



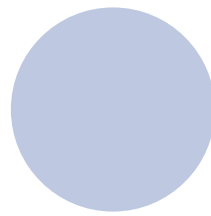
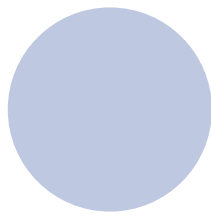
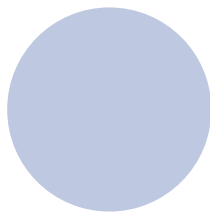
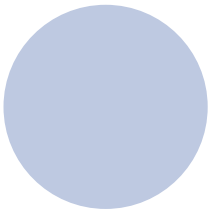
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**REPORT ON PROGRESS WITH  
THE NATIONAL AEROSPACE  
TECHNOLOGY STRATEGY**

MARCH 2007







# Report on Progress with the National Aerospace Technology Strategy



## Foreword by Malcolm Wicks, Minister for Science & Innovation.

I am pleased to present this progress report on the National Aerospace Technology Strategy. The aerospace sector makes a significant contribution

to the economy and needs to invest heavily in research and technology to maintain its competitiveness. The rise in air travel globally and increasing concerns about its environmental impact also pose challenges that we must address collectively.

The aerospace sector has made good progress in taking forward the strategy. It represents a combined effort by industry, regional and national government, and the research base. It is clearly focused on applied research and demonstration in areas where the industry can succeed globally. It has been the most successful sector in winning support from the DTI-led Technology Programme and from regional bodies, creating a genuine national-regional partnership in supporting our priority projects. I recognise that seeking support from a number of public bodies causes complexity but I am optimistic that this approach can provide benefits to all, and further work is in hand to make the process more business-friendly.

We are seeing the launch of a number of substantial and ambitious aerospace programmes, including in the key areas for UK industry of wing technology, propulsion, autonomy and systems. These programmes will represent a major step towards realising the objectives set out in the Aerospace

Innovation and Growth Team report of 2003. We need to sustain the strategy by building on the good progress so far and helping the industry provide the technological solutions that will ensure its success over the longer-term.

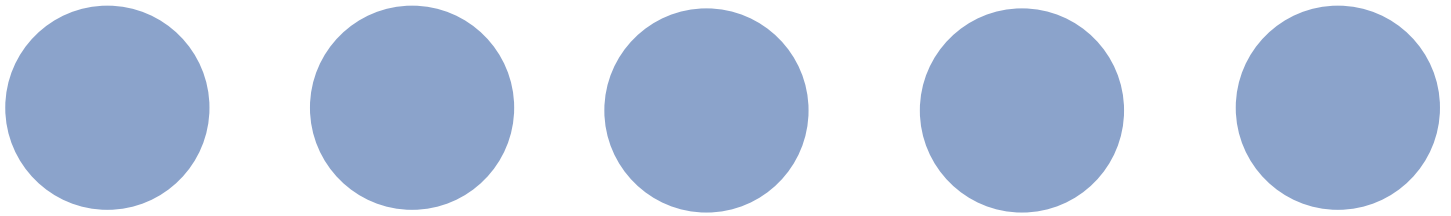


## Foreword by Ken Maciver, Chairman of the Aerospace Technology Steering Group

The National Aerospace Technology Strategy came from the recommendations of the Aerospace Innovation and Growth Team (AeIGT)

for a focused programme of applied research and demonstration, and for an authoritative forum to coordinate the activities that make up the programme. The Aerospace Technology Steering Group (ATSG) has provided this coordinating role and has laid out the minimum programme necessary to maintain the UK's world-class aeronautical industrial capabilities. This programme, consisting of both applied research and technology demonstration, requires expenditure of over £300m per year, with funding coming from industry and government. Within that total, the AeIGT requested the Government to provide some £70m per year on civil aerospace research and technology.

Since publication of the AeIGT report, considerable progress has been made. Projects have been launched in all the technology demonstration topics, which cover the first stages of the full demonstration work



required in these areas. In addition some of the Aerospace Innovation Networks have launched active programmes of applied research. Government has been strongly engaged on the civil work and the overall programme has built up public funding commitments of over £150m in the past two and half years. This translates into current annual outlay of around £45m. In addition, the industry contribution now benefits from the R&D tax credit scheme. This represents a major increase of Government support over historic levels of investment by Government in this area, which ran at around £20m per year. However there is still more to be done, by both industry and Government. In order to launch the full programme, the technology demonstration activity needs to be expanded and a greater range of applied research activated through more Aerospace Innovation Networks. Government and industry need to increase their levels of activity and funding and we need to do more to identify areas of overlap between civil and defence research so as to utilise our resources more effectively. I regard it as of vital importance to the future of the aerospace industry in the UK that the full programme of research and technology demonstration is achieved to carry the UK strongly forward into the future.

## Introduction

1. The Trade and Industry Committee undertook an inquiry into the UK aerospace industry and published its findings in its Fifteenth Report<sup>i</sup> of Session 2004-05 on 5 April 2005. The Government's response was published on 21 July 2005<sup>ii</sup>. In making its response the Government agreed to produce an annual progress report of the National Aerospace Technology Strategy, and proposed that the Department of Trade and Industry (DTI) should produce one for the Secretary of State in collaboration with industry.

## State of the Aerospace Industry

2. The aerospace industry is one of the UK's most dynamic and successful sectors, in an increasingly competitive global environment. It has a turnover of more than £22.6 billion, with UK companies directly employing 124,000 people and supporting more than 276,000 jobs in total across the UK economy. The UK aerospace industry recognises the importance of R&D, investing £2.7 billion in 2005, 13 per cent of total UK R&D investment, and second only to the pharmaceuticals industry. The sector provides high value employment with more than 30 per cent of employees educated to degree level. There are over 2,700 apprentices in the industry.<sup>iii</sup>

3. In 2005 the sector saw substantial increases in turnover, employment, R&D investment and new orders. New orders for UK based aerospace companies exceeded £30 billion, a 33 per cent increase on the previous year and an all time high for the industry.

## Aerospace Innovation and Growth Team Vision

4. The Aerospace Innovation and Growth Team (AeIGT) was established by the then Secretary of State for Trade and Industry, Patricia Hewitt, in May 2002. The mandate was to map out a 20-year vision for the industry and to recommend how to make the vision a reality. Over 140 senior people from aerospace companies, government departments and trade unions, as well as universities and research bodies, were involved. The AeIGT's vision is that by 2022:

*"The UK will offer a global Aerospace Industry the world's most innovative and productive location, leading to sustainable growth for all its stakeholders."*

The AeIGT report published in June 2003<sup>iv</sup> recommended action on five fronts for success:

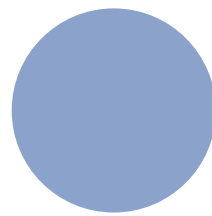
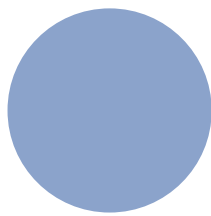
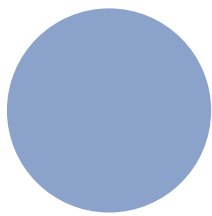
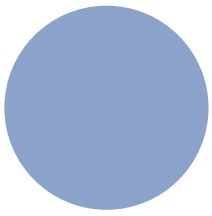
- i) Focused aerospace applied research and demonstration.

<sup>i</sup> Fifteenth Report from the Trade and Industry Committee, Session 2004-05, UK Aerospace Industry, HC 151-1

<sup>ii</sup> UK Aerospace Industry: Government Response to the Committee's Fifteenth Report of Session 2004-05, HC 368

<sup>iii</sup> SBAC UK Aerospace Industry Survey 2006

<sup>iv</sup> An Independent Report on the Future of the UK Aerospace Industry, URN 03/956



- ii) Systematic and continuous delivery of productivity improvement.
- iii) Continuous development of a world-class workforce.
- iv) Creation of the right economic conditions, socio-economic environment and focused policies.
- v) Spearheading international sustainable development in Aerospace.

5. Since mid-2005, implementation of the AeIGT work has been overseen by the Aerospace Innovation and Growth Leadership Council, jointly chaired by Margaret Hodge, Minister for Industry and the Regions, and Mike Turner, Chief Executive of BAE Systems. Its membership consists of leading aerospace industrialists, senior Government officials, regional partners, and trades unions. The Council's role is to drive work across all areas of AeIGT implementation, and to take account of emerging strategic issues affecting the sector. The Council meets twice a year; in addition it meets annually with the Secretary of State for Trade and Industry to report on progress and discuss key developments or issues affecting the sector.

### National Aerospace Technology Strategy

6. The National Aerospace Technology Strategy (NATS) produced by the AeIGT identified the areas of applied research and demonstration needed for success; these were set out in an implementation report in 2004<sup>v</sup>. The strategy identified areas where the UK aerospace industry could remain globally competitive if action were taken to sustain and develop its technology capability. It proposed the establishment of twelve Aerospace Innovation Networks (AINs) to determine and carry forward research in the following fields:

- Aerodynamics and Computational Fluid Dynamics;
- Environmental Technology;
- Advanced Aerospace Materials & Structures;

- High Temperature Materials;
- Advanced Electrical Power Systems;
- Systems Engineering;
- Sensor Technologies;
- Interactive Network Systems;
- Health Management & Prognosis;
- Through-Life Support;
- Electro-Magnetic Interaction & Effects;
- Synthetic Environments and Systems Simulation.

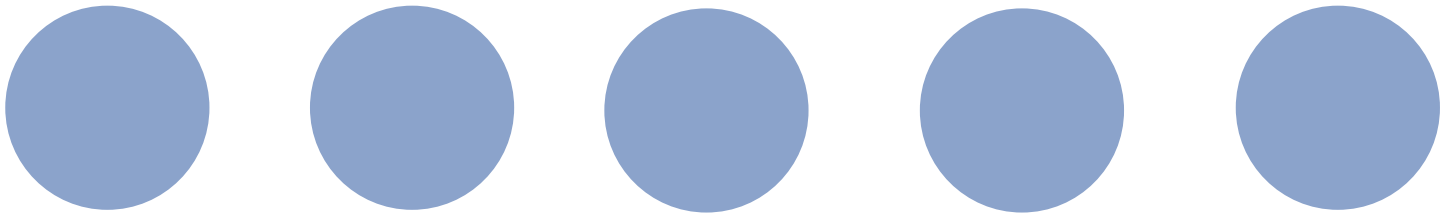
A further one on Disruptive and Emerging Technologies has since been added. The normal process of innovation would lead to the outcomes of these AINs becoming the subject of technology validation programmes before the technologies could be applied to projects.

7. The National Aerospace Technology Strategy (NATS) produced by the AeIGT also identified that six Aerospace Technology Validation Programmes (ATVPs) should be taken forward immediately:

- Powered Wing (now called Integrated Wing (IW));
- More Electric Aircraft;
- Environmentally Friendly Engine (EFE);
- Autonomous Systems (UAV/UCAV) (now Autonomous Systems Technology Related Airborne Evaluation and Assessment (ASTRAEA))
- Integrated Air Traffic Management Network (now Air Traffic Management);
- Future Air Battlespace (now Information Networks For Operations in the Air (INFOAir)).

8. Aside from the AeIGT, but as part of the DTI's generic Technology Programme, the DTI has established a Knowledge Transfer Network (KTN) for aerospace and defence technologies, one of twenty-two across a range

<sup>v</sup> National Aerospace Technology Strategy, Implementation Report



of technologies and sectors. The Aerospace & Defence Network is jointly funded by DTI and the Ministry of Defence with support from the Engineering and Physical