ACARE

Advisory Council for Aeronautics Research in Europe

Aeronautics and Air Transport Research

Success stories

and benefits beyond aviation

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1 Background

Aviation has dramatically transformed society over the past 40 years. The economic and social benefits throughout the world have been immense in 'shrinking the planet' with the efficient and fast transportation of people and goods. The growth of air traffic over the past 20 years has been spectacular, and will continue in the future, particularly in the growing markets of the Far East.

The European Air Transport sector made up of Civil Aeronautics and Air Transport generates a turnover in excess of Euro 94 billion and represents a pinnacle of manufacturing which employs almost half a million highly skilled people directly and spins-out technology to other sectors. About 2.6 million indirect jobs can be attributed to air transport related activities and a contribution of around Euro 240 billion to gross domestic product.

ACARE brings together over 40 members who represent the whole spectrum of stakeholders in the European air transport community: the aeronautics industry, airlines, airports, air traffic control service providers, the European Commission, Member States, research institutes and academia. The top level objectives are to:

- **Meet society's needs for a more efficient, safer and environmentally friendly air transport;**
- **Win global leadership for European aeronautics, with a competitive supply chain, including small and medium size enterprises.**

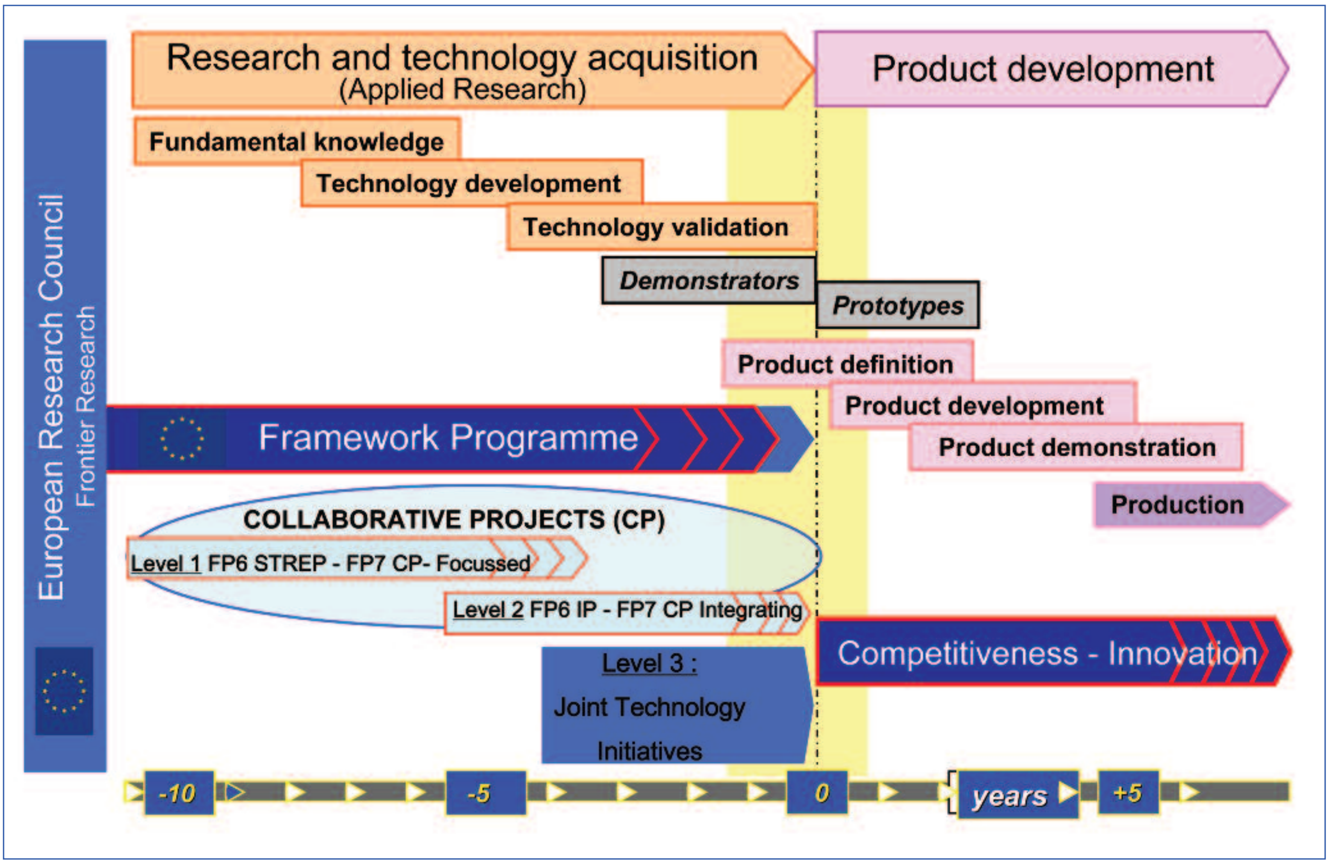
ACARE's primary mission has been to establish and carry forward a Strategic Research Agenda (SRA) aimed at influencing all relevant stakeholders in the planning of aeronautics research programmes, at National, EU and even private levels. The SRA is not a research programme, but rather a roadmap outlining the strategic orientations which should be taken if Europe is to meet society's needs for aviation as a public mode of transport as well as noise and emissions reduction requirements in a sustainable way.

The SRA provides strategic goals and Research and Technology (R&T) roadmaps for proposed solutions to achieve the objectives outlined in Vision 2020. The SRA goals have had a clear influence on current aeronautical research. There is strong evidence of a vigorous programme of Aeronautics and Air Transport research, which is already delivering important initiatives and benefits for the aviation industry, including: EU collaborative research in Aeronautics and Air Transport (EC's Framework Programme research), the Clean Sky Joint Technology Initiative, the SESAR Joint Undertaking, national programmes in many Member States and research establishment as well as private company programmes.

This document details examples of success stories, as well as benefits that go beyond aviation, associated with technology developed as part of the National programmes and those of the Strategic Research Agendas for Aeronautics and Air Transport.

