Handover-Document

Brussels

28 November 2011

Content Handover-Document

ACARE Presentation at ICAS summarizing the Work of ACARE (Sept. 2010)

Executive Summary Strategic Research Agenda 1 (Oct. 2002)

Executive Summary Strategic Research Agenda 2 (Oct. 2004)

ACARE Brochure on European Aeronautical Research Infrastructure (2006)

ACARE Position paper on The European Research Area Green Book Consultation (Sept. 2007)

An ACARE view of possible R&T implications of Emission Trading Schemes applied to the Air Transport Sector (Nov. 2007)

Addendum to the Strategic Research Agenda (2008)

ACARE position on “A sustainable future for transport” (the European Transport Policy) EC communication (2009)279/4

ACARE position on Joint Programming (2009)

Aeronautics and Air Transport Research Success stories and benefits beyond aviation (2010)

ACARE Position Aeronautics-Air Transport and the EU Common Strategic Framework (2010)

Status report ACARE Implementation Group (Jul. 2011)

Status report ACARE Communication Group (Sept. 2011)

Status report ACARE Member States Group (Sept. 2011)

Status report ACARE Infrastructure Group (Sept. 2011)

Status report ACARE Human Resource Group (Sept. 2011)

ICAS von Karman Award for ACARE (Sept. 2010)

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A European cooperation with International Impact

Francois Quentin

Joachim Szodruch

ICAS 2010 von Karman Award Lecture

ACARE

- ► The Beginning
- ► Present Activities
- ► Future Considerations

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The Beginning : FP 6 Strategy to maintain position

- Develop the scope of aeronautics and by that win a wider stakeholder community favourable to aeronautics:
  - By embracing social dimensions of aeronautics.
  - By recognising the wider "Air Transport System".
  - By identifying the benefits to the whole EU and not just the big aero nations.
- Sustain or increase the funds allocated.
- Influence their allocation strongly.
- Maintain a coherent industry position.
- Perform well in FP5 !!

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The aeronautic environment in 2000

- Airbus was established as an integrated company across 4 countries.
- A380 was about to be launched, a major undertaking concerning technology, production, global partnerships, future operation, financing, etc.
- IPCC report on climate stimulated political debate
- Air Traffic growth planned at a steady ~5%.
- Economic environment good with high growth in emerging Asia
- Aeronautical research in Europe celebrates its 10th year

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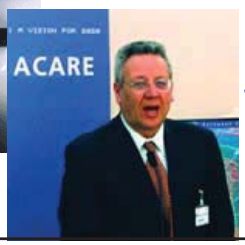
The way from the EAG to ACARE

External Advisory Group Report
April 2000

Vision 2020
January 2001



Le Bourget
Kick-Off
June 2001

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ACARE: The Mission

- Establish a ***network*** for strategic research in aeronautics and the air transport sector for all European stakeholders
- Launch and approve the ***Strategic Research Agenda (SRA)***, update it periodically and monitor implementation towards the 2020 vision
- Make ***strategic and operational recommendations*** and priorities for implementing the SRA and achieving the 2020 Vision
- Recommend measures for optimising the use of existing ***research infrastructures*** and achieving cost-effective investments
- Recommend measures for improving ***educational policies*** to attract the scientists, engineers and other skills that the sector needs
- Develop and implement a ***communication*** strategy to promote awareness of the SRA and to disseminate information on stakeholders' research programmes for facilitating consensus on priorities

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ACARE: The Members

36 Members of European Organisations of Stakeholders :

- European Commission
- Member States
- ASD (Industry)
- EREA (Research Establishments DLR, ONERA, NLR)
- Eurocontrol (ATM)
- JAA / EASA (Certification)
- EASN / Pegasus (Universities)
- AirTN (Ministries / Agencies)
- Airlines and Airports

(ACARE - Advisory Council for Aeronautic Research in Europe)

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ACARE: The Goals

Challenges	*and associated goals*
Quality and Affordability	*Reduced passenger charges* *Increased passenger choice* *Transformed freight operations* *Reduced time to market by 50%*
Environment	*Reduction of CO2 by 50%* *Reduction of NOx by 80%* *Reduce perceived external noise by 50%* *Substantial progress towards 'Green MMD'*
Safety	*Reduction of accidents rate by 80%* *Drastic reduction in human error and its consequences*
System Efficiency	*3X capacity increase* *99% of flights within 15' of schedule* *Less than 15' in airport before short flights*
Security	*Airborne - zero hazard from hostile action* *Airport - zero access by unauthorised persons or products* *Air navigation - No misuse. Safe control of hijacked aircraft*

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Strategic Research Agenda –
Organising the work

ACARE Plenary
Chairman / Vice-Chairman
36 Members from
Governments, Industry, Airlines, Airports, Research Establishments, Universities, Regulators, EC

Quality & Affordability	Environment	Safety & Security	Efficient AT-System	Research & Education	Institutional Issues	
Team Leader	Team Leader	Team Leader	Team Leader	Team Leader	Team Leader	Integration Team 12 members
Rapporteur	Rapporteur	Rapporteur	Rapporteur	Rapporteur	Rapporteur	Support Group 10 Members
36 members & experts	45 members & experts	34 members & experts	60 members & experts	22 members	17 members	

5000 working days by about 200 representatives from stakeholders

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The Development of the Strategic Research Agendas 2002 - 2004

October '02 : The Strategic Research Agenda (SRA-1) Challenges

- Quality & Affordability
- Environ-ment
- Safety
- Air Transport System Efficiency
- Security

October '04 : The SRA-2 High level Target Concept

- Very Low Cost ATS
- Ultra Green ATS
- Highly Customer Oriented ATS
- Highly time-efficient ATS
- Ultra Secure ATS
- 22nd Century

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Addendum in 2008

SRA 1 & 2 cover all the main issues for 2020

- Some changes of emphasis
  - Greater intensity of work on ***environment***
  - Increased attention to hassle-free ***security operation***
  - ***Alternative fuels*** in aviation, focusing on drop-in fuels for 2020 timescale
  - In ***International Collaboration***, emphasise strategic collaborations to establish European positions
- Airspace use and ATM aspects of potential European air taxi and personal air transport business
- Consider the role of ***rotorcraft*** and the progress on autonomous air vehicles in future air transport system.
- Europe to devote effort to ***Key Aeronautical Facilities***
- Increase ***technological progress and effectiveness*** including the deployment and exploitation of technology

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Present Activities

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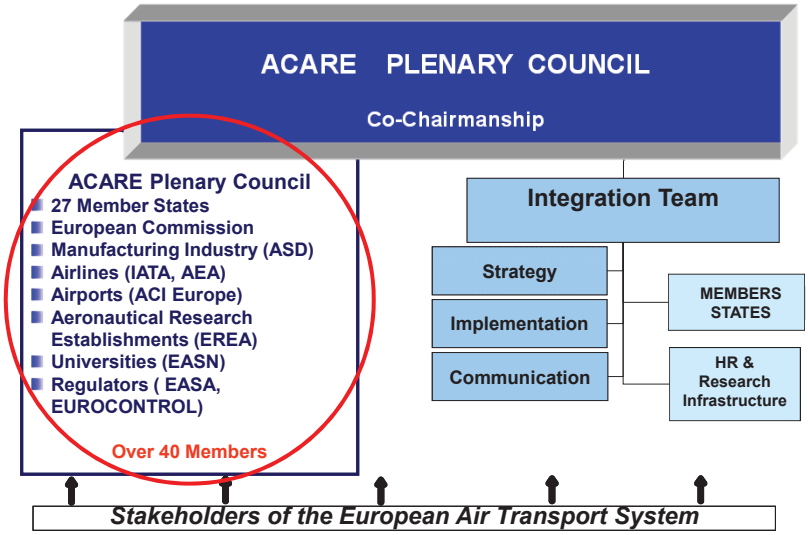
ACARE: Present Organisation



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ACARE: Various Supporting Activities

- Aerodays contribution
- First Position Paper on JTI's
- Input to SESAR
- Assessment Papers on Clean Sky
- Recommendation papers for EC
- Input to work-programmes
- Representation in Member States Activities
  - Support of national ACARE set-up's
- Representation in ETP's leaders conferences
- Contribution to ESFRI Programme

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ACARE - Examples of Activities: From „Out of the Box" to „Strategic Infrastructures"

- OUT OF THE BOX with all stakeholders generated 100 novel ideas clustered and expanded into 6 larger concepts

- STRATEGIC FACILITIES were investigated which are a key element to the research tasks envisaged: Aerodynamic-, Structural-, Propulsion- and System-Testing , Flying test beds, Flight simulators, ATM Simulators, Human factors and High Fidelity Computing / Simulation

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ACARE: Human Ressources Workshop

Industry View
- No big shortage of engineering graduates but of professionals
- Ideal is technical background, teamwork, multicultural skills and passion
- Aeronautical industry no longer prestige industry !!

SME and Research Establishments
- High level graduates, innovative thinking
- Extensive curricula, total air transport system approaches desirable

University Viewpoint
- Concern about industry policy and communication
- European quality system for confidence and mobility
- Job Preparation by involvement in industrial European research
- Encouragement of women to come into aeronautics

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ACARE in 2010

- The Air Transport System is now acknowledged as the relevant scope for optimization.
- FP 6 and 7 have integrated ATS as designated area of strategic importance.
- New tools have been designed and implemented to accommodate special needs: JU's SESAR and CLEAN SKY.
- Cooperation is now the rule of the game between stakeholders, even between competitors.
- National programmes are fully aligned with the SRA recommendations.
- A recent assessment of the research conducted within the framework of the SRA is giving good reasons to believe that in 2025 new aircraft will deliver the objective level of performance set in 2000.

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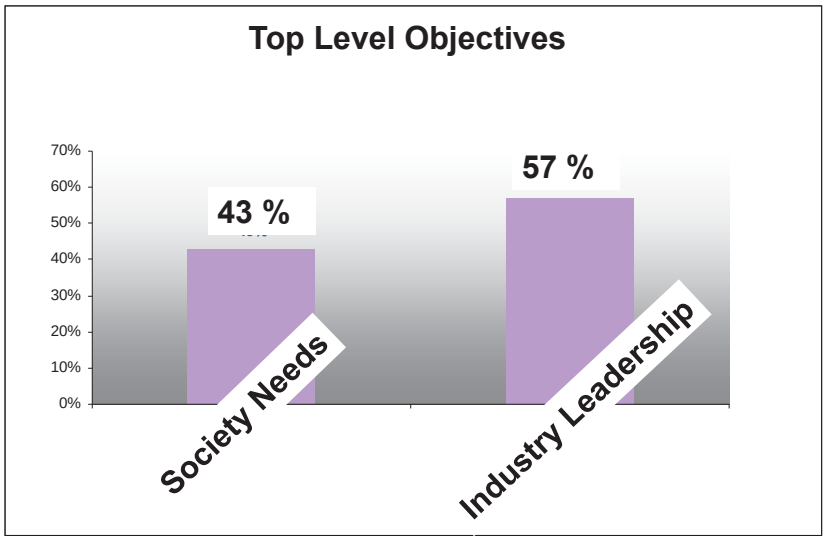
ACARE: FP6 and ACARE Conformity



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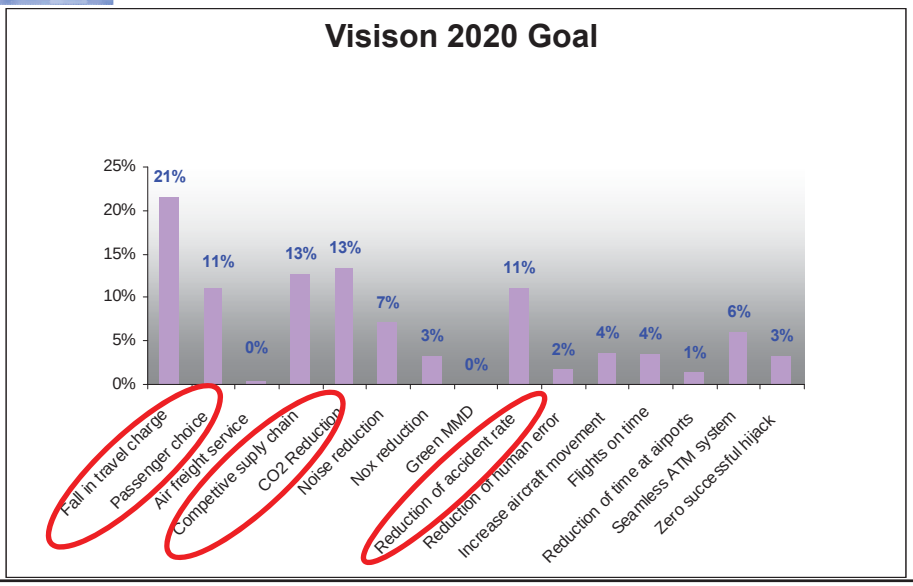

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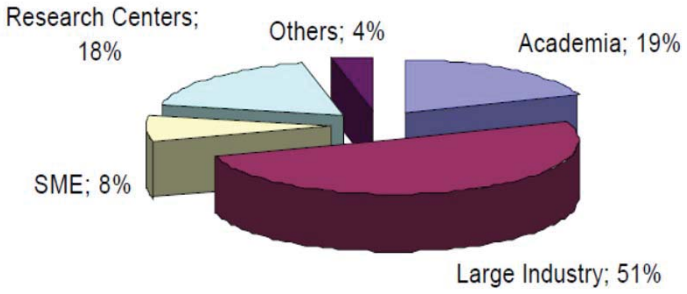
ACARE: FP6 and ACARE Conformity

Wide participation of stakeholders basis for excellent research partnership



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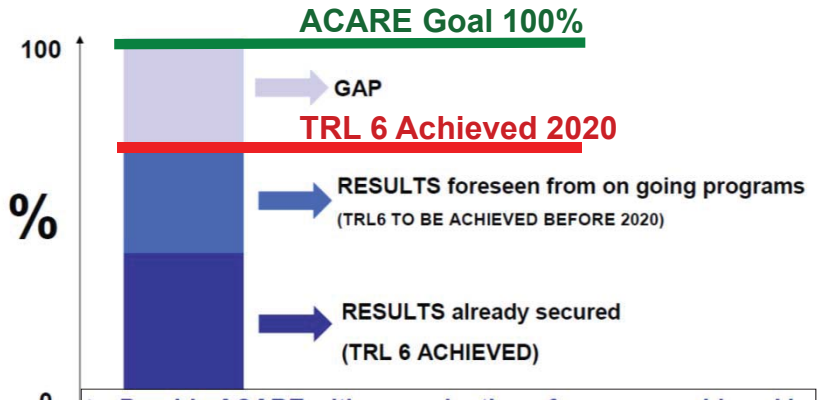
ACARE: AGAPE Study



- Provide ACARE with an evaluation of progress achieved in relation to VISION 2020 GOALS
- The evaluation of progress towards ACARE goals are processed from results identified from FPs as well as National and Privately funded Research projects

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International Cooperation

Criteria for selection of cooperation partner countries:

- ►Technology and capabilities
  - Unique or special capability
  - Supply chain development
- Political support
  - Cooperation agreements
  - Financial support in country
- Strategic benefits
  - Market, competition, offset
- Ease of business
  - Bureaucracy, export control, IPR
  - Communication, working practices, cooperation attitude
- Exchange of scientists

Future Considerations

ACARE: The Background Document

- Since 2000, society's perception of Air Transport has changed due to :
  - 11th September 2001,
  - growing environmental awareness,
  - the rise of oil prices in 2008,
  - and the recent financial crisis.
- In the future, aviation is likely to face even more radical challenges - with some arising from its own success.
- Europe needs to play its part in helping to meet such stringent goals in order for Europe's Air Transport sector to maintain its lead and its acceptability to society.
- The need for new knowledge and solutions has never been greater, international cooperation is a key issue.

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ACARE: Preparing the Future

Apart from Strategy-, Communication-, Implementation- and Member States- Groups the following activities are persued preparing information for the next Vision:

- **Sub-Group on Environment**
- **Working Group on International Cooperation**
- **Working Group on Intergovernmental Issues**
- **Human Ressources Working Group**
- **Working Group on Infrastructures**
- **Intermodal Transport Group**

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ACARE: The Background Document

A changing world

- Air Transport will have to find **innovative ways** to meet the future needs of society for mobility. This "new version" of aviation must be competitive and complementary with other transport modes.
- Europe, with its unique infrastructure, is able to develop advanced **multimodal transport solutions** Including an appropriate role for aviation in order to provide safe, affordable and sustainable transportation.
- This will be driven by the need for more **fuel efficient and eco-efficient vehicles**.
- Important changes in **infrastructure and operations** will also be needed.

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ACARE: The Background Document

Environment

- **New scientific knowledge will lead to re-formulation of the goals**
- **Environmental trade-offs (example: emissions and noise)**
- **Reducing disturbance around airports**
- **Aviation is directly impacted by energy trends**

- **The International Civil Aviation Organisation (ICAO) is promoting effort in four key areas: technology, operations, infrastructure and economic measures.**

- **Similarly, the International Air Transport Association (IATA) has declared a target to stabilize net CO2 emissions (carbon neutral growth) by 2020 with a long-term goal to reduce aviation net carbon emissions by 50% in 2050 compared to 2005 level.**

- **Global Research Establishments - IFAR (International Forum on Aviation Research) – will define a Roadmap in 2011**

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ACARE: The Future Recommendations

- ACARE recommends that for Europe to remain at the heart of the global aviation sector, policymakers must build on the **substantial results** the sector has achieved since setting the 2020 Vision

- In view of the changing landscape of challenges facing Air Transport since 2000 and with the prospect of new and greater challenges emerging in future, the formulation of a timely **new vision for the horizon towards 2050** is essential.

- The need for new knowledge and solutions has never been greater, hence, a new European vision is vital if Europe is to play its part in helping to meet the **needs of society** and in order for **Europe's Air Transport sector** to maintain its leading position.

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ACARE: Summary

- ACARE has provided with its SRA's goals and roadmaps
- Over the last ten years the SRA's have contributed to better coordinate and implement the aeronautics research in Europe
- Key elements are sustainability, reliability and affordability
- Significant progress towards the ACARE goals during this period.
- Since 2000, significant changes that will oblige the whole aviation community to position aviation beyond 2020
  - reducing environmental footprint,
  - adapting to the changes of social and economic context, facing new competitors and opening for cooperation
  - improving safety, security and quality of the air transportation system.
- ACARE will further analyse this new background and the consequences for aeronautics and air transport towards 2050.
- A new Vision 2050 and the corresponding Strategic Research Agenda is required

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Lessons learnt

- **Airlines and Airports** have not contributed as expected, for good reasons.
- **Education** was only partly taken into account.
- Two serious **crisis** have impacted the community in the decade somehow shaking the confidence of the stakeholders
- **Solutions** to address the new sets of constraints are more complex and less obvious to identify.

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Personal Remarks I

- ACARE has inserted itself very well in the **working processes** of the community of stakeholders.
- **Working together** to achieve shared objectives has provided credibility and critical mass, different engineering cultures have contributed to the overall effectiveness of the team.
- ACARE had a **global influence** concerning the ambitious goals and the potential for further cooperation

Advisory Council for Aeronautics Research in Europe

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European Aeronautics

A Vision for 2020

www.acare4europe.com

ACARE

Strategic Research Agenda Executive Summary

Advisory Council
For Aeronautics
Research in Europe

October 2002

Executive Summary

Background

Aviation and a New Age - An imperative for Europe

Proud of its contributions during the first century of flight, world aeronautics now stands at the threshold of the new, third age of aviation. First came the Pioneering Age, from the inception of powered flight to the jet airliner. Then, the Commercial Age, which has become familiar to all with 50 years of dramatic air traffic growth. Today, Europe approaches a watershed, bright with opportunity, but heavy with risk, at the start of the New Age - the Age of Sustainable Growth - requiring more affordable, cleaner, quieter, safer and more secure air travel. **See Figure 1.**

Last year's formation of the Advisory Council for Aeronautics Research in Europe (ACARE) signalled that Europe is ready to seize these opportunities in the new age of aviation and will not succumb to the risks. The relentless increase in aviation traffic cannot be endured by the world's present systems, particularly in Europe, for more decades without profound and unacceptable penalties. Fundamental changes in perspective will be required in future years to balance upward demand and the broader needs of society for economic and social benefits. The solutions must embrace such challenges as noise, emissions, congestion, delays and inconvenience. Europe now has a fresh opportunity to shape its contribution to the global future of aeronautics and this Strategic Research Agenda (SRA) provides its technological foundations.

It is an ambitious and very challenging plan but the penalties of failure would be a loss of immense dimensions to the whole of Europe and not just to the aviation community. ACARE therefore presents its first year's work, fully conscious of the difficulties ahead, but committed to success in a great European endeavour.

