Co-ordinated Action

A E R O N E T

Aircraft Emissions and Reduction Technologies

http://www.aero-net.org

Currently funded by the European Community DG Research, Aeronautics
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AERONET III

Version: 26 Apr 2004

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History of Development of the Network

- **AERONET** **Aug 1997 - Dec 2000** *(Budget 0.9 Million €)*

  Thematic Network on Identification of Aircraft Emissions Relevant for Reduction Technologies

- **AERONET II** **Jan 2001 - Dec 2003** *(Budget 1.4 Million €)*

  Thematic Network on Aircraft Emissions and Reduction Technologies

- **AERONET III** **April 2004 – March 2008** *(Budget 1.8 Million €)*

  Coordination Action on Aircraft Emissions and Reduction Technologies

Objectives / Goals

- Initiate communication
  in the aeronautical community and with atmospheric scientists;
- facilitate exchange of information and experience;
- foster and support co-operation and joint actions
  on the basis of personal and corporate knowledge and confidence;
- identify gaps of knowledge and needs for research and development;
- support policy in the regulatory process and R&D programme;
- increase visibility and awareness in the general public;

Partners & Communities involved

Aeronautical Research Centres

DLR
QinetiQ
NLR
FOI
ONERA
GFRI
IoA

Universities / Research Institutes

BUGH Wuppertal University (Physical Chemistry)
University Karlsruhe (Thermal Turbomachinery)
FZK-IMK Institute (Atmospheric Chemistry)
ARIC - Manchester University (Atmosph.Res.+Inf.Ctr.)
NTUA – National Technical Univ. Athens
USFD – University of Sheffied

Aero-Engine Industry

RRD
SNECMA Moteurs
MTU
RR plc

Aircraft Industry

Airbus (UK)

Fuel Industry

Shell Aviation
Air BP

ATM R&D centres / SMEs

EUROCONTROL
AUXITROL

Airports

Unique-Zurich Airport

Airlines

Lufthansa

Additionally in the Steering Group

DG Research, Aeronautics

DG Research, Environment & Climate

DG Transport

Regulatory Bodies

Swiss FOCA
Joint Aviation Authorities (JAA)
European Civil Aviation Conference (ECAC-ANCAT)
European Ozone Research Co-ordination Unit (EORCU)

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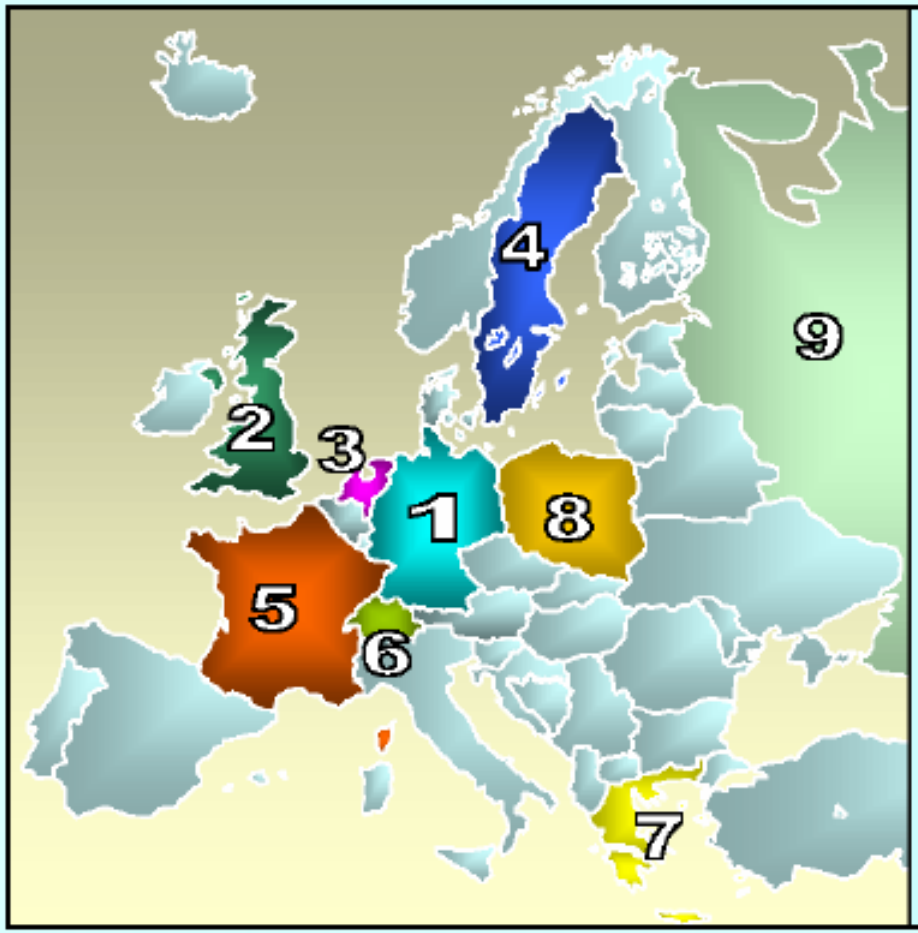
25 Partners from 9 Countries



