships between the EU and Canada in identified technical themes ideally suited for mutually beneficial aeronautics and air transport R&D co-operation;
- to promote Canadian participation in the aeronautics and air transport activities of the Seventh Framework Programme (FP7) through focused workshops, information and advisory services;
- to develop a technology roadmap that will have clear objectives with identified partners, with the involvement of Canadian partners, who are representatives of key enabling Canadian organisations.

Description of Work

The work is carried out not only within the CANNAPE partnership, but also through a wider steering group that has access to regional organisations and funding. This extra funding will allow additional attendance at events.

CANNAPE has three non-administrative work packages (WPs).

WP 1 will undertake a desktop study of Canadian aeronautics and air transport activities, and then compare this with a selected mapping of EU research capabilities. This will lead to the development of an information platform.

WP2 will facilitate four workshops, two taking place in Canada and two in Europe. The workshops will be aligned with the timing of the last two calls for aeronautics in FP7. The first workshop will focus on the identification of collaboration opportunities for Level 1 projects; the second and third workshops focus on the identification of collaboration opportunities for Level 2 projects. The fourth workshop is on the evaluation of

FP7 for Canadian/EC collaboration and preparation for Horizon 2020.

WP3 will feature the creation and facilitation of European/Canadian awareness road shows and the formation of an R&D funding task group. This work package is focused on enabling Canadian organisations to undertake collaborative R&D in aeronautics with European organisations.

Expected Results

CANNAPE's successes and impact assessment will be based on:

- bringing about increased networking and partnering in the aeronautics R&D community, measured by determining the greater extent of FP7 consortium arrangements, and the range and number of EU partner organisations with which Canada collaborates;
- involvement of key Canadian organisations who can assist with the joint activities;
- the extent to which co-operative relationships are leveraged through joint identification of needs and priorities for collaboration and strategies;
- an overall increase in participation in FP7 by the Canadian aeronautics research communities.

Following the end of this project, Canada wants to maintain an interface with Europe. They will identify a role for their science and technology personnel at Canadian embassies by providing information and advisory services.

Acronym:	CANNAPE	
Name of proposal:	Canadian Networking Aeronautics Project for Europe	
Grant Agreement:	284663	
Instrument:	CSA – SA	
Total cost:	792 144€	
EU contribution:	299 620€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.05.2011	
Ending date:	30.04.2013	
Duration:	24 months	
Website:	http://https://ktn.innovateuk.org/web/cannape/overview	
Coordinator:	Dr Gillian Richards	
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EC Officer:	Pablo Pérez Illana	
Partners:	Cranfield University	UK
	Aerospace Valley	FR
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	APRE – Agenzia per la Promozione della Ricerca Europea	IT
	ISDEFE – Ingeniera de Sistemas para la Defensa de España SA	ES
	Slot Consulting Ltd	HU
	Aerospace, Aviation & Defence KTN	UK
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	Short Brothers PLC	UK

Fundacja Partnerstwa Technologicznego Technology Partners	PL
HWF – Hamburgische Gesellschaft fuer Wirtschaftsfoerderung mbH	DE
CDTI – Centro para el Desarrollo Tecnológico Industrial	ES
Airbus Operations SAS	FR
Department of Industry	CA
AIAC – Aerospace Industries Association of Canada	CA
NRC – National Research Council Canada	CA
NSERC – Natural Sciences and Engineering Research Council	CA
DFAIT – Department of Foreign Affairs and International Trade Canada	CA

CARGOMAP

Air-cargo Technology Roadmap

State of the Art – Background

Air cargo is a key factor of the world economy and the airline industry as it has an estimated revenue of more than EUR 42 billion per year. Despite the current economic downturn, Boeing and Airbus expect air cargo to grow by nearly 6% per year globally over the next 20 years. As the airmail component will grow substantially less, this growth is mainly due to additional air freight, including express traffic.

The air-cargo industry plays a critical role in any economic activity as it gets involved right from the start of the procurement cycle by delivering finished products. However, one may not expect totally new aircraft to be developed before 2030, but new cargo aircraft may benefit from military developments and novel civil airliner developments, using configurations like the blended wing body aircraft.

The aircraft industry expects only a modest number of new aircraft will be needed before 2025 and focuses on the traditional way of converting used civil airliners and derivatives of passenger aircraft to serve the cargo market.

Assuming that no steady-state scenario will be likely, new challenges to be addressed in the future for the air-freight system include:
- airport capacity and curfews;
- new commodities and new logistic concepts;
- intermodal solutions and substitution;
- environmental regulations;
- air traffic management issues;
- oil price development.

Objectives

The CargoMap proposal focuses on the future role of air freight and the definition of a technology roadmap for future cargo aircraft responding to end-user requirements and environmental needs. In order to improve the seamless flow of goods, inter- and co-modality approaches will be considered within the SESAR operational concept.

The main issues covered by the project are:
- analysis of the current situation versus the demand, with the involvement of European stakeholders (manufacturers, research establishment, regulators, airspace users, infrastructure providers, airport managers);
- expected future bottlenecks/challenges in air-freight transport and the identification of the corresponding requirements, thus ascertaining the technology needs and regulatory issues to be addressed;
- synopsis and evaluation of possible improvements related to future business models;
- definition of a technology roadmap to fill the technology/regulatory/operative gaps in order to fulfil the requirements, bearing in mind the current capabilities.

Description of Work

Initially a market analysis will be carried out to identify the current situation and the related problems so as to derive possible solutions and connected requirements. On the basis of these findings, different scenarios related to possible business models will be identified, thus evaluating the impact on the technological requirements. These requirements and related scenarios are the input for developing the roadmap.

Depending on the scenarios, different requirements can be derived. Special attention will be given to the safety requirements for future cargo aircraft and the whole air cargo system. A dedicated chapter will be included in the roadmap for this purpose. Within the project, possible scenarios will be investigated but only the most relevant ones will be detailed for the following reasons:
- due to the increase of air-freight demand, the number of dedicated aircraft will increase;
- the increase of passenger demand on air travel will bring the existing hubs to saturation point;
- regulations will impose very strict requirements on emissions;

- regional passenger transport models (including small aircraft) will be adopted to respond to travel demands and smaller airports will be used;
- the large trucks used for long-distance ground transport will have to be reduced due to environmental concerns, the adoption of alternate fuels and/or road saturation.

Expected Results

CargoMap will make recommendations for a roadmap for the air-cargo sector. Although IT processes are the most important part of seamless air cargo today, this issue will not be specifically addressed in this particular call for proposals on aircraft technologies. However the team is aware of all kinds of novel IT developments in the sector, for example the smart gate concept.

In order to prepare the roadmap, different novel aircraft will be assessed. Their main characteristics will be derived and the aircraft's available timeframe noted. Enabling technologies will then be identified. The team will analyse the availability of these enabling technologies, based on current European and national research. The roadmap will therefore show which specific enabling technologies will be needed and at what time. At that point, recommendations will be made on appropriate actions.

Acronym:	CARGOMAP	
Name of proposal:	Air-cargo Technology Roadmap	
Grant Agreement:	284551	
Instrument:	CSA – SA	
Total cost:	469 202€	
EU contribution:	321 077€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.10.2011	
Ending date:	30.09.2013	
Duration:	24 months	
Website:	http://www.cargomap.eu	
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EC Officer:	Hugues Felix	
Partners:	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	Gruppo Clas Srl	IT
	Ad Cuenta BV	NL
	TU Delft – Technische Universiteit Delft	NL
	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	ILOT – Instytut Lotnictwa	PL

CEARES-NET

Central European Aeronautical Research Network Events

State of the Art – Background

Central-Eastern Europe has been a fragmented area in terms of aeronautical research co-operation for the last 20 years, and organisations in the region are unaware of other research potential. Recent efforts have started to change this situation. One of the most influential is the Central European Aeronautical Research Initiative (CEARES), but their activities could not solve the problem entirely in a relatively short period of time; Central Europe is still far from being fully integrated with the European aeronautics research arena.

The CEARES project established a CEARES Network, and this continues today with their activities providing a regional co-operation framework among aeronautical research establishments, universities and interested industrial participants.

The activities are:
- maintaining a focal role in Central European research activities in aeronautics and air traffic management;
- helping to disseminate information.

The participants of the CEARES Network can be grouped as follows:
- Network members: researchers working at universities or in research centres;
- CEARES Advisory Board: the board continuously provides their support to the CEARES Network;
- Other CEARES stakeholders: these include a large number of European aeronautics researchers who hear about CEARES' activities via newsletters and workshops.

Geographical area of the CEARES activities

Objectives

The Central European Member States have the capacity to perform significant research work for European aeronautics, but this capacity is underutilised. Participation by research establishments from this area in the Seventh Framework Programme (FP7) was low at the beginning and was organised more on a case-by-case ad hoc basis, rather than following a clear strategy of research interests.

The lack of enough events focusing on co-operation was and still is one of the main bottlenecks for integration. Most European research workshops are organised either in Belgium or some other Western European country. Travelling to these events is often difficult for Central European researchers as these destinations are far and travel costs are high. Consequently the participation from this area is limited and too small to achieve a real breakthrough in terms of networking.

Therefore the main goal of CEARES-NET was to support the work of the Central European Research Network by organising two workshops.

The timing of these workshops related to the upcoming aeronautical calls of the European Commission. The first one, in Vienna, was preceding the Fourth Aeronautics and Air Transport (AAT) call, while the second one, which took place in Warsaw, was related to the Fifth AAT call. Both workshops addressed other topics including Clean Sky, SESAR and possibilities for bilateral co-operation.

