Stratospheric optimisation

Dr András Sóbester is engaged in wide-ranging research which aims to develop technologies for the design, manufacture and testing of complex scientific instrument platforms, in particular low cost, high altitude unmanned aircraft.

ROYAL ACADEMY OF ENGINEERING

Research area

Dr András Sóbester is a senior lecturer in Aerospace Engineering in the Faculty of Engineering and Environment at the University of Southampton. Dr Sóbester has BEng and MEng degrees in Mechanical Engineering and Design and Manufacture respectively. He completed his PhD at the University of Southampton, where he joined the Computational Engineering and Design research group.

His doctorate was on the application of statistical techniques to optimise aerospace systems and this influenced much of his later research work too. He devises computational models which reduce the dependency on expensive and time-consuming simulation techniques required in the development of complex systems.

Dr Sóbester's ideas have led to applications in aerospace systems, including the design of unmanned air vehicles that operate at a wide range of altitudes. His statistical methods have also been applied to recent work on climate modelling which attempts to isolate and optimise the factors which cause the greatest uncertainty in current models.

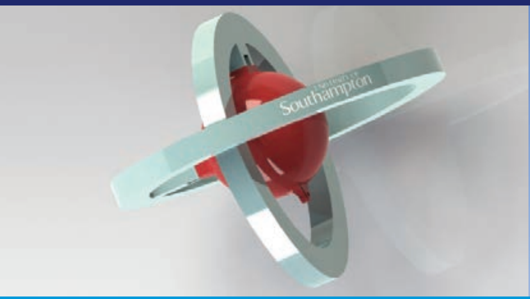
Biography/ Career Progression

1992 - 1996 BEng in Mechanical Engineering, Technical University of Cluj

1996 - 2000 MEng in Design and Manufacture, University of Central Lancashire

2000 - 2004 PhD, University of Southampton

2004 - Present Senior Lecturer, University of Southampton



Academy support

Dr András Sóbester received a Royal Academy of Engineering Fellowship in 2007. The Fellowship supported research work on various aerospace projects, including research to minimise the negative environmental impact of next-generation airliners by reducing their noise signature.

During the course of his Fellowship, Dr Sóbester's research increasingly focused on issues surrounding the scientific exploration of the stratosphere. His ASTRA (Atmospheric Science through Robotic Aircraft) initiative at Southampton was set up to rethink the technology that takes scientific instruments into the stratosphere for earth science and meteorology research. "The aim is to have rapid and low-cost development and deployment of fully customised systems, avoiding the expense and complexity of current generic systems," he said.

At the same time, he developed computational optimisation techniques to analyse the parametric shapes which make up the external surfaces of aircraft. Using these models, aircraft designers can save testing time and improve aerodynamic performance.

Research impact

Dr András Sóbester's work challenges conventional thinking on engineering design and development, and while its primary applications so far have been in the area of aerospace, his ideas may have implications across engineering and science.

Dr Sóbester's postdoctoral research was on a project for BAE Systems which took him into the field of unmanned aircraft. Here he was able to apply his research ideas on difficult-to-model systems and work on a new unmanned aerial vehicle (UAV) concept that would have no external moving surfaces, or flaps to control its direction. Instead, the UAV would use a fluidic thrust vectoring system, which would steer the craft by modifying the angle of the jet that comes out of the gas turbine engine.

More recent work on high-altitude scientific experimentation has sought to challenge the conventions on the methods for launching balloon-borne scientific instruments into the stratosphere and then retrieving them. With support from Microsoft Research, the ASTRA project explored the use of low-cost, commodity devices such as high-altitude data logging, computing and communications platforms. Dr Sóbester believes these systems can be developed and deployed faster and could also reduce the manufacturing and logistical costs which are barriers to some atmospheric science missions.

Another idea is to reduce the mass of such instrument platforms, which would increase their likelihood of regulatory approval and enable their widespread use. "The use of miniaturised systems would therefore increase deployment flexibility and speed, enabling scientists to observe transient phenomena such as thunderstorms," he said.

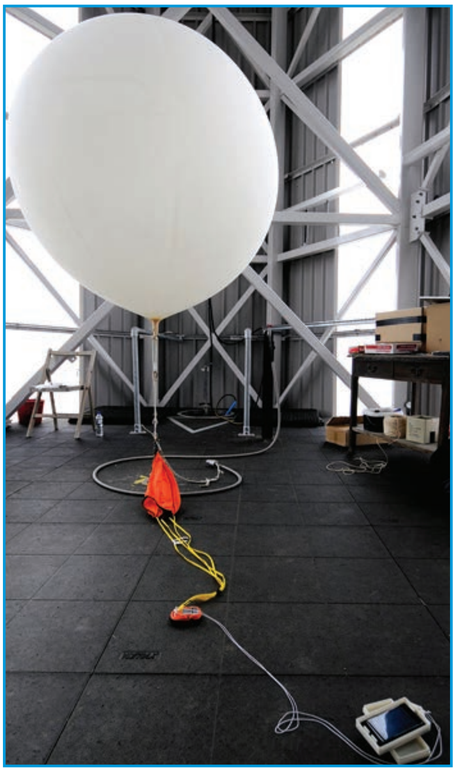
Future challenges

Dr Sóbester will continue to work on high Dr Sóbester will continue to work on high-altitude systems and is working with the ASTRA team to develop a family of high-altitude balloon-launched instrumented gliders. One of the benefits of working in academic research, he said,

is the ability to put new ideas into practice quickly: "In the aerospace industry, the fruits of research are often measured over a timescale of a decade, whereas our timescales are as short as two weeks." Rapid manufacturing techniques, such as 3d printing, help this – "It means we can get our hands on a physical device much faster, and thus flight testing becomes a much better integrated, more organic step of the development process," he said.

The work on optimisation technology is also continuing, including the recent work on climate model tuning. "Exploiting the similarities between modelling and optimising

complex engineering systems and optimising models of the Earth system, we are assisting colleagues in the climate modelling community to reduce the computational cost of what are, in general, extremely expensive simulations," he said.



"The Royal Academy of Engineering Research Fellowship allows you to concentrate on a particular area of research, and that's a luxury most people don't have after they finish their PhDs"

Dr Andras Sobester