1	DE	Germany DLR, BUW, DLH, UNIKARL, FZK/IMK-IFU, RRD, MTU
2	UK	United Kingdom MMU-ARIC, USFD, Air BP, Airbus, QinetiQ, RR, SAV
3	NL	The Netherlands NLR
4	SE	Sweden FOI
5	FR	France ONERA, AUXITROL, EUROCONTROL, SNECMA
6	CH	Switzerland UNIQUE, FOCA
7	GR	Greece NTUA
8	PL	Poland IOA
9	RU	Russia GFRI

26 Partners from 9 Countries

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Work Packages

Co-ordination & Management

and

Policy Matters

DLR

Aircraft and Engine Technology Aspects of Emissions Reduction

USFD / DLR

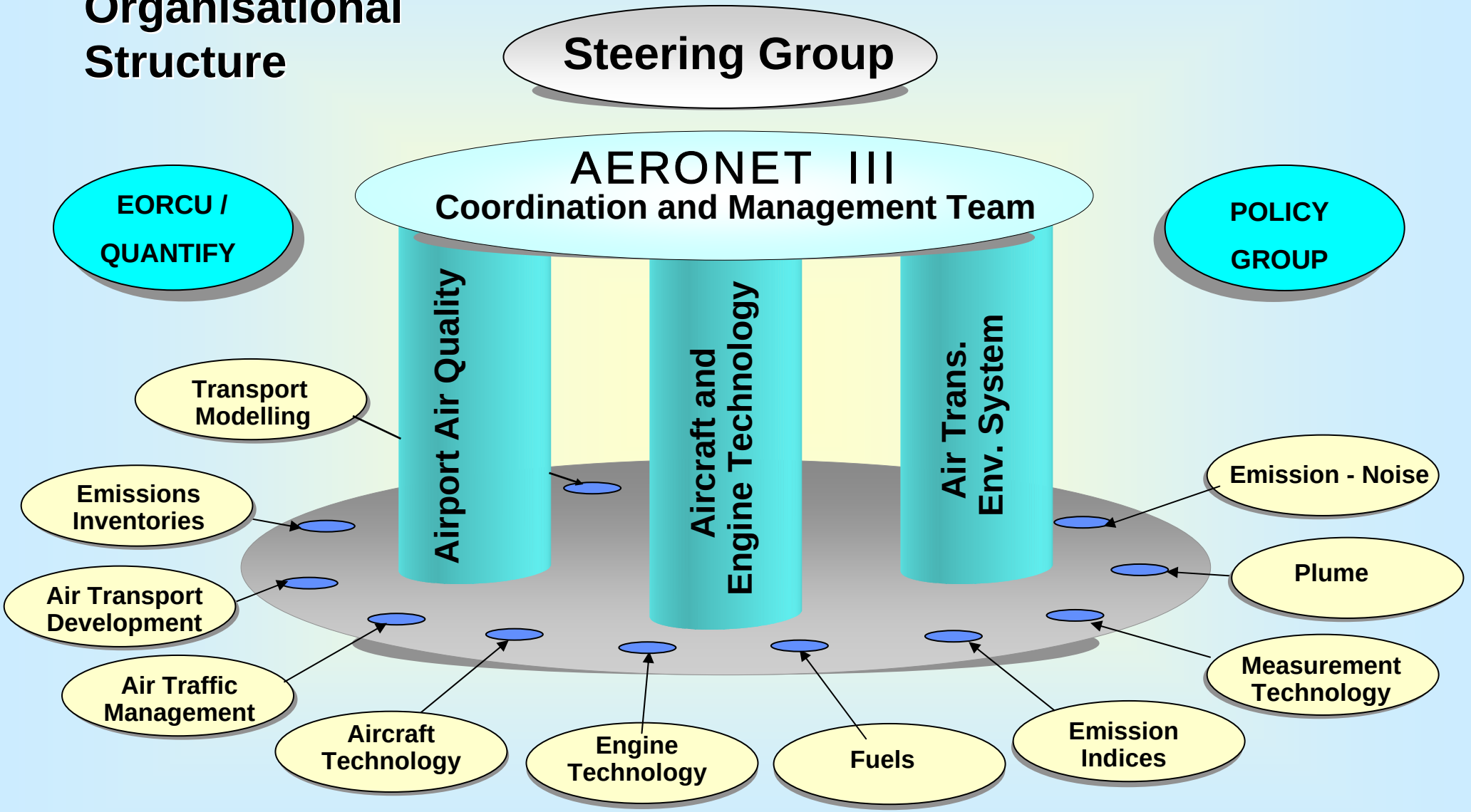
Airport Air Quality

NLR / ONERA

Air Transportation Environmental reference System

FOI / MMU

Organisational Structure



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Policy Matters

- Dialogue between policy makers and AERONET partners;

- Information exchange in both directions;

  ⇒ Consultation on and contribution to:

  - Environmental policy drivers and pressures
  - Policy and regulation situation - EU, ICAO, ECAC
  - Gaps and needs in RTD activities for the definition and in the execution of the Work Programme.

  ⇒ Invitation to AERONET workshops and meetings

  ⇒ AERONET reports, working papers, studies as contribution e.g. to CAEP WGs

  ⇒ SAE E31 particulate matter subcommittee to standardise measurement methodologies

Aircraft and Engine Technology Aspects of Emissions Reduction

- **Measurement Techniques:**
  Intrusive and non-intrusive techniques for the measurement of aero-engine emissions, emphasis on particulate matter and aerosols and under standing of the formation of carbonaceous and volatile particles , developing more accurate and reliable measurement technologies, health impact of particulate emissions, info exchange between aero-engine, automotive and power generation industry experts