2 Research and technology timescales

Research in air transport takes time and this, in part, is determined by the stringent safety requirements prevalent in this sector. The elements of the phased research programme comprise a range of Technology Readiness Levels (TRL). The chart below details the timescales that are involved in typical research programmes within aviation.



Typically, the 'Research and Development' phase will establish technology from TRL level 1 to TRL level 3. The 'Demonstration' will take this input to develop technology to TRL level 6. Together these form the 'Research and Technology Acquisition' phase detailed in the chart above which can take up to ten years to achieve.

Deployment of the technology in the market place as part of the 'Product Development' phase can take a further five years plus.

It is also worth noting that aircraft typically remain in service for 30 to 40 years. This means that in aviation where products are highly developed and complex, the total technology life cycle could be around 50 to 60 years.

3 Institutional enablers

ACARE has published two editions of the Strategic Research Agenda in 2002 and 2004, followed by an Addendum in 2008. The first edition (SRA-1) was driven by five major Challenges, each of which addressed a set of the Vision 2020 Goals through research and technology development roadmaps.

- **Quality and Affordability** – delivering to passenger, freight and other customers the increased quality, economy and performance they need.
- **Environment** – meeting continually rising demand while reducing the environmental impact of manufacturing, operating and maintaining aircraft.
- **Efficiency of the Air Transport System** – rising traffic should not exacerbate the downsides of congestion, delay and lost opportunities. The efficiency of the whole system must be substantially improved, which will call for the introduction of radical new concepts.
- **Safety** – convincing passengers and society at large that, notwithstanding greatly increased traffic, commercial aviation has to further reduce the risk of accident in order to remain extremely safe.
- **Security** – devise methods that will improve security, on a global basis, within a highly diverse and complex system.

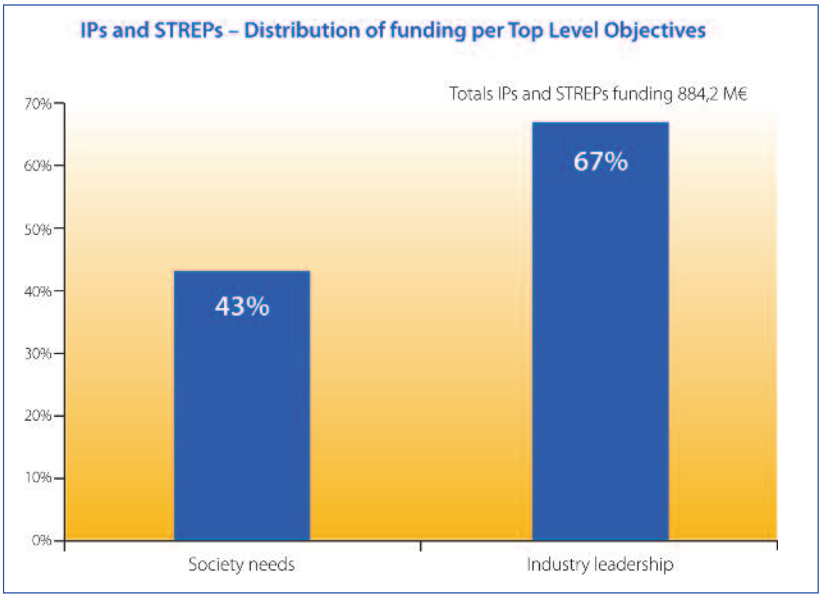
Complementing the SRA, ACARE has identified a number of policy-related aspects, which are key to a successful implementation of the SRA. They constitute the so-called *institutional enablers*:

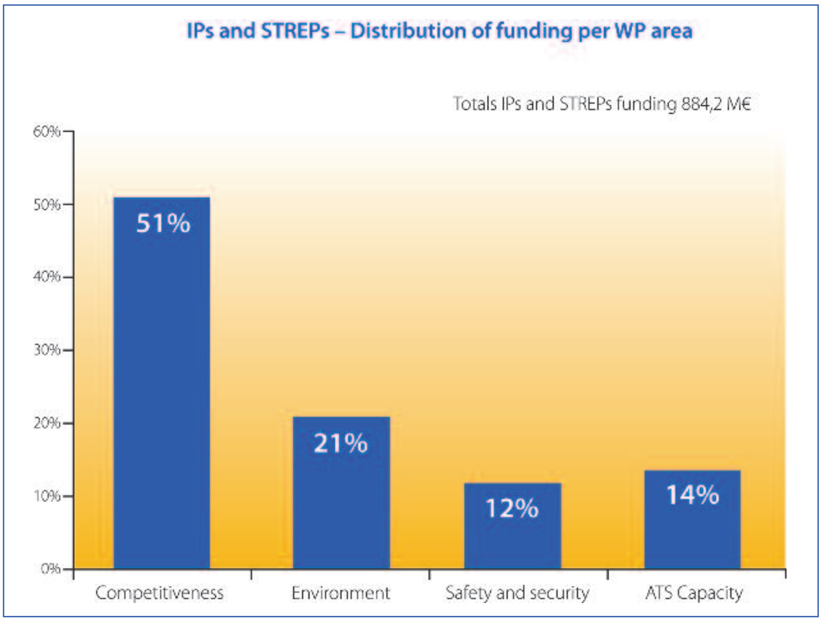
- Recognise Aeronautics and Air Transport System as a distinct European and National priority and enabler for growth;
- Identify and preserve Europe's research infrastructure requirements;
- Maintain R&T support mechanisms at both European and National level;
- Encourage sustained flow of competent, trained and motivated people;
- Ensure coordination at all levels from integrator to SME in innovation and exploitation;
- Ensure certification and qualification procedures for a safe Air Transport System meeting society's needs.

4 Achievement of objectives

An analysis of research conducted within the Framework Programmes to date shows that both aims of meeting society's needs as well as winning global leadership for European aeronautics are well covered by the funded projects. This is considered a good balance between the two top level objectives outlined on page 2.

At the level of the five Challenges, allocation of 51 per cent to Competitiveness shows the high industrial interest. These also seem to be appropriate in the sense that the three areas Environment, Safety and Security and ATS Capacity are covering roughly the society's need, thus in good balance with Competitiveness.





