PROJECT

ELECT-AE
European Low Emission Combustion Technology in Aero Engines

Funding: European (6th RTD Framework Programme)
Duration: Jan 2005 - Dec 2008
Status: Complete with results
Total project cost: €1,492,003
EU contribution: €1,492,003

Call for proposal: FP6-2003-AERO-1
CORDIS RCN : 78485

Background & policy context:
The Vision 2020 as formulated by Advisory Council for Aeronautics Research in Europe, (ACARE) sets ambitious targets; especially the demand for 80% NOx and 50% CO2 emissions reduction from aviation with for the year 2000, requires focused and balanced research and technology initiatives for the near future. Aero-engines are committed to contribute 15 to 20 %-points to the CO2 emission target, other contributors being the air-framers (20-25%), operations and air traffic management (5-10%).

European companies are joining their research capabilities to promote the development of viable low emission combustion systems on a pre-competitive level. The timescale for the development of aero-engine combustors is long but there is a clear vision and forecast of environmental needs.

Objectives:
The ambitious ACARE targets, and especially the demand for 80% reduction of NOx emissions from aviation, require very well-focused and balanced RTD initiatives for the near future, to prepare the technology for a successful implementation of a new generation of aero-engine combustors and, therefore, a highly integrated research strategy platform. The EC funded Coordination Action ELECT-AE aimed to provide the impetus to bring together the key engine manufacturers and research establishments to enable this. The development of a concerted research strategy involves many complex interactions, and the continuous improvement of the corresponding processes and perspectives will ultimately provide good coordination.

Methodology:
The Coordination Action 'European Low Emission Combustion Technology in Aero-Engines' was dedicated to the support of the implementation of the goals of Vision 2020, i.e. strengthening the competitiveness of the European jet engine manufacturers and minimising the environmental impact of civil aviation with regard to emissions, thus generating economical and ecological benefits for European society.

The actions undertaken under the project and designed to support the establishment of a pre-competitive research strategy in respect to actual measures as well as the actions in the context of combustion technology for low emission of pollutants were as follows:

- Strategy on How-To-Do technology development
- Integration and strengthening of the European Research Area
- Enhancement of technology exploitation in Europe
- Dissemination of European research results and exchange of information
- Search and identification of appropriate SMEs and capable research partners in the EU and from new Member States.
Parent Programmes:
FP6-AERO-1.2 - Improving environmental impact with regard to emissions and noise

Institute type: Public institution
Institute name: European Commission
Funding type: Public (EU)

Lead Organisation:

Rolls-Royce Deutschland Ltd & Co Kg
Address:
Eschenweg 11
15827 BLANKENFELDE-MAHLOW
Germany

Organisation Website:
http://www.rolls-royce.com/deutschland
EU Contribution: €0

Partner Organisations:

Alstom Power Ltd
Address:
Newbold Road
Rugby
CV21 2NH
United Kingdom

Organisation Website:
http://www.techcentreuk.power.alstom.com
EU Contribution: €0

Rolls Royce Plc
Address:
65 Buckingham gate
LONDON
SW1E 6AT
United Kingdom

Organisation Website:
http://www.rolls-royce.com
EU Contribution: €0

Turbomeca
Address:
n/a
BORDES
France

Organisation Website:
http://www.turbomeca.com
EU Contribution: €0

Deutsches Zentrum Fr Luft Und Raumfahrt E.v
Address: Linder Hhe 12489 KLN Germany
Organisation Website: http://www.dlr.de
EU Contribution: €0

Office National D' Etudes Et De Recherches Aérospatiales
Address: 29, avenue de la Division Leclerc BP72 CHÂTILLON CEDEX France
Organisation Website: http://www.onera.fr
EU Contribution: €0

Mtu Aero Engines
Address: Dachauer Strasse 665 80995 MUENCHEN Germany
Organisation Website: http://www.mtu.de
EU Contribution: €0

Snecma
Address: 2 Bd du Général Martial-Valin PARIS France
Organisation Website: http://www.snecma-moteurs.com
EU Contribution: €0

Avio S.p.a.
Address: Via 1 Maggio 99 00187 RIVALTA DI TORINO Italy
Organisation Website: http://www.aviogroup.it
EU Contribution: €0

Key Results:

European companies are pooling their resources to develop commercially viable low emissions combustion systems and ELECT-AE provided the impetus to bring together the key engine manufacturers and research establishments to enable this. The European key aero-engine manufacturers in ELECT-AE developed a strategy for the environmentally friendly combustion system. The development of this joint research strategy involved complex interactions. However, it is believed
that advanced low NOx technology is required and will be successful in the end. The vision for 2020 as formulated by ACARE sets ambitious targets; especially the demand for 80% NOx and 50% CO2 emissions reduction from aviation with reference to the year 2000, requires focused and balanced research and technology initiatives for the near future. The aero-engines are committed to contribute 15 to 20% points to the CO2 emission target, other contributors being the airframers (20-25%), operations and air traffic management (5-10%). The technology for a new generation of aero-engine combustors has to be prepared on a precompetitive level of close cooperation and thus generating economic and ecological benefits for the European and the global society. Targets have been developed, designed to support the establishment of a pre-competitive research strategy consisting of actual measures and actions in the context of combustion system technology for low emissions of pollutants.

The conclusion was that the optimisation of the combustion process is an essential means to reducing NOx production from aero-engines. It has to be noted that advanced low NOx combustion technology contributes to fuel burn reduction by enabling cycles with higher pressures and bypass ratios, with higher turbine entry temperatures and by reducing cooling air and combustor pressure losses. Research on highly innovative architectures has to be carried out to reduce complexity, size and weight of ultra-low NOx combustion systems. Due to the extremely complex nature of this technological field and the fact that the development of ultra-low NOx technology has by far not yet reached production readiness level, it will not be possible to down-select the successful combustion technology in the near future.

**Technical Implications**

ELECT-AE supported the implementation of the ACARE objectives (80% NOx reduction). Aero-engine manufacturers, research establishments and leading universities in the field in Europe were brought together. The following important fields have been identified for further initiatives:

- Combustion Technology
- CFD Methods, Design Methodology and Life Prediction
- Diagnostics & Test Rigs
- Alternative Hydro-Carbon Fuels

Lean-burn technology is essential to achieve the low NOx targets and has to be driven towards higher technology readiness. The development of lean combustion systems, featuring lean injection systems and single-annular combustor architecture has to be intensified and efforts have to be increased.

Documents:

[Final Publishable Report (Final report)](#)

**STRIA Roadmaps:** Vehicle design and manufacturing, Network and traffic management systems

**Transport mode:** Air transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Decarbonisation, Societal/Economic issues, Deployment planning/Financing/Market roll-out, Environmental/Emissions aspects

**Geo-spatial type:** Infrastructure Node