Description of Work

Besides work package (WP) 1 that dealt with the management of CEARES-NET, there were two work packages covering the organisation of the two workshops.

WP2 covered the arrangement and coordination of Workshop 1. This workshop concentrated on matching the regional research capabilities with upcoming research possibilities, such as the fourth call. It also addressed the invitation from the Clean Sky leaders to discuss the calls, and possible associations and research opportunities.

WP3 was responsible for the organisation and coordination of Workshop 2, which offered opportunities to discuss Level 1 project proposals for the Fifth AAT call with EASN and EREA experts and others. Special attention was paid to small aircraft-related research and industrial activities.

Expected Results

The impact of the CEARES-NET project was twofold. Firstly, it further strengthened the network activities begun during the first CEARES project. More and more aeronautic research organisations and SMEs are now involved and the initial fragmentation is disappearing. The Central European players on the aeronautical research field are more aware of each other, and are starting to represent co-operation opportunities as a group. Due to the efforts of representatives from the European Commission, Clean Sky, SESAR and many others providing information on CEARES events, these researchers are also aware of the possibilities available in Framework Programmes and others.

Secondly, CEARES-NET enabled major European aeronautical organisations and institutions to assess the so-far hidden potential of Central European aeronautical research organisations. Thus the CEARES-NET project provided a much clearer picture of the potential available in the Central European aeronautical research field.

Acronym:	CEARES-NET
Name of proposal:	Central European Aeronautical Research Network Events
Grant Agreement:	266136
Instrument:	CSA – SA
Total cost:	80 590€
EU contribution:	63 818€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.06.2010
Ending date:	31.07.2011
Duration:	14 months
Website:	http://www.ceares.eu
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EC Officer:	Pablo Pérez Illana

Partners:	AIT – Austrian Institute of Technology GmbH	AT
	ILOT – Instytut Lotnictwa	PL

COOPERATEUS

Conditions of Success for R&T Open Options through a Platform of Communications and for Expressing Recommended Actions to Team-up Europe and the US

State of the Art – Background

COOPERATEUS is a strategic initiative supported by the European Commission to foster collaboration between the EU and the USA on pre-competitive scientific and technological aeronautical themes of mutual interest. The project seeks to enhance EU/US aviation research collaboration compatible with the long-term aviation visions on both sides of the Atlantic. COOPERATEUS is co-funded by the European Commission.

Objectives

The objectives of the Strategic Supervision are to ensure momentum and strategic guidance to the COOPERATEUS project, obtaining the views from the Advisory Board and reflecting both EU and US recommendations:

- views from the pan-European ACARE aeronautics public and private stakeholders;
- views from the US community, represented on the Board via their high-level permanent members (and/or ad hoc US points of contact).

The objectives of the technical supervision are to obtain and synthesise the information and recommendations from the focal points of European manufacturing industry, research establishments and laboratories, and the universities. This information includes input on the existing EU-US R&T co-operation actions, the supply of EU-US network contributions, elements of EU-US roadmaps and recommendations for the methodology to implement R&T co-operation.

Description of Work

COOPERATEUS is essentially divided into two phases. The first one explores and identifies potential aeronautic research co-operation topics between the EU and the USA. The second is aimed at consolidating these opportunities by making co-operation proposals. At the end of the second phase, a report will be issued to the European Commission providing the subjects and the recommended methods to accomplish them. Phase 1 ended in June 2011; Phase 2 will end in October 2012.

The work has been concentrated on the following areas:

- provide a synthesised overview of the EU-US co-operation in R&T, either at European level or by each Member State;
- provide a mutual understanding of administrative mechanisms: clarify the principles governing such EU-US R&T co-operation, respective funding mechanisms, intellectual property rights, etc., and the main barriers to that co-operation, suggesting ways to overcome all the problems;
- build up ad-hoc EU-US R&T co-operation areas of mutual benefit;
- propose win-win R&T roadmaps/areas of co-operation.

Expected Results

The COOPERATEUS project will indicate the areas where the co-operation topics are mutually favoured, assuring a good reciprocity between the parties. Moreover, COOPERATEUS is in line with the EU-US memorandum of co-operation. It will not interfere with the various EU-US R&T co-operative activities already undertaken, but might nonetheless provide rules and reference that could be beneficial to all.

The project will provide common R&T roadmaps for co-operation to be introduced in future calls for proposals within European Commission framework programmes and similar mechanisms in the US.

A short list of possible future R&T EU-US co-operation will be set up, with topics proposed by the European aeronautics, aircraft and equipment manufacturing sector, the research organisation sector, and the scientific and academic sector, together with their US counterparts. The consolidated research proposals will be regrouped into a collaborative EU-US aeronautics research roadmap.

Acronym:	COOPERATEUS	
Name of proposal:	Conditions of Success for R&T Open Options through a Platform of Communications and for Expressing Recommended Actions to Team-up Europe and the US	
Grant Agreement:	265211	
Instrument:	CSA – SA	
Total cost:	661 056€	
EU contribution:	467 959€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	15.08.2010	
Ending date:	14.10.2012	
Duration:	26 months	
Website:	http://public.cooperateus.org/	
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Partners:	Airbus Operations Ltd	UK
	CDTI – Centro para el Desarrollo Tecnológico Industrial	ES
	Alenia Aeronautica S.p.A.	IT
	Terence Frederick Knibb	UK
	Barthelemy Jean Pierre Michel	FR
	Dassault Aviation SA	FR
	SNECMA – Société Nationale d'Étude et de Construction de Moteurs d'Aviation SA	FR
	Thales Avionics SA	FR
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	EASN Technology Innovation Services BVBA	BE

EDUCAIR

Assessing the Educational Gaps in Aeronautics and Air Transport

State of the Art – Background

The European air transport system is a vital element of European mobility and a significant contributor to European wealth. Additionally, the air transport sector is arguably one of the main pillars of today's economy and society. The European air transport sector, however, currently faces considerable challenges to its growth.

The recent dynamics and evolution have indisputably brought changes in the demand for professional competences in air transport and aeronautic-related professions. As such, prospective employees have to master the current (and ideally future) competences, so that they can aspire to become competent professionals. This requires universities and other educational institutions to consistently update their courses and curricula. In the face of constant change, there is a real risk of mismatch between the prospective employees' competences and the market's actual requirements. And if such mismatches are not addressed, there is a danger of creating a significant competence gap that will inevitably affect the competitiveness and efficiency of the European air transport and aeronautic sectors.

Future developments in these sectors need to be fundamentally linked to the education and formation of human resources.

Objectives

The purpose of EDUCAIR is to improve the match between the needs and offers of competences in the European Union's aviation sector.

EDUCAIR will begin by assessing the competence gaps, so that recommendations for improvement can be proposed.

To explore the sources and extent of the competence gaps, an assessment framework will be developed. Using the concept of competence and analysing them from two perspectives – industry (demand) and educational institutions (supply) – the assessment framework will identify four areas:

1. the gap between the competences that employees need and the actual competences of the students;
2. the gap between the knowledge that the companies need and the actual competences of the employees;
3. the gap between the knowledge that the universities generate and the actual competences of the students;
4. the gap between the knowledge the companies need and the knowledge the universities have.

EDUCAIR will evaluate the gap between the number of students graduating from European schools and universities, and the requirements for engineers and scientists in European industry, education and research centres, now and in the future.

Description of Work

The project is structured into work packages (WP).

WP1: Project coordination.

WP2: Development of structures for knowledge sharing.

WP3: Setting the assessment framework for the education and training: review current and possible future scenarios of educational techniques; assess and analyse the competence gaps.

WP4: Quantitative and qualitative assessment of educational supply in the air transport and aeronautic sectors: identify the current curricula and number of courses; assess the approximate number of students and their core competences.

WP5: Quantitative and qualitative assessment of human resources for research in these sectors: identify the number of current educational curricula; assess the approximate number of researchers and their competences.

WP6: Competences required by industry in these sectors: assessment of the employees' current competences and the gaps between the industry's knowledge needs and employees' competences.

WP7: Job availability and analysis of labour attractiveness: assess the evolution of demand for jobs and the attractiveness in these sectors.

WP8: Gap evaluation and recommendations: evaluate the gaps between the number of students graduating from education, and the needs of engineers and scientists in European industry; recommendations for new curricula and courses, and improving the attractiveness of the industry.

Expected Results

A number of impacts are expected with the fulfilment of the EDUCAIR objectives, of which the following are highlighted:
- increase the visibility of European educational offers in the air transport and aeronautic sectors;
- improve the relevance of the European education offered in these sectors;
- improve the relevance of the European applied research in these sectors;
- disseminate new courses and curricula for students and researchers;
- contribute to the employability of students and to the productivity of current employees.

By placing research information where it is most needed, EDUCAIR will help bridge the educational needs and offers in the air transport and aeronautic sectors in Europe between the following:
- employers and employees;
- industry, academia and research;
- industry, educational institutions and research institutes;
- students and the professional market.

Acronym:	EDUCAIR	
Name of proposal:	Assessing the Educational Gaps in Aeronautics and Air Transport	
Grant Agreement:	284899	
Instrument:	CSA – SA	
Total cost:	326 840€	
EU contribution:	326 840€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.06.2012	
Duration:	18 months	
Website:	http://www.educair.eu	
Coordinator:	Prof. Rosário Macário	
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EC Officer:	Eric Lecomte	
Partners:	Athens University of Economics and Business – Research Center	GR
	Universiteit Antwerpen	BE
	ULPGC – Universidad de Las Palmas de Gran Canaria	ES
	TU Delft – Technische Universiteit Delft	NL
	Stichting Nationaal Lucht – En Ruimtevaartlaboratorium	NL

EUROTURBO 9

Support for the Ninth European Conference on Turbomachinery – Fluid Dynamics and Thermodynamics, Istanbul, Turkey, 21-25 March 2011

State of the Art – Background

The European Turbomachinery Conference (ETC) is held every two years, and it was unanimously decided to hold the ninth conference in Istanbul (TR), endorsing the invitation from Istanbul Technical University. The conference, which ran from 21 to 25 March 2011, was held for the first time in a country not yet integrated in the EU.