5 Portfolio of success stories

This section provides examples of research projects that have been completed since the formation of ACARE and the launch of research programmes in support of the Strategic Research Agenda.

In recognition that there is **complementary research at a European and National level** that ultimately brings together a complete picture of this effort, examples are drawn both from European Framework Programmes as well as National Research Programmes from Member States.

The examples, categorised in support of the key challenges, include the following:

1. **Quality and Affordability**

   Advanced Low Cost Aircraft Structures (ALCAS)

   Automated Repair and Overhaul System for Aero Turbine Engine Components (AROSATEC)

   Value Improvement through a Virtual Aeronautical Collaborative Enterprise (VIVACE)

   Significantly Lower Community Exposure to Aircraft Noise (SILENCER)

2. **Environment**

   Efficient and Environmentally Friendly Aircraft Engine (EEFAE)

   Technology Enhancements for Clean Combustion (TECC-AE)

   Glare Allowable Development & Verification Program GTO (1998 – 2003)

3. **Efficiency of the Transport System**

   Crosswind-Reduced Separation for Departure Operations (CREDOS)

   Supporting Platform for Airport Decision-Making and Efficiency Analysis (SPADE)

4. **Safety and Security**

   Inflight Lightning Strike Damage Assessment System (ILDAS)

   Optimised Procedures and Technologies for Improvement of Approach and Landing (OPTIMAL)

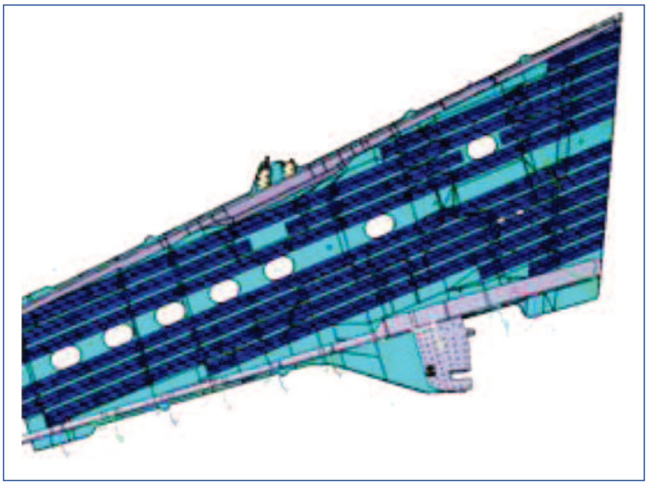
   Improved connections between pilots, aircraft and ground systems (UPLINK)

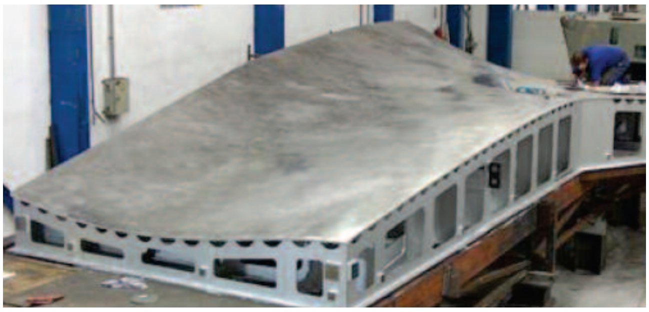
5.1 Quality and affordability

Advanced Low Cost Aircraft Structures (ALCAS)

Led by Airbus UK with 58 partners and a research budget of Euro 101 million.

Carbon Fibre Aircraft Primary Structure leading to reduced weight, manufacturing and maintenance costs.





ALCAS has managed resources equivalent to 530 person-years and succeeded in all three main goals on:

- cost effective application of carbon fibre composites to aircraft primary structures;
- weight saving potential; and
- reducing manufacturing and maintenance costs.

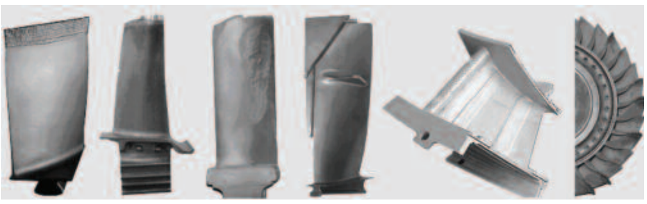
ALCAS continues the work of previously successful FP research efforts (eg TANGO) and ensures that the next generation of products significantly reduces the direct operating costs of the operators.

ALCAS improved structural efficiency to:

- reduce acquisition cost, through improved material utilisation, design and manufacturing processes;
- reduce operator fuel costs through lower airframe weight, which also reduces environmental impact.

Automated Repair and Overhaul System for Aero Turbine Engine Components (AROSATEC)

Led by BCT GmbH with seven partners and research budget of Euro 2.3 million.

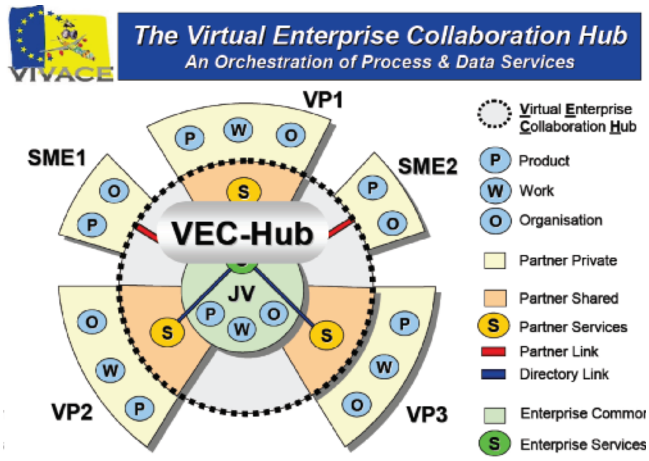


The AROSATEC consortium have developed a new data management system which will constitute the core of a fully automated overhaul process, integrating individual steps into a comprehensive automated repair chain that is more competitive and provides better quality than manual work.

