held leadership positions in NASA's Advanced Subsonic Technology (AST) program since its inception in 1993, and has strongly supported organizations that promote research in aeroacoustics such as the AIAA Aeroacoustics Technical Committee. As a NASA contractor, Boeing has provided substantial cost share in the form of private data bases brought into the AST program, and in direct labor and test hardware fabrication support to NASA test programs. Boeing has also provided direct support to aeroacoustics research programs at several universities, including Stanford, Florida State, Florida Atlantic, Boston University, MIT, VPI, LSU, and Arizona.

Boeing's broad approach to aeroacoustics research is an indication of the difficulty of finding solutions to commercial aircraft community noise issues. Participation in the OAI Aeroacoustics Consortium is a unique opportunity to help bring together distinguished researchers to collaborate on problems of extraordinary difficulty and vital importance to the aviation industry. Boeing is committed to this objective.

GE

GE Aircraft Engines is a world leader in the design, development, and manufacture of aircraft engines for all sizes of aircraft, from the small turboprop commuter planes to the largest jumbo jets. Through the development of its CF34, CFM56, CF6, and GE90 engine families, GEAE has gained a wealth of engine data that has enabled the company to aggressively develop and validate innovative noise-reduction technology for commercial aircraft engines.

Leveraging the intellectual resources of GE's Corporate Research and Development Staff (GE-CRD), GEAE has developed the basic physical understanding of the noise sources in aircraft engines and the two have teamed to develop novel concepts for reducing component noise. These concepts are quantified through advanced mathematical models and associated computer codes that explain the characteristics of these noise sources.

GEAE pioneered the development of small-scale fan-nacelle simulator models for developing advanced turbofan designs such as the GE90, one of the quietest engines in its thrust class. These models allow GEAE to economically evaluate performance, operability, and acoustics of advanced fan-nacelle designs in one test without the expense of full-scale engine testing. The company has conducted successful fan-nacelle simulator test programs in wind tunnels all over the world, including Boeing's Low Speed Aeroacoustic Facility, NASA-Glenn's 9X15 foot Low-Speed Wind Tunnel, and the Duits-Nederlandse-Windtunnel (DNW) Large Low-speed Facility in the Netherlands.

As an active participant in NASA's Advanced Subsonic Technology Noise Reduction program, GE has made significant progress in developing both fan and jet noise reduction concepts. Examples of these concepts include fan blade and vane sweep and lean, jet exhaust chevron nozzles, improved treatment design methods, and active noise control. GEAE is transitioning the most promising of these noise reduction technologies to new engine programs as they become mature enough to economically implement into production.

GEAE is committed to developing noise reduction technologies that provide both acceptable community noise and a reliable, low cost engine for airline customers. As a participant in the OAI Aeroacoustics Research Consortium, GE sees an opportunity to foster synergistic collaboration between industry and the best research scientists from both industry and academia, in pursuit of this commitment.

Honeywell

Honeywell Engines & Systems is the world's largest manufacturer of small gas turbine engines. Engines & Systems designs and manufactures engines for business, regional, commercial, military, and industrial and marine applications. It is a leading supplier of auxiliary power units for commercial/regional airlines, business and military aircraft. The company developed the modern hi-bypass turbofan engine used in today's business jets, and it builds turboshaft and turboprop propulsion engines for business aviation, regional airlines, military aircraft, and marine and industrial markets.

The Acoustics Group at Honeywell Engines & Systems is responsible for providing low noise designs for all new engines and engine installations in a variety of applications. To support these efforts the Acoustics Group conducts extensive research and technology development in the areas of engine components, acoustic treatment/duct design, jet noise and acoustic analysis and testing. Technology programs with NASA have included the Quiet, Clean General Aviation Turbofan (QCGAT) engine program, development of the General Aviation Synthesis Program (GASP) for business jet noise predictions, quiet high-speed fan designs, innovative mixer nozzle exhaust systems and the validation testing of a variety of new low noise technologies. Honeywell Engines & Systems maintains an FAA approved static engine acoustic test facility designed to meet all of the standards of SAE ARP 1846. The static engine measurements are part of an FAA approved noise certification process to predict flight noise levels from static engine noise measurements. Honeywell Engines & Systems is investing in new technologies to provide the next generation of gas turbine engines.