The conference is of primary interest to researchers, design engineers, users of turbomachinery components, as well as to students and PhD candidates who are allowed to present and discuss their most recent scientific results. The conference is an ideal forum to relate and disseminate the results of research projects funded by the European Commission.

The presentations at these conferences describe new experimental, numerical and/or theoretical work emphasising the contribution to theory, design methods and optimisation, reliability and operability. For example, in 2011, the latest developments in blade design and optimisation, three-dimensional methods, unsteady flows, heat transfer, aero-elasticity, noise and two-phase flows were of prime interest. Consistent with the objective of European technology exchanges, the European Commission strongly encourages researchers involved in its programmes to take this excellent opportunity to present papers demonstrating the technical progress of their projects.

Objectives

This conference is the only scientific event within the EU that covers all fluid dynamic and thermodynamic aspects of turbomachinery design and operation. Its objectives are to enhance excellence in this field, and to improve the technological level and competitiveness of turbomachinery design products and their operation as part of propulsion systems and energy conversion processes.

EUROTURBO 9 was of interest to researchers, design engineers and users of turbomachines. The local organising committee decided to apply reduced registration fees to attract researchers and students from all over Europe, especially participants from the newly integrated countries and from those countries soon to be integrated to the European Union. This made the conference a prime event for European integration in the field of turbomachinery (fluid dynamics and thermo-dynamics).

Description of Work

The scope of the conference was announced at the ETC Secretariat and on ETC9 local committee websites. Fifteen hundred flyers, with a 'call for papers', were distributed and the conference announcement also made by e-mail.

The ETC committee met to discuss the papers received:
- 307 abstracts were evaluated in the abstract review meeting in Brussels in 2010;
- 291 abstracts were accepted and 174 papers were submitted for review;
- 65 review organisers arranged for 522 reviews.

The ETC committee met in Istanbul for the final evaluation of the papers in November 2010:
- 134 papers were finally accepted for the conference;
- 14 papers were suggested for journal publication;
- 49 papers had at least one author from the industry.

Regarding the affiliation of the authors, 18% came from the industry, 66% from academia and 16% from research centres.

The papers were presented in 36 sessions and published in the conference proceedings, as well as on a CD-Rom, which was given to all attendees. The papers will be published on the ETC website for free download to increase the dissemination of scientific results.

Lectures were given by representatives from industry and universities and two technical tours were organised on the last day of the conference.

Expected Results

The total number of participants was 284, of which 110 were students. The number of students and young researchers had increased significantly for this latest conference. Delegates came from 29 different countries.

The bi-annual conference has a direct scientific and engineering impact on the fluid dynamics and thermodynamics involved in improving the performance, stability and sustainability characteristics of the design, development and operation of axial, mixed flow and radial turbomachines to turbomachinery, which is significant in industrial research. This provides some indirect impact on citizens through better turbomachinery (better efficiency, reliability, operation, environmental aspects) use in the fields of energy conversion technologies and transportation.

Attending the event provides a unique access to a formidable concentration of top-level scientists in the field. ETC 9 further improved its impact via the following:

- dissemination of newest turbomachinery knowledge;
- actions for the harmonisation of disseminating scientific knowledge in the field of aeronautics in co-operation with other European associations;
- additional dissemination through the 'call for papers' using the National Contact Points from the EU to increase the visibility of the conference and thus attracting more abstracts (papers were presented from Turkey for the first time).

Acronym:	EUROTURBO 9	
Name of proposal:	Support for the Ninth European Conference on Turbomachinery – Fluid Dynamics and Thermodynamics, Istanbul, Turkey, 21-25 March 2011	
Grant Agreement:	265974	
Instrument:	CSA – SA	
Total cost:	18 987€	
EU contribution:	15 000€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	30.03.2010	
Ending date:	29.07.2011	
Duration:	16 months	
Website:	http://www.etc9.itu.edu.tr/	
Coordinator:	Prof. Dr Mete Sen	
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EC Officer:	Rémy Dénos	
Partners:	Università degli Studi di Napoli Federico II	IT
	VKI – von Karman Institute for Fluid Dynamics	BE

GRAIN
Greener Aeronautics International Networking

State of the Art – Background

The continuous growth of air passenger transport generates an increasing use of hydrocarbon fuel with excessive emissions of CO_2 and NO_x (greenhouse gases and pollutants and noise). It is well known that commercial aircraft operations impact the atmosphere by the emission of greenhouse gases and greenhouse gas precursors and also through the formation of contrails and cirrus clouds. In 2000 the European Commission published the ACARE Vision 2020 on the future of aeronautics and the environmental impact, which detailed the ambitious goals of 80% reduction in NO_x emissions, 50% reduction in CO_2 emissions per passenger kilometre, and the reduction of noise by 20dB (50% reduction on the perceived noise).

To achieve the ACARE Vision 2020 goals, green aeronautical technologies need to play a much more dominant role. The GRAIN Supported Action, based on the same collaborative and win-win spirit introduced in the EU-China AEROCHINA 1 and 2 projects, will provide inputs and roadmaps for the development of large-scale simulation strategies for greener technologies to meet future requirements on emissions, fuel consumption, noise and green materials.

Objectives

The main objectives of GRAIN are to identify and assess the future development of large-scale simulation methods and tools to achieve greener technologies and so reach the Vision 2020 environmental goals. GRAIN will prepare the R&T development and exploitation with new large-scale simulation tools used on distributed parallel environments to gain a greater understanding and to minimise the effects of aircraft/engine design on climate and noise.

The participating institutions will focus on future collaborative applied research concerning modelling, experiments, simulation, control and optimisation for greener aircraft and engine technologies including: emissions reduction, drag reduction, noise reduction and green materials, with an emphasis on multidisciplinary approaches (aero acoustics, aero thermals, aero engines, etc.) for environmentally friendly aircraft. These collaborations will be dedicated to 3-D configurations (take-off, cruise, approach and landing), for which the partners will use high-performance computing facilities that are now available and upcoming in both Europe and China. New developments will be investigated concerning innovative methodologies on robustness and uncertainty for greener aircraft applications by using high performance computing environments that can include graphic processors and high-end supercomputing centres.

Description of Work

The organisation of the activities of the GRAIN project has been defined around the following key green technological (KGT) areas within work packages (WP):

WP1: Management, project specifications, communication platform.

WP2: KGT1: NO_x reduced global warming design with conceptual and detailed design tools (contrails).

WP3: KGT2: CO_2 reduced drag design with conceptual and detailed design tools.

WP4: KGT3: Noise reduction; green noise design with conceptual and detailed design tools.

WP5: KGT4: Green materials.

WP6: KGT5: Large-scale high performance methodologies with advanced IT tools.

State-of-the-art analysis of future and emerging technologies, and the prospects for existing technologies will be assessed using the following aspects:
- Modelling: understanding the involved processes and how they are modelled through experimental and numerical solutions.
- Experimentation: providing physical test information for each of the phenomena related to each KGT.
- Simulation: a parallel line to experimentation to seek the best model that can help to predict real behaviour.
- Optimisation: by taking the advantages from the three aspects mentioned above the best configuration, design or device that helps to improve cutting-edge technology will be found.

Events to disseminate the knowledge between the partners and the global scientific and technological world will be organised.

Expected Results

GRAIN will gather engineers, designers and scientists from multi-physics and computer science to improve the local and global environmental compatibility of future aircraft and engines, to support the multidisciplinary design process, to foster the understanding between scientists and engineers, and to increase the dissemination of relevant knowledge.

Expected project achievements are:
- The identification of greener technologies via new large-scale simulation tools and the investigation and evaluation of their maturity, benefits and confidence.
- The development of strategies for their implementation into greener digital aircraft/engines.
- The multidisciplinary assessment of candidate technologies for digital configurations.
- The dissemination of project information and results via the GRAIN communication platform.
- Support on collaborative international joint projects.
- Inputs for coordinated calls in 2012.

Acronym:	GRAIN	
Name of proposal:	Greener Aeronautics International Networking	
Grant Agreement:	266184	
Instrument:	CSA – SA	
Total cost:	521 301€	
EU contribution:	427 392€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.10.2010	
Ending date:	30.09.2012	
Duration:	24 months	
Website:	http://www.cimne.com/grain	
Coordinator:	Ms Anna Font	
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Partners:	Institut National de Recherche en Informatique et en Automatique	FR
	Airbus Operations SL	ES
	Alenia Aeronautica S.p.A.	IT
	EADS France SAS	FR
	University of Manchester	UK
	Ingeniería Aeronáutica INGENIA-AIE	ES
	Numerical Mechanics Applications International SA	BE
	University of Sheffield	UK
	University of Birmingham	UK
	Centro Italiano Ricerche Aerospaziali ScpA	IT
	Von Karman Institute for Fluid Dynamics	BE
	Airborne Technology Center B.V.	NL
	Acondicionamiento Tarrasense Associación	ES
	Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique	FR
	Cranfield University	UK
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE

IFARS

International Forum for Aviation Research Support Action

State of the Art – Background

A global growth in air traffic of about 5% p.a. is the basis for economical growth but this also has an influence on climate change, which is currently discussed worldwide by scientists, decision-makers and the public.