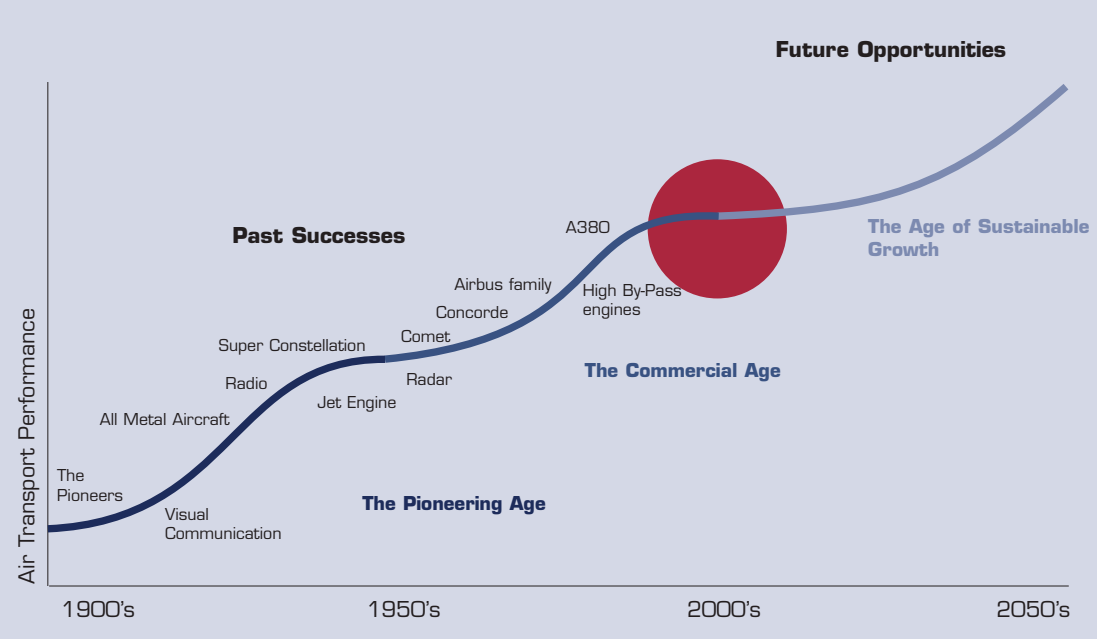

Figure 01

ACARE - The First Year

How it all started

The Commercial Age was a period during which major advances were made in terms of speed and range. More aircraft tended to mean more noise and more fuel consumed but this was tackled aggressively by the aircraft and engine builders. Engine and aerodynamic efficiency were raised, noise was dramatically reduced, and fuel consumption halved. Larger aircraft were introduced. Despite all of this success the relentlessly rising tide of demand has brought the aviation community to the realisation that all air traffic demand forecasts indicate fundamental problems for the future. Social change and familiarity, as well as the increase in traffic, means that protests have become louder – not just against noise and pollution, but also about delays, unreliable schedules, crowded facilities, congestion and inconvenience.

These issues present fundamental challenges that will not yield to incremental and steady progression but will need an aggressive, ambitious and more holistic approach. So, in 2000 Commissioner Philippe Busquin contributed significantly by inviting a Group of Personalities to set out an ambitious vision for the future of aeronautics over the medium to long-term. Their report "European Aeronautics - a Vision for 2020" was published in early 2001.

It recommended the formation of an Advisory Council to create a Strategic Research Agenda that would enrol all those with a stake in the future of aeronautics to collaborate in exploring and advancing the technologies that will lead to the realisation of the goals of Vision 2020. The Advisory Council for Aeronautics Research in Europe (ACARE) was formed in mid 2001.

The two **Top-Level Objectives** for **European aeronautics**, identified in the Vision 2020 report, were:

- To meet society's needs
- To achieve global leadership for Europe.

ACARE's main activity to date has been to assemble this Strategic Research Agenda by organising pan-European working teams. Their initial findings are presented below.

ACARE Key Findings

- The **Top Level Objectives, even though ambitious, are achievable in Europe**, if the challenging Strategic Research Agenda, prepared by ACARE, is adopted, implemented and its results deployed into practical products and services with a high level of commitment.
- The SRA provides strategic directions for solutions and R&T[1] road maps to achieve the Top Level Objectives as outlined in Vision 2020. The objectives are **not** achievable **without important breakthroughs, both in technology and in concepts of operation** - evolutions of current concepts will not be sufficient.
- Delivering these European ambitions will require substantially more output from the European aeronautic research community which must devise **new ways to make the system of research, in all its forms, more efficient.**
- Delivering the Top Level Objectives **will require a number of additional and significant Pan-European enabling mechanisms within the European Research Area.** Five areas for new mechanisms are identified: the European research infrastructure, the supply chain, certification and qualification, education and Trans-European synergy of research.
- **It is clear that more investment from both public and private sources will be needed.** The preliminary estimate as mentioned in Vision 2020 "possibly in excess of 100 billion euro over 20 years" has been confirmed.
- The aspirations for European leadership will only be achieved if the climate in Europe remains conducive to retaining and advancing core competence, capacities and centres of aviation research. The ambition of SRA is for the European stakeholders to succeed in the global market, both by competition and by collaboration, from a strong, effective European base. **This requires that major corporations, which increasingly have international links and options, continue to invest their resources in Europe. From its side Europe must provide a receptive environment, ensuring equal competitive footing with other countries and economic regions, to encourage those investments to remain in Europe.**

[1] *R&T: Research and Technology refers to developing new technologies – more specifically it covers basic research, concepts, technology development and technology integration & validation*

The establishment of these findings has involved a vast amount of work undertaken under ACARE's leadership, extending across European stakeholders in aeronautics, the European Commission and in the governments of Member States, European Institutions, and across manufacture, operation, regulation and research. This has been the first time that a proposal on this scale has been attempted in Europe and, in itself, represents a substantial vindication of the concept that a single SRA could be created from the diverse interests of Europe's stakeholders. It is an important achievement from the first year.

The work has underlined very clearly the immense scale of the ambition contained in Vision 2020. This ambition stems from a determination not to compromise the conflicting demands of cost, performance and society's needs at a low level but to extend our reach and grasp the challenge of having more benefits in more ways. The SRA will enable the magnitude of that challenge to be dimensioned. It provides a new perspective within which to comprehend the prerequisites for success. The SRA is focused on technology and the reality that the great changes that are needed will be impossible without new technologies in new applications. The SRA also points the way toward actions in other fields where equally important changes will be needed; in public policy, in regulation, and in areas of international co-operation.

The Strategic Research Agenda

The strategic directions set out in the SRA necessarily look beyond 2020 since it will only be in later years that the results of some of the ongoing research will have their impact. In addition the SRA addresses additional enabling mechanisms that will be needed to ensure a successful outcome.

The **technical content of the SRA** is driven by **five major challenges** that interact in addressing the top-level objectives. The ambition to provide more affordable, cleaner, safer and more secure air travel determines the major challenge areas. These challenges, each of which has clearly identified goals, contributors and solutions, are:

- **Quality and Affordability** – the challenge of delivering products and services to airlines, passengers, freight and other customers whilst increasing quality, economy and performance for sustained international competitive success.
- **The Environment** – the challenge of meeting continually rising demand whilst demonstrating a sensitivity to society's needs by reducing the environmental impact of operating, maintaining, manufacturing and disposing aircraft and associated systems.
- **Safety** – the challenge of sustaining the confidence of both the passenger and society that commercial flying will not only remain extremely safe, notwithstanding greatly increased traffic, but will reduce the incidence of accidents.
- **The Efficiency of the Air Transport System** – The economic needs of Europe's citizens, international competitiveness and the convenience of passenger and freight customers' demand that rising traffic shall not exacerbate the downsides of congestion, delay and lost opportunities. The challenge is therefore that the efficiency of the whole system taken together must be substantially increased. This will require radical new concepts to be introduced.
- **Security** – Recent events have underlined the reality that protected and uninterrupted air services are a foundation for all the economic and social benefits of the air transport system. The challenge is to devise measures that will improve security, on a global basis, within a highly diverse and complex system and against a strong backdrop of increasing traffic.

Meeting the Challenges
Solutions and technical contributions are identified to meet these challenges. But considering each challenge separately is not enough, a global or holistic view is necessary if the optimum benefit for all stakeholders is to be achieved. To this end the SRA identifies both positive and negative interactions amongst the different challenges and highlights vital concurrent developments required to create a breakthrough in order to achieve the Top Level Objectives.

To some extent change will be evolutionary, progressive and incremental. ACARE investigation shows this alone will not suffice. Just as the demands of 20 and more years ahead will be different in nature from those of today, so the solutions will also need to be different in nature, and not just in degree. This will require step changes in concepts using new and breakthrough technologies to create a future system that is as distinct and different from today's air transport system as today's is from that of the 1930's.

Two examples are in the areas of environmental mitigation and in air traffic management. The Environmental Challenge has clearly identified the limits of current technology, which, whilst it has more to offer and more that will be achieved over the next decade or so, must be succeeded by completely fresh approaches that require an early start. In the air traffic management area, the Efficiency Challenge has shown clearly that extrapolated development of the current paradigm of control over air-craft movements will not meet future traffic demand. So new concepts are being studied and these will require new and critical technologies to be developed before they can reach operational maturity.

New concepts and novel technology will need other changes for their exploitation. In particular they may need new or amended regulations to allow different approaches to be introduced in ways that protect the interests of the public whilst permitting the benefits of the new concepts to be realised.

Realising the Ambitions
Vision 2020 was not focused on implementing research programmes but on delivering change. This change is likely to be dramatic. ACARE has considered how best to exploit the technical research and bring it to fruition for the European citizen. This must be seen in a Pan-European setting in which the Research Agenda will become implemented through research programmes subscribed to in a variety of ways by the stakeholders who fund research at company, national and European levels. Their participation will vary but the SRA, their own creation, will be a powerful influence on the formation of these research programmes. This is illustrated at **Figure 2**. But creating vital research programmes is not enough. The programmes need to be supported and exploited by a variety of enabling mechanisms that allow them to be efficient and effective and which will encourage and stimulate their output to be used in pursuit of the objectives. Many of these mechanisms exist, of course, but ACARE has identified the need for more efficient or new mechanisms grouped in five enabling themes:

- **A research infrastructure** capable of delivering the means by which the planned research can be completed to a world leading standard.
- **A competitive supply chain**, from strong primes to the smallest suppliers, capable of exploiting all of the expertise in Europe and contributing to the necessary research and turning new technologies into competitive products.
- **Certification and qualification processes** that facilitate the rapid introduction of new and innovative technologies into production models.
- **An educational system** capable of delivering the required diverse and multi-cultural skilled research workforce.
- **Trans-European synergy** to make best use of the research effort being applied.

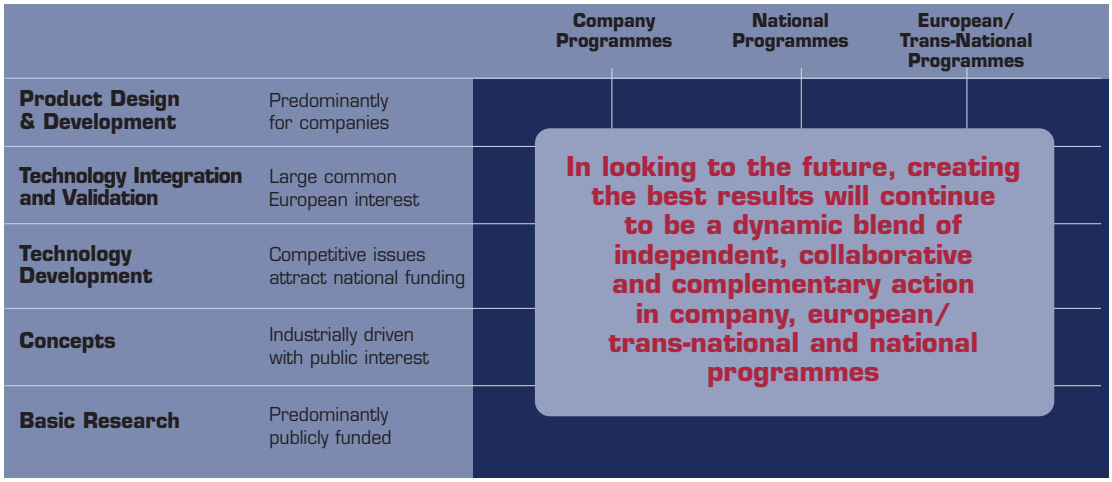

Figure 2

The Mechanisms

The new mechanisms that will support the enabling themes above fall into two categories – Project Based Mechanisms and Broad-based (or transversal) mechanisms.

Project-based Mechanisms

Mechanisms for R&T already exist serving the spectrum of engagement, from basic research and concepts through to technology development and integration and for accommodating varying roles in company, national, trans-national and European level programmes. The existing mechanisms need to be continued and built upon but the following new mechanisms are identified, particularly to support trans-national and European programmes.

- **Technology Integration Platforms** (allowing a number of technologies to be validated in a system context) will be concerned with ensuring that technical concepts work reliably in integration and at the scale of the full system needs
- **Large Scale Research Test-Beds** will be needed in Europe on a scale that are unlikely to be affordable by single companies or countries, and which can be used flexibly by the whole supply chain for testing advanced systems.
- **The Nursery, or Incubator mechanism** (encouraging new concepts to be explored under the protection of ring-fenced funding) will give support to the essential concept work that must provide some of the breakthrough thinking for the future. This needs to be highly innovative to aim to strive for major advances in performance, even if accompanied by radically new approaches embodying both new technology and new methodologies.

Broad-Based mechanisms

Alongside the project based mechanisms, ACARE has identified the need for additional general mechanisms in support of the enabling themes.

- **Mechanisms in support of improving the research infrastructure in Europe**
  Improving the capability and utility of the European research infrastructure is an important investment in the future. The opportunities for Pan-European collaborative research efforts to exploit the very best research capabilities, both human and capital, rest in three main areas – testing and simulation facilities, R&T programme structures, and collaborative mechanisms.
  A number of possible mechanisms have been proposed; for example the establishment of a forum able to identify opportunities and needs for a European approach to investing in infrastructure and facilities.
- **Mechanisms to support the ambition to realise the untapped energy and expertise of Europe's technology supply chain**. New mechanisms will address one priority aspect of this challenge, lifting the levels of awareness by both customers and suppliers to very much higher levels. Customers need to have better information on the capabilities of suppliers whilst suppliers need much better knowledge of what opportunities exist. A central objective is to establish a powerful information network with Aeronautics Contact Points supported by a comprehensive web-based portal to enable easy knowledge transfer across the whole European technology supply chain. The need is clear – unless Europe can establish a different concept of supply chain information networking major opportunities for benefit are being lost.
- **Mechanisms to optimise the system of certification and qualification** that will enable advances in technology and design to be deployed in a safe and timely manner into products that will lead to the changed experience of travellers, customers and citizens. As systems become more complex and technology is able to provide new solutions the needs of safety and security remain vital. New mechanisms for certification and qualification will enable advances in technology to be deployed quickly and safely.
- **Mechanisms to promote education**. Unless there is a sustained flow of competent, trained and motivated people into aerospace the ambitions for creating the future vision will be limited. Among mechanisms proposed is one to assemble a transparent comparison of the scope of European educational qualifications as an aid to mobility for researchers.
- **Mechanisms to encourage Trans-European synergy** of research in aeronautics. The extent of complementary and collaborative effort achieved will be a balance. Advantages of economy, effectiveness and scale flow from complementary programmes and many such programmes exist already. But independent programmes are also needed to sustain competitive advantage and meet regional needs. Many industrial concerns have a trans-national character, ACARE exists and is proving a valuable forum and its stakeholders are committed to create better mechanisms. They are developing mechanisms to encourage transparency, allowing opportunities for collaborative and complementary programmes to be visible and to be subscribed to under the over-arching principle of voluntary participation.

Efficiency and Resources:
"More research for the money: more money for the research"
Underpinning all of this, and examined by the SRA, is the need for substantially greater output from the European Research Area in the field of aeronautics and how this is to be resourced, in terms of funding and people.

More output is needed as European aeronautics prepares itself for the new phase of developments that will become the Age of Sustainable Growth. The research work for this needs to be started now, and needs acceleration from continuing the development of existing trends. New and radical solutions are needed and they will demand intensive research preparation.

Some of the increased output must be the product of greater efficiency and the additional mechanisms identified will enable greater output to be produced from the same levels of funding. The SRA will, with its wide support from the stakeholders, act as a powerful agent for focusing research on to those areas where the greatest benefit will result, avoiding wasted duplication of effort.

The mechanisms for harnessing the research output are illustrated in **Figure 3**. Efficiency will stem in large part from a combination of well-focused research programmes that reflect the strategic directions of the SRA. Efficiency will also come from sustaining a balance and integration between areas of research. The research work done under each of the challenge headings of the SRA does not stand alone, each will impact on work elsewhere. In the end the concepts, products and services of the stakeholders will deliver the changes that are needed to the system.

Nevertheless, even allowing for the gains expected to be achieved through greater efficiency, it is clear that more funding will be needed. In producing the SRA it has been confirmed that the estimate of the figure quoted in Vision 2020 "possibly in excess of 100 Billion euro" will prove to be within the right ballpark, which represents a substantial increase relative to current funding levels. This funding will need to come from both public and private sources. This is in line with the general conclusions of the Barcelona European Council meeting in March 2002 for research in Europe. It concluded that overall spending on R&D[2] and innovation in the Union should be increased with the aim of approaching 3% of GDP by 2010.

Finally the whole will depend, as ever, on people. The great opportunities and the great needs of the new century will demand educated and trained people who can bring both vision and competence to bear on these exciting challenges and the SRA addresses the issues that will arise in ensuring that the human resources needed can be provided.

[2] *R&D: Encompasses Research and Technology (R&T) as well as the effort for the development of new products.*

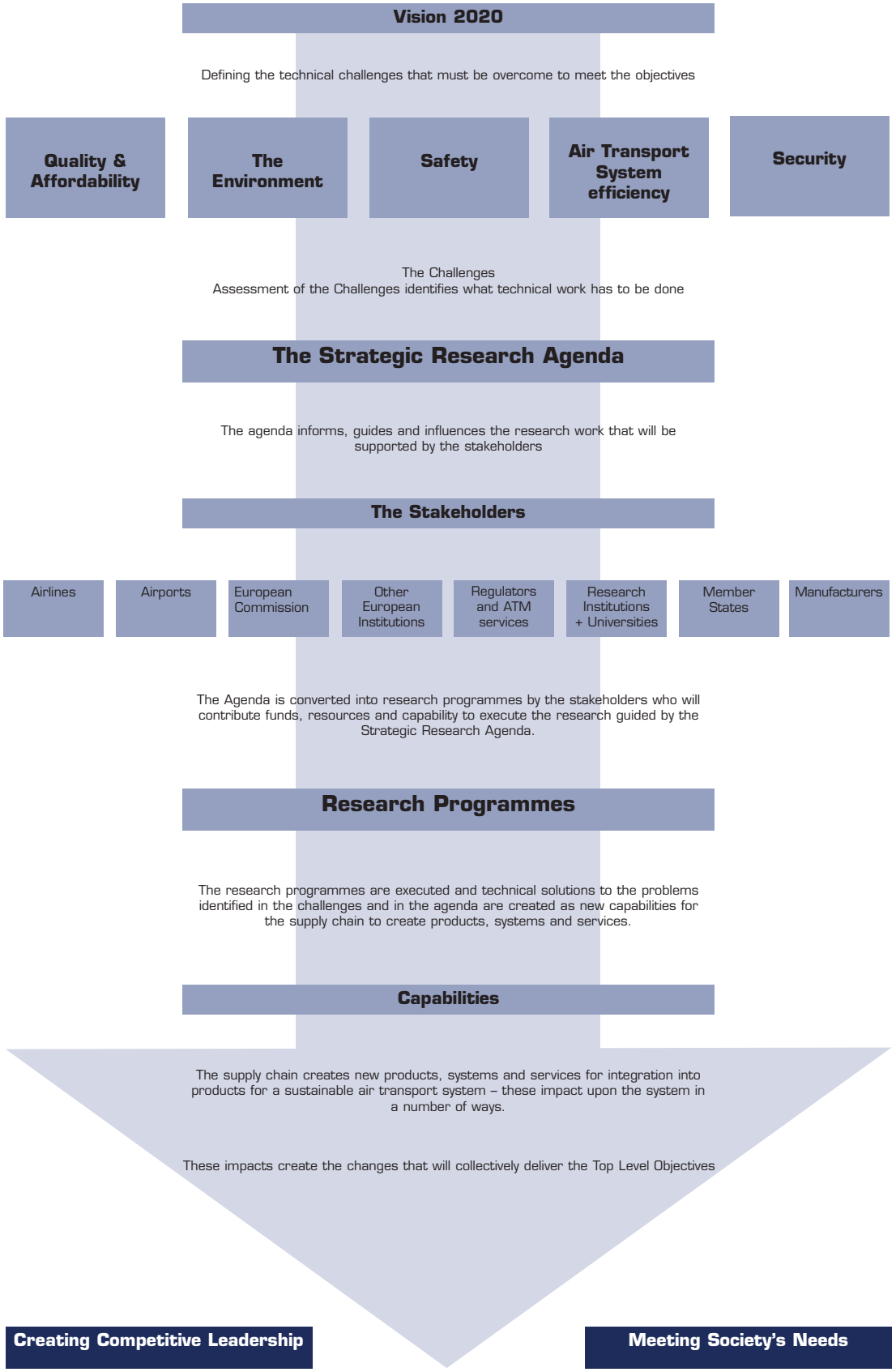
Vision 2020
Defining the technical challenges that must be overcome to meet the objectives
Quality & Affordability
The Environment
Safety
Air Transport System efficiency
Security
The Challenges
Assessment of the Challenges identifies what technical work has to be done
The Strategic Research Agenda
The agenda informs, guides and influences the research work that will be supported by the stakeholders
The Stakeholders
Airlines
Airports
European Commission
Other European Institutions
Regulators and ATM services
Research Institutions + Universities
Member States
Manufacturers
The Agenda is converted into research programmes by the stakeholders who will contribute funds, resources and capability to execute the research guided by the Strategic Research Agenda.
Research Programmes
The research programmes are executed and technical solutions to the problems identified in the challenges and in the agenda are created as new capabilities for the supply chain to create products, systems and services.
Capabilities
The supply chain creates new products, systems and services for integration into products for a sustainable air transport system – these impact upon the system in a number of ways.
These impacts create the changes that will collectively deliver the Top Level Objectives
Creating Competitive Leadership
Meeting Society's Needs

Figure 3

The Next Steps

This is the 1st Edition of the Strategic Research Agenda. No edition of the SRA can be a rigid long-term plan and successive editions, probably at 2-3 year intervals, will allow new information and changed circumstances to be admitted to the Agenda. In parallel it will be possible progressively to look at selected aspects in more depth and to assemble a wider set of studies on situations that might have significant influence on the priorities for the future. These will allow the optimum balance of investment to be assessed and will inform and guide stakeholders in their support for specific research programmes.