The success is due to the innovative ideas developed by complementary partners bringing together different skills and knowledge to the project, in particular SMEs. Participants included software specialists and experts in scanning, milling and welding technologies. Importantly, the project involved several SME partners, including BCT GmbH itself. SMEs are widely considered to be drivers of innovation in an industry dominated by giant corporations. All the partners were very committed to the achievement of the project goals which are important for their own companies' business.

Value Improvement through a Virtual Aeronautical Collaborative Enterprise (VIVACE)

Led by Airbus with 62 partners and research budget of Euro 75 million.



The project was to develop a collaborative design environment and the associated processes, models and methods. The objective is for this environment to support the design of an aircraft and its engines as a whole, providing to the aeronautics supply chain virtual products with all requested functionalities and components in each phase of the product engineering life cycle.

The targets were to:

- halve the time to market for new products;
- increase the integration of the supply chain in the network;
- maintain a steady and continuous fall in travel charges.

VIVACE, as a strategic European Aeronautics project, has been successful in building and disseminating the tools supporting a 'Behavioural Digital Aircraft'. This Digital Aircraft model enables the concept of 'extended enterprise' where all stakeholders from aircraft integrator to systems and components suppliers work together and concurrently to design the same virtual aircraft, avoiding multiple interfaces between different software and databases.

A tangible proof of success is that Airbus management is committed to implementing these practices in their design and engineering structures.

Significantly Lower Community Exposure to Aircraft Noise (SILENCE(R))

As a six year European Union project dedicated to the reduction of aircraft noise, SILENCE(R) regrouped over 50 companies (including Airbus Industrie, Rolls-Royce, MTU Aero Engines and Snecma), along with research centres and universities. SILENCER® has a budget of Euro 112 million, about 50 per cent of which is funded by the EC. Snecma is the programme coordinator.

SILENCE(R) has delivered significant steps towards the ACARE 2020 research goals of reducing aircraft noise by 10dB per operation. Combined with novel low noise operational procedures studied within the same timeframe, the SILENCE(R) technologies have accomplished the 5dB mid term noise reduction objectives of the EC Research Framework programme.

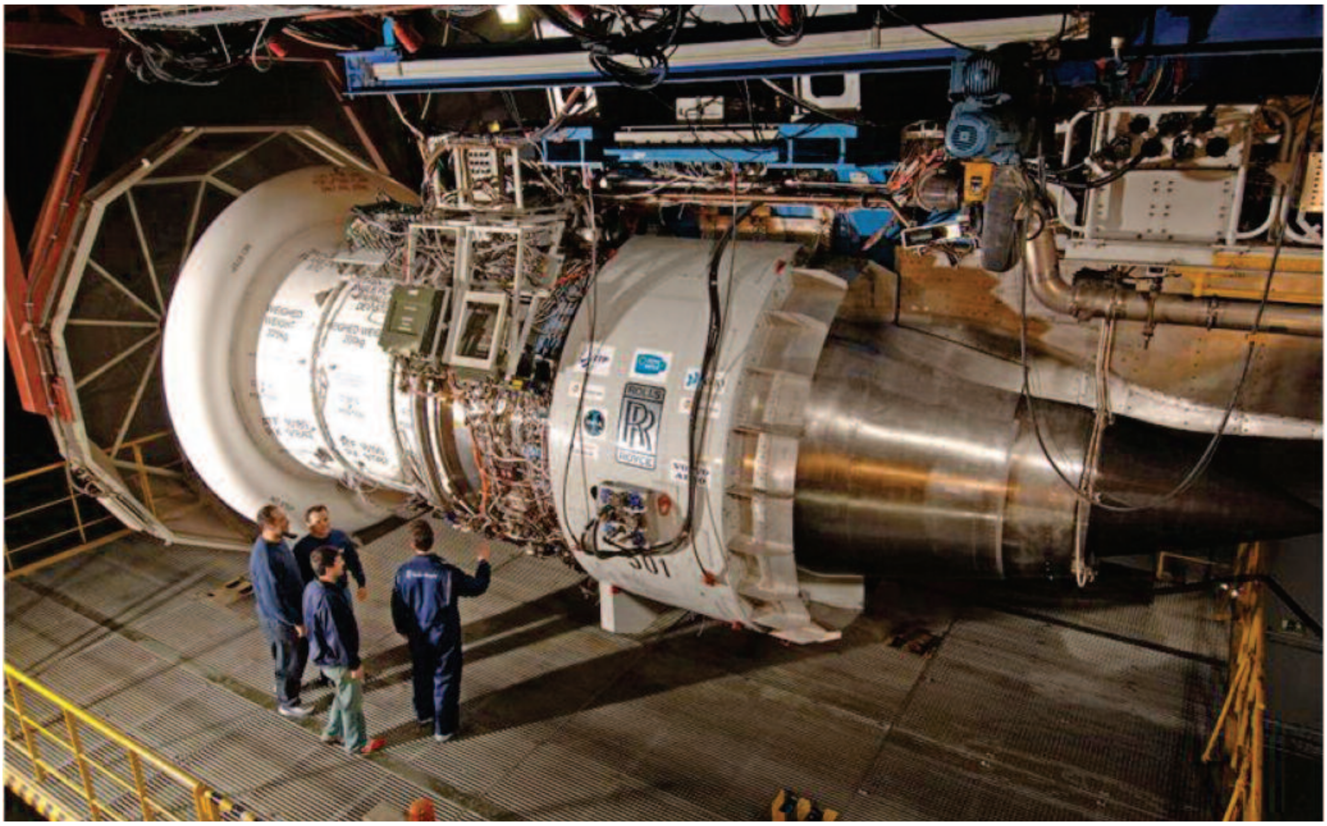
The aim of SILENCE(R) was the large-scale experimental validation of noise reduction solutions concerning the engine (aeroacoustic design, active technologies), the nacelle (aeroacoustic design, innovative acoustic treatment, active noise control), and airframe (aeroacoustic design).