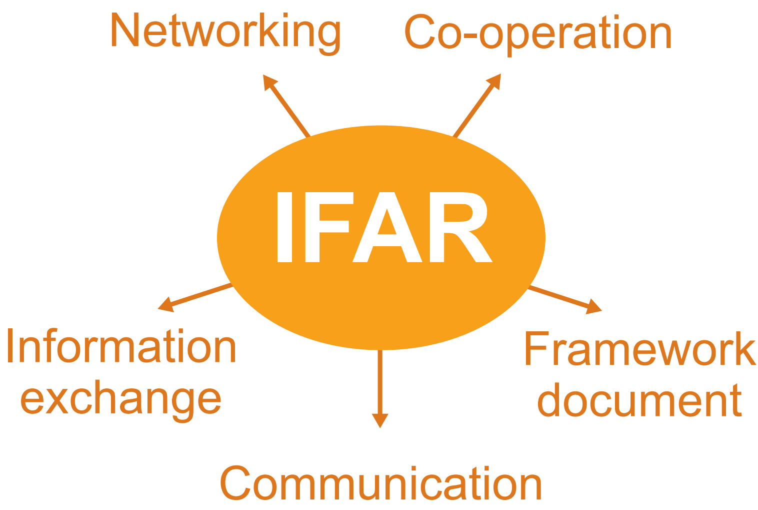
The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has stirred an intensive public debate on future aeronautical research challenges and policies. This report identifies that aviation contributes 2-3% of today's total global anthropogenic CO_2 emissions. This prompted the International Air Transport Association (IATA) to set the long-term challenge of zero emission aviation by 2050 and emphasised the importance of addressing these challenges at the global level. The answers and solutions to these demands are expected to be given by research. Apart from regional networks, aviation research organisations were not organised on a worldwide level prior to 2010 and did not have a representation that was able to react to global questions and demands.

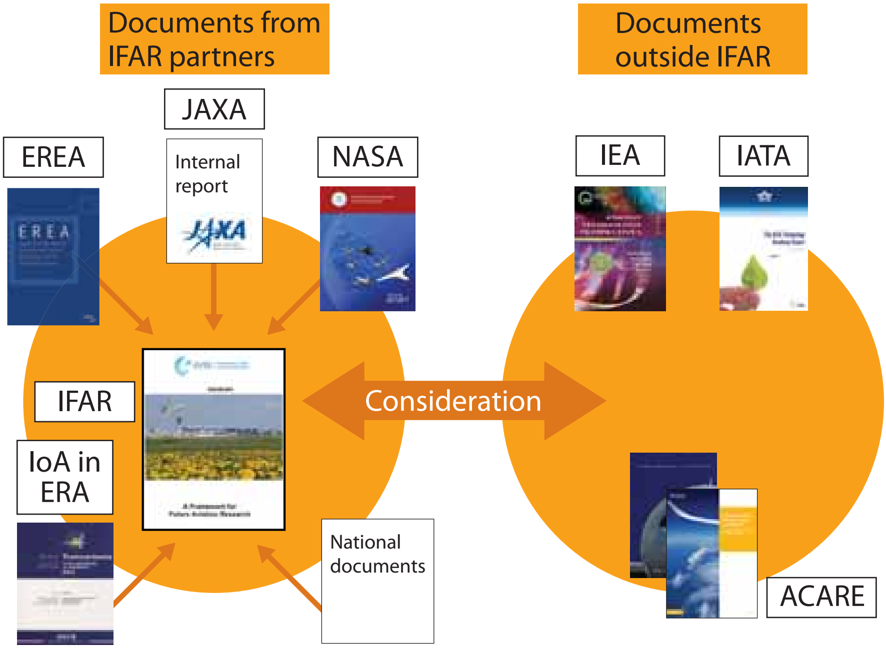
The new International Forum for Aviation Research (IFAR) filled this gap. Founded in 2010, IFAR is comprised of the world's major aeronautical establishments. The IFAR members agreed to a common IFAR Charter defining the main objectives and rules of participation, as well developing the IFAR Framework Document, which outlines global research objectives and technological opportunities.

Objectives

The objectives of IFARs are directly linked to the objectives of IFAR itself.

IFAR aims to realise the following activities (cf. Figure 1):
- connecting the global aviation research community worldwide;
- serving as a venue for information exchange and communication, for example by its summits, meetings, workshops and conferences, hosting Internet forums, etc.;
- developing among its members a shared understanding on a common set of key challenges faced by the global aviation research community;





- developing views and recommendations, for example the IFAR Framework Document, to inform on future research strategies and – where appropriate – to develop a combined research strategy for the future. The framework document is based on:
- a comparison of existing goals/objectives (cf. Figure 2);
- an inventory of possible concepts or technologies which could be developed to accomplish certain objectives;
- publishing and disseminating information (via a website, flyers, publications, conferences);
- issuing IFAR views and recommendations, and giving advice on aviation topics. The purpose of issuing such views and recommendations is to define trends in aeronautics research and/or inform on emerging regulations. The views and recommendations are not meant as a binding guidance to individual IFAR members.

Description of Work

From the beginning, the IFAR activities have been supported by the IFAR Secretariat. Since mid 2011, the IFAR Secretariat and the IFAR activities have been supported by the EU-funded project IFARs. IFARs will support IFAR for the first three years (the duration of the project). During that time IFAR will develop a framework document on climate change, noise, security and safety. The topics are considered and discussed at annual high-level IFAR summits and at other times in expert meetings. The outcome of each summit will be a public declaration which contributes directly to the regularly updated technical framework document. In addition, IFAR is active in non-technical topics, such as education exchanges and promoting young scientists and engineers.

The project IFARs is divided into four work packages (WP). WP1 develops the regularly updated IFAR Framework Document and a format for IFAR to be able to continue its activities beyond IFARs. WP2 covers the IFAR summit in Year 1 – which is focused on climate change and noise. WP2 considers the organisation of the summit event and the development of a declaration as main outcome of the summit. WP 3 and WP 4 are the IFAR summit meetings for project years 2 and 3 on the originally planned topics of security and safety, respectively. However, the topics may be modified if other themes become more relevant.

Expected Results

The main result of IFARs is the set-up and support during its first three years of the new IFAR forum. Such a forum has not existed before and needs initial support. The measurable results of IFAR within the period of IFARs can be summarised as follows:

- design of an IFAR charter which is the basis for co-operation;
- organisation of the annual high-level IFAR summits and reporting on their outcomes;
- organisation of expert meetings;
- development of the IFAR Framework Document which summarises the objectives and outlines technological opportunities;
- concept, in which form IFAR can continue its activities beyond IFARs;
- dissemination of the results (website, flyer, publications, conference participation, etc.).

These activities allow the research organisations to have strategic discussions and react to global problems on a worldwide level. In addition, IFAR defines trends in aviation research and informs on emerging regulations.

At the end of this project, IFAR is expected to be self-sufficient.

Acronym:	IFARS
Name of proposal:	International Forum for Aviation Research Support Action
Grant Agreement:	282308
Instrument:	CSA – SA
Total cost:	231 316€
EU contribution:	200 000€
Call:	FP7-AAT-2011-RTD-1
Starting date:	15.06.2011
Ending date:	14.06.2014
Duration:	36 months
Website:	http://www.ifar.aero
Coordinator:	Prof. Richard Degenhardt DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV Lilienthalplatz 7 DE 38108 Braunschweig
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EC Officer:	Dietrich Knoerzer

INNOVATION PLATFORM

Innovation Management Platform for Aeronautics

State of the Art – Background

The goal of innovation management is to enable continuous processes of innovations to be born and implemented.

Following on from the work carried out in CREATE, this project will develop a software-based innovation management platform (IMP) that is founded on structured and precise innovation management processes. This will enable it to generate, assess, define and schedule industrial innovation projects, thus leading to step changes in aeronautics. Currently many companies are unaware of the modern innovation methods available.

The platform will support sustainable innovation – based on a mix of incremental and breakthrough changes – enabled by the newly developed innovation platform and systematic innovation management methods. The benefits of the platform will be business process integration and increasing innovation efficiency (goal-orientated, systematic and model-based approach), so as to foster continuous and process-flow-based collaboration, and to establish a database that efficiently manages knowledge for the users.

Objectives

The project objective is to keep aeronautics innovation leadership in Europe by enhancing sustainable innovation, enabled by a newly developed innovation platform that integrates innovation management processes and modern, systematic innovation management methods. By integrating these modern methods, the probability of developing breakthrough ideas and proven solutions (products, processes and business models) will be highly increased.

In order to optimise the generation of new ideas, a variety of ideation methods will be evaluated with regard to their effectiveness and cost efficiency, and then integrated into the processes and platform as guidelines. Another focus of the IMP is on process coupling, feedback and process performance measurement to enable continuous improvement and learning (key performance indicators – KPIs – and KPI innovation management dashboard). An advanced technology watch process (push and pull aspects) will be defined and integrated as well. The platform will be web- and work-flow based and will integrate modern innovation methods.

Description of Work

The project is divided into three major phases.

Phase 1: Development of the innovation management process model, system modelling and software requirements.

Phase 2: Software implementation, web-based software platform.

Phase 3: Pilot launch, acceptance testing, pilot innovation workshops and dissemination.

As from January 2012, the innovation management process model has been completed, together with the definition of the advanced technology watch. System and software requirements, as well as the IMP model, were modelled using unified modelling language/requirements modelling tool called Enterprise Architect. The initial web-forms were developed with a tool called Balsamiq.