Further Information

Proposal applications are continuously accepted and are reviewed periodically by the management council, if interested please visit the following web page.
http://www.oai.org/aeroacoustics/

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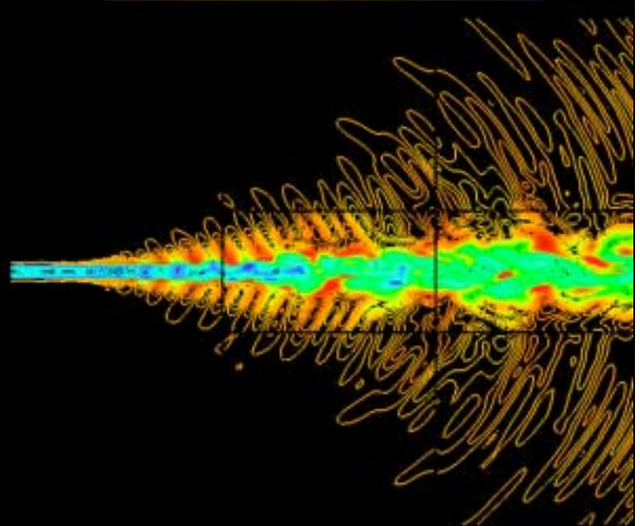
The Aeroacoustics Research Consortium



The AeroAcoustics Research Consortium

The Challenge

Aircraft noise will continue to be a problem well into the next century. Even though the noise levels are being reduced by the introduction of new technology, projected growth in air traffic and increased sensitivity to noise near airports will demand even quieter aircraft. In 1997, NASA introduced a stretch "pillar" goal aimed at eliminating community noise problems near airports:

Reduce the perceived noise levels of future aircraft by a factor of two (10 EPNdB) from 1997 subsonic aircraft by 2007, and by a factor of four (20 EPNdB) by 2022.

The Advanced Subsonic Technology Noise Reduction Program started in 1994 and is on schedule to provide noise reduction technology by 2001 that will meet half of the 10 dB goal. This program has mobilized researchers from NASA, U.S. industry and universities to work on ways to reduce engine and airframe noise sources. The NASA Glenn Research Center is responsible for engine noise reduction.

The researchers and manufacturers will need to overcome many challenges in order to meet a 20-dB aircraft noise reduction goal. It will be important to aggressively pursue new ideas, but also not overlook what has been done in the past. There is a wealth of information available from the extensive research that has been done over the past 50 years. There are still active researchers from around the world that have contributed to this work.

It is clear that there is a need to refocus the efforts of these researchers on the new challenges and to bring new researchers into the field.

A mechanism for attracting these people is needed. These researchers, working collaboratively with researchers from NASA Glenn, will increase the potential to meet aircraft noise reduction goals.

The Challenge Accepted

A virtual AeroAcoustics Research Consortium (AARC) has been established by NASA Glenn Research Center (GRC) and its partners (GE Aircraft Engines, Boeing and Honeywell) and will be administered by OAI. It is expected that the consortium will attract world class researchers who will reside at GRC for various lengths of time. It is also expected that the researcher will continue to be connected with GRC and industry partners at their home institutions. Accordingly, the Consortium will represent a dynamic, supplementary, workforce of researchers that will be regularly replenished. New PhD's, as well as faculty, who are performing cutting edge aeroacoustics research will be sought in order to bring new ideas, methods, concepts, etc. to GRC and to interact with industry members. Researchers will also be invited from U.S. industry and governmental laboratories to complement this virtual workforce. Every effort will be made to attract the very best aeroacoustics researchers in the world.