ACARE is confident that the SRA provides a firm foundation for the fulfilment of European aspirations for sustainable long-term global aerospace leadership, providing that the measures that it suggests for adoption receive the universal support that is required.

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Academia	Billy Fredriksson	Linköping University

ACARE

STRATEGIC RESEARCH AGENDA

Advisory Council for Aeronautics Research in Europe

October 2004

EXECUTIVE SUMMARY

Strategic Research Agenda

Executive Summary

Advisory Council for Aeronautics Research in Europe

October 2004

Executive Summary

This is the 2nd edition of the Strategic Research Agenda that addresses the research needs of Europe in the field of air transport systems over the next 20 years. It sets out the likely directions of technological change that will need to be converted into specific research programmes over the coming years if the objectives of the work are to be realised. As the 2nd edition it builds on, updates, and widens the work done in the 1st edition published in October 2002.

The background to the Strategic Research Agenda was the work done on the seminal report on the future of air transport "Vision 2020" published in 2001. That report recommended the formation of an advisory body – since known as ACARE – to set out a series of agenda documents that progressively looked forward to give a long-term view of research priorities and needs. These agenda documents are intended to act as stimulating guidance to all those with an interest in the relevant research programmes, whether from a governmental, industrial, social, funding, policy or regulatory perspective. They do not comprise specific research programmes with lists of collaborating agencies but pave the way for them by setting directions and priorities.

Recalling the origin

Before summarising the structure and content of the Agenda it is appropriate to recall the overall objectives of the whole initiative, started in the late 1990s to bring a more coherent, long-term and inclusive view to bear upon future priorities.

The fundamental perception in the late 1990s was that air transport was a key part of the infrastructure that would support us in the 21st Century. Without it the future of Europe would be weaker, its place in the world slighter, its economic power diminished. All involved understood that there would be air transport of some form with or without any European attempt to take the long-term view. The issue was whether or not a laisse-faire system that was encouraged simply to grow as it wished, fragmented and incoherent, would be likely to serve the interests of Europe adequately. It was clear that one that had the benefits of coherence, system-wide thought and the involvement of all the key players in its future would be more likely to succeed. Air transport needed to be addressed strategically and coherently and not and in a tactical, fragmented way.

The objectives of this work have been European from the outset. The high level objectives are set out as the achievement of both (not either) society's needs and global leadership for Europe. These concepts have been subject to massive study in the course of the Agenda work and need to be enlarged slightly for their profound significance to be grasped.

Society's needs embrace the whole range of benefits that all citizens of Europe expect of the air transport industry now and in the future. These benefits are direct, as in the quality and price of travel, and indirect, as in the preservation of security and safety in a globalised world. They encompass the personal needs of travellers and the collective needs of non-travellers who want to live in quiet streets, safe from pollution. These same people must still benefit from the economic advantages of a thriving air transport system that allows businesses to operate, permits goods to flow, and generally lifts the prosperity of Europe.

So the second objective of economic leadership in the sector for Europe works hand in hand with the benefits to society. If Europe is to have economic benefits that will pay for social needs, whether or not related to air travel, then one of the engines of this prosperity is air transport. Taking the wider definition used in the Agenda that air transport includes manufacture, and the operations of airports, airlines and air traffic control together with all the regulations that control them, leadership for Europe is a massive concept. Very few regions in the world can aspire to belong to the leadership group that will set the direction and pace of development in this area. For many decades the clear leader has been the USA but now Europe outsells the US in airliners and has a population comparable to that of the US as its domestic arena. China, Japan or perhaps Russia and India may also seek to exert influence on this sector in the future.

Operating the air transport system at this leadership level means being able to have strong influence on the need for and detail of international regulation. It means having a critical mass of suppliers able to become expert and economic suppliers to the needs of the world, not just of Europe. It means having the means to balance priorities in a European context and not having to accept a European adaptation of international agreements largely forged by others. Finally it means securing and sustaining a balance of payments surplus that will feed money and technology into the wider economy. All of these advantages of economic progress and success have the ability to be harmonised with the social needs of Europe and, conversely, the social aspirations of Europe have a much smaller chance of being realised unless there is economic and competitive success in the world industry.

This connection is not because there is some necessary linkage with air transport, although this is the case in such areas as environment and noise, but because air transport is so big and such a powerful contributor to the economic architecture of Europe.

Against this backdrop ACARE has prepared this 2nd edition of the Agenda. It is built upon the technical foundations of air transport that relies for progress upon the application of science and technology. Without research and the creation of new ways of achieving ambitions there will be no progress. New problems, such as the determination not to allow world terrorism to halt or hinder development of travel, require new solutions and these in turn require new research and the development of systems. The growing concern for the environment points to the need for new research to understand the mechanisms that govern our complex global environment better than we do and then to develop solutions. The continued growth of globalised industrial trading requires that freight and passenger patterns are changing and new services are needed. Congestion of our fixed airport and air traffic management infrastructure is causing massive frustration to operations and passengers alike and needs new technologies and different ways of co-operating to overcome.

The agenda in summary

This Agenda is a complete and self-standing document although it does not repeat all of the points, still valid, that were made in the 1st edition.

Section 1 – Summary

Section 1 of the Agenda summarises the content and findings for a rapid assimilation of the main messages.

Section 2 – Preparation

Section 2 recalls the preparation of the second edition starting from the basics of SRA-1. It covers the underlying points on the macro-economic importance of the sector and the expectation of creating between 2 and 4 million additional jobs by 2020 and with a direct impact on up to 13% of Europe's future GDP. The section sets out other key figures for an understanding of the sector.

It continues with the history of the Agenda and the key findings of the 1st edition. It makes the point that the Agenda is not only concerned with direct technology programmes but also about the factors that will enable these to be productive and efficient. It also reports on activities since the 1st edition, the dissemination activities and the actions already taken by governments and industries to make use of the Agenda in their technology planning measures.

The work set in hand after edition 1 to create a better assessment of likely uncertainties in the future is set out in Section 2. This scenario work enabled three clearly different possibilities for the future to be identified in addition to the base-line scenario of the 1st edition. This was an important precursor to the 2nd edition and enabled the new Agenda to deal more effectively with possible futures and to consider the technology development implications of these. This work has been one of the main advances of this edition of the Agenda.

This is taken forward in the final part of the Section by the identification of the main advances needed and delivered by this edition. The objectives for the edition are set out and the section describes the notion of the High Level Target Concepts or HLTCs. These are extensions of the scenario work to create emphasis on particular characteristics coming from the scenarios. In the evolution of this concept five HLTCs were selected:

- The highly customer oriented air transport system
- The highly time efficient air transport system
- The highly cost efficient air transport system.
- The ultra green air transport system
- The ultra secure air transport system

Section 3 – High Level Target Concepts

The next Section 3 is in parts that correspond to these HLTCs and discusses each one in depth and is, in many senses, the heart of the Agenda where the technology issues are discussed. There is no sense in which one HLTC will be chosen in isolation or that technologies identified in one will not be appropriate in another but the concept allows the priorities of the technologies to be discussed and examined.

Section 3 also looks beyond the horizon of the HLTC's and is a useful extension of the concept into the further future. By looking towards the latter part of the century and examining possible developments it adds to the understanding of what technologies should be kept alive now, or even started so that these outlying possibilities will be supported with technology at the time.

Section 4 – Implications

Section 4 brings the HLTCs into focus in considering an integrated view of their implications across the whole air transport system. It considers the issues as Business, Policy, Process or Technology and it is here that the wider implications of the Agenda are discussed as a whole.

In the assessment part of the Section the Agenda addresses the institutional and public implications of the work. The scope for public decisions to influence the progress of the Agenda is great. It ranges from investments in facilities, co-operation in the construction of new facilities, research co-operation, education as well as in many aspects of public policy for qualification and mobility of researchers and, indeed, in their broader availability.

The final part of this section deals with the resource and efficiency implications of the Agenda. The overall need is for the technical issues identified by the Agenda to receive more effective research. Some of this increment of progress can be delivered by greater efficiency in the research processes and the means of doing so are identified. Notwithstanding this there is a need for substantially more funding, about 65% more, to be applied from public and private sources if the issues facing the sector are to be properly addressed.

Key findings

1. SRA-1 has been a success and this has contributed to SRA-2, not only in the confidence that ACARE has had in extending the scope but in the feedback that ACARE has had from SRA-1. SRA-1 has been adopted as **the** reference for a number of national and institutional bodies that have established their research programme using it as a guide e.g. FP6, French and German National Programmes, EUROCONTROL and an increasing number of industry stakeholders. This is helping with the transparency of programmes and with collaboration. As this process develops we expect to move on to using the Agenda to improve the efficiency of the research process and to highlight those activities that are most value-adding and also those which are duplicative for no good reason. The Agenda will give a strong, common background for this.

2. Wealth generator – Air transport is in itself a significant contributor to European wealth. The resultant benefit is spread across all Member States, either as a result of its direct contribution (2.6% GDP and 3 million jobs) or, even more importantly, as a consequence of its lubrication effect on all modern economies enabling our life-style and the way we do business. Its total contribution to the economy is estimated in excess of 10% of GDP.

3. The Agenda is more robust – This edition of the Agenda reflects alternative socio-economic scenarios and their associated technologies in the holistic approach advocated by ACARE and it is thus more robust than SRA 1. It also provides an indication as to the importance of each separate technology and the timescale of its importance. It presents important new planning aids to research programmers.

4. European research needs more money – re-analysis has shown that, taking an encompassing view of the research needed and the necessarily associated facilities and demonstrators, about 65% more funding is now required over the 20 year forward view than is presently being invested. Whilst this expenditure is not evenly paced there is clearly an urgent need to see a reversal in the trend to decreasing amounts of research funding assigned to air transport research at national level.

5. European research needs more people – The Industry may face a shortage of skilled young people in the future, partly due to demographics and partly due to the reduced attractiveness of the aerospace business as it may be perceived by young people. Future graduates will need additional skill sets most notably in multi-disciplinary approach, excellent communication skills, open mindedness and cultural awareness.

6. Research needs to be more efficient – The research funds used across Europe must be better co-ordinated with less duplication of work that has no justification for being conducted. This could perhaps start with areas of common societal interest (safety, security, environment, ATM). Some examples of progress are already evident such as the joint action between EUROCONTROL and the EC.

7. Implementation monitoring – The Observation Platform is launched – it will provide a snapshot of current status, trend over time and together will guide and inform future research programmes and will facilitate better co-ordination.

8. Money alone is not enough – The creation and funding of research programmes will be to no avail unless European companies are encouraged to retain their European bases and to conduct their own research in Europe. In addition to the work outlined in the Agenda a number of policy actions are needed to ensure that the entire community involved in the aircraft and air transport sectors sustain a coherent and stable future. Part of this policy challenge is to ensure that the competition between major regions is recognised as a major factor in the development of industrial plans. Stability will be encouraged by equality of treatment both inside and outside of Europe.

9. Action is required by each Member State if the full contribution of their own industry is to be fully exploited.

Next steps

Many of the actions expressed in this Agenda need to be monitored and encouraged among the nations and the other stakeholders of the EU. ACARE will continue to act as the disseminator, proposer and general promoter of the Agenda as the standard point of reference for all aeronautically related research work across the Community. These actions for ACARE are almost self-evident in its role.

There is, however, a set of even more challenging actions that ACARE wishes to accept and to meet. ACARE perceives that important actions need to be addressed during the next 2-3 years in the following areas:

- Member States should designate the Air Transportation System and the relevant industry and research institutions as a distinct national priority and/or enabler for economic growth.
- Encouraging more debate, and research, about the impact of aviation on the atmosphere and to plan the environmental controls of the long-range future.
- Pressing the nations, the EU, airports, airlines and the ATM community to address the new business models that will be necessary in the future.
- Promoting more international debate about the far-term consequences for and of the aviation transport world.
- Facilitating links between the Member States and their collaboration on matters of aviation research within the framework of the Agenda.
- Proposing actions that will lead to the establishment of a European repository of aviation knowledge and act as a centre for new studies of the issues that are outlined in the Agenda.
- Integrating representatives from the new Member States into the framework of ACARE and together with them strengthening the Agenda with their new knowledge, experience and capabilities.
- Each Member State should review how its own industry can be facilitated to develop to its full potential.

Only with ACARE taking an active, unified role within the wider community can the benefits of the research programme outlined in this Agenda be brought to deliver the Top Level Objectives of Vision 2020.

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For further information

www.acare4europe.org

EREA

European aeronautical research infrastructures

ACARE

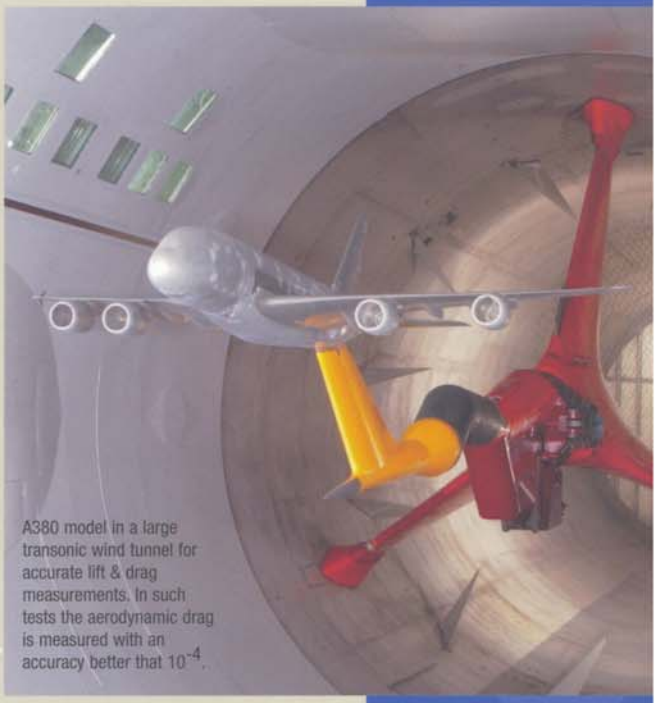
Advisory Council for Aeronautics Research in Europe

Within the ACARE, it is acknowledged that a set of world-class and efficient research capabilities is a strategic factor which enables the prosperous development of Aeronautics in Europe.

It is a fact that fundamental and applied research in various scientific disciplines (Fluid mechanics, Materials, Structures, Systems, etc.) as well as the development of sub-components and components (engines, etc.) and of aeronautical end products (fixed-wing aircraft, rotorcraft, etc.) have always been associated with extensive design, computation, testing, optimisation and validation activities.

This complicated process calls for the systematic use of various research facilities, for example aerodynamic wind-tunnels, combustion and structural test beds, material elaboration apparatus, clusters of small computers or, on the contrary, high power super-computers, air traffic management and air traffic control simulators, flight simulators and research aircraft.

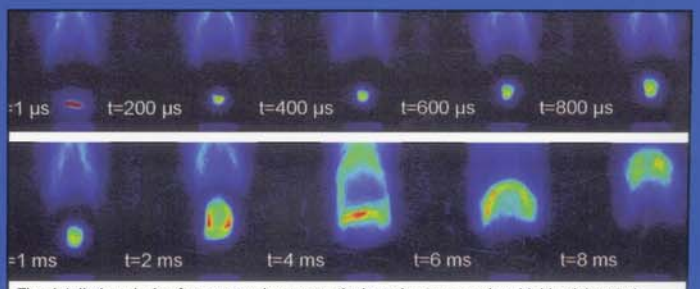
These facilities, which address different disciplines and specialities, may differ greatly in size and range of application and are often linked to one another through a complex immaterial network which in the end transforms basic scientific knowledge into competitive products, while integrating environmental, safety and security concerns. As such, they actually represent an essential asset for Europe even if the vast majority of them were originally developed to meet national objectives.



A380 model in a large transonic wind tunnel for accurate lift & drag measurements. In such tests the aerodynamic drag is measured with an accuracy better that 10^{-4}.

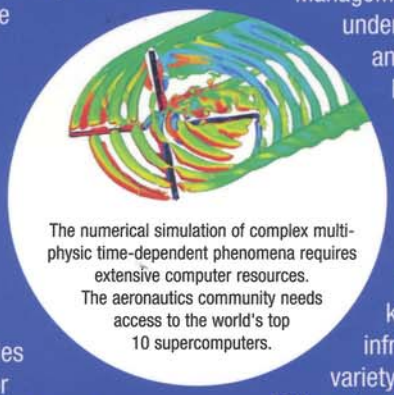
CAPABILITIES FOR EXPERIMENTAL AND NUMERICAL SIMULATIONS ARE KEY ENABLERS FOR THE DEVELOPMENT OF AERONAUTICS

The importance of research infrastructures for the aviation industry and the scientific community involved in aeronautics is a well known fact.
All past and present aeronautical components or products have been tested in aerodynamic wind tunnels. It is likely that the same will be true for future products. This observation is not in contradiction with the trend towards increasing dependency on numerical simulation. Indeed, the fast, detailed and accurate design procedures necessary to meet increasing constraints (in particular those related to environmental and safety issues) call for increasingly powerful testing and evaluation capabilities involving multi-disciplinary and multi-physics features. In short, both experimental and numerical simulations will still be complementary. Consequently, in parallel with the effort regarding testing capabilities, effective and affordable access to top level European High Performance computing resources should be made available to the aeronautics research community.



The detailed analysis of processes in aeronautical combustors requires highly elaborated measurement techniques like the Coherent Anti-Raman Stokes (CARS) Scattering.

Aeronautics research facilities also contribute to European integration through the exchanges associated with various industrial customers (mostly trans-national companies) or researchers of different nationalities involved in operating them. Additionally, formal pan-European networks have also been established in order to improve overall efficiency, by exchanges of best practices and progressive specialization in areas of application. Examples are AT-One in the field of Air Traffic Management, DNW, ATA or EWA (Network of Excellence created under EU/FP-6) in the field of aerodynamic wind tunnels and measurement techniques. Very encouraging results have been obtained so far and this approach will have to be developed in other domains (flying test beds, airport research, etc.) in the future.


The numerical simulation of complex multi-physic time-dependent phenomena requires extensive computer resources. The aeronautics community needs access to the world's top 10 supercomputers.

AERONAUTICS INFRASTRUCTURES ADDRESS BOTH SCIENTIFIC AND INDUSTRIAL RESEARCH IN A COMPLEMENTARY WAY

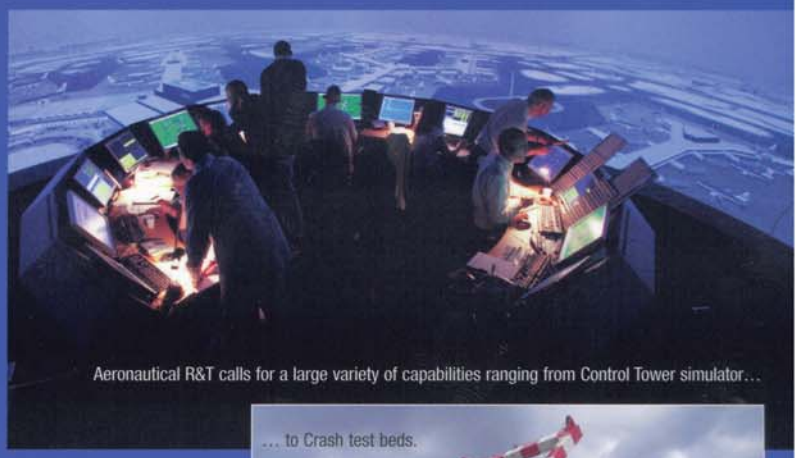
Industrial customers (aircraft manufacturers) use facilities - on a commercial basis - during limited test periods for developing and improving their products. This contributes towards making these facilities available for scientific research to alternate users who also need them for limited periods of time.