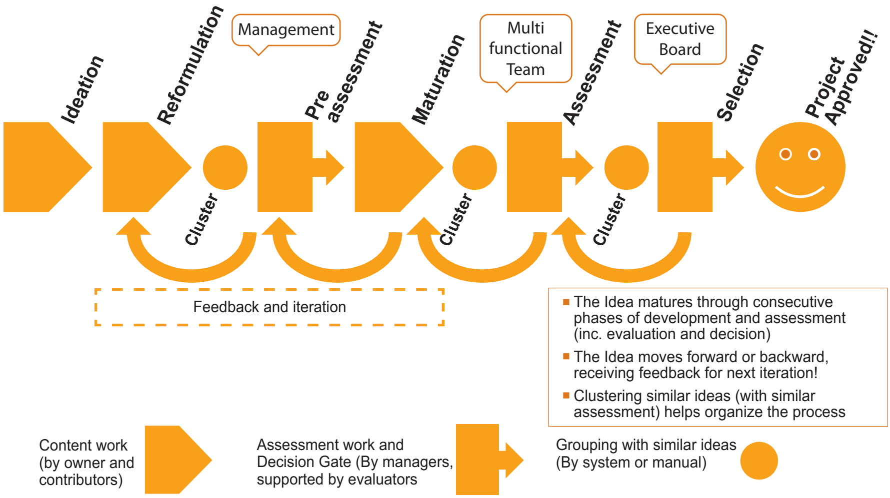
A small Sharepoint prototype has been developed in order to check the workflow concept, process linkage, and to assist with graphical user interfaces/web-form development.

Analysis is conducted on different implementing technologies and a comparison made on their functionality, the functionality to be extended, development cost and license/maintenance fees. The following options are looked into:

1. .NET development with Sharepoint front;
2. Sharepoint;
3. BPML solution with Appway;
4. Hype extension.

Expected Results

The results of this project will be an innovation management software platform that will enable active use of innovation methods and innovation/technology management at universities and premier industries in



Process workflow

order to innovate within the aeronautical sector. User communities will embrace the platform in a collaborative and well-managed way so that the power from large numbers of users will come into effect.

A real-case process will be launched to apply the IT platform to current challenges of the aeronautics sector in order to generate, assess, track, and – in the long term – implement resulting step changes, which will lead to increased competitiveness within the European aeronautics industry.

Acronym:	INNOVATION PLATFORM
Name of proposal:	Innovation Management Platform for Aeronautics
Grant Agreement:	266249
Instrument:	CSA – SA
Total cost:	685 383€
EU contribution:	449 576€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.09.2010
Ending date:	31.05.2012
Duration:	27 months
Technical domain:	Breakthrough and Novel Concepts
Website:	http://www.altran.ch/industries-solutions/project-references/innovation-management-sw-platform-for-aeronautics.html
Coordinator:	Dr Saso Jezernik Altran AG Seestrasse 513 CH 8038 Zurich
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Tel:	+41 (0)76 491 81 01	
EC Officer:	Pablo Pérez-Illana	
Partners:	Altran SA	BE
	Micos Engineering GmbH	CH
	Carl Zeiss Optronics GmbH	DE
	EADS France SAS – European Aeronautic Defence and Space Company	FR

NEARS
New European Aviation Research Strategy

State of the Art – Background

In 2000, a Group of Personalities (GoP) was formed to create an experts' view on the future of air transport and the resulting challenges for European research. The group published its report, Vision 2020, in 2001. Apart from setting out a vision on air transport for 2020 with challenging goals, the group advised the formation of a standing body: the Advisory Council for Aeronautics Research in Europe (ACARE).

ACARE was set up in 2001 with the task of creating a Strategic Research Agenda that would describe the technical work needed if Vision 2020 was to be realised. Since then, ACARE has published the Strategic Research Agendas SRA 1 (2002), SRA 2 (2004) and an Addendum to SRA 2 (2008).

Over the last ten years, substantial progress has been made in research. Supported by the actions of the European Commission, research is not only performed in a European setting but also the co-operation in joint research and technology development in Europe has increased at a faster pace than anyone thought possible in 2000. Clean Sky has added technology demonstration on a European scale, and SESAR has enabled a common view on future air traffic management in support of the Single European Sky initiative.

As the year 2020 approaches and many of the targets set for 2020 have been achieved, ACARE now needs to address the longer-term future.

Objectives

Initiated by the Vice-President of the European Commission, Siim Kallas, and Commissioner Máire Geoghegan-Quinn, a high-level group on Aviation and Aeronautics Research has prepared a new 'vision' extending to 2050. This document, entitled Flightpath 2050, was presented at AERODAYS 2011.

Flightpath 2050 defines the major goals and challenges for the air transport sector for the first half of this century. The document also explicitly requests a new strategic roadmap for aviation research.

The objective of the NEARS project is to provide the driving support to the development of this Strategic Research and Innovation Agenda (SRIA) by assisting ACARE, and supporting the involvement and consultation of all the major stakeholders in this sector.

NEARS supports the whole process of creating the new SRIA through four consecutive steps:
- initial preparations;
- supporting the working groups to address the different goals set by Flightpath 2050;
- assembling the different views and contributions and creating a consistent draft of the new agenda;
- editing, designing and printing the new report.

Description of Work

The NEARS project has six work packages (WP).

WP1: Preparation. Relevant data is collected from the GoP and the work structured in preparation for SRA3. The findings are validated and workshops held with the main stakeholders to check progress.

WP2: Collection of SRIA input. The work is further developed, potential contributors are briefed and support is given to specialist groups. Relevant data is collected from these groups.

WP3: First draft. All the relevant material is assembled and the SRIA document drafted.

WP4: Final document. The approved version is designed, printed and disseminated. The SRIA should be an easy-access, easy-to-read and clear document that will be the basis for future EU work programmes, national research programmes and private research efforts.

A key element in this project is the management of information, particularly background information, to support substantiated work in the groups and the documentation of their results. WP5 operates the common database for this project. In addition, it provides technical, operational and administrative support to the participants; this has to be coordinated at project level, but goes beyond the usual scope of project management (e.g. user help desk, data acquisition, data mining, etc.).

The whole process of designing, collecting, writing and publishing the SRA3 and its elements is managed in WP6.

Expected Results

The SRIA will be the vehicle to advance and give directions for future aeronautics and air transport research, at European level as well as for national and industrial programmes, in order to achieve the goals set in Flightpath 2050. The aim is to ensure that, in times of unpredicted challenges and limited resources, the mobility needs of European citizen are satisfied safely and more sustainably, and that Europe continues to maintain its leading position in a technology sector of strategic and commercial importance and political prestige.

Acronym:	NEARS	
Name of proposal:	New European Aviation Research Strategy	
Grant Agreement:	266176	
Instrument:	CSA – SA	
Total cost:	557 211€	
EU contribution:	470 375€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.01.2011	
Ending date:	30.06.2012	
Duration:	18 months	
Website:	http://nears-project.eu	
Coordinator:	Dr Martin Spieck	
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EC Officer:	Rémy Dénos	
Partners:	ASD – Aerospace and Defence Industries Association of Europe	BE
	Ad Cuenta BV	NL

OPTI
Observatory Platform Technological and Institutional

State of the Art – Background

OPTI is a European project funded within the Seventh Framework Programme (FP7) that aims to prepare the groundwork for the continuous monitoring of the progress achieved towards the ACARE European Technology Platform (ETP) goals as defined in the ETP Strategic Research Agenda. Both technological and institutional enabler statuses will be assessed.

Objectives

OPTI will create a platform and an approach to monitor the progress being achieved towards the ACARE Strategic Research Agenda (SRA) goals for both technological and institutional enablers (TE and IE). The project will adopt the year 2000 as a reference for the assessment.

As regards the technological objectives, an update will be carried out on the state of progress by adding two years to the period of analysis that was considered in the former AGAPE project, thus the analysis involves evaluating the impact of European aeronautics research projects performed in the period 2008-2010.

For the first time the institutional enablers will be thoroughly analysed to assess the state of progress. This means that the impact of specific institutional actions or initiatives in the period 2004-2010 will be evaluated.

OPTI has identified the following IE:
- education, knowledge, workforce;
- research infrastructures;
- standardisation, regulation, certification;
- supply chain optimisation;
- European synergy in RTD;
- international collaboration.

These have been regrouped into four classes:
- people orientated;
- infrastructure orientated;
- technology and innovation orientated;
- policy orientated.

Cross-cutting issues are also considered:
- environment and CO_2 reduction;
- energy: alternative fuels;
- air transport system management and infrastructures.

Description of Work

The main potential objects of analysis are the Framework Programmes, in particular FP7, and possibly relevant national and privately funded programmes.

In order to monitor the IE and the TE, an Institutional and Technological Observation Platform (IOP and TOP) will be created through the following actions:
- refine the institutional enablers to be investigated/assessed;
- identify the projects to be monitored/assessed;
- define a questionnaire to collect information concerning the IE and TE statuses;
- define an approach to make a synthesis of the collected information;
- identify expert working groups and an Advisory Board;
- validate the format and methodology with the support of experts (European Commission, EU bodies, Member States, EASA, etc.) and the Advisory Board;
- make the questionnaire available on a dedicated website (knowledge database);
- engage relevant stakeholders to answer the questionnaires;
- assess the IE and TE status through analysis of the knowledge database with the support of the working groups and the Advisory Board;
- organise a specific workshop to discuss IE and TE: status, progress, relevant actions/recommendations;
- the Synthesis Workshop will involve experts, the Advisory Board, ACARE Member State representatives, ACARE working group-5, ACARE monitoring, Air-TN members, etc.;
- load results into the knowledge database.