SILENCE(R) has successfully carried out testing on more than 35 prototypes to validate ten technology concepts from the noise reduction standpoint. These include in particular a series of Advanced Low Noise Fan Rotors as well as the elements of a complete low-noise nacelle (Negatively Scarfed Intake, 'Squid' nozzle fitted with high frequency liner) flight tested on an Airbus A320. Flight tests were also carried out on an Airbus A340 with landing gears equipped with aerodynamic fairings.

5.2 Environment

Efficient and Environmentally Friendly Aircraft Engine (EEFAE)

Led by Rolls-Royce with 19 partners and research budget of Euro 101 million.



The EEFAE technology platform aim was to test advanced technologies capable of providing significant improvements to future generations of aero engines. The project built two vehicles to integrate and test a range of new aero engine technologies with the objective of:

- reducing fuel consumption and CO_2 emissions
- reducing NOx emissions (relative to ICAO 96 standard)
- reducing cost of ownership
- improving reliability
- reducing life cycle cost.

The first vehicle built and tested was **ANTLE (Affordable Near Term Low-emissions Engine)** to test a range of technologies suitable for implementation in new three-shaft engines in the thrust range 50 to 110klbs. The technologies validated included the HP compressor, combustor, all stages of the turbine, control system, tail-bearing house, oil system and the advanced accessory gearbox.

The second vehicle was **CLEAN (Component validation for Low-Emissions Aero eNgine)**. This is the first application of technology initially developed for a geared turbofan engine and in the longer term for an inter-cooled recuperative aero engine. The technologies validated included active surge control, HP compressor, combustor, turbine, control system, turbine exhaust casing and heat exchanger.

The technologies successfully validated by the two vehicles forming part of this project are available in new aero engines entering service since 2008.

Technology Enhancements for Clean Combustion (TECC-AE)

Led by Snecma with 17 partners and research budget of Euro 11.9 million.

TECC-AE will have a major impact on short and long-term engine manufacturer competitiveness as it will provide:

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

This is a good example of a Level 1 project with a very sound scientific content involving both experiments and modelling. It is expected that a number of publications will result but also development in a number of key technologies that will pave the way towards the development of low NOx combustors. It is an interesting example of a true, effective and well balanced collaboration between industry and academia/research centres on an industrial applied research problem where several tasks are likely to produce new knowledge and some innovations.

Glare Allowable Development and Verification Program GTO (1998 – 2003)

An example of a National research programme in the Netherlands on glass fibre reinforced aluminium (Glare).

Fibre Metal Laminates have been developed between 1970 and 1990 by the TU Delft, the Netherlands as a solution to enhance the fatigue properties of bare aluminium. In the 90's industrial partners became involved: Alcoa, a US aluminium manufacturer and AKZO, manufacturer of aramid fibres joined forces with the TU Delft to develop Arall, an abbreviation of Aramid Fibre reinforced aluminium. In a later stage glass fibre reinforced aluminium was developed to give better compressibility strength. Applications that were developed included fuselage panels, pressure bulkheads, flap skins and more.

At the end of the 90's, Stork Fokker and Airbus worked together to commercially apply Glare on the A380. As a basis for the qualification, a large programme under the name GTO (Glare Technologie Onderzoek) was launched in 1998 in the Netherlands to establish the design allowables over the full spectrum of operational conditions. This programme was funded by national funds through NIVR, the Dutch Agency for Aircraft Development.

Under the GTO programme, large quantities of Glare samples were produced under a certified process. These samples were tested to establish the static, fatigue and damage tolerance properties under the full range of operational conditions. Besides, an extensive 'effects of defects' programme was executed to determine the acceptance criteria for anomalies in the production. As an example, the maximum size of a void in the laminate was determined. Above a certain threshold value, the anomaly either could result in a repair or in scrap, below the threshold, it is 'use as is'.

The programme has contributed to a large extent in the certification of Glare for the A380. The EIS was a great success for the Glare development team. The high expectations with respect to weight reduction and maintenance free operation were met.

5.3 Efficiency of the transport system

Crosswind-Reduced Separations for Departure Operations (CREDOS)

Led by EUROCONTROL with ten partners and research budget of Euro 5.4 million.

The CREDOS consortium delivered a mature and detailed baseline Concept of Operations, together with a consolidated Validation Case, (including safety, human factors and cost benefit considerations). The documents were made freely available to any airport or Air Navigation Service Provider (ANSP) interested in implementing the concept.

The concept development and validation were carried out based on actual airport information, including actual vortices records collected at the Frankfurt airport.

The consortium managed to efficiently collaborate with the Federal Aviation Administration from the United States, which enabled an early alignment of European solutions with American thus creating a consistent transatlantic baseline approach to tackling adverse wake vortex effects.

The consortium managed to generate the largest collection of real traffic and wake vortex data ever producted worldwide. This created a solid baseline for the validation of the concept and an extremely valuable data set for progressing on the theoretical understanding of wake vortex phenomena, notably made possible by participating universities. The collaboration with the FAA to come up with a coherent approach to wake vortex issues and the exchange of data collected by the FAA on US platforms and by CREDOS in Europe was extremely effective and certainly much appreciated from both sides.

Supporting Platform for Airport Decision-Making and Efficiency Analysis (SPADE)

Led by NLR with 16 partners and a budget of Euro 18.9 million (phase1 and 2).

The SPADE project addresses airport efficiency. Phase 1 aim was to develop a complete design of the decision support system and implement two mock-ups to demonstrate computational capabilities, functionality and validity of concepts. The anticipated result formed the basis for actual realization of the system in phase 2.

The aim of phase 2 was to implement, test and evaluate a user friendly decision-support system for airport stakeholders and policy makers. The system integrates a set of airport case studies in the form of decision-making questions. Each case study concerns one or more specific airport decision-making questions on development, planning or operations and enable trade-off analysis for a variety of measures of airport effectiveness (eg capacity, delay, level of service, safety, security, environmental impacts, and cost-efficiency).

5.4 Safety and security

Inflight Lightning Strike Damage Assessment System (ILDAS)

Led by NLR with 12 partners and research budget of Euro 4.2 million.