This situation benefits the numerous research projects conducted within the framework of various national or EU programmes on both fixed and rotary wing aircraft and also serves the need to improve basic knowledge (e.g. flow stability, transition, wakes, vortices, combustion process...) through tests directly funded by Research Establishments with the underlying objective of increasing fuel efficiency and reducing noise. Conversely, the industrial community benefits from the results of fundamental research which provides improved technologies in several areas.

The need for increasingly accurate experimental databases also calls for the development of highly sophisticated non-intrusive measuring instruments, which stimulates fundamental research in particular domains of physics (coherent optics, etc).

Even if it is true that 'traditional' ground based facilities (like aerodynamic wind tunnels, propulsion test beds, etc.) are the most emblematic and well known examples of aeronautics research infrastructures, the sector also needs and exploits a large variety of other capabilities. Examples are Vibration and Fatigue test beds, Crash facilities, Electromagnetic compatibility facilities, Control Tower simulators and, of course, Flying Test Beds.

Similarly, at system level, an all new operational concept of Air Traffic Management will have to be validated using a sophisticated infrastructure covering, amongst other things, automatic / Fast-Time simulation Tools, Human-in-the-loop simulation Platforms and Field experiment Platforms.


Aeronautical R&T calls for a large variety of capabilities ranging from Control Tower simulator...

... to Crash test beds.

The automotive, rail, civil engineering and wind power industries can also benefit from publicly maintained infrastructures and associated know-how.

AERONAUTICS FACILITIES REPRESENT AN ASSET THAT HAS TO BE PRESERVED

Most of the major aeronautics facilities were funded by national governments in the '50s and '60s to fulfil national needs and it is striking when you realize that a product like the A380, which is likely to be in service for the next 40 years, was extensively tested in 50-year old aerodynamic wind tunnels.

Most large and medium size facilities are run on an operating costs recovery basis by national aeronautics research establishments and are open to any customer.

ETW, the European Transonic Wind Tunnel is the largest aeronautics facility built at the European scale (FR, GE, UK and NL). It represents an asset worth more than 500m and is a unique facility.

University aeronautics departments also operate laboratory facilities more suited to conducting basic research whilst industrial companies own some limited research equipment for their exclusive use.

Aeronautics facilities are essential for improving basic knowledge and for supporting the competitiveness of the European industry. They represent a tremendous asset that is estimated to be worth more than 4b. Maintaining, renewing / upgrading or replacing these facilities represents an enormous challenge and a financial burden that operators using national funding schemes are increasingly less bale to support alone. The result is that less than 1% of the total asset is re-invested each year. Such a situation is unsustainable in the long term.

Europe (through the Union and through intergovernmental tools) will have to be increasingly involved in the process of (re)investments while facility operators will have to make further progress in the rationalization process undertaken several years ago and which already produced tangible results. In this field, as in others, Europe should be in a position to compete on an equal footing with the US where large aeronautics facilities are considered to be national assets and supported as such at federal level.

Operators, in particular of medium-size (key) capabilities, will also have to examine, in relation with national and European public authorities, fair ways and procedures for fostering the optimal use of existing facilities, reducing existing unnecessary duplications and preventing any risk of new duplication involving public funds.

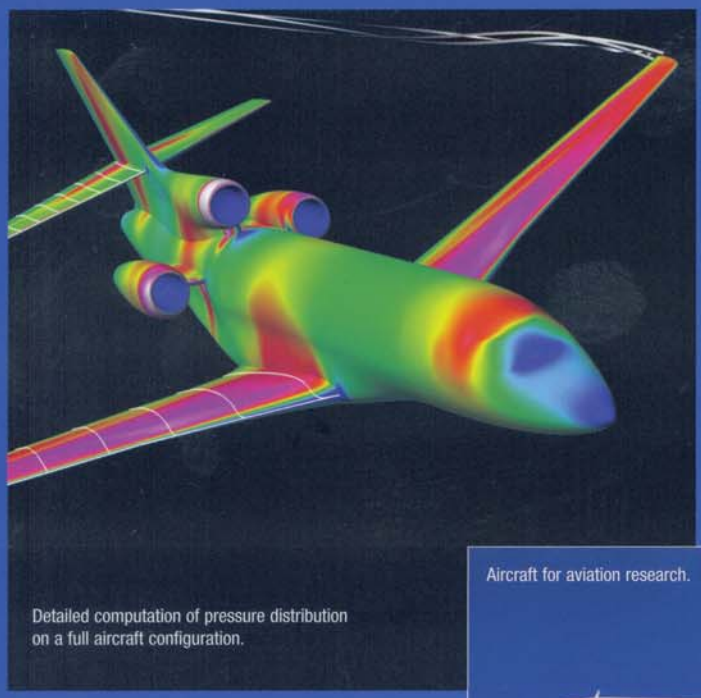
AERONAUTICS FACILITIES BENEFIT OTHER SECTORS

"Low-speed" as well as "high speed" aeronautics research infrastructures (in particular wind tunnels) have been serving the objectives of several sectors other than aeronautics. Surface transport (road and rail) and the civil engineering sectors have already been mentioned. Similarly in the space sector, launch and re-entry configurations have been extensively modelled and tested using tools developed for the aeronautics sector.

Flow visualization on an Ariane 5 model.

The Environment and Aviation Safety also benefit from aeronautics infrastructures. This is, for example, achieved through regular improvements at component level (e.g. combustor performances) or through the direct study of specific phenomena (e.g. wake vortices and icing). Security is also likely to profit more from the investments made so far by the aeronautics community (e.g. UAVs).

Aeronautical infrastructures play a pivotal role in the development of environmentally friendly technologies for aviation and for various security aspects (surveillance missions of UAVs).



Detailed computation of pressure distribution on a full aircraft configuration.

Model ready for aeroacoustic investigation in a large wind tunnel.

Aircraft for aviation research.

TYPOLOGY OF EUROPEAN AERONAUTICAL FACILITIES

Strategic facilities

individually correspond to investments higher than 100m and have an operating budget as high as 10m/year. They are open to any customer and address the industrial market on a commercial basis as well as national and EU programmes. Such facilities are competing in a worldwide market. Europe boasts no more than 10 complementary strategic facilities in that category for civil aeronautics.

Key facilities

individually correspond to investments higher than 10m. They are also subjected to tariffs based on full operating costs recovery (excluding capital investments and depreciation) and are used by other players than the operator on the basis of their own funding. Facilities with an obviously unique character are also included in this category. There are about 100 such key facilities spread all over Europe.

Common facilities

refer to a large number of other medium or small size capabilities covering a wide range of applications in various disciplines. Such facilities are considered as basic tools whose associated costs are in general borne by operators/owners.

ACARE

BY ADDRESSING BOTH BASIC AND APPLIED RESEARCH, BY COVERING A WIDE RANGE OF SCIENTIFIC DISCIPLINES AND ASSOCIATED EXPERTISE, THE EXISTING COMPLEX NETWORK OF AERONAUTICAL RESEARCH INFRASTRUCTURES IS A KEY ENABLER FOR THE DEVELOPMENT OF EUROPE.

SUCH A NETWORK, AT THE HEAD OF WHICH STAND THE SMALL GROUP OF STRATEGIC FACILITIES, REPRESENTS A TREMENDOUS ASSET AND THE NEEDS OF THAT PARTICULAR COMMUNITY, WILL HAVE TO BE CONSIDERED WITH GREAT ATTENTION AT REGIONAL, NATIONAL AND EUROPEAN LEVELS IN THE FUTURE.

EREA

This brochure is published by the Association of European Research Establishments in Aeronautics (EREA - http://www.erea.org) under the auspices of ACARE (http://www.acare4europe.org) and within the framework of the activity of a specific working group led by ONERA.

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And by: DNW, ETW

Some other useful links:
ATA: www.ata.aero EWA: www.eu-ewa.aero
AT-One: www.AT-One.aero

ACARE
Advisory Council for Aeronautics Research in Europe

Position paper on
The European Research Area Green Book Consultation

Date: 3rd September 2007

INTRODUCTION

In 2000 Commissioner Philippe Busquin developed his vision on the European Research Area (ERA) which was adopted politically by Council and Parliament as Guideline for European Research funding mainly implemented by FP7. Driven by the challenges for European Aeronautics identified by the ***Vision for 2020*** and based on the lasting experience in European Collaboration the aeronautical sector contributed successfully to the development of ERA in particular by establishing the ***Advisory Council for Aeronautics Research in Europe (ACARE)*** as first European technology platform giving guidance to all European aeronautical research.

In April 2007 the European Commission has issued a document[1] aiming at assessing the progress made and at discussing future orientations of the European Research Area.

All concerned institutions, organisations or even individuals have been invited to comment or react on that Green Paper through a web consultation process or in written form.

With the following contribution ACARE provides its views to maintain aeronautics as model case for ERA. It is structured according to the six major headings of the Green Paper:

- **An Adequate Flow of Competent researchers**
- **World class research infrastructures**
- **Excellent research institutions**
- **Effective knowledge sharing**
- **Optimising research programmes and priorities**
- **Wide opening of the European Research Area to the world**

In addition to that detailed answers to each question raised in the Green Paper are attached as annex to this document.

AN ADEQUATE FLOW OF COMPETENT RESEARCHERS

Europe has a long tradition of excellent universities and Research Establishments offering high quality Aeronautics education. Despite the creation of university networks like the ***European Aeronautics Science Network (EASN)*** and ***Pegasus*** and the ***Association of European Research Establishments (EREA)*** there is still untapped potential for developing breakthrough knowledge and technological innovation. To exploit this potential measures to convert new knowledge into the engineering base and mechanisms to improve the degree of integration in European Research organisations and universities should be further strengthened.

[1] GREEN PAPER The European Research Area : New Perspectives COM(2007) 161 final, 4.4.2007

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□ypology of European aeronautical facilities

Strategic facilities *individually correspond to investments higher than €100 million and have an operating budget as high as €10 million/ year. They are open to any customer and address the industrial market on a commercial basis as well as national and EU programmes. Such facilities are competing in a worldwide market. Europe boasts no more than 10 complementary strategic facilities in that category for civil aeronautics.*

Key aeronautics facilities *individually correspond to investments higher than €10 million. They are also subjected to tariffs based on full operating costs recovery (excluding capital investments and depreciation) and are used by other players than the operator on the basis of their own funding. Facilities with an obviously unique character are also included in this category. There are about 100 such key facilities spread all over Europe.*

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- Such a network, especially the small group of "aeronautical strategic facilities", represents a tremendous asset and the needs of that particular community have to be considered with greater attention at regional, national and European levels in the future. **ACARE believes that ESFRI, with an enhanced representation of aeronautics, should play a pivotal role in this respect. This will require a broadening of ESFRI's scope towards industrial oriented research infrastructure.**
- The case of 'Key aeronautics facilities" should be addressed, for example, through an appropriate voucher system that would allow at the same time an easy access to existing facilities and avoid unwanted duplications. **ACARE believes that such an approach which includes synergies with EU cohesion policy should be explicitly integrated in the ERA new perspectives**
- Operational costs of larger facilities should be secured at an acceptable level by public funding of specific activities like development tests that would in the end benefit all customers and ensure the best possible service worldwide. Tests in relation with EU programmes that are performed in large industrial facilities should be 100% funded as any other industrial tests**. ACARE believes that this would be a means to ensure long-term continuous improvement of their infrastructures through science and technology programmes.**

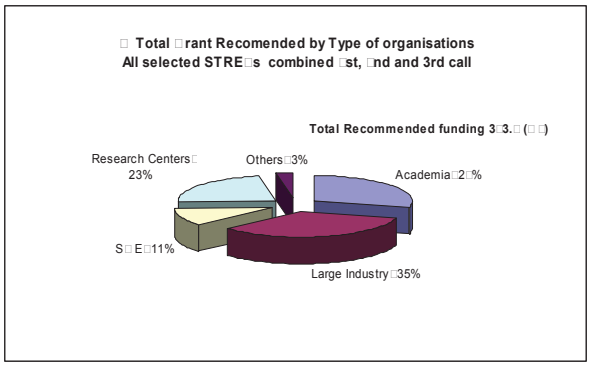
3. EXCELLENT RESEARCH INSTITUTIONS

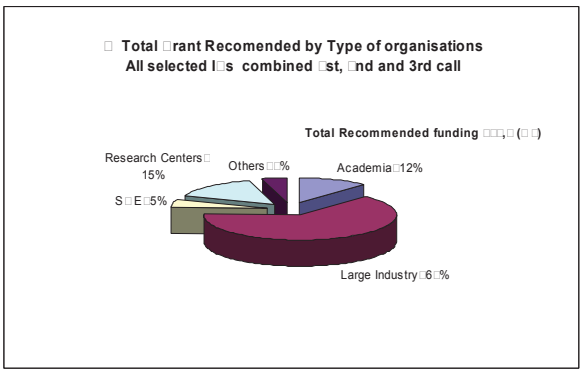
European excellent research establishments and universities form together with the industry the basis for the competitiveness of European aeronautics. These successes result from, depending upon topic and boundary conditions, an interrelation between co-operation on the one hand (e.g. with the integration into large-scale initiatives such as Integrated Projects in FP6, *SESAR*, *Clean Sky,* ...) and competition on the other hand (e.g. during technology development and innovation). This more or less balanced system is one of the reasons that Europe is working on similar technological level (partly even leading) as the international competitors despite much lower public funding. In total the European aeronautics stakeholders spend about **five billion Euro per year for research and development (R&D)** (of which about 200 million Euro from Community funding, another around 200 million Euro from National programmes' funding, 300 million Euro from Research organisations institutional funding and the remaining part from private investments).

The future European research funding will have to take into account this interrelation between cooperation and competition („Coopetition"). For topics of common European interests (defined by the European Technology Platforms, e.g. ACARE for aeronautics research) it is important to use the „right" cooperation instruments.

With respect to the experience from 5th and 6th Framework Programme, ACARE proposes to continue with an adequate distribution between bigger, top-down defined technology demonstration and validation projects (Level 2/ Integrated Project) and smaller, bottom-up defined research projects (Level 1/ STREP) in FP7 and follow on. In particular within the smaller projects (ref. to the picture comparing participation in IPs and STREPs in FP6) universities and research organisations will be able to work on break through and revolutionary ideas, exploring and pioneering new

technologies, new thinking and new solutions, in line with *the* ***□□eyon□ □□□□□ □i□□ □e□el □ar□et Conce□t*** in the ***□n□ □ssue of t□e □trate□ic □esearc□ □□en□a*** of ACARE, for which industry, because of several constraints, might not have the appropriate resources.





The application of integrating instruments like ***□et□or□s of □□cellence*** (NoE) will have to take into account, that **long lasting integration** can only be implemented on the basis of **long term oriented common goals** (common customer, common demand). Researchers do not aim for cooperation and integration, but will use them to reach their goal.

In addition integrative projects will have to take into account that integration is a long lasting process. Therefore ACARE proposes that integration instruments like NoE should support **this time consuming integration process** (stepwise approach□ contact/inventories/expertise -□ cooperation -□ harmonisation -□ coordination -□ integration), and not only the final result of a joint plan of activities and the formation of a legal entity, as it is asked for in FP7.

Apart from the cooperation needed for bigger projects, Europe will have to take into account the necessity of the competition of ideas, technologies and national/regional researchers (cf. red team □ blue team at industry side), which will lead to the best ideas and technologies in Europe. Following the **principle of subsidiarity**, it is therefore necessary to **□eep the various levels of funding** (regional, national and European) independently, as this will further support the European advantage of using the various cultures and mentalities.

□owever competition is only meaningful, if the competitive efforts (costs) can be counterbalanced by appropriate funding of the research projects. Success ratios of 20% and even smaller discourage the researchers and do not support European Excellency. Therefore appropriate financial resources are essential for research programs, in particular in aeronautics research.

□. Effective □nowledge sharing

Intellectual □roperty Rights (IPR) and **Ownership of □nowledge** are the most critical topic in negotiation on common projects, as these form the typical „products“ of the research organisations. Giving them away without appropriate cost compensation might hamper the research centre's own future research perspectives.

Therefore new measures have to be developed that foster the fast transfer of knowledge from research to industry while facilitating the use of this knowledge for further research internally. ACARE supports the preparatory work with respect to the **I□-Charter**, which will have to take both issues into account.

Furthermore ACARE supports the continuation of the work with respect to a **European patent scheme**, which failed recently.

In addition to that appropriate measures on the basis of the COR□IS or other project databases should be established to make results of European research projects available for further exploitation of European organisations.

Finally, ERA efficiency should be increased by encouraging all research partners (industry, research organisations and universities) to create sustainable and responsible partnerships between themselves for research results exploitation in order to create economic value, growth and jobs in Europe

□. O□TI□I□IN□ RESEARCH □RO□A□ □ES AND □RIORITIES

Since more than 30 years process to harmonise European (and national) research have been developed (GARTEUR[2] and recently Aeronautics ERA-Net AirTN). These concentrate mainly on European projects, which cannot be performed under the responsibility of one □ember State alone, are aiming for a common goal and finally facilitating optimisation of national programmes e.g. by using benchmarking mechanisms.

Furthermore the common definition of research strategies (strategic research agendas) in the framework of European technology initiatives will support the harmonisation of research funding. But the implementation of the SRA itself will have to continue to be under the individual responsibility of the various stakeholders. With respect to the experience in aeronautics, ACARE proposes to include □ember States and their funding agencies directly into the work of the various European Technology Platforms, as this will ensure that **all sta□eholders participate** and are committed to the SRAs.

□owever apart from the European products/projects like Airbus airplanes, SESAR and Clean Sky in aeronautics, one has to take into account the necessity of inner European competition, in particular within the different product supply chain and here amongst S□Es. Therefore it is important to keep national and regional research programmes under separate responsibilities, which will be used in coordination activities only for topics of European importance (critical mass, common goal,□).

At European level, research is conducted primarily at Community level (FP) but also at **intergovernmental level** (COST, EUREKA, European □efence Agency (E□A) as examples). The relative strengths/weaknesses of each programme, and the synergies/duplications between them should be identified and analysed for the

[2] GARTEUR: Group for Aeronautics Research and Technologies in Europe (DE, ES, FR, NL, IT, SE, UK)

benefit of all and the role of the Community into intergovernmental programmes should be clarified. Of particular relevance for ACARE is the interface between aeronautics and security related research at Community level and defence related/dual use research in E□A.

□. □ ide opening of the European Research Area to the world

Apart from existing international cooperation in aeronautics (e.g. AT□, Safety, Propulsion) one has to take into account that Europe is competing heavily with industries from US and other countries on the globali□ed aeronautics market. In its Green Book the European Commission warns for the upcoming new competitors like China and India. **This competition can be won successfully only by □eeping the technology leadership in Europe.**

At the same time the European Commission would like to use the international research cooperation to open the door for foreign markets and international issues. This can bear a risk of enabling the use of European technology knowledge for non-EU products competing against those of European industries.

Although ACARE is fully aware that the globalisation of aeronautics and air transport requires pro-active initiative on International Collaboration, it I very important, that all initiatives consider the long-term impact to the European stakeholders in aeronautics research.

Primarily global problems (like climate change, safety/security, sustainable energy, □) can only be solved in international cooperative efforts.

In specific high-tech areas a more cautious approach is required towards a complete opening of the European Framework Programmes for international cooperation with all partners on all topics. In particular for the development of new technologies, which will help to maintain the European leadership, a too close cooperation with future industrial and research competitors should be avoided.

Therefore ACARE propose to focus on „International Cooperation“ in particular of those specific topics, where a win-win situation for Europe and its aeronautics stakeholders can be ensured or solutions for global problems can be expected.

Final remar□

□espite numerous achievements in the European aeronautical research community - some of them were highlighted in this paper -, the statement, which ACARE□s first chairman Professor Walter Kr□ll used while presenting the first issue of the Strategic Research Agenda, still holds true□

□ ore research for the money □-□ more money for research □□

ACARE
Advisory Council for Aeronautics Research in Europe

An ACARE view of possible R&T implications of Emission Trading Schemes applied to the Air Transport Sector

Position paper

Date: 8th November 2007

BACKGROUND

Air transport has become an integral part of society in the 21st century, enabling both passengers and freight to travel large distances at an unprecedented speed and contributing to European and global integration.

Aviation also contributes to climate change, e.g, by emitting currently about 2% of all man-made carbon dioxide (CO_2). Past and predicted future air traffic growth raise concerns that its environmental impact may increase, in particular as the growth in transport volume was so fast that it has outstripped the effect of substantial reductions in specific emissions from technological progress and operational improvements. Since international aviation is not yet covered by the Kyoto Protocol, this growth currently does not have legal implications.

Nonetheless, the EU policy makers have initiated a process which aims to address the growing climate change impact attributable to aviation through the inclusion of aviation in the EU Emissions Trading Scheme (ETS).

In September 2005, the Commission adopted a Communication on Reducing the Climate Change Impact of Aviation. A key conclusion of the Communication was that in view of the likely future growth in air traffic, further policies and measures are needed to address the climate impact of aviation. Having analysed a number of options, the Commission considered that "…the best way forward from an economic and environmental point of view, lies in including the climate impact of the aviation sector in the [Community] scheme". On the basis of this conclusion, the Commission announced its intention to present a legislative proposal and invited the other EU institutions to consider the policy and design recommendations in the Communication.