Expected Results

OPTI will deliver a platform and an approach to perform the monitoring of progress being achieved towards the ACARE SRA goals for both technological and institutional enablers.

The project will perform the assessment for both IE and TE statuses but will mainly focus on institutional enabler status progress.

In the final deliverable, the measures of overall progress and the understanding of potential barriers for further progress towards SRA goals will be given, together with recommendations.

The proposed evaluation and recommendations will provide the air transport community with elements relevant to future strategic planning.

Environment	Security & Safety	Quality and Affordability	Time Efficient Air transport System
50% CO_2 reduction	Zero successful hijack	Fall in travel charges	3-fold increase in traffic
80% $_{Nox}$ reduction	80% $_{Nox}$ reduction of accident	Passenger choice	99% flights within 15 min
10dB reduction in external noise	Minimize human error	Air Freight Sertvices	Time in airport <15 or 30 min
Noise footprint reduction		Halve time to market	Seamless ATM system
Green manufacturing			

Acronym: OPTI

Name of proposal: Observatory Platform Technological and Institutional

Grant Agreement: 265416

Instrument: CSA – SA

Total cost: 376 251€

EU contribution: 356 341€

Call: FP7-AAT-2010-RTD-1

Starting date: 01.01.2011

Ending date: 30.06.2012

Duration: 18 months

Website: http://www.optiproject.eu/

Coordinator: Patricia Pelfrene
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EC Officer: Rémy Dénos

Partners:

CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE

RETROFIT

Reduced Emissions of Transport Aircraft Operations by Fleetwise Implementation of New Technology

State of the Art – Background

Do we want to reduce aircraft emissions now, or not until in 2030?

EU framework programmes aim to provide improvements in cost-effectiveness, passenger friendliness and the environmental impact of new transport aircraft. Typically the development time of a new aircraft programme is around five years. It may then be another ten years before a sizeable fleet of the new aircraft is in operation on a global scale.

A new generation of airliners will only be introduced on the market if a large number of new technologies can be incorporated into the new design to make these products substantially better. Existing aircraft still have a long life to serve. But the operational environment is changing. Airlines are confronted with emission trading limits, new noise rules, increasing fuel prices, and new safety and security demands. Aircraft need to operate in a new environment of air traffic management where older aircraft cannot now comply. Also passengers expect the highest levels of comfort and safety possible.

Retrofitting existing aircraft with separate new technologies will enable these aircraft to effectively bridge the gap between the generations of aircraft. This implies that specific new technologies can be already applied and that air transport will not have to wait until a large number of new technologies become available to justify a new generation of aircraft.

Objectives

The objective of RETROFIT is to identify feasible retrofit programmes for current European aircraft and to identify specific RTD needs to enable the European industry to implement these fleet-wise. This would allow advanced technological benefits to be obtained earlier, and on a much larger scale, because a large body of the future transport fleet will still be formed by aircraft in service today.

This project also investigates how such retrofit programmes could be stimulated to achieve a sufficiently large scale of impact. The project will define and investigate different options to upgrade existing aircraft with advanced technologies so as to make the existing fleets more environmentally and passenger friendly and cost-effective. This could involve re-engineering with new generation engines, adapting engines to possible biofuel variants, the introduction of aerodynamic refinements, improving the crew and passenger environments during flight (cabin, cockpit), as well as the exchange of structu ral elements by lower weight components and smart structures, and systems to improve the flight efficiency in future air traffic control environments.

Description of Work

Firstly a literature study on the subject will gather relevant information on the current views on retrofit, as well as applicable new technologies and RTD programmes that might be suitable for use in future retrofit programmes. Based on this, stakeholder requirements will be identified by using questionnaires and these will then be reviewed in a workshop.

These requirements will be investigated interactively with a reference group as to which current and future technology options are suitable to retrofit on existing aircraft. The need to perform additional research to make retrofits attractive will be addressed, as well as the question of which specific research activities should be integrated into framework programmes.

Special attention will be given to certification, as modified aircraft should be accepted as derivatives of existing types in order to keep certification time and cost as low as possible.

The range of retrofit technologies will be evaluated for their potential for application and relevance. A cost-benefit analysis will be made based on existing airline fleets and the potential applications of new technical solutions. Based on this, the industrial consequences and the risks of retrofit programmes will be evaluated.

An assessment will be made about funding mechanisms in order to stimulate the application of retrofit technology.

Expected Results

The literature study resulted in a long list of possible retrofit technologies. Already several of these have been identified as having great potential, but which require additional RTD before actual application. Another selection was made of technologies that show large potential but which are already suitable for application. An elaborate cost-benefit analysis will be done on three of these technologies in order to indicate their actual commercial potential as a retrofit and to provide insight on factors that play a role in the commercial considerations for applying retrofits.

Acronym:	RETROFIT	
Name of proposal:	Reduced Emissions of Transport Aircraft Operations by Fleetwise Implementation of New Technology	
Grant Agreement:	265867	
Instrument:	CSA – SA	
Total cost:	270 381€	
EU contribution:	266 363€	
Call:	FP7-AAT-2010-RTD-1	
Starting date:	01.11.2010	
Ending date:	31.10.2011	
Duration:	12 months	
Website:	http://www.fokkerservices.com/RETROFIT_FP7	
Coordinator:	Mr Bastiaan Knegt Marinus	
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	NL 2152 CZ Nieuw-Vennep	
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EC Officer:	Christiane Bruynooghe	
Partners:	Ad Cuenta BV	NL
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	ADSE – Aircraft Development and Systems Engineering B.V.	NL
	Paragon Anonymh Etaireia Meleton Erevnas Kai Emporiou Proigmenhs Texnologias	GR
	L-up SAS	FR

SAT-RDMP

Small Air Transport – Roadmap

State of the Art – Background

Small Air Transport (SAT) focuses on the new, affordable, accessible, energy-effective component of the air transport system (ATS), which fills the niche between surface transport and scheduled large air transport.

This future SAT system will provide a greater choice of transportation modes, and the wider use of small aircraft served by small airports will create transport access to more communities using a cost-effective method and in a shorter time.

Objectives

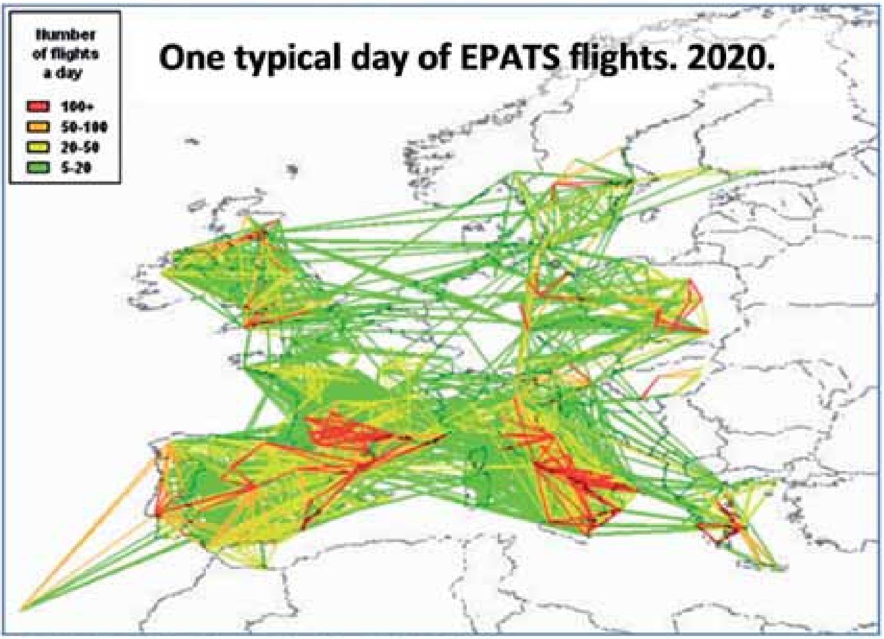
The following strategic objectives are addressed:

- improving the energy efficiency of all modes of transport (according to the European Strategy for Transport);
- providing travellers with a free choice of transport mode – according to their needs and the time available;
- revitalising the European general aviation industry and regional airports by answering the European demand for small commercial aircraft and creating an economic, reasonably new component of the air transport system.

Description of Work

The main work issues of the SAT-Rdmp study are:

- definition of a common vision of the small aircraft transport system for inter-regional mobility through the identification of the corresponding requirements. The requirements will identify the technology needs and regulatory issues to be addressed;
- definition of a business case compliant with the identified requirements which describe the relations among all the system's components;
- assessment of the current capabilities versus the ATS demand, collection of previous results and the involvement of European stakeholders among all actors (manufacturers, research establishment, the European Aviation Safety Agency, airspace users,



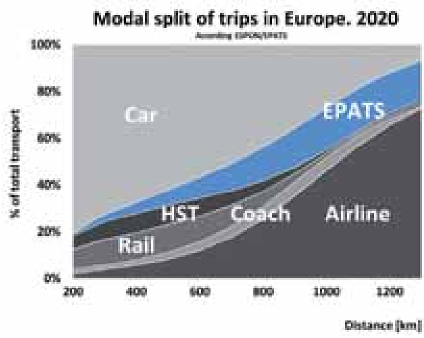
EUROCONTROL, D3.1 EPATS ATM, 2008 [3]

infrastructure providers, airport managers, small aircraft service providers).
- definition of a roadmap to fill the technology/regulatory/operative gaps in order to fulfil the requirements considering the current capabilities. Dissemination actions will be identified and a network of stakeholders established.
- assessment of risks and benefits of the identified new system's concept.