- **Fuels:**
  Fuel sustainability, alternative fuels, synthetic fuels, bio fuels, blended fuels, unconventional fuel sources like coal (e.g. SASOL) and gas, use of thermal stability additives with improved emission performance (particulates), enhanced aviation fuel thermal stability , “ideal” aviation fuel, fuel specifications,

- **Soot modeling:**
  Higher combustor inlet temperature and richer fuel/air mixtures lead to more soot emissions thus need for better Soot modeling and measurement, relation to SIA-TEAM project

Aircraft and Engine Technology Aspects of Emissions Reduction

- **Piston engine emissions:**
  Piston engines used in commercial regional air transport i. e. engines above 150 hp, presently no regulations in the US and Europe governing aviation piston engine emissions, unleaded AVGAS 100 LL may be forbidden as emissions and soot, unleaded AVGAS?, modification of existing piston engines, piston engine for unleaded fuels e.g. MOGAS, certification issues

- **Emissions-Noise Trade-off**
  Noise and emissions interdependence and trade-off issues, communication between noise and emissions communities, environmental impacts of noise and emissions, emerging technologies aimed at reducing both noise and emissions e.g. aircraft ground movements procedures for minimising both noise and emissions impacts , specific emissions trade-off issues, such as NOX v CO2, enhanced engine cycles operate at increased temperatures resulting in increased NOX**,** NOX emissions at cruise altitudes have a greater effect than CO2 on global warming

- **Potential of reducing the NOx emissions for H2 and kerosene fuelled aero gas turbines**
  Potential to design a combustion system using hydrogen that produces less NOx emissions than any system using kerosene, a “like for like” technology comparison of the two fuels and their emission levels is needed

Airport Air Quality

- Emission inventories of sources in the airport region:
  Airport emissions inventory including air traffic emissions from aircraft with operational actual LTO cycle, handling / infrastructure and ground access vehicles, vehicles for airport logistics and passenger transportation, APU emissions, quantifying particulate emissions

- Development of adequate dispersion models:
  Modelling the dispersion of the pollutants, “micro scale” dispersion, local and regional dispersion

- Air pollutants measurements and monitoring
  Monitoring of local air pollution is necessary to validate models, gas phase and PM measurements

- Public concerns e.g. health issues
  Volatile Organic Compounds at Airports: speciated VOC emission from aircraft at airports, their importance on air quality and toxicology

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Air Transportation Environmental System

- Long term scenarios (2050) and emissions:
  Initiated “CONSAVE 2050 - Quantification of Constrained Scenarios on Aviation and Emissions”, 4 basic scenarios,

  “Unlimited Skies” (ULS); global, dominant actor: market
  “Regulatory Push & Pull” (RPP); global, dominant actor: policy
  “Fractured World” (FW); regional, dominant actors depending on regions
  “Down to Earth” (DtE); global, dominant actor: society

- Green flight, flexible flight:
  Exchange between the atmospheric science and aviation communities, aviation impact on the atmosphere with environmentally friendly flight operations and route networking, atmospheric effects of altering flight altitudes, Airframe and aero-engine design, ATM and operational aspects other flight routing and route networking, emissions effects of Continuous Descent Approach

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AERONET: Related Projects and Proposals

CONSAVE	Constrained Scenarios on Aviation and Emissions	DLR
PARTEMIS	Particle Emission from Aircraft Engines	QuinetiQ
NEPAIR	Development of the technical basis for a New Emissions Parameter covering the whole Aircraft operation	QinetiQ
CYPRESS	Future Engine Cycle Prediction and Emissions Study	QinetiQ, DLR
AERO 2 K	Global Aviation Emissions Inventories for 2002 and 2025	QinetiQ
X2Noise	Aircraft noise reduction Network	SNECMA

AERONET: Related projects

AIRPUR	Airport Emissions Characterization and numerical Forecast of ambient air quality	ONERA
AEROTEST	Remote Sensing Technique for Aero Engine Emission Certification and Monitoring	Auxitrol
ELECT	European Low Emission Combustion Technology	RRD
QUANTIFY	Quantifying the Climate Impact of Global and European Transport Systems	DLR
ECATS	Environmental Compatible Air Transport System	DLR
VITAL	Environmentally Friendly Aero Engine	SNECMA

Outlook: issues for research

- Contrails and Cirrus cover and climate impact: The impact of contrails and aircraft induced cirrus cover needs to be clarified

- Alternative aviation fuels: Design fuels from oil, coal or gas, biofuels or alternative renewable fuels need to be considered for a sustainable environmentally friendly air transport after the next decades, to develop a comprehensive strategy for identifying and introducing technically and economically viable alternative fuels.

- Noise and Airport air quality: Airports may become the most critical bottle necks for future air transport growth.

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Outlook: issues for research

- **Aviation scenario capability and requirements: high quality scenario work and quality in Europe can support industry in its decisions for long term technologies and related major investments.**

- **Low NOx combustion technology in aero-engines: Lean-burn technology is essential to achieve the low NOx targets, it has to be driven towards higher technology readiness levels and application in aero-engine gas turbines.**

- **Interdependency Modelling: A European Interdependency modelling capability is needed to assess technical, operational or regulatory options and the effects on aviation emissions and noise environmental impact, airport / airspace capacity and at what economic costs.**

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