The innovative and efficient measurement system Concept Prototype in-flight measurement of lightning strikes to aircraft was realised and actual tests have been performed as planned (with a real A320 on ground). From the start of the project two major Maintenance, Repair and Overhaul (MRO) companies, Air France Industries and Lufthansa Technik have been heavily involved. The ILDAS results showed that effective use of the innovative internal window sensors is certainly possible, which is a major achievement of the project.

Initial objectves were met. ILDAS system is capable of in-flight measurement of the properties of actual lightning strikes. Airbus may pursue further testing, especially if weather events with lightning become more usual and/or extreme. Quite a degree of interest was raised beyond EU, for instance, by the main aviation safety agency: Federal Aviation Administration (FAA) in the US. ILDAS obtained the Best Paper Award at the International Conference on Lightning and Static Electricity held in Pittsfield US. ILDAS is also of interest regarding Helicopter safety, as increasing off-shore operations in storm prone regions.

Optimised Procedures and Technologies for IMprovement of Approach and Landing (OPTIMAL)

Led by Airbus with 23 partners and research budget of Euro 42.3 million.

The benefits of Optimised Procedures and Techniques for IMprovement of Approach and Landing (OPTIMAL) innovative approach procedures were:

- Environment: Reduction of noise, fuel consumption and emissions
  Enablers: Continuous Descent Approach (CDA) for aircraft, steep approach for rotorcraft, low Required Navigation Precision (RNP)-Area Navigation (RNAV) approach.
- Increase of airport capacity
  Enablers: low RNP-RNAV approach, simultaneous non-interfering IFR procedures for rotorcraft, dual/displaced threshold approach.
- Safety improvement
  Enablers: enhanced vision system, approach with vertical guidance.
- Cost-effectiveness improvement
  Enablers: Continuous Descent Approach, LPV5 approach, Satellite Based Augmentation System (SBAS), Airborne Based Augmentation System (ABAS), Ground Based Augmentation System (GBAS), low RNP-RNAV approach.

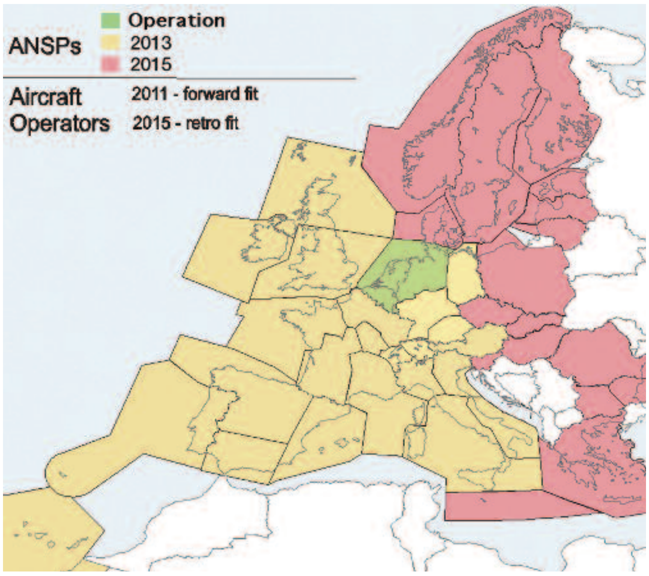
All project objectives were met and OPTIMAL demonstrated that the studied procedures provide in general the expected benefits in terms of capacity, safety and/or environmental impact and that the procedures are feasible. The OPTIMAL project delivered some validated, innovative concepts and promising results, which will certainly contribute to the SESAR JU and the implementation of the future European Air Traffic Management (ATM) system.

Improved Connections between Pilots, Aircraft and Ground Systems (UPLINK)

Led by EUROCONTROL with a research budget of Euro 576 million.

This aim of this programme was to provide datalink connecting pilots and controllers or aircraft and ground computer systems in order to have fewer misunderstandings and reduced workload for controllers as part of their management of airspace. This would as a consequence lead to increased safety and efficiency.

The deliverables were split between air and ground aspects (EC Euro19.3 million for airborne acceleration). Although system operational validation began at the time when Vision 2020 was established in 2000, full European system deployment is envisaged by 2015.



6 Aviation's technology development and innovation spill-over effects in other sectors

The technology developed by Air Transport not only contributes to the European aviation sector but also has spill-over benefits that provide advantage to other sectors.

Aviation technologies are catalysts for innovation, enabling the fertilisation of developments in many other areas, sectors and domains. Here are some past and ongoing examples of the numerous spill-over effects that aviation's high technologies and innovation have had on other domains:

- Complex systems and information technologies including Computer Aided Design, Computational Fluid Dynamics, virtual reality, critical software and systems, micro-computers and vocal command systems.
- Health and medicine, computer, information processing and telecommunications with applications of new Ti-alloys prosthesis, ultra-sound scanners, new laser types, digital imagery and related data-processing.
- Automation, robotics and advanced materials including manufacturing technologies and processes, precision tools, manufacturing robots, advanced welding techniques, innovative materials and composites.
- Systems for other modes of transport (eg AMADEUS system used by SNCF French rail) were adapted and benefited from Global CRS systems (Computer Reservations Systems) or GDS (Global Distribution Systems) which were first introduced for airlines in the 1960s.
- Measurement methods and sensing technologies developed for aviation provide benefit to various domains (advanced sensors and probes, temperature, pressure measurements, non-destructive testing processes, etc).
- Sports, home and leisure have also benefited from technology emerging from aeronautics with applications including composites sport equipments and gears, break-proof and scratch-proof lenses for optics, high performance light batteries.

Aviation's unique safety and certification standards warrant complex methodologies and processes to introduce aero-innovations to the market. Applications of such techniques including the modelling of risk management and mitigation, fault-proofing for complex systems can be read across to other sectors.

Beyond the direct catalytic effect for technology, aviation also has indirect benefits to other sectors allowing fast and safe mobility and exchanges in Europe thus contributing to the growth of the European economy as a whole.