Expected Results

The SAT-Rdmp study contributes to an improved understanding of the role that small-sizes aircraft operating on scheduled or non-scheduled flights can play as a component of the air transport system to satisfy the needs of transportation in regions where transport networks are underdeveloped, and thus enable access to more communities in less time.

This roadmap will be a very important tool to support the European Commission in defining appropriate actions to implement the Agenda for Sustainable Future in Business and General Aviation. This was recommended by the EU Parliament Resolution of 3 February 2009.



The SAT-Rdmp study is building European synergy in this segment of the air transport system, and will create a European general aviation community by discussing and finding common approaches for European key players: users, air traffic management, manufacturers, regulators and research establishments.

Acronym:	SAT-RDMP
Name of proposal:	Small Air Transport – Roadmap
Grant Agreement:	265603
Instrument:	CSA – SA
Total cost:	393 471€
EU contribution:	369 377€
Call:	FP7-AAT-2010-RTD-1
Starting date:	01.01.2011
Ending date:	30.06.2012
Duration:	18 months
Coordinator:	Mr Krzysztof Piwek ILOT – Instytut Lotnictwa al. Krakowska 110/114 PL 02 256 Warsaw
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EC Officer:	Pablo Pérez Illana

Partners:	CIRA – Centro Italiano Ricerche Aerospaziali ScpA	IT
	INCAS – Institutul National de Cercetari Aerospatiale Elie Carafoli SA	RO
	NLR – Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	PZL – Polskie Zaklady Lotnicze	PL
	Piaggio Aero Industries S.p.A.	IT
	Evektor Spol. s.r.o.	CZ
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	Budapesti Muszaki Es Gazdasagtudomanyi Egyetem	HU
	TU Delft – Technische Universiteit Delft	NL
	Ad Cuenta BV	NL
	Fly Aeolus BVBA	BE
	M3 Systems SARL	FR
	Tony Henley Consulting Ltd	UK

SME-AERO-POWER

Empowering European Aeronautical SMEs to Participate in EU Research

State of the Art – Background

Small and medium-sized enterprises (SMEs) and small organisations (SOs) are already an integral part of the aeronautics marketplace, but they will also be key players in accelerating the innovation processes, thus increasing European competitiveness in the world market.

Many fruitful collaborations between SMEs/SOs and companies have been established but this has also led to the recognition of several factors which play against a deeper co-operation:

- there is a lack of the competencies required to enhance the speed and likelihood of successful partnerships:
- the regulatory requirements of the aerospace market and their implications are often poorly understood;
- within the Seventh Framework Programme (FP7), the time at which relevant information is delivered often happens too late for the SMEs/SOs to properly prepare their participation, so it is difficult for them to be able to exploit it;
- SMEs/SOs are necessarily focused on day-to-day cash flow and time-paucity problems and do not always give adequate attention to long-term research objectives;
- time and cost investment in considering bidding may be daunting and that coupled with a perception of low rates of success in organisations with less risk flexibility reduces attraction;
- intellectual property rights remain a large obstacle for SMEs/SOs participating in research projects.

Objectives

The project aims to improve and widen the inclusion of SMEs and SOs in innovative collaborations with companies and within FP bids by pursuing a strategic three-level approach:

- Mobilisation of SMEs/SOs: attract relevant innovative and research-intensive SMEs/SOs from the aeronautic technology sector and assist them in getting involved in self-defined research activities within the FP aeronautic theme;
- Coaching and self-realisation for SME and SO intermediaries: two methodologies will be integrated: a formal structured coaching methodology, plus a narrative-based self-realisation process with qualitative and quantitative outputs of SME/prime innovation. The main aims of this strategic level are to develop innovation coaches from SME & SO intermediaries – like national contact points, innovation relay centres – and add a further dimension to the ways in which opportunity and hidden talent can be drawn out and ignited via a narrative-based knowledge-economy approach;
- Competence development: The third phase will introduce the PEER-AERO-NET, a network that will bring together all the relevant stakeholders and will coordinate the activities of the learning community, to a) achieve the quantified targets of the project in terms of competence development, knowledge sharing and professional guidance, and b) lay the foundation for self-sustainability.

Description of Work

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

WP2 focuses on mobilising relevant SMEs and other small organisations and attracting them to take part in the project activities. This will raise awareness about the activities, form collaborations with other initiatives, and lead to holding regional awareness workshops.

WP3 is aimed at coaching those people who will serve as intermediaries by means of self-awareness sessions for mobilised SME groups and by creating the PEER-AERO-NET. There will be three steps in the peer-net development:

- establishing the PEER-AERO-NET network and nurturing it;
- performing training workshops within PEER-AERO-NET;
- initiating at least 30 peer-to-peer collaboration interactions.

WP4 addresses formal and informal associations between the project and those networks, projects or events that foster relevant activities. It will also increase the pan European clustering through the PEER-AERO-NET.

WP5 handles the visibility of the project to the targeted SMEs, associations, societies, clusters, networks, professionals and large companies. It will also constitute a window for the European Commission to follow-up on the work and activity carried out. This work package involves developing the dedicated material for the awareness actions, and also developing the recommendations which resulted from the training sessions and workshops.

Expected Results

A major impact of SME-AERO-POWER will be the support for increased participation by research-intensive SMEs, in the FP7 aerospace activities and programmes, thus contributing to the technological competitiveness and growth of the European industry, and enhancing innovation objectives.

Another foreseen impact of the project is the resulting European Community of Innovation Coaches, the PEER-AERO-NET Community, which will provide a sustainable European basis for facilitating and coaching more SME-driven innovation projects long after the project has ended. A healthy, proactive and economically self-sustaining PEER-AERO-NET is vital to enable it to grow by adding new members and so multiply the results and therefore its impact.

Acronym:	SME-AERO-POWER	
Name of proposal:	Empowering European Aeronautical SMEs to Participate in EU Research	
Grant Agreement:	285174	
Instrument:	CSA – SA	
Total cost:	531 860€	
EU contribution:	473 744€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.07.2011	
Ending date:	30.06.2013	
Duration:	24 months	
Website:	http://www.sme-aero-power.eu	
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SUNJET
Sustainable Network for Japan-Europe Aerospace Research and Technology Co-operation

State of the Art – Background

SUNJET is a European project within the Seventh Framework Programme aiming at establishing an initial framework, database and network in order to facilitate and enhance the co-operation in R&T activities between Japan and Europe. Through the participation of all the relevant stakeholders, it introduces a more structured dialogue to identify the similarities in the respective research agendas/roadmaps.

Objectives

The strategic objectives are to ensure momentum and strategic guidance to the SUNJET project, obtaining the views from the advisory board, reflecting both the EU's and Japan's recommendations:
- views from the pan-European ACARE aeronautics public and private stakeholders,
- views from the Japanese community, represented on the board by it's high-level permanent members.

The technical objectives are to obtain and synthesise the information and recommendations from the focal points of the European manufacturing industry, research establishments and laboratories, and the universities. This information includes inputs on the existing EU-Japan R&T co-operation actions, the supply of EU-Japan network contributions, elements of EU-Japan roadmaps and recommendations for the methodology to implement R&T co-operation.

Description of Work

From the beginning, the work has been concentrated in the following areas:
- build up ad-hoc EU-Japan R&T co-operation areas of mutual benefit;
- propose win-win R&T roadmaps / co-operation;
- ensure a mutual understanding of administrative mechanisms: clarify the principles governing (such as EU-Japan R&T co-operation, respective funding mechanisms, intellectual property rights, etc.) and the main barriers to that co-operation, and suggest ways to overcome all the problems.

Expected Results

The SUNJET project will indicate the areas where the co-operation topics are mutually favoured, assuring a good reciprocity between the parties.

It will not interfere with the various EU-Japan R&T co-operative activities already undertaken, but might nonetheless provide rules and reference that could be beneficial to all.

Finally, the project will provide common R&T roadmaps for co-operation to be introduced in future calls for proposals within EU framework programmes and similar mechanisms in Japan.

Acronym:	SUNJET
Name of proposal:	Sustainable Network for Japan-Europe Aerospace Research and Technology Co-operation
Grant Agreement:	284881
Instrument:	CSA – SA
Total cost:	333 347€
EU contribution:	308 494€
Call:	FP7-AAT-2011-RTD-1
Starting date:	01.06.2011
Ending date:	31.12.2012
Duration:	19 months
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WEZARD
Weather Hazards for Aeronautics

State of the Art – Background

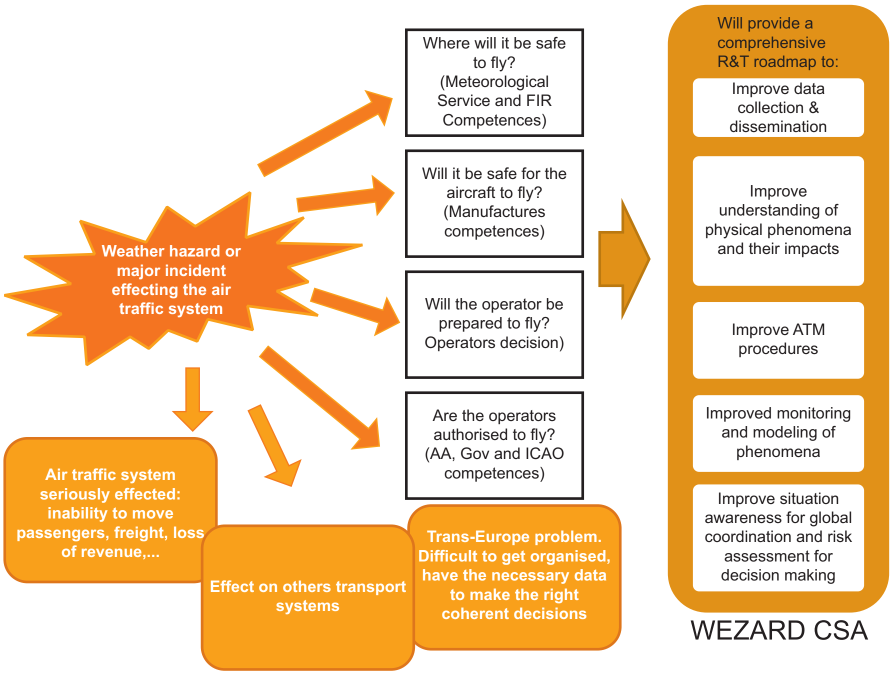
On 14 April 2010, the eruption of the Eyjafjallajökull volcano in Iceland and the accompanying cloud of volcanic ash forced most countries in northern Europe to close their airspace between 15 and 20 April, grounding more than 100 000 flights and affecting an estimated 10 million travellers. This event revealed to what extent our society and economy rely on the availability of a safe and efficient air transport system and how fragile it still remains when faced with the complexity of atmospheric conditions.