The specific mission of the AeroAcoustics Research Consortium is to establish an organizational structure to promote world-class aeroacoustics research while providing a stimulating environment that can attract high quality researchers in this area and complement the NASA GRC acoustic research workforce.

Both analytical (numerical) and experimental pre-competitive research will be pursued within the Aeroacoustics Research Consortium. The initial work will emphasize the following areas:

- Fundamentals of jet noise source definition and prediction
- Computational aeroacoustics (CAA)
- Core noise
- Fan broadband noise

The objectives of the Aeroacoustics Research Consortium are:

- To attract acoustics experts from around the world to have direct interaction with GRC and industry researchers.
- To concentrate research efforts on technical barrier problems associated with engine noise prediction and reduction.
- To emphasize fundamental understanding of noise generation from engine components, e.g., fans, jets, and core through analytical and experimental methods.
- It is also envisioned that the Aeroacoustics Research Consortium will organize and host technical meetings, seminars, workshops, short courses and conferences that will bring additional focus and visibility to the aeroacoustics research.

In summary, the proposed Aeroacoustics Research Consortium is expected to be a very visible, cost effective, strategic national asset for GRC, industry, other governmental laboratories and universities.

The GRC Acoustics Branch

The Acoustics Branch at the NASA Glenn Research Center conducts research directed at aircraft engine noise reduction. Both experimental and analytical research is performed within the branch. The research focuses on noise reduction technologies for turbofan engines while maintaining acceptable aerodynamic performance. Emphasis is given to fan and jet noise reduction for both subsonic and supersonic applications. Fan/nacelle models are tested in wind tunnels to determine the aerodynamic performance and acoustic characteristics. Nozzles are tested in anechoic free-jets for jet noise research. Detailed diagnostic measurements are also obtained using LDV, hot-wires, acoustic mode measurements, kulites, and phased array methods. Computer codes are developed that model the steady and unsteady aerodynamics for various components of a turbofan engine. Engine noise prediction codes are developed and validated using experimental data. Advanced computational procedures and codes are developed (Computational Aeroacoustics) that directly compute the sound. Active noise control methods are explored for both fan and jet noise reduction.

OAI

OAI will administer and coordinate the AeroAcoustics Research Consortium. OAI is one of the major consortia in the United States, and the only one devoted to the Aerospace area. Member organizations such as the US Air Force Wright Laboratory, NASA GRC, as well as numerous Ohio universities, major national companies, and the Cleveland Clinic make OAI a unique resource and a neutral ground for collaborative activities.

OAI is a private not-for-profit consortium of university, industry and government focused on the creation, integration, application and communication of aerospace-related knowledge and the commercialization of aerospace-related knowledge and the commercialization of related technologies. Founded in 1989, OAI has facilitated collaborations among universities, industry, NASA Glenn Research Center, and Wright-Patterson Air Force Base, building a network of resources that benefits the citizens of the United States both economically and intellectually. OAI capabilities in team building and program management and enabling of subsequent technology commercialization have been demonstrated in major programs such as the NIST ATP-supported Rapid Agile Metrology for Manufacturing program (PP94-01-0789).

Boeing Company

The Boeing Company is the world's largest manufacturer of commercial transport aircraft. In keeping with its corporate objective of providing environmentally friendly products, Boeing has aggressively sought to acquire, develop, and implement new technology for reducing aircraft community noise while maintaining the operational efficiency and customer value of its products. Internally, Boeing has invested heavily in new facilities, test equipment, and methods for aeroacoustics research and noise control. Research projects have been planned with a long-term focus that addresses the challenge of transition of new basic technology to production. Major research projects are staffed with multi-disciplinary teams to address cross-functional design, manufacturability, maintainability, durability, and cost, all issues that are obstacles to implementation of new technology. Externally, Boeing has