OECD high-tech classification

Aviation and aerospace is a leading sector for high technology and innovation identified by the OECD ('High-tech trade by enterprise characteristics', Alexander Loschky, EC Joint Research Centre, 2009). This classifies industries according to their technology intensity, and approach according to finished products:

- Aeronautics and space technologies
- Artificial intelligence
- Biotechnology
- Energy
- Instrumentation
- Nanotechnology
- Nuclear physics
- Optoelectronics
- Robotics
- Telecommunications
- Electrical engineering.

Note: Technologies which are not seen as high-tech, like Information technology, may also be considered in the scope of higher technological developments.



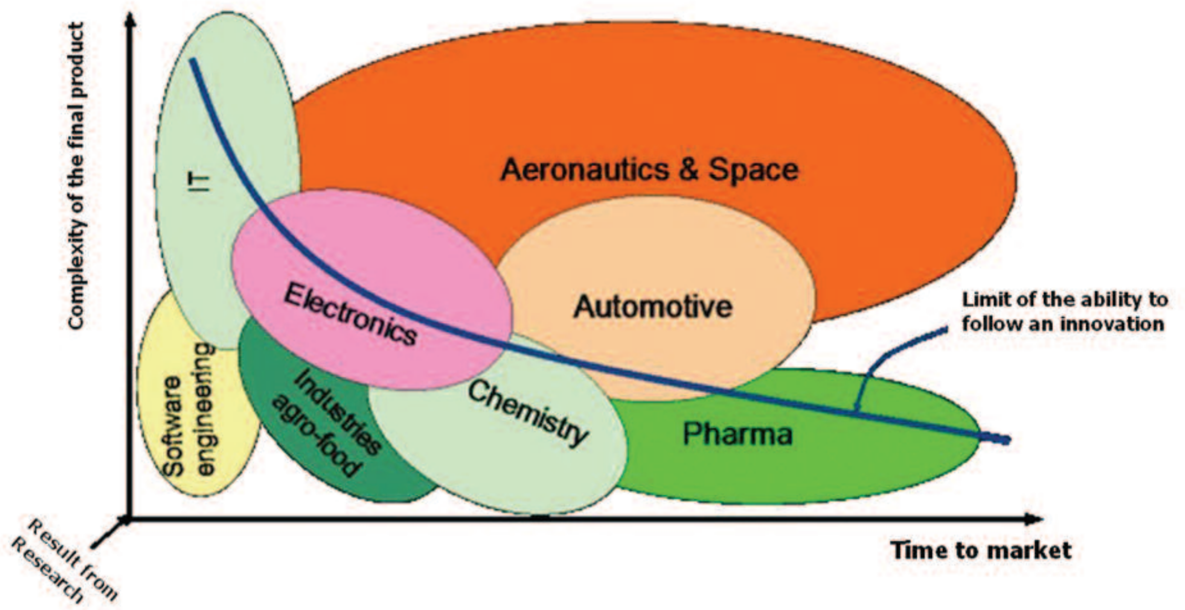


Aviation is also amongst the five high-tech industrial domains considered by OECD in terms of R&D intensity:

Industry name	Total R&D intensity
High technology	
Pharmaceuticals	10.46
Aircraft & spacecraft	**10.29**
Medical, precision & optical instruments	9.69
Radio, television & communication equipment	7.48
Office, accounting & computing machinery	7.21
Medium-high technology	
Electrical machinery & apparatus	3.60
Motor vehicles, trailers & semi-trailers	3.51
Railroad & transport equipment	3.11
Chemical & chemical products	2.85
Machinery & equipment	2.20

Today, the aeronautics R&D spending in Europe is close to 12 per cent of turnover (ASD). This ranges from 8 per cent up to 20 per cent depending on the aviation domain considered.

To continually reduce the duration of the innovation cycle aviation requires significant effort in R&D as well as management of system complexity executed in programmes that span over multiple years.



Source: from Mr Ronan Stephan, Compiègne University:
'Which practices for universities to enhance exchanges and transfer'.

Aviation innovation combines both product complexity and long lead-time to-market, typically 10 to 20 years.

7 Technology integration and application

The results of key research programmes, shown in the attached illustration, have been applied to the launch of the Airbus A380 aircraft (maiden flight April 2005), demonstrating that both EU and National research programmes are necessary in an integrated complex system requiring participation of entire supply chains.

Airbus A380 aircraft (maiden flight April 2005)

Integrated and modular avionics architecture (IMA)
NEVADA B*3, PAMELA FP5, VICTORIA FP5, NATACHA

Skin to stringer welding (first on A318)
WAFS FP5

Carbon composite rear fuselage (Section 19)
APRICOS FP4, TANGO FP5

On-board maintenance system
TATEM FP6-1

Dual air conditioning pack concept
ASICA FP5, CABINAIR FP5

Upper fuselage skin in Galare®
TANGO FP5

Centre wing box in CFRP
TANGO FP5

Landing gear fairing
RAIN FP5, SILENCE® FP5

New four post landing gear fairing (4-6-6-4 wheels configuration)
ELGAR BE*4

High Reynolds number: low drag wing design
ECARP BE*3, EUROLIFT FP5, AVIATOR FP5, C-WAKE FP5

New low weight fuselage structure
ADPRIMAS FP4, TANGO FP5

Low noise nacelle and engine integration
SILENCE® FP5, RAMSES

Highly loaded LPT
EEFAE FP5

***BE=Brite Euram**

The aim of the research programmes is to provide a seamless technological progression. In the case of propulsion systems this includes:

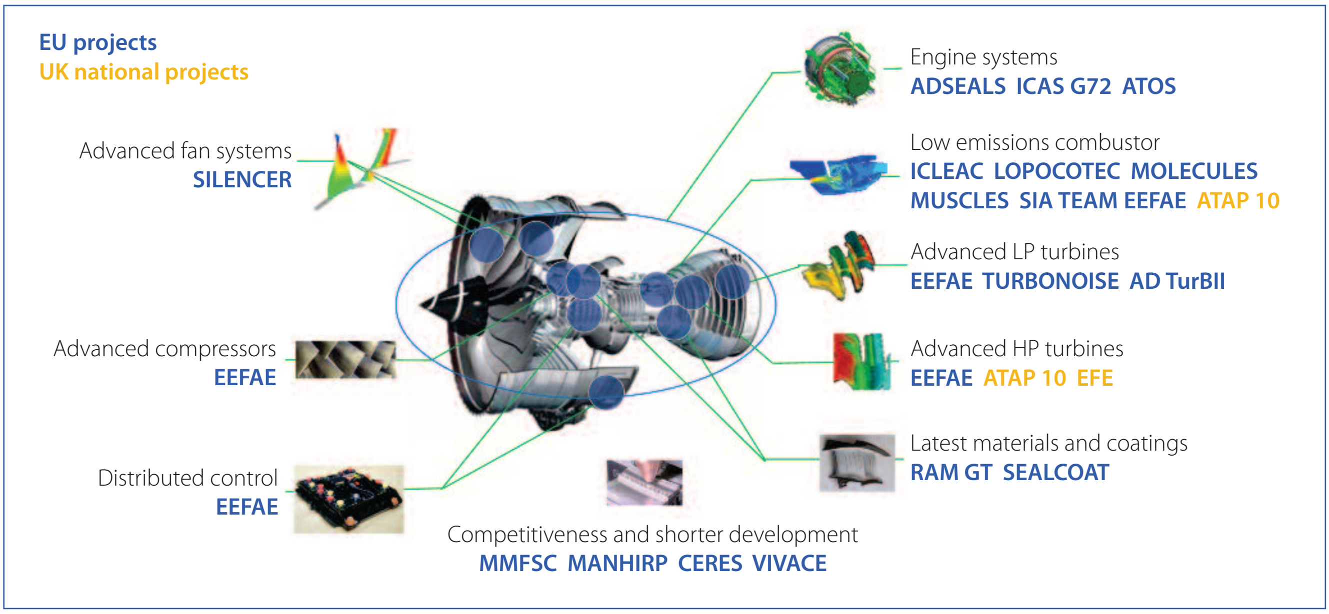
1 Initial technology concepts and development through the Level 1 programmes.

2 Rig testing on viable technologies within the Level 2 programmes. Before

3 Final system validation in the Level 3 CLEAN SKY programmes.

As the technology reaches a higher level of maturity (TRL) it can be exploited within the latest engine programmes with the aim of moving closer to achieving the ACARE goals.

Within the Level 1 technology programmes there is a higher involvement and influence by universities and research institutes. As the technology moves into the validation and demonstration phases (Levels 2 and 3) then the larger industrial businesses tend to drive the programmes, supported by universities and SMEs.



Such an approach to research programmes is applied to other vehicles in aviation. The attached illustration shows programmes applied to the launch of the Falcon 7X (maiden flight May 2005).

Falcon 7X (maiden flight May 2005)

Metallic structure technology and improvement of assembly by fasteners criteria
ADPRIMAS FP4

Internal noise
ENABLE FP5

Reduction of airframe noise
RAIN FP5

Jet exhaust aerodynamic and noise
JEAN FP5

Contribution to the efficiency of the aerodynamic design
ECARP BE*3, AVTAC FP4, EUROLIFT FP5

Drag assessment process
FLIRET FP6

RTM process simulation (rudder)
APRICOS FP4

AGE formable panels for aeronautics (upper wingbox panel)
AGEFORM FP5

Ultra sound NDT (central box)
INDUCE FP5

*BE=Brite Euram

By courtesy of DASSAULT

Similarly programmes applied to the launch of the Eurocopter 175 and AgustaWestland GRAND New are shown below.

Eurocopter 175 and AgustaWestland GRAND

Fuselage drag reduction of rotors
HELIFUSE BE*3

Aerodynamic integration Rotor/fuselage/tail unit
HELIFLOW FP4
HELINOVI FP4

Improved handling qualities: flight control: flight procedures
HELIFLOW FP4, RESPECT FP4, FRIENDCOPTER, OPTIMAL FP6

Improved aerodynamic efficiency of rotors
HELISHAPE BE*3

Reduction of rotor noise
HELISHAPE BE*3, HELINOVI FP4, FRIENDCOPTER FP6

Reduction of interior noise
FACE FP4, FRIENDCOPTER FP6

Toolbox for helicopter flight physics
HELIFUSE BE*3, EROS BE*3, ROSA BE*3, HELIFLOW FP4

*BE=Brite Euram

Eurocopter 175 – maiden flight in 2009

By courtesy of EUROCOPTER (EADS)

AgustaWestland GRAND New – maiden flight in 2009

By courtesy of AGUSTAWESTLAND

8 Summary

ACARE has shown the combined strength of working together across the whole community of industry, research establishments, universities, governments, regulatory authorities, and the European Commission.

Substantial results have been achieved since the launch of Vision 2020. Projects conducted in Aeronautics and Air Transport across the European community have been wide ranging.

This track record can progress further provided the level of momentum applied to research is such that the much needed innovation continues to be undertaken.

There are significant programmes underway as part of FP 7 as well as Clean Sky and SESAR that will deliver much needed solutions that can be integrated into future aircraft and the broader Air Transport system.

ACARE will play a pivotal role in providing strategic advice to the European Commission's Aviation Platform, which will have the following fields of actions:

- Accelerating the Single European Sky (SES);
- Strengthening the competitiveness of the European industry, by expanding the market to a Common Aviation Area with the neighbouring countries;
- Determining and planning priorities for future air transport policy initiatives;
- Analysing challenges and solving problems to ensure the development of the sector;
- Identifying bottlenecks and proposing steps to complete the single market for aviation.

ACARE has also played a central role in providing support to the High Level Group on Aviation Research, convened by the European Commission, and whose role is the formulation of a timely new vision beyond 2020 for the horizon towards 2050.

The members of the High Level Group comprise CEO's of stakeholder organisations representing aeronautics and air transport including airlines, airport operators, air traffic management providers, product manufacturers, fuel producers and research centres. The New Vision is expected to be released in March/April 2011. In response to this New Vision a new Strategic Research Agenda will be elaborated by ACARE with the objective that it is ready by year-end, concurrently with the establishment of the next European Research Framework Programme.

ACARE

Advisory Council for Aeronautics Research in Europe

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