Natural hazards that can severely impact the air transport system are not restricted to the results of volcanic eruptions and can include other hazards involving particles, such as icing (super-cooled large droplets, mixed phase and glaciated icing conditions).

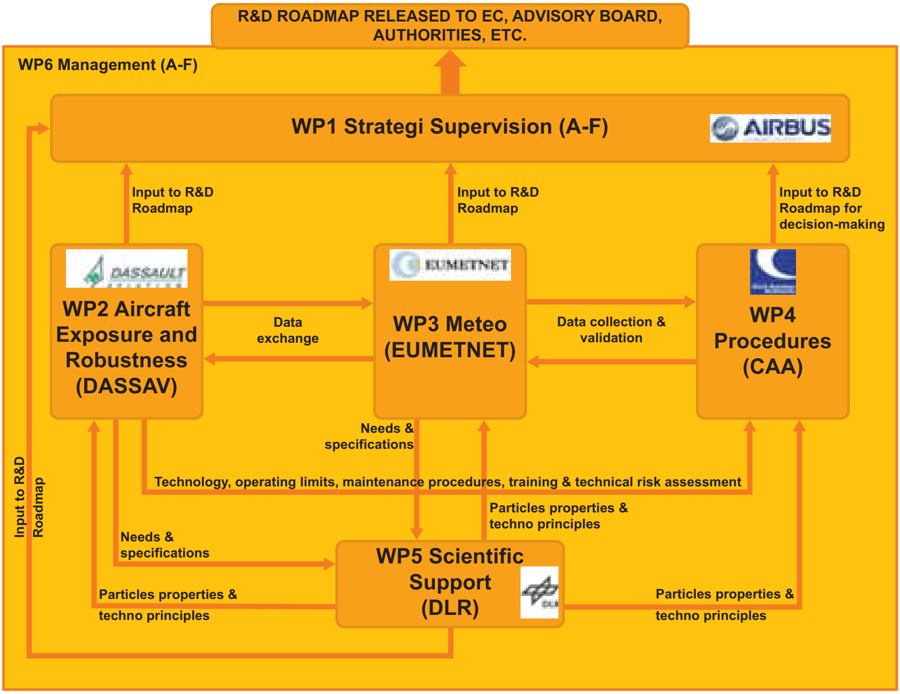
Objectives

This project aims to support and contribute towards the preparation of future research to achieve more robust air transport systems that are able to deal with severe weather hazards.

The detailed objectives of WEZARD are:
- to set up an interdisciplinary and cross-sectoral network;
- to compile the technical consequences of the main weather hazards on aircraft;
- to compile an inventory of recent and ongoing research and development (R&D) activities within the relevant areas, which are financed through different programmes at European as well as national level, and within the relevant institutions;



WEZARD project concept – sharing competences



WEZARD work structure

- to compare, analyse and validate the results of relevant projects and activities in a structured peer review process, and to propose the most mature and relevant new developments for concepts and methodologies, data sources and models, etc. for take-up in risk detection, assessment and risk management;
- to develop a coherent approach to the validation of relevant input data, models, etc., which are targeted for the specific purpose of risk management in air transport;
- to provide a roadmap on further R&D and validation activities, including priorities, impact analysis and the consequences of decision-making.

In particular, the work will cover hazards which can spread over very large areas, such as volcanic ash clouds or severe atmospheric conditions like icing.

Description of Work

Several European actors are involved in the understanding, decision-making and risk-assessment process around the crisis management of an event that has a major impact on the air traffic system:

- aircraft and engine manufacturers support the evaluation of aircraft and engine operating limits, develop the necessary instruments and equipment, and develop instructions and training for operators;
- meteorological services support the collection of observation data and provide reliable and accurate weather forecasts;
- authorities establish safety standards and approved procedures;
- research institutes, universities and test facilities provide their expertise and support to the above organisations.

WEZARD is structured into six work packages (WP).

WP1 ensures momentum and strategic guidance to the project.

WP2 takes stock of the knowledge on weather hazards affecting airframes, engines and systems.

WP3 compiles knowledge on the collection, processing and communication of meteorological data related to weather hazards.

WP4 investigates the current and future safety standards and procedures necessary to ensure safe aircraft operation and to reduce the impact of weather hazards on air traffic management.

- WP5 reports on the capacity of the scientific community to better understand, observe, reproduce and simulate hazardous particles.
- WP6 covers project administration.

Expected Results

The results of this work will provide:
- an interdisciplinary and cross-sectoral network comprising expertise from observation and measurement, aircraft and engine manufacturers, system suppliers, scientists, etc.;
- a state-of-the-art review of ongoing research actions;
- an in-depth analysis which will identify the shortcomings, the areas for improvement and the type of activity needed to develop a safer air transport system that limits the effects of disrupting events;
- a consolidated recommendation and roadmap report validated by the main stakeholders of the aeronautics community.

Acronym:	WEZARD	
Name of proposal:	Weather Hazards for Aeronautics	
Grant Agreement:	285050	
Instrument:	CSA – SA	
Total cost:	747 439€	
EU contribution:	498 306€	
Call:	FP7-AAT-2011-RTD-1	
Starting date:	01.07.2011	
Ending date:	30.06.2013	
Duration:	24 months	
Website:	http://www.wezard.eu	
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	Rolls Royce plc	UK
	Thales Avionics SA	FR
	ONERA – Office National d'Etudes et de Recherches Aerospatiales	FR
	DLR – Deutsches Zentrum fuer Luft – und Raumfahrt eV	DE
	EADS Deutschland GmbH	DE
	EUMETNET Groupement d'Intérêt Economique	BE
	Direction Generale de L'Armement/Dga Essais Propulseurs	FR
	CNR – Consiglio Nazionale delle Ricerche	IT
	CAA – Civil Aviation Authority	UK

Index by Acronyms

Acronym	Project name	Grant Agreement	Vol	
IMPACT-AE	Intelligent Design Methodologies for Low-pollutant Combustors for Aero-engines	265586	2	43
INFUCOMP	Simulation Based Solutions for Industrial Manufacture of Large Infusion Composite Parts	233926	1	192
INMA	Innovative Manufacturing of Complex Ti Sheet Aeronautical Components	266208	2	106
INNOVATION PLATFORM	Innovation Management Platform for Aeronautics	266249	2	182
iSPACE	innovative Systems for Personalised Aircraft Cabin Environment	234340	1	123
KIAI	Knowledge for Ignition, Acoustics and Instabilities	234009	1	66
LAPCAT-II	Long-term Advanced Propulsion Concepts and Technologies II	211485	1	234
LAYSA	Multifunctional Layers for Safer Aircraft Composite Structures	213267	1	149
LEMCOTEC	Low-emissions Core-engine Technologies	283216	2	46
MAAT	Multibody Advanced Airship for Transport	285602	2	136
MAAXIMUS	More Affordable Aircraft through eXtended, Intergrated and Mature nUmerical Sizing	213371	1	152
MARS	Manipulation of Reynolds Stress for Separation Control and Drag Reduction	266326	2	50
MASCA	Managing System Change in Aviation	266423	2	108
MERLIN	Development of Aero-engine Component Manufacture using Laser-additive Manufacturing	266271	2	53
MISSA	More Integrated System Safety Assessment	212088	1	138
MONITOR	Monitoring System of the Development of Global Aviation	233999	1	277
MYCOPTER	Enabling Technologies for Personal Air-transport Systems	266470	2	139
NEARS	New European Aviation Research Strategy	266176	2	185
NINHA	Noise Impact of Aircraft with Novel Engine Configurations in Mid-to-High Altitude Operations	266046	2	55
NOVEMOR	Novel Air Vehicle Configurations: From Fluttering Wings to Morphing Flight	285395	2	141
ODICIS	ODICIS - One DIsplay for a Cockpit Interactive Solution	233605	1	129
ON-WINGS	ON-Wing Ice DetectioN and MonitorinG System	233838	1	114
OPENAIR	Optimisation for Low Environmental Noise Impact Aircraft	234313	1	78
OPTI	Observatory Platform Technological and Institutional	265416	2	187

Index by Instruments

CP – FP

CP – IP

CSA – CA

CSA – SA

Index by Partners

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Aeronautics and Air Transport Research in the Seventh Framework Programme

The aim of this publication is to provide information on the 65 projects which were selected in the 2010 and 2011 Calls for Proposals of the Seventh Framework Programme for Research and Technological Demonstration (FP7) in the field of Aeronautics and Air Transport.

The background, objectives, description of work and expected results of each project are described. 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.

Project information

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