Investigation of the Viability of MEMS Technology for Boundary Layer Control on Aircraft

Fact Sheet

Project Information

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EU contribution € 0

Coordinated by BAE SYSTEMS (OPERATIONS) LTD
United Kingdom

Objective

The recent development of micro-machining technology has made possible the fabrication of Micro Electro Mechanical Systems (MEMS) where arrays of sensors and actuators having dimensions of a few tens of microns can be integrated with distributed controlling electronics. These advances in technology open up the possibility for a wide range of "smart materials". Individual sensor devices based on micro-fabrication are now finding application within everyday engineering products but the use of structures that employ distributed systems of sensors, actuators and integral control systems are only just being investigated. One potential application of
MEMS is the control of the boundary layer flow close to the external surface of an aircraft. The ability to control such flows has the potential to lead to very large improvements in efficiency and performance resulting in dramatic reductions in fuel consumption and pollution. This will give rise to significantly increase product competitiveness. Research into this potential application has begun in the USA but as yet little co-ordinated progress has been made within Europe. The current expert understanding of the state-of-the-art, within the partnership, is that there is the potential for a MEMS based flow control system to be incorporated on a production aircraft within the medium term. Many questions still remain to be answered if this goal is to be achieved and it is felt that both confidence in and awareness of the potential application of MEMS within the aerospace industry needs to be boosted. It is therefore considered opportune to initiate a programme of basic research to answer some of these questions and provide a basic demonstration of the viability of this technology. The primary aim of this research project is to assess, quantify and demonstrate the viability of employing MEMS for a medium term (10 to 15 years) industrial aerospace flow control application. In order to achieve this objective it will be necessary to demonstrate that MEMS hardware technology has the potential to be matured and that the performance benefits will have commercial viability. It order to do this it will be necessary to apply and extend the current state-of-the-art in fluid mechanics and micro-fabrication technology. The work programme will involve undertaking co-ordinated theoretical and experimental studies to evaluate and compare various sensing, actuating and control strategies. The issues of MEMS hardware technology will be addressed and a preliminary development of appropriate prototype sensors, actuators and control systems will be undertaken. Finally, it is proposed that two simple experimental demonstrations of the use of MEMS scale technology to control boundary layer flows for an industrially relevant application will be undertaken. The consortium comprises two of Europe's major aircraft manufacturers and nine universities. The skills represented within the partner organisations are complementary and cover the fields of theoretical and experimental aerodynamics together with expertise in micro-fabrication technology and control theory. In the field of fluid mechanics, the programme will be scrutinised and guided by a "Senior Fluid Dynamics Panel" comprising six of Europe's recognised experts. The partnership reflects the fact that a significant proportion of the knowledge, skills, experience and facilities required for successfully undertaking this work lies within the research and academic institutions. All have a proven "World class" track record of innovative research in the disciplines essential to the success of this project. The industrial partners are committed to evaluating the use of MEMS technology for flow control and have experience in the development of MEMS hardware and in the theoretical evaluation of MEMS for flow control. They will bring focus to the objectives and will ensure that realistic consideration is given to the key issue of industrial viability.

**Fields of science**
Programme(s)

FP4-BRITE/EURAM 3 - Specific research and technological development programme in the field of industrial and materials technologies, 1994-1998

Topic(s)

0301 - Aeronautics

Call for proposal

Data not available

Funding Scheme

CSC - Cost-sharing contracts

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