In July 2006, the European Parliament adopted a Resolution welcoming the Commission's Communication and recognising that emissions trading has the potential to play a role in addressing the climate impact of aviation, provided it is appropriately designed.

In December 2006, the European Commission published a proposal for the inclusion of aviation into the European Emissions Trading Scheme. The goal is to include aviation within the EU by the year 2011, aviation from and to the EU by 2012.

In March 2007 the European Council decided to reduce the overall emissions of equivalent CO_2, making a firm commitment to achieve at least a 20% reduction in absolute GHG emissions by 2020 compared to 1990.

The current proposal of the EC does not include any effects beyond the emission of gases from the Kyoto basket, i.e., only CO_2 emissions are considered in the case of aviation. However, in October 2007 the European Parliament Environment Committee voted to include the effects of NO_x emissions by taking into account an impact factor of 2, despite the lack of scientific justification.

In light of the above, what are the implications for ACARE?

In the past ACARE has seriously considered the environmental and climate impact of aviation, e.g. ACARE put up the ambitious goals of reducing the specific CO_2 emission by 50% and NO_x by 80% by 2020.

Nevertheless neither of the two SRA editions (2002 and 2004) took ETS into account as a possible boundary condition in its scenario-building exercises. The ETS concept is new for the aviation sector and deserves deeper consideration for possible future addendum of SRAs.

A dedicated task force was therefore created by ACARE and Terms of Reference established.

The top level objective of the task force was to better understand the different possible Emission Trading Schemes and their potential impact on the air transport community and, on this basis, to provide advice to the ACARE stakeholders on R&T topics to pursue in order to achieve a sustainable air transport system.

To support the above aim, the activity foreseen included an assessment of whether ETS may (or may not) contribute towards the achievement of the ACARE goals.

ETS RATIONALE

Cap-and-trade systems, such as the EU ETS, rely on economics-driven tools to effect climate change. Trading is more efficient than standards-based, legislative approaches because it allows companies – not governments – to decide the best, most cost-effective ways to reduce emissions.

The mechanism consists in establishing a cap on CO_2 emissions through the allocation of permits (or CO_2 “credits”) to the various participants/plants of an industrial sector. A certain amount of those credits is allocated for free, while the rest might be auctioned by governments, i.e. has to be purchased by industries. In order to achieve an emission reduction across all sectors over time, the total amount of free permits will probably decrease with time, though different pathways might be appropriate for different industrial sectors.

So, if a trading entity, e.g., an airline, is allocated a given amount of credits annually to operate, but it needs more, it can buy the extra credits from another airline, or create additional certificates via CDM/JI-projects or alternatively buy on an open market from any other sector or company that has excess permits. By purchasing permits from a company, an airline is theoretically refunding that company’s investment in efficiency and CO_2 reduction. This is in essence the ETS mechanism.

CONSEQUENCES OF ETS AND EC CLIMATE TARGETS FOR AVIATION

Both, the extension of the EU ETS on aviation and the EC target of reducing equivalent CO_2 emissions by 20-30 % (relative to the 1990 value) until 2020 may

have a significant impact on aviation. In particular as these targets are in conflict with the forecasted annual growth rate of 4-5 % for global aviation transport volume; this growth rate corresponds to an increase of aviation transport volume by a factor of 1.7 to 1.9 from 2007 to 2020. (Note that the growths rates of aviation transport volume vary from region to region.)

To meet the ambitious EU climate protection target the aviation sector will strongly seek to reduce its specific emissions, though a critical option for aviation RTD progress could be to purchase additional permits from other industrial sectors. Additionally, aviation has also a long-standing commitment to reduce its non-CO_2 climate impacts (from NO_x emissions, from particle and particle precursors emissions and from modifying cloudiness).

In order to obtain further substantial decreases of specific emissions (and potentially also absolute emissions) more research is needed with respect to technological improvements of airframes and engines, and with respect to operational procedures. This may include revolutionary approaches off the current main stream in aviation industry. This research effort is becoming even more challenging if negative effects on noise level and local air quality at airports should be avoided in parallel. Obviously, the two ACARE High Level Target Concepts that will be more relevant to an ETS scenario will be the Ultra Green combined with the Highly Cost Efficient.

In addition to reducing CO_2 emissions more research is necessary to quantify the non-CO_2 climate effects and to develop metrics that allow the inclusion of short lived emissions from aviation (and from other industrial sectors) in climate protection regulations.

Moreover, more research is needed to better understand the scope for addressing non-CO_2 climate effects and possible ways to deal with trade-off among different effects, e.g, CO_2 versus ozone from NO_x..

It has to be remarked that substantial efforts are already being made in this direction, also in the context of EU Framework Programmes. For example AERONET III and ECATS are multi-subject networks aimed, among other things, at identifying gaps of knowledge and needs for research and development in the context of aviation emissions reduction. Another example is the Integrated Project QUANTIFY aiming at the quantification of the climate impact of global and European transport systems.

New European initiatives (FP7, Clean Sky, SESAR) as well as National Programs are aimed to provide useful context for performing such research as requested above.

Further large-scale initiatives are also underway both at European and International levels (with ECAC and ICAO) to develop comprehensive toolsets for the modelling of aviation's emissions and noise, their impact on the environment and on the communities living in proximity of airports. These tools, when available in an integrated system, will be the natural framework for the simulation of ETS scenarios and their economic implications.

A more open dialogue between the different scientific communities and sectors shall also be promoted, avoiding the creation of closed circles of expertise where knowledge remains confined. This will increase the speed at which progress is achieved.

ACARE RECOMMENDATIONS

ACARE therefore supports an integrated multi-disciplinary approach on the following areas:

- **Atmospheric sciences research:**
  - To better understand the physics and chemistry of the atmosphere, in particular to quantify the climate impacts resulting from the emission of NO_x and particle or particle precursors, and from aircraft-induced modifications of clouds, i.e. from the non-CO_2 effects.
  - To establish new metrics that allow the comparison of the climate impact of short-lived effects with the impact from long-lived greenhouse gases. Eventually, this would allow informed decisions on how to include the short-lived effects in climate mitigation measures or environmental regulation, in a way that ensures a fair comparison among industrial sectors and allows each sector to minimize its climate impact.
  - To establish space (geographical position and altitude) and time dependent cost-functions that allow to include climate effects in an ATM system.

- **Aircraft technology research:**
  - To minimize the CO_2 emissions associated with the whole air transport system, considering the necessary trade-offs with other environmental parameters like noise, NO_x, water vapour and others, in view of an overall optimization of the environmental impact.
  - To continue research on understanding effects of aviation on the atmosphere and in particular to provide the atmospheric scientists with different combinations of aircraft speed and altitude to make sensitivity analyses for better understanding of their impact on global warming, to optimize aircraft and mission combinations, including new aircraft or engines configurations. Advanced systems for real time prediction and assessment of "airspace vulnerability" in terms of contrail/cirrus effects shall also be considered.
  - To improve current technology solutions, including retrofitting, when economically and technically viable.

- **New energy concepts research:**
  - To investigate near, mid to long term options for alternative fuels in terms of source, process and final product as well the impact on aircraft and engine technology.
  - To analyse the life cycle CO_2 emissions from different fuels, i.e., from production to usage (well to wing) and their environmental impact on the local, regional and global levels.

- To address economic aspects in terms of a cost benefit analysis of a transition to alternative fuels, in particular to analyse economic effects on food prices and markets when using biomaterial for the production of biofuels.

– **ATM and airport operations research:**
  - To develop an operational ATM concept for 2020 and beyond to ensure that the European ATM system can safely cope with a substantially increased base load of traffic while ensuring that the (environmental) performance advances of new generation aircraft are fully exploited.
  - To optimise ground trajectories, incorporating fully flexible taxi times. This will require more research into automation at airports, linking Collaborative Decision Making with Controller Pilot Data Link, low visibility procedures and system-wide information management.
  - To explore operational towing: This requires a reassessment of airport infrastructure as well as research into surveillance, guidance and control systems, management of towing vehicles and impact on throughput.
  - To explore increased automation of operations in the air and at airports to ensure efficient flows of traffic in a very high capacity context.

– **Airline operations research:**
  - To better understand and quantify the potential for emissions reductions that operational measures implemented by airlines (of varying business models, route networks, aircraft types etc.) represent as a function of the market price of carbon allowances.
  - To understand the relations between aviation as transport mode and the growth of europes economy as a whole.

– **Economics research:**
  - To understand how to achieve sustainability for operators and for the whole value chain by assessing e.g. the elasticity of the demand for air travel under different scenarios.
  - To understand the costs and benefits of potential additional regulatory and/or operational measures for the limitation of the non-CO_2 effects of aviation as well as their possible trade-offs with respect to emissions accounted for under the Emissions Trading systems for aviation.

– **Transport research:**
  - To study on how to use the best suited transport mode (for passenger as well as freight) with respect to environment, costs, quality and time (modal shift, optimising the total transport system).
  - To prepare (really) comparable studies on the emissions produced by the various transport modes.
  - To analyse the current costs (taxes, regulations, instruments) to charge environmental damage by the various transport modes and their impact on the markets as well as their possible use for research to improve sustainable/environmental friendly transport.
  - To optimise interfaces between air and surface transport, to reduce emissions during the whole travelling (door to door).

ACARE

2008 Addendum

to the

Strategic Research Agenda

Advisory Council for Aeronautics Research in Europe

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

The context in which aviation is operated is changing rapidly. This context embraces not only technical change and the development of economies and businesses but also the growing realisation that some important world resources are limited and our climate is changing in ways that must be mitigated.

It is four years since the last Strategic Research Agenda was published and it is timely to look at the nature of these changes and to determine what changes may be necessary to the priorities, pace or content of the SRA. The review was undertaken by the Strategic Review Group within ACARE.

This Addendum is intended to bridge the time between the last SRA and a full review of aviation, its direction and the technologies necessary to support it. This full review is presently expected in 2010.

Progress on the Agenda

Progress on the technical topics of the Agenda has been generally good but with less headway being possible on institutional topics the pace of which is limited by governments. Less funding has been available for research than had been considered necessary and some items have therefore been given a lower priority. About 200 projects have been launched from the European Commissions Framework Programmes in this field worth about 2 B€.

Two very large Joint Undertakings have been started since the last SRA: "Clean Sky" a project devoted to technologies that will improve the impact aviation has on the environment and "SESAR" the comprehensive change in European ATM.

Technical Issues

Three important areas have been identified for increased priority: The Environment, Alternative fuels and Security.

The Environment

Aviation is a component of environmental impact, albeit presently a small one. However, it is growing and it becomes urgent that the aviation community should address the challenge to a sustainable aviation system. The challenge is in two parts: both global climate change and local noise and air quality. Much the more important is addressing climate change although local conditions are meeting a declining level of tolerance around airports and this too is an urgent matter.

Three main factors arise in considering climate change: the scientific understanding, the funding and the technologies. The findings of the IPCC point very clearly to the need to do something but there are areas of detail where more understanding is needed. Increased funding is vital if the evolutionary and breakthrough technologies are to be developed. Technologies are at the heart of the matter and breakthroughs are required to approach a state where aviation can reduce its impact on the environment as fast as its growth rate is adding to it.

Local air and noise performance needs to address many of the same issues of CO_2, NO_X, and particulates, including noise. Public tolerance appears to be reducing and visibility of new targets for the future as well as an independent approach is therefore needed. Solutions must include ATM components as well as aircraft components.

Key Recommendations for the Environment

- **Global climate change** is the most serious environmental issue which needs to be considered globally with Europe pressing for common actions
- **More investment is needed** involving both public and private capital.
- The application of new **and advanced technologies** is required in the field of aircraft but also in the important area of ATM.

- The technical agenda should remain unchanged for incremental improvements and be **accelerated** towards breakthrough and contributing technologies whether these address reductions in CO_2, NO_x particles, contrails etc. on local or global levels.
- The **phenomena and data** relevant to aircraft emissions should be better understood and collected respectively.
- **New concepts for the long term** future should be encouraged by support to innovative research.

Alternative Fuels

The world's fossil reserves of oil are declining as consumption rises. Peak oil production may already have occurred. The adaptation of aviation to other fuels is not yet a necessity but its possibility is certainly now a matter of concern. Current fuels have high energy density and their systems have been refined to deal with their particular burning and ignition characteristics. Replacing these fuels will be cheaper and easier if the new fuels are "drop-in" rather than completely or partially novel in their characteristics of use. A number of drop-in fuels are potentially possible from coal, coal tar, or biomass etc. Alternative fuels might include liquid hydrogen, liquid methane, nuclear power etc.

The whole life environmental impact of fuel candidates in their production, refinement, storage and use needs to be studied carefully for every candidate drop-in or new fuel.

Key Alternative Fuel Recommendations

- **The technological option**s offered by different alternative fuels need to be studied in detail along with the related environmental ("well-to-wake") and economic aspects.
- **International co-operation** on these issues will probably be necessary.
- Two parallel **research efforts** are needed focusing (a) on drop-in alternatives to crude-based kerosene fuel, within current basic jet engine technologies and (b) on 'revolutionary' aircraft power systems.

The Security Challenge

Security threats have increased since the publication of the last Agenda. The impact of these threats has been the imposition of increased security measures at airports resulting in delays for passengers increasing and not decreasing as planned. Passengers see the responses to threats being applied piecemeal and often not corresponding to the current threat assessment. Whilst the systems in use have individually become more capable they are being integrated incoherently and unresponsively and this needs to change.

In airborne security the favoured approach is to work towards a system wherein the aircraft can be controlled from the ground in an emergency.

Key Security Challenge Recommendations

- The system by which security requirements are established should be reviewed with a closer look at the causes of **inconsistencies and changes** which rest mainly with regulatory and political networks.
- More capable, wider scope and **less intrusive systems** at the level of both deterrence and detection should be developed.
- **Variable** performance capabilities should be investigated to relate to a variable threat scenario.
- Security **research** will need to be focused towards a number of specific solutions at system-level.

Most of the topics above are already contained in the SRAs, which supports the robustness of the Agenda. However, what has changed is the increased emphasis on a more "**systemic view**" and the need for rapid variation in threat.

Institutional Issues

Business Models

New business models are constantly under consideration and this will not change. The technologies necessary to deliver a new business model and the market for that model must clearly go hand in hand if the resultant business is to prosper. Many new models will arise to exploit new technologies and these are in the hands of the business corporations that will make the new technologies serve a business end. However, it is also the case that technologies might be encouraged with greater knowledge of the business aims that are unfulfilled in their absence. External factors such as fluctuations in exchange rates effect business models and the technological solutions required. Business models are also much influenced by regulation changes. The Group concludes that ACARE should cultivate a greater engagement with the business and regulatory world to ensure that technological outlets in new business streams are being adequately factored into the technical research programme.

International Collaboration

There is a pressing need for international collaboration in the aviation community on issues of standardisation and alignment of processes, materials, fuels, procedures and protocols, climate and environmental impact and of regulation in these areas. The Group understands this as **strategic collaboration.** But Europe is not presently having the impact on these strategic international matters that it should. The Group recommends renewed engagement with these areas of international concern. For this to be effective it will be necessary that Europe equips itself better for the discussions and negotiations with prepared data and a strategic plan for their presentation before international fora.

Another sort of international collaboration is commodity or **commercial** collaboration. This is undertaken by companies for their own ends and has very little relevance to initiation by ACARE, or by national or European governments.

Key International Collaboration Recommendations

Strategic collaboration should enable the European air transport sector to benefit from the increasing worldwide demand for air transport, both in terms of providing services and in terms of developing and selling products. The prime issue for strategic collaboration is setting and applying **worldwide standards** for aviation and European industry must be as active as its American competitors in the standardisation arena.

Commodity cooperation must be initiated by the interests of the **parties concerned** in making the particular collaboration effective in their context. There will continue to be opportunities for collaboration in basic research but the balance of gain and loss should be carefully considered before embarking on such collaboration.

Infrastructure and Education

ACARE has been working hard to advance the causes of a more integrated and appropriate infrastructure. Numerous changes to establish harmonised education and training systems with voluntary accreditation systems with more Industry-Academia partnerships will all increase educational coherence, helping to ensure a supply of trained, adaptable and mobile people attuned to the needs of the future. The focus on maintaining and upgrading 'Key Facilities' should be continued. Some advances have been possible but in general progress has been slower than hoped because many of the changes being promoted require one or more governments to act in their support and this has not happened at nearly the rate that is required. ACARE is encouraged to renew its communication with national governments to press for action in these areas in the interests of a more effective and more cost-efficient research community.

Conclusions and Recommendations

Overall the Group found that the current Agenda is correct in its direction and content. Relatively few but important adjustments are now indicated. The dominating issue for aviation in the immediate future is reconciling the pressure for reduced climate change impact with the growth in aviation that brings enormous economic benefits. Further downstream we expect the aviation community to become involved in new challenges as the effects of climate change, reduced resources of oil water and land change the nature of the world. With some of these issues remaining to be drawn into the review expected in 2010 the Group's principal conclusions were:

- The present Agenda is endorsed in its essential direction and content.
- Adjustments and accelerations are recommended in the area of environmental technology development, action on alternative fuel, and on security systems.
- Revitalised action is indicated to encourage faster and effective progress on the supporting mechanisms that will make increased technological progress and effectiveness possible, economic and useful.
- A new effort is recommended for international collaboration that emphasises the European contribution to globally relevant solutions for aviation.
- ACARE should develop engagement with policymakers and industrial leaders as an essential part of its understanding of the contributions of the technologies that it supervises.
- The importance of the long-term is re-emphasised.

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ACARE position on
"A sustainable future for transport" (the European Transport Policy)
EC communication (2009)279/4

ACARE welcomes the publication of the EC communication on "a sustainable future of transport (EC COM (2009)279/4) and the possibility for ACARE to participate in the debate.

The communication outlines the EC's political goals for a future sustainable transport system on the basis of trends and challenges and the possible instruments to implement them.

Based on its mission, ACARE would like to give inputs to the following topics:

- Sustainable transport system
- transport to respond to society's needs
  (safe, secure, accessible, environmental friendly, comfortable and affordable)
- transport networks and intermodality:
- funding/finances/pricing
- research, technology and Innovation to prepare solutions

Sustainable transport system

The EC communication is outlining, that the present economical and societal concept will still need transport for goods and passengers,

According to its white paper, EC is looking for a decoupling of transport from GDP development, but history has shown that previous decoupling efforts could not be realized, as the global economic system is based on transport means (globalisation, just in time production, ….) There may be constraints (e.g. from congestion) on some areas of transport (particularly roads) which could effect the linkage between transport growth and GDP but overall, and particularly for aviation, <u>this goal seems to be questionable if not unrealistic and has to be carefully reviewed.</u>

Nevertheless a decoupling of environmental impact from transport growth is necessary to create a sustainable transport system. Technology will be a significant part of such solutions. Therefore policy should support the development of a sustainable transport system, which allows growth of economic welfare, combined with growth of transport, but with reduced impact on the environment. <u>The appropriate political goal should be the decoupling of the impact on climate from growth of transport (and economy).</u>

Transport to respond to society's needs (safe, secure, accessible, comfortable, affordable and environmental friendly)

EC assumes that pricing based primarily on the environmental impact will be the main control option for the choice of the transport mode by passengers and goods. From ACARE's point of view this assumption seems too limited[1] and has to be widened.

Transport policies in general (and therefore also the future of research) will have to respond to society's needs, which have been identified by the group of personalities in its Vision for European Aeronautics in 2020 as a safe, secure, accessible, comfortable and affordable air transport system. Furthermore the society's needs are affected by the passenger's choice of travel mode with regard to distance, time, speed and reachability of his destination.

As this was accepted by all stakeholders (Member States, Commission, airlines, airports, manufacturing industry, research establishments, Eurocontrol, regulators) in the air transport system, ACARE has elaborated its strategic research agendas to fulfil these widely by society accepted needs.

Following ACARE's approach, all transport related technology platforms (ERRAC, ERTRAC, Waterborne) use in principle the same concept of challenges for their respective transport mode.

ACARE would like to point out that <u>the future global sustainable transport system needs to be at the same time environmentally friendly, safe, secure, accessible, affordable and comfortable</u>. ACARE would like to propose to use this holistic approach including all challenges with special emphasis on sustainability.

Transport means (vehicles, networks and intermodality)

To ensure the above defined sustainable transport system the various elements of the global transport system and the system itself will have to be improved:

- innovation of sustainable vehicles
  improvement of vehicle efficiency and sustainability incl. alternative fuels, safety, security, comfort, increased routing capacity, seamless adaptation of vehicles and infrastructure
- improvement of the individual networks (e.g. air transport system/SESAR, Railroad/ETCS, …)
  Topics like Single European Sky, political and technological needs for efficient and sustainable modal networks, accessibility of networks, …
- improvement of the interfaces between transport modes / intermodality

[1] Provided a cheap system is not or barely (oder poorly) accessible and uncomfortable, only a few customers will choose the cheapest solution (Example: Low cost airlines created a new market, but only in very limited case they replaced the traditional airlines).

airports as link between air transport and road/rail transport, integration of air transport with high speed rail transport, as well as understanding the impact of transport on the climate.

Funding/finances/pricing

As outlined above pricing is a major point for choosing transport modes/means.

Before pricing can be applied with respect to the impact on the climate, it is necessary to understand the complete impact of transport and its modes on the climate.

This knowledge needs to be shared and agreed upon worldwide, to form a basis of sound scientific, economic and social understanding of the environmental impact for a global pricing system.

For some modes of transport a European system might be established as a pilot for the rest of the world. But global transport networks and society's choice of transport modes like air transport, shipping and even rail and road transport will need a global solution to ensure appropriate handling and also a level playing field for international transport means.

ACARE encourages a worldwide approach to discuss and probably set up worldwide systems for setting prices according to the environmental impact.

But pricing according to the environmental impact will not be sufficient to decouple environmental impact from growth of transport (and economy). Additional efforts are necessary to develop new technologies for transport to reduce the environmental impact.

Therefore ACARE proposes that the income created from such pricing systems should be (at least partially) (re)invested in the necessary research:
(pricing without investment in research will decrease transport with the consequence of decreasing economic welfare, whereas pricing and reinvestment in research will increase and support research, as only with better innovations transport and economic growth can be decoupled from the impact on the climate, which should be the primary goal)

Research, technology and Innovation to prepare solutions

Apart from regulative aspects a main driver for solutions will be appropriate research and development for all levels of transport (global transport system, individual transport systems like ATS, infrastructure, vehicles, propulsion).

Long product and system cycles will need strategic approaches, as decisions today will have their impact in the longer future. The only way to ensure this is a continuous debate between all related stakeholders, as done in ACARE, where MS, regulators, manufacturing industry, operators, research, universities are working together to

define jointly the strategy for aeronautical research in Europe (not only technically but also with respect to institutional enablers).

The European research and innovation system needs to cover the whole innovation chain from gaining knowledge, developing technologies, demonstrating technologies, system demonstration and implementation. This will need the cooperation of all research stakeholders from universities, research organisations up to industry, including operators, regulators, …, as outlined in the sketch below.

Sketch showing the whole innovation chain needed

ACARE has identified the following topics as guideline for future transport related research. Work should cover the wide remit of the whole transport system:

- Atmospheric science research to better (or fully) understand impact of transport (and transport modes) on the climate,
- Vehicle oriented research to cover societies needs, this will include improvements on the level of the vehicle and in particular new energy concepts
- Modal system research to improve the individual transport systems like air transport, maritime, rail, road, also including operational aspects (like ATM, airport, airline operation)
- Transport research to better understand how to use the best suited transport mode, to compare the various transport modes, and to improve interfaces between transport modes,

Main messages by ACARE (Summary)

- To ensure a sustainable future transport system the political goal should be a decoupling of environmental impact from growth of transport (and economy) (Decoupling growth of transport from growth of economy seems not to be an appropriate realistic goal)

- Sustainable transport needs to respond to society's needs and therefore needs to be (in addition to environmentally friendly) safe, secure, accessible, comfortable and affordable.

- Several levels of transport need to be tackled: the overall transport system, the individual transport modes and the various infrastructures incl. vehicles.

- With respect to EC's approach on pricing (costs related to the environmental impact) ACARE would like to highlight the need to fully understand the various impacts of transport and its modes/vehicles on the climate.

- On the basis of a worldwide accepted knowledge ACARE encourages a worldwide approach in case pricing on the basis of environmental costs is applied.

- Income generated from environmental based pricing systems should be (at least partially) invested in research and technology in order to decrease the environmental impact of transport and to decouple environmental impact from transport and economic growth.

- A suitable European research and innovation scheme needs to be maintained and improved to ensure the complete innovation chain. This research system needs to cover atmospheric, vehicle related, modal and intermodal system related, and overall transport related research.

ACARE will continue to prepare the future for a sustainable air transport system as part of a sustainable global transport system. Therefore ACARE will be glad to continuously contribute to the debate on the future of transport.

ACARE position on Joint Programming

Introduction

In early 2007, the European Commission published the '**ERA Green Paper**'[1]. After broad public consultation which ACARE contributed to, and which culminated in the Lisbon Conference[2] "the Future of Science and Technology in Europe " the Commission launched a set of initiatives to overcome some of the perceived weaknesses of ERA. One of these initiatives is **Joint Programming**[3]. Its primary aim being to respond to the need of "Optimising Research Programmes and Priorities" expressed within the green paper.

In essence, " **Joint Programming involves Member States engaging voluntarily and on a variable-geometry basis in the definition, development and implementation of common strategic research agendas based on a common vision of how to address major societal challenges** ..... It aims to increase and improve the cross-border collaboration, coordination and integration of Member States' publicly funded research programmes **in a limited number of strategic areas**, and thus to help Europe boost the efficiency of its public research funding so as to better address major societal challenges…"

In December 2008, the Council endorsed the Joint Programming concept proposed by the Commission. The Council "…welcomes the concept and objectives of Joint Programming as formulated in the communication of the Commission" , underlines that **Joint Programming is a Member States' led process** with the Commission acting as a facilitator, and "asks Member States to collaborate...to identify the themes for Joint Programming chosen following broad public consultation..."

The Joint Programming concept is at an advanced stage of development, and it appears that Joint Programming is to be first and foremost a **public -public cooperation**. It is meant to address major societal challenges and overcome the fragmentation and compartmentalisation of publicly funded research.

ACARE recognises the basic concept of Joint Programming. This paper highlights ACARE's position, contribution and initiatives which aim to identify, develop and implement a common strategic research agenda. ACARE has since 2001 developed a vision on future research in the air transport sector and defined two editions of its strategic research agendas which are influencing air transport research worldwide.

[1] EC Communication COM (2007)161 Final "**The European Research Area: New Perspectives", April 4, 2007**
[2] http://ec.europa.eu/research/conferences/2007/fst/index_en.htm, October 8-10, 2007
[3] EC Communication COM (2008) 468 final **"Towards Joint Programming in Research: Working together to tackle common challenges more effectively", July 15, 2008**

Why is ACARE unique?

Before defining the ACARE position on Joint Programming, it is appropriate to provide some historical perspective on ACARE. This would help appreciate the relevance of its position.
ACARE was established in June 2001 and was, de facto, the very first European Technology Platform (ETP). It came about before the ETP concept was even established. Over the years, many new ETPs have emerged: over 35 are listed on http://cordis.europa.eu/technology-platforms/individual_en.html. It is striking to see that only a few ETPs, ACARE being one of them, claim openly their identity as **advisory councils**. ACARE for example, discusses long term implementation issues and required mechanisms with all the stakeholders to achieve the Strategic Research Agenda's. Also ACARE has been asked to provide an independent evaluation of the Clean Sky proposal. Contrary to many other ETPs, from its very beginning **ACARE has been involving Member States as full members** of the ETP, and not only through a mirror group. **The European Commission is also a full member of ACARE**. Through this Membership of ACARE, Member States and the European Commission have always been in a position of ensuring that **national programmes are aligned with each other and with community programmes.**

ACARE position on Joint Programming

ACARE welcomes the Joint Programming (JP) concept in principle as it will complement existing mechanisms and considers that JP can be a powerful tool to address societal issues;

- where societal relevance is high and major challenges exist beyond the capabilities of individual Member States and where competitiveness is not the primary research driver
- where the research community lacks structure, a clear vision and long term strategic research agenda and where research is fragmented and compartmentalised, or where effort is wasted in excessive duplication.
- where public leadership is currently missing as a necessary enabler towards addressing major societal or socio-economic challenges and therefore where a sufficient number of Members States are prepared to engage themselves and pool together a critical mass of resources over a long period to address these challenges jointly.
- where policy relevant research is needed, and therefore research programming has to be primarily a publicly led process, particularly that for which the public sector is the only real or major customer

ACARE believes that since beginning in 2001, it has enabled its members to coordinate and programme research and technology development beyond the Joint Programming concept now proposed by the Commission. Indeed, where the JP, as projected by the Commission, is essentially a public-public programming tool with research players involved primarily at the consultation and implementations stage, ACARE has all research players, private and public, including the Commission and the Member States, involved directly at the programming stage (SRA development).

The aeronautical research community is well structured in Europe (the unique character of ACARE itself, as described above, is an illustration of this) and research in this sector is relatively well coordinated at Community level (ASD for industry, EREA for research organisations and EASN for Universities) as well as through bi- or multi-lateral agreements between stakeholders. In addition, there is an ongoing specific ERA Net (Air TN) in air transport coordinating national research programmes. An example of this is where AirTN successfully initiated joint calls between Germany and Austria. Furthermore, national research programs are already open for joint applications from organizations outside the host country thus overcoming national borders. Developing Air TN into an ERANet+ could be a significant step towards developing further joint activities. Therefore, it could be suggested that **research in the aeronautical and air transport sector is far less fragmented and less compartmentalised than in other sectors** and already bears several of the characteristics of the new Joint Programming concept proposed by the Commission.

The societal challenges and 'Greening and Environment' are very high on the agenda of the aeronautical and air transport sector and of ACARE, and are addressed by both public and private stakeholders.

Competitiveness and European leadership are also top-level objectives for the aeronautical and air transport sector. Indeed, this sector continues to evolve in an arena of fierce competition worldwide. Europe is competing not only with its traditional US competitors, but increasingly also with emerging economies. In order to maintain its competitiveness, the sector needs to remain highly research intensive. Currently, the European aeronautical sector is spending 12.4% of its turn over on R&D[4], of which over 70% is coming from industry (up to 85% if one considers civil aeronautics alone), the rest (30%, or 15% for civil aeronautics alone) coming from public funding. This is far better than the Barcelona requirement (at least 2/3 from industry, less than 1/3 from public funding). With such a large amount of R& D investment coming from industry**, it is clear that the private sector has to be closely associated with the programming aspects of research in its sector.**

[4] ASD Facts & Figures 2007 http://www.asd-europe.org/content/default.asp?PageID=16

Further, ACARE believes that **maintaining competitiveness on the global market requires maintaining a certain amount of healthy competition between stakeholders internally within Europe**. This holds true not only for the aeronautical sector but also for other sectors with a significant competitive dimension. Therefore ACARE suggests that the Joint Programming concept should be balanced with competitive national research activities in order to keep **a healthy balance between collaboration and competition.** This would be inline with the long term interests of European industry. Joint Programming should meet **subsidiary principles**: it should not be seen as an alternative, but as a complement to existing research mechanisms, instruments and national programmes. Furthermore, independent of the instruments and schemes, the funds for aeronautics should increase in order to maintain investment in R&D in Europe to address market based grand challenges such as European leadership, as well as environmental and other societal challenges

ACARE believes that Joint Programming should be considered as one of the elements of future European Research Area. **Joint Programming may also have merit in addressing "grand challenge" driven research for addressing major societal challenges.** In some cases, the public sector is setting the research agenda and results are needed to develop public policies. Examples could be safety & security or environmental studies near airports. In such cases Joint Programming may indeed bring added value to support coordinated public research in Europe.

However, ACARE proposes that a full spectrum of research instruments exist in the future European research area that are dedicated to specific challenges and specific objectives. The ongoing discussion and debate taking place on ERA governance (Ljubljana process, Vision 2020), FP6 evaluation (Rietschel report), FP7 progress and monitoring, FP7 mid term review, etc. that will undoubtedly influence the future organisation of research in Europe at all levels (community, intergovernmental, national). Of particular importance is the recommendation of the Rietschel report that Research should be organised around 2 main pillars:

- Curiosity-driven research or "Great Ideas" in a bottom-up approach: this can be interpreted as covering what is currently considered under the "Ideas" programme and possibly some parts of the "People" programme of the current FP7.
- "Grand challenge" driven research for addressing societal challenges in a top down approach.

ACARE notes in particular that this omits the challenges of European competitiveness and ACARE sees competitiveness as a third pillar.

One of the main challenges in Aeronautics and Air Transport is reduction of the environmental footprint of Air Transport. When taking into account that Air Traffic is expected to grow in the coming years, the enormity of reaching sustainable air transport becomes clear. The major issues of noise and emissions are being tackled mainly through the competitive research programmes in the Commission and Member States. In the minor areas where the public sector is setting the research agenda in aviation environment, e.g. where organisations are developing their own environmental models, both in Europe and even outside Europe, increased coordination might be one area where a Joint approach between Member States could bring benefits. ACARE suggests that this topic could be considered to build experience in Joint Programming.

ACARE would like to **recommend that Joint Programming can be only one of the processes of addressing the above second pillar**. In recognition of the rejection of the "one size fits all" method, European research should leave **ample room for other avenues than Joint Programming** to address grand challenges and in particular, amongst these, the challenge of competitiveness. In effect ACARE agrees with the Rietschel report saying that only "... a limited number of challenges of paramount societal concern should be strategically addressed via JP initiatives". This is also recognised in the Commission proposal on JP where the concept is to be applied “in a limited number of strategic areas”.

ACARE believes that there is an important pillar missing in the preparation of FP8. The current framework (FP7) is based upon an overarching objective given within the FP7 decision[5] it states, "...The Community has the objective, set out in the Treaty, of strengthening the scientific and technological bases of Community industry, thereby **ensuring a high level of competitiveness at international level**...". ACARE believes that competitiveness, which was the main justification behind FP7, cannot simply disappear from the explicit objectives of FP8. ACARE is in no way disputing the relevance of the two pillars Great Ideas and Grand Challenges, but believes that **Competitiveness deserves to be a pillar in its own rights in FP8.** ACARE believes that **neither Joint Programming nor JTIs alone would be sufficient to cover the long term research needs of the aeronautical and air transport sector. Under such a Competitiveness pillar should be traditional collaborative research, including small, medium and large size projects, as in the current “Cooperation” specific programme of FP7.** As imperfect as it may be, the Cooperation programme has demonstrated its capability to involve research organisations and supply chain SMEs from small member states.

[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:412:0001:0041:EN:PDF

The proposed Joint Programming concept calls upon the Commission to be involved essentially as a facilitator and not necessarily as a funding contributor. **ACARE stress the importance of the EU in providing a significant financial community contribution to addressing grand societal challenges and becoming involved in Joint Programming initiatives,** without setting the rules of a process which remains primarily a Member States responsibility**.** Setting up distinct parallel initiatives between Member States and the EU would in the future lead to extra coordination efforts between these two.

ACARE welcomes the consultation process led during the summer of 2009 on Joint Programming. This process should include all stakeholders involved in Research Programming. In Aeronautics and the Air Transport industry, research establishments and universities are involved in this planning and should be consulted. The experience of the current Air TN shows that Member States can delegate their ERA-Net role to public research organisations. In addition, in the aeronautical sector, research infrastructures are key to maintaining and enhancing the competitiveness of European industry and tackling the environmental challenges. Many of these research infrastructures have been created on a national basis and are often operated by national public research organisations, but over the years have acquired a European or even worldwide dimension. Therefore research infrastructures should be given due consideration in the Joint Programming process.

Finally, ACARE would like to stress that Joint Programming should be aligned with the welcomed **simplification** of European research and in particular, that the existing instruments and funding schemes should be maintained.

ACARE Views on Joint Programming (JP)

1. ACARE welcomes the JP concept, complementary to current instruments, which is potentially relevant to overcome R&T fragmentation or addressing major societal challenges through multinational public-public partnerships.
2. In the aeronautical and air transport sector, ACARE has enabled a coordinated RTD programming since 2001. ACARE includes all players (private, public, including Member States), and has developed a common vision, strategy and research agenda to meet societal needs and win global leadership.
3. Research in Aeronautics and Air transport is far less fragmented and compartmentalised than in other sectors. Further coordination of national programmes is less needed, except for research infrastructures.
4. The main part of R&D funding (~85%) for civil aeronautics is coming from the private sector. Therefore private stakeholders cannot be excluded from the programming, and the consultation process on JP, including governance aspects, should involve both public and private organisations.
5. For technical intensive sectors where competitiveness is a major driver for research, internal competition is required. As a coordination tool JP may be more appropriate for upstream research than for applied and competitive research. ACARE believes that a healthy balance and a continuum has to exist between competition and cooperation, i.e. between competitive research and JP. Therefore significant parts of national programmes should remain under national control.
6. JP may be a way to address grand societal challenges. However, existing instruments such as the Cooperation Programme of FP7, should be kept in future European research plans such as FP8, in addition to JPIs and JTIs.
7. As JP addresses major societal challenges, the Commission should be more than a facilitator, it should commit itself financially to the implementation of JPIs, without however setting the rules.
8. The JP concept has to be developed in terms of its governance, its relation with existing mechanisms (national and EU programmes) and instruments (ERANETs). JP should not have the effect of making the operational aspects of research more complex by creating new instruments/funding schemes.
9. ACARE stresses that the Aeronautics and Air transport sector (including the Member States) have a shared societal responsibility in reducing its impact on environment & climate change. This is mainly being met through the competitive programmes but this also includes for example research for the sole benefit of public bodies. In that respect, possible JPIs on these grand challenges may have their benefits and ACARE is ready to consider a contribution to such initiatives.
10. ACARE will keep analysing in the future whether Joint Programming can possibly bring added-value in complement to all already existing schemes, and in line with the needs and demands of its stakeholders. Any new activities and initiatives should be rooted on the two top level objectives of ACARE: serving society's needs and ensuring global leadership by Europe.

ACARE

Advisory Council for Aeronautics Research in Europe

Aeronautics and Air Transport Research

Success stories

and benefits beyond aviation

ACARE

Advisory Council for Aeronautics Research in Europe

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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.**

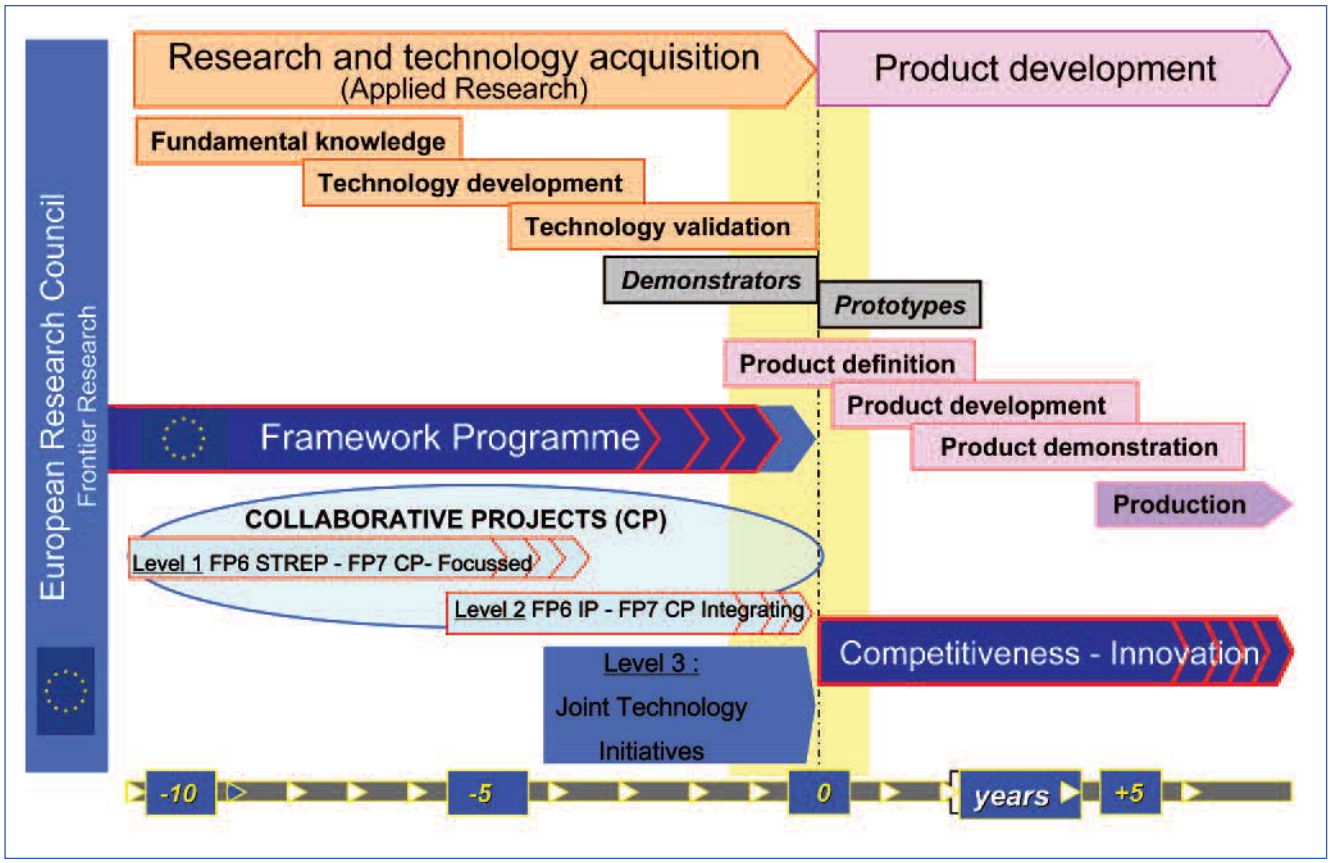
ACARE's primary mission has been to establish and carry forward a Strategic Research Agenda (SRA) aimed at influencing all relevant stakeholders in the planning of aeronautics research programmes, at National, EU and even private levels. The SRA is not a research programme, but rather a roadmap outlining 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.

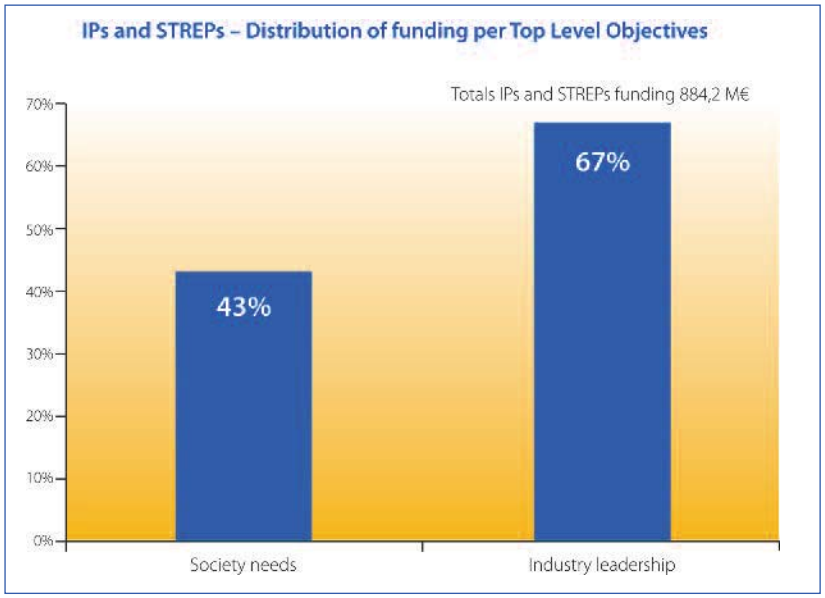
Complementing the SRA, ACARE has identified a number of policy-related aspects, which are key to a successful implementation of the SRA. They constitute the so-called *institutional enablers*:

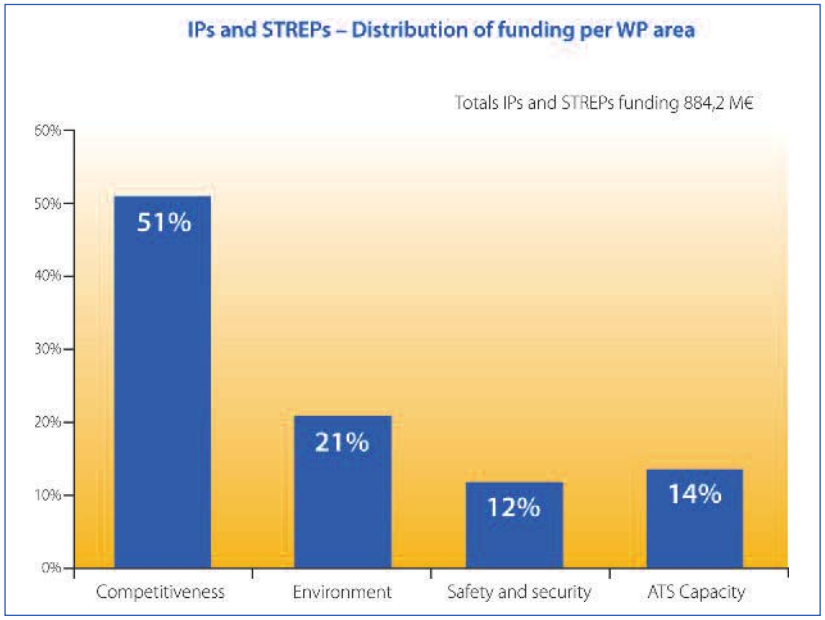
- Recognise Aeronautics and Air Transport System as a distinct European and National priority and enabler for growth;
- Identify and preserve Europe's research infrastructure requirements;
- Maintain R&T support mechanisms at both European and National level;
- Encourage sustained flow of competent, 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)

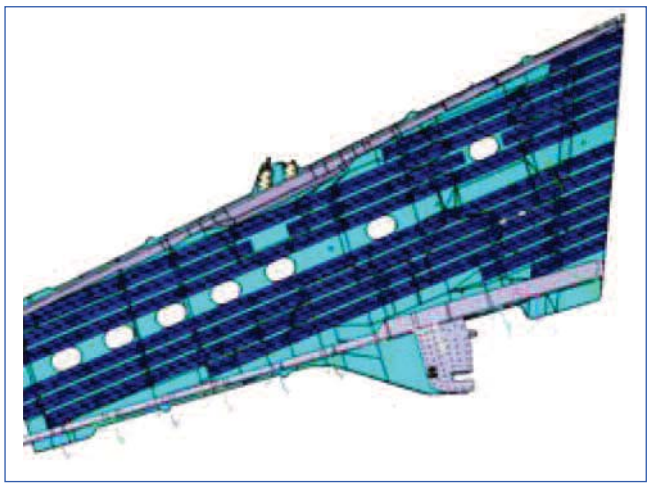
Improved connections between pilots, aircraft and ground systems (UPLINK)

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)

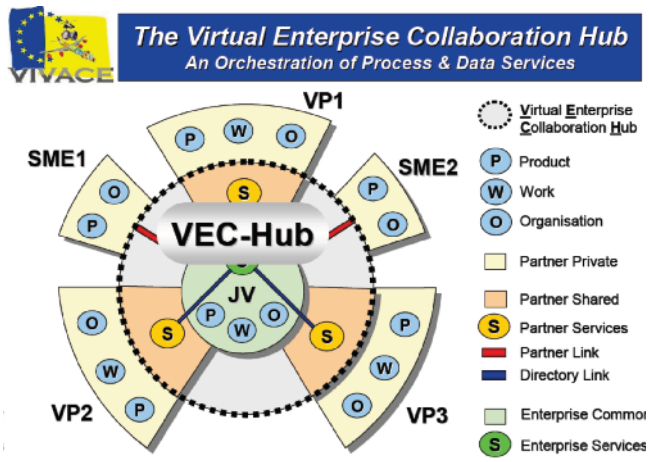
Led by BCT GmbH with seven partners and research budget of Euro 2.3 million.

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.

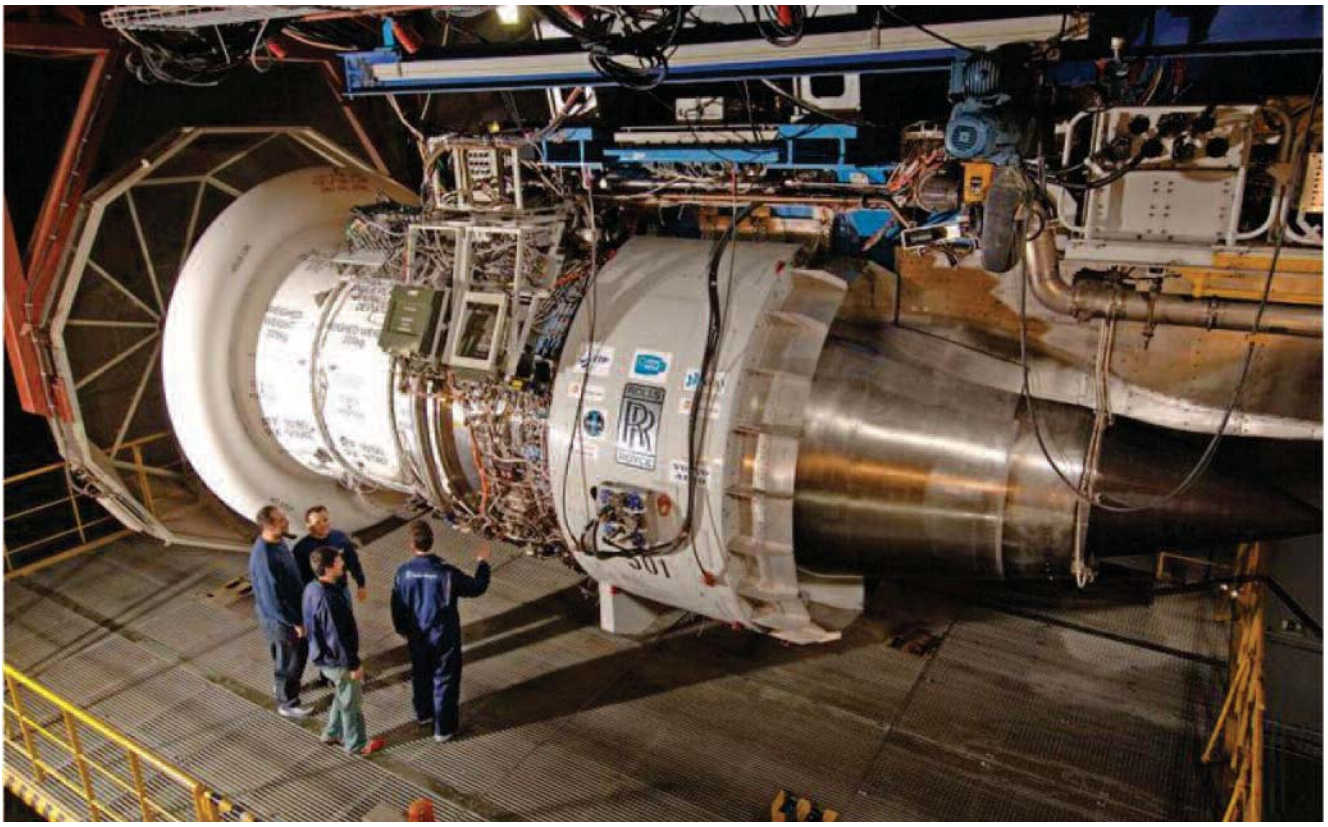
The aim of SILENCE(R) was the large-scale experimental validation of noise reduction solutions concerning the engine (aeroacoustic design, active technologies), the nacelle (aeroacoustic design, innovative acoustic treatment, active noise control), and airframe (aeroacoustic design).

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.

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.

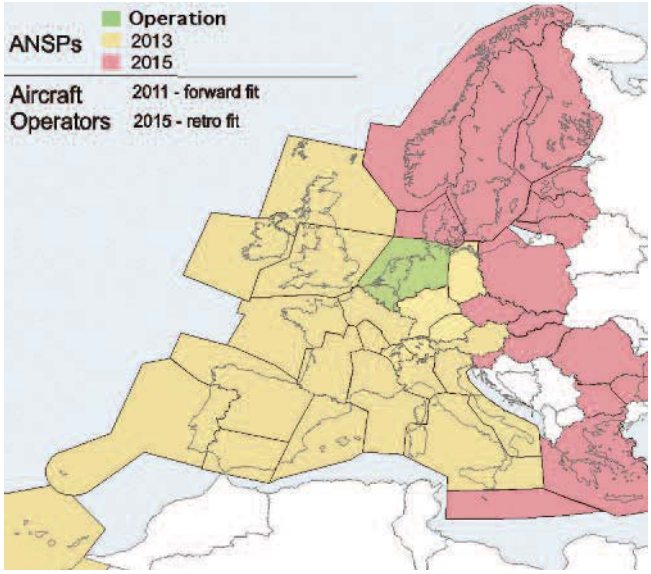
All project objectives were met and OPTIMAL demonstrated that the studied procedures provide in general the expected benefits in terms of capacity, safety and/or environmental impact and that the procedures are feasible. The OPTIMAL project delivered some validated, innovative concepts and promising 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.

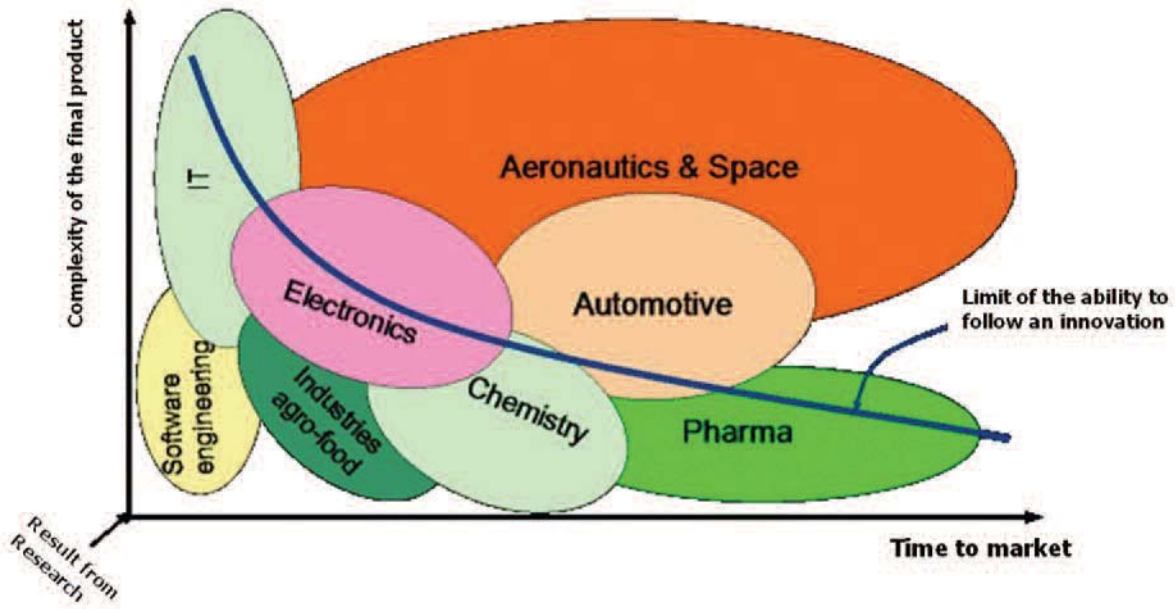
Note: Technologies which are not seen as high-tech, like Information technology, may also be considered in the scope of higher technological developments.

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:

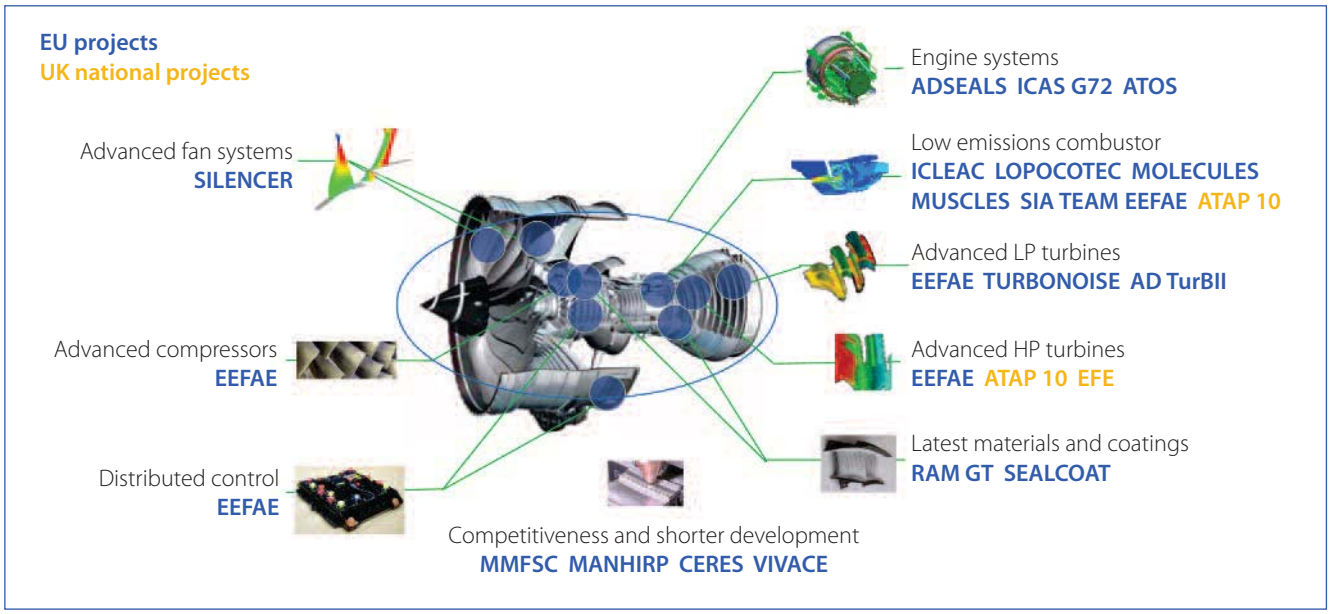
1 Initial technology concepts and development through the Level 1 programmes.

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

www.acare4europe.org

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Aeronautics-Air Transport and the EU Common Strategic Framework (CSF)

The European aeronautics and air transport industry leads the world in developing sustainable aviation products, meeting the needs of EU citizens and society. Technological leadership is the foundation of this success. Significant and sustained investment in technology is required to maintain this position. The next Common Strategic Framework is a vital element in the continuing research and innovation effort. Aeronautics is at the heart of EU policies, in particular the EUROPE 2020 strategy and its flagship initiatives: Innovation Union - An industrial policy for the globalisation era - Resource efficient Europe – An agenda for new skills and jobs. The EU can enable the delivery of this strategy through smart, sustainable and inclusive growth by supporting the aeronautics industry in the Common Strategic Framework.

EU & Aeronautics-Air Transport: Working together to deliver value to European citizens

Smart Growth

Aeronautics is dedicated to innovation.
Innovation drives the European aeronautics sector. Innovative, leading-edge technology is the major competitive differentiator when offering environmentally friendly and operationally efficient products to growing world markets under fierce and increasing competition from existing powers and new entrants. European aeronautics is currently facing ever-greater worldwide competition particularly from emerging nations (Brazil, Russia, China, India). The European industry cannot compete on price with these nations and therefore must innovate technologically. Continuous research, which drives step-changes in innovation, is the cornerstone of this industry and its prospects for growth in new and emerging markets.

Aeronautics is a growth sector and has prospects for a growing highly skilled workforce in Europe. Europe has almost 2,000 aeronautical companies and 80,000 subcontractors. The 466,000 highly-qualified direct employees turn over revenues of €100.4 bn (of which 60% for civil applications). The sector dedicates an average of 12% of its revenues to R&D. Aviation (encompassing all its components: manufacturing, airports, airlines, air navigation, maintenance) represents around 2.3% of European GD P (i.e. roughly € 275bn) and 3.4 million jobs.

Aeronautics benefits adjacent sectors in its capacity as a growth enhancing industry. Aeronautics technologies are catalysts for innovation and spill over into other sectors, thus stimulating the growth of the wider European economy. Aeronautics R&D not only develops technologies that are incorporated in products and systems in its own sector, but

often result in "spill-over" benefits for adjacent sectors. Aeronautics is often the proving ground for new technologies, particularly new materials, and for new processes, such as advanced manufacturing. A variety of studies show that the "spill-over" benefit of aerospace technology investment is larger than the manufacturing average. This enables supply chain companies in particular to diversify into multiple sectors. The main effect of "spill-over" is at the lower end of the supply chain, where technological advances and process improvements filter down and are available for use in the range of sectors beyond aeronautics, such as transport, power generation and broader engineering.

Sustainable Growth

Sustainable development and energy efficiency are of paramount importance in the aeronautics sector. The sector continues to concentrate its efforts through ACARE[1] to reduce the environmental impacts of air transport in terms of CO2, Noise and NOx emissions and increasingly green manufacturing. Over the past 40 years, commercial aircraft have become 70% more fuel-efficient through the application of innovative technologies. Though great progress has been achieved more is required to continue along this path in order to sustainably meet the growth of demand for air traffic. The industry will further develop the concept of ecoefficient flying in order to offer sustainable mobility.

Inclusive Growth

The economic, societal and technological weight of the aeronautics and aviation sectors is substantial in terms of economic growth, GDP, employment, export, and as a lead contributor to the trade balance. Aeronautics employs a highly skilled workforce in Europe. It is a key pillar of the air transport sector which is a catalyst for growth and employment across the EU. The air transport sector represents a vector for mobility and exchange, supporting cohesion between the regions of Europe. As a contributor to economic recovery, aviation is strategic for a vast majority of Member States and massively contributes to Europe's economic and political strength.

Green, Smart and Safe Mobility

Through the delivery of innovative products and systems incorporating state of the art technology with respect to the environment, air traffic management and safety, the aeronautics sector contributes concretely to the European policy for Green, Smart and Safe Mobility. The aviation industry interfaces with other forms of transport. In this context it has a unique role to play in contributing to a holistic comodal policy through its technology base and expertise.

[1] Advisory Council for Aeronautics Research in Europe.

DRAFT

The Common Strategic Framework (CSF) for Research, Technological Development and Innovation: an essential tool for Aeronautics and Air Transport

In order to fully realise the potential which the aeronautics and air transport sector is capable of delivering to Europe, the specific and unique nature of aeronautical innovation must be recognised.

Roadmaps for Research and Innovation

The specific characteristics of aeronautics are marked by the high complexity of its products, systems and systems of systems, all of which are technology and capital intensive, and subject to very long cycles (20 to 30 years). If the objectives established by ACARE's Strategic Research Agenda are to be achieved, research efforts must continue to be based on a programmatic approach that necessitates continuity across R&T efforts over several years. This will also necessitate the continued availability of excellent research infrastructures. Aeronautics research is not attractive to financial markets because of the scale of risk associated with large investments, which have long timescales for returns on investment. This is why public sector support - which is common to all aeronautics powers worldwide - is essential both at European and national levels. Backed by this public support, the aeronautics and air transport sector is in a position to co-fund those research and innovation activities required to deliver benefits to the European citizens and maintain European leadership. To achieve these overall objectives, the sector's research and innovation needs are outlined in the ACARE Council's 20-year roadmap which is acknowledged by all as the reference document for aeronautical research in Europe. The ACARE Council will now take the new "Vision 2050"[2] as a baseline. **This updated roadmap will be the common European reference shared by the Member States and all air transport stakeholders** for aeronautical research and innovation within the CSF.

Maximising the impact of the CSF

In order to maximise its impact, the CSF must be articulated with a view to meeting the specificities inherent to each mode of transport. For aeronautics the development of innovative technologies relates to several aircraft categories and new air systems including Unmanned Aerial Systems. The improvement of their environmental, energy and economic performance levels is at stake. The full research and innovation cycle must encompass all stages, from the incubation of upstream and pioneering activities to the demonstration and in-flight validation of current and new technology areas and breakthrough technologies. The CSF must aim at technological excellence, which

[2] This Vision has been drawn up by the Group of Personalities Implemented subsequent to an agreement between Commissioners M. Geoghegan-Quinn and S. Kallas.

enables innovation, leading to the worldwide leadership and competitiveness of Europe and its industry. At the same time it is essential to pursue the necessary societal and environmental objectives. To achieve this, **Europe must develop an industrial policy for aeronautics.**

To ensure resources are used efficiently, flexibly, continuously and in a targeted manner, it is recommended that 7th Framework Programme instruments continue to be used, and further improved and simplified. **Recently implemented, they contribute to stability and facilitate the involvement of all research stakeholders**. They have proven to be fit-for-purpose in upstream pioneering research projects, targeted research projects (level 1), technological integration projects (level 2), as well as Public Private Partnerships, Joint Technology Initiatives (level 3, Clean Sky, SESAR).

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Recommendations

It is in Europe's interest to pursue, within the Common Strategic Framework, a technological innovation dynamic for aeronautics in order for air transport to deliver green, smart, safe and secure mobility. In order to rise to the numerous challenges of the next 10 to 20 years in a context of emerging and often highly subsidised competition, the following recommendations are of paramount importance:

- **Preserve the structuring role and leverage power of the Framework Programmes in order to prepare the future of the high-technology, long cycle European aeronautics sector.**

- **Support the Aeronautics thematic within the future CSF, with a dedicated funded aeronautics programme enabling Europe's extended long-term objectives for 2050 to be met.**

- **Ensure the stability of instruments recently deployed in the 7th Framework Programme and which have proven their value, such as upstream pioneering research (level 1), technological integration projects (level 2) as well as PPP and JTIs (level 3), whilst improving their efficiency by further simplifying their implementation.**

- **For European air transport, develop a standardisation and interoperability strategy which will anticipate aeronautical innovation and strengthen Europe's competitiveness (e.g. Single Sky, SESAR).**

- **In the wider context of European Union policies and strategies (Lisbon, Europe 2020), place aviation at the heart of EU priority actions such as EU industrial policy, EU research and innovation policy ahead of the CSF, and policies relative to the environment and sustainable development.**

By implementing the recommendations above, the EU can fulfil its ambitions and aspirations and make full use of the innovative potential offered by the aeronautics and air transport sector through a durable and stable CSF. This sector offers a great return on Research and Innovation investment and great potential in answering EU citizen's needs with respect to education, jobs creation and reduction of the environmental impact of air transport.

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ACARE Implementation Group DRAFT Report – July 2011

The Implementation Group retains an overview of implementation of the ACARE Strategic Research Agenda (SRA) and reports to the ACARE Integration Team. Members of the group come from the ACARE stakeholders and meet on an appropriate basis – usually every 2 or 3 months. Secretarial support has been provided through EUROCONTROL.

The activity routinely involves a comprehensive overview of the European Framework programmes, including European Framework Collaborative Research, the Joint Undertakings (SESAR and Clean Sky). These report routinely, coverage and relevance to the SRA goals areas are discussed.
For example, the issue of Long Term research in Air Traffic has been discussed in the recent past. A sub-group was formed and recommendations formed for the Framework Collaborative programme and SESAR and national programmes. In addition a view and paper was formed on research for safety and certification. The papers were drafted in the IG and passed up through the IT to the Plenary.
Looking ahead, issues which could arise are the final call in the aeronautics programme in Framework 7 as well as the planned content of releases in SESAR or progress in Clean Sky.

The Group also reviews the full range of mechanisms and procedures for implementation of the SRA, including institutional enablers, structure of future European Frameworks, European Technology Platforms, technology watch tools, infrastructure, HR and mobility initiatives. This has encompassed collaboration (inside & outside Europe) and coordination in research including ERA-NET, potential joint programming, etc.
In the recent past there has been discussion leading to an ACARE view formed on Level 0 mechanism and on Joint Programming. Looking ahead, there will be opportunity to review and comment on the mechanisms proposed for Horizon 2020 and for any follow on JTI/PPP to Clean Sky and SESAR.

The third major theme of the Group has been to advise on the way ahead for the future. This has included getting a firm baseline from monitor success of SRA implementation to date.
The Group closely monitored and advised on the AGAPE work and has kept an overview of other studies of a general nature (e.g. CREATE, MEFISTO, etc). In the future there are a number of projects which have relevance to the Group and which will continue to be monitored. These include NEARS, OPTI, Aera-Pro, Cooperatus, Cannape, Sat RDMP, Retrofit, Cargomap, Educair and Sunjet.

A particular aspect of the immediate work to be continued in the Monitoring Group is to advise and input to the Working Groups on how the new Strategic Research and Innovation Agenda (SRIA) can be structured to facilitate monitoring in the future.

In the short term, while the new SRIA is being produced, the Group, which will be renamed to the Monitoring Group, will continue to monitor the existing SRA and will discuss how to modify its activities to reflect the new SRIA when it is produced. A particular feature will be to broaden the agenda to reflect the wider aviation agenda compared with the Air Transport System coverage at present (e.g. including airlines,

airports, energy, etc). A recent initiative to be followed up is attracting participation and views from ‘Eastern’ countries.

List of IG members:

Rolf Ahlers	ASG
Marcello Amato	CIRA
Torsten Bardewyck	Airbus
Béatrice Bettignies-Thiébaux	EUROCONTROL
Roberto Bojeri	Selex Galileo
Marco Brusati	European Commission
Gianfranco Chiocchia	Politecnico di Torino
Chrystelle Damar	ACI Europe
Giuliano d'Auria	SELEX
Eric Dautriat	CleanSky
Ad de Graaff	AD Cuenta
Guido De Matteis	Università di Roma
Rémy Denos	European Commission
Patrick de Prevaux	ASD
Patrice Desvallees	DGAC (French Civil Aviation)
Julio Dolado	CDTI
Pablo Garcia Tello	ASD
Regis Gautier	Thales
Myriam Goldsztejn	Dassault Aviation
Roland Guraly	Slot Consulting
Tony Henley	BAE Systems
Peter Hotham	SESAR JU
Sepp Huber	Eurocopter Group / ECD
Aurélie Jablonski	Clora
Ray Kingcombe	BIS (Department for Business Innovation & Skills)
M. Kivelmazuy	CIRA
Gerben Klein Lebbink	NIVR
Werner Kleine-Beek	EASA
Dietrich Knoerzer	European Commission
Prof. Kostopoulos	University of Patras
Volker Krajenski	DLR
Robert Lundberg	Volvo
Jean-Luc Marchand	SESAR JU
Plácido Márquez Sánchez	ITP
Bruno Mazzetti	Finmeccanica
Christiane Michaut	Onera
Uwe Moeller	DLR
Patrick Monclar	Safran
Romain Muller	ASD
Vladimir Olteanu	ACI Europe
Chris Ovenden	General Electric

Giuseppe Pagnano	CleanSky
Spiros Pantelakis	University of Patras
Nick Peacock	Rolls-Royce
David Perez	Innaxis
Hans-Wilhelm Pohl	Airbus
Stefano Porfiri	SELE□ Sistemi Integrati
Gill Richards	DTI
Prof. Jacek Rokicki	Polish Representative
Javier Romero	CDTI
Luis Sagredo	Pegasus Europe
Torbjorn Salomonson	Volvo
Doris Schroecker	European Commission
Solly Side	Thales
Michael Standar	SESAR JU
Pauli Stigell	Tekes (Finnish Funding Agency for Technology and Innovation)
Mathias Stranzenbach	BMWI (Federal Ministry of Technology & Economics Germany)
Dave □oung	EUROCONTROL

Acronym	Lead	Topic	POC	status □□/□□
NEARS	DLR	Support to the SRIA process of ACARE new	Martin Spieck	Started □.□.□□
Aera-Pro	ASD	Dissemination of SRIA	Pablo Garcia-Tello	Starting Jan □□□□
OPTI	ASD	Monitoring of progress towards Vision □□□□ goals	Pablo Garcia-Tello	Running
Cooperateus		EU-US cooperation	Alain Garcia	Running
Cannape		EU-CAN cooperation	Gill Richards	Running
SAT RDMP□	Ilot	Small Air Transport Roadmap		Running
Retrofit□	Fokker Services	Research need for retrofitting of existing aircraft with new tech.		Running

EDUCAIR	Institute Superior Tecnico Portugal	Educational and Training Needs for Air Transport and Aeronautics		Under Negotiation
SunJet		Collaboration with Japan	Pablo Garcia-Tello	Running

ACARE Communications Group Report – September 2011

The Communications Group reports to the Integration Team and is responsible for developing□publishing and disseminating communication material to support the work of ACARE. Members of the group come from the ACARE stakeholders and meet typically every six to eight weeks and although some secretarial support is provided by ASD each member organisation supports its own costs. Costs for recent publications have been supported by the European Commission□Eurocontrol and Rolls-Royce plc.

Since the formation of ACARE□following the launch of Vision □□□□ by the EC in □□□□□ the Communications Group has actively supported the dissemination of a spectrum of strategic publications including□

- Strategic Research Agenda (SRA □ □ □□□□)
- Support National dissemination events
- Strategic Research Agenda (SRA □ □ □□□□)
- Addendum to SRA □ (□□□□)
- Beyond vision □□□□ - towards □□□□) (□□□□)
- ACARE Success Stories (□□□□)
- Flightpath □□□□ (European Commission □□□□)

□Historical ACARE documents including the above can be found on www.acare4europe.org□

The Communications Group has also led□organised and/or participated in various events associated with the work of ACARE. Notable events have included extensive engagement of the Air Transport sector in the European Commission□s □Aerodays□.

The Communications Group has a remit to work with all stakeholders to promote the work of ACARE and over the recent years a strong relationship has been established with SESAR and CleanSky in this regard.

In the short term the priority for the Communications Group is to support the transition of the ACARE organisation to the new structure which will require a review of the all the PR materials and mechanisms. A particular aspect will be to review and update the generic ACARE PR material including the □Frequently Asked □uestions□and the core presentation slides for use by stakeholder to brief new stakeholders that have now become members of ACARE through the launch of □Flightpath □□□□.

Immediately following this□the Group will support the development□publication and dissemination of the new Strategic Research and Innovation Agenda (SRIA) that will inform the preparation of □Horizon □□□□□as part of the European Commission□s Research Framework Programme □.

The Communications Group will continue to support relevant events□conferences and seminars to promote the work of ACARE. Notable events over the next year will include the air shows at Farnborough and Berlin in July and October □□□□ respectively.

ACARE Member States Group

Participants

In the ACARE Member States Group (MSG) representatives of all 27 EU-Member States meet. Furthermore Members of the Programme Committee for Transport can attend the meeting. The meetings are organized on a regular basis, normally back to back with a meeting of the Transport Programme Committee. The focus of the ACARE MSG is to foster the involvement of Member States in the formation and execution of the European Aviation Research and Innovation Strategy.

Activities

The main activities of the ACARE MSG are

- Discussions and (written) contributions to the ACARE activities and actions such as the development of strategic documents, monitoring of progress towards the common agreed objectives of ACARE and drafting of inputs to ACARE endorsed studies
- Exchange of views on the roles and content of public funded programmes (such as framework programmes) for the realisation of the ACARE goals
- Drafting of positions on new ideas and initiatives of the European Commission
- Support the networking between the different States in the area of Aeronautics and Air Transport and exchange of national capabilities and strategic considerations, through surveys, workshops and whatever means deemed necessary.

Terms of Reference

The ACARE Member States Group (MSG) operates according to its Terms of Reference (version April 2009).

Results

In the past several workshops have been organised were the group members presented their national Aeronautical sector, their Research capabilities or national strategies. Other deliverables of the group include a written overview of capabilities and national players and a survey of national views on the next framework programme.

A third group of results include position papers such as a view on Joint Programming (in close cooperation with the Implementation Group), a contribution to the CSF consultation and a paper on the future organisation of ACARE 2.0.

Issues / Recommendations

For the transition to ACARE 2.0 there are a few issues

1. Broader involvement of Member State Representatives.
   The new ACARE has widened it scope. Air Transport, Intermodality, Energy and Education will get increased attention. This may need involvement of a wider scope of Ministries and their representatives.

2. The current Terms of Reference have been drafted in line with the ambitions of ACARE related to Vision 2020. The new 'Flightpath 2050' approach may require an update of these terms of reference

3. The Member States Group provides an excellent platform for European wide involvement of all stakeholders in the new ACARE process. At the moment this potential is underexploited. A recommendation is to invite the Member States Representatives to suggest participants from their national sector for involvement in the SRIA process.

ACARE WG5
Summary report

In 2005, an ACARE working group was set-up with the aim to define a coherent, harmonised and strategic approach to improve the optimal use, major upgrade and development of aeronautical research infrastructures in the European Union.

The Working Group 5 on Research Infrastructures met 5 times between November 2005 and December 2006.

The Working Group was chaired by D. Maugars (Onera) and the Rapporteur was H. Consigny (Onera)

The following persons participated at least at one of the meetings :

- DLR : V. Harbers, K. Klein
- NLR : J. Hoekstra, R. Ruigrok
- DNW : G. Eitelberg
- EWA : M. Bazin, B. Timmins
- CIRA : L. Vecchione, F. Fusco, B. Imperator
- INTA : A. Cragnolini
- VZLU : J. Kaspar
- Eurocontrol : R. Jerram
- Airbus : D. ollinger
- SAFRAN : R. Carrillo
- EC/Aeronautics : J.P. Lentz
- EC/Infrastructures : D. Pasini

A typology of the European aeronautical facilities, based on the investment costs, has been defined:

- **Strategic** facilities (investments higher than 100M€)
- **Key** facilities (investments higher than 10 M€)
- **Common** facilities(investments smaller than 10 M€)

<u>The main conclusions from the WG5 were:</u>

1. Capabilities for experimental and numerical simulations are <u>key enablers</u> for the development of aeronautics;
2. Aeronautics RIs address both <u>scientific and industrial research</u> in a complementary way;
3. Aeronautics facilities represent an <u>asset</u> that has to be preserved;
4. Aeronautics facilities <u>benefit other sectors</u>.

<u>The recommendations from the WG5 were:</u>

- ✓ To make a unique inventory of all relevant research facilities covering wind tunnels, simulators, large scale computing facilities etc. in the various EU countries;
- ✓ To analyse the corresponding investment policies, priorities and mechanisms at national and/or regional levels;
- ✓ To identify needs for new research infrastructures in Europe and to give priorities;

- ✓ To make the results accessible to European Commission and the ACARE stakeholders to avoid duplication;
- ✓ To provide inputs to ESFRI.

Following these recommendations, this activity has been proposed in the context of the ERANet AirTN-FP7 project and is currently under investigation.

Publication (available on ACARE web site):
"European aeronautical research infrastructures" leaflet.

ACARE Human Resources Group
Summary report

In 2004, ACARE set-up a working group with the aim to review the situation in Europe concerning human resources in aeronautics. Based on this, AHRG was requested to provide input and propose actions which would help to ensure the future workforce for the European aerospace industry, as well as to identify needs for actions and inputs for the envisaged new vision for aeronautics.
Based on the recommendations of ACARE (WT5 report), the ACARE study on "Education" and the ASTERA-II studies on "human resources and mobility" and "accreditation", the AHRG Terms of Reference were defined.

The Terms of Reference (ToRs) took into account the following:
- Education at schools
- University Education
- University Degrees (Accreditation System)
- Industrial issues including research staff, demand and supply, lifelong learning

Defined ToRs

1. Ensuring the Future workforce for European Aerospace
2. Improve the image of a career in the air transport sector
3. Education training and mobility through the EU
4. Education toward polytechnic schools
5. Quality of education through accreditation and student qualification
6. Improve life-long learning mechanisms
7. Research workforce – working conditions and mobility
8. Stimulate long-term research in Europe
9. Implement mechanisms to stimulate incubation of new knowledge breakthrough technologies and innovation
10. Personal development

The Group has been chaired by Prof. Sp. Pantelakis (University of Patras) and the first Rapporteur was Mr. Alf Junior (DLR). After his withdrawal no Rapporteur has been available.

The Group initially consisted of the following members:

Chiocchia Gianfranco	PEGASUS/University of Torino/Italy
Cragnolini Alider	EREA/Spain
Goraj Zdobyslaw	EASN/University of Warsaw/Poland
Horst Peter	Technical University Braunschweig
Junior Alf	DLR/Germany
Knoerzer Dietrich	European Commission
Pantelakis Spiros	EASN/University of Patras/Greece
Pusch Christian	Eurocontrol/France
Reich Norbert	ASD/Brussels
Sagredo Jose	University of Madrid
Stankunas Jonas	Gediminas Technical University/Lithuania

During the operation of the Group, two hurdles were encountered:

1. limited industrial participation
2. several academia representatives had difficulties to attend the meetings due to lack of funds

To overcome this, an effort was made to restructure the Group. The last Group meeting took place in Madrid during the Aerodays conference in March 2011.

The following colleagues participated, at least once, to an AHRG meeting

Knoerzer Dietrich	European Commission
Pantelakis Spiros	EASN
Papadopoulos Michael	EASN
Prats Maria Angeles Martin	PEGASUS
Revel Pascal	PEGASUS
Sauer Joachim	Airbus
Szodruch Joachim	ACARE
Tang Stanley	DLR
Youssefzadeh Maria	ZHAW

Further Colleagues who expressed their willingness to contribute to AHRG activities but did not manage to attend meetings are:

Franco Bernelli	PEGASUS
Jürg Wildi	RUAG
Remy Denos	European Commission
Rolf Henke	DLR
Simon Weeks	Rolls-Royce
Yves Favennec	Eurocopter

The activities of the AHRG included:

1. **Facing the 1st and 2nd ToRs,**

namely

- *Ensuring the Future workforce for European Aerospace* and
- *Improve the image of a career in the air transport sector)*

The main recommendations given concerning ToRs 1 & 2 were:

- Need to classify and compare syllabuses and best practices in University curricula in Europe
- Need to develop mechanisms to account for future requirements on the demand side (industry, research establishments and airlines) in aeronautics engineering curricula
- Need to suggest measures to implement new knowledge resulting from aeronautics innovative research into university curricula
- Need to perform steps towards a voluntary common accreditation system and to develop a common European strategy for constantly updating University curricula in

order to be in harmony with the state of the art and the current needs of the society

2. Participation in studies

- Participation in ACARE education study (2004) *"What changes are needed in European Aerospace Engineering Education to assure the Quality of the Future Engineering Workforce?"*
  (**final report and more** http://www.easn.net/news/15/98/)

- Participation in ASTERA II study on accreditation (2006) "*Developing a voluntary European accreditation system for higher education in aerospace engineering* (**final report and more** http://www.easn.net/news/15/4/

3. Organization of workshops

- February 25th 2009, Brussels: Workshop on Education and Training of Engineers and Researchers in Aeronautics for Europe

4. Several meetings of the Group

-2006 (Brussels, Athens), 2007 (Madrid, Athens, Brussels), 2009 (Brussels), 2010 (Brussels), 2011(Madrid)

5. Other activities

- Motivation and endorsement of a CSA proposal facing the 2nd ToR entitled "My Own Green Flying Machine Contest" was submitted in the frame of the 2nd FP7 call but was not successful. (Coordinator ASD)

- Motivation and endorsement of a CSA proposal facing the 1st ToR entitled "Harmonizing the European supply and demand of huMAN resources in aeronautics" (HE-MAN). The proposal was submitted in the frame of the 4th FP7 call in the area "Assessing the educational needs of engineers and researchers in aeronautics and air transport" (Coordinator EASN, scored 12,5 but was not funded!)

ICAS

The International Council of the Aeronautical Sciences

Presents the

ICAS Von Karman Award

to

ACARE

(Advisory Council for Aeronautics Research in Europe)

in recognition of creating a common and shared European view, combining public and private interests, into a strategic research agenda for European aeronautics R&T

In recognition of this Award
Francois Quentin and Joachim Szodruch
ACARE Co-chairmen
presented the
ICAS von Karman Lecture
at the 27th ICAS Congress in Nice, France, September 2010

Ian Poll
President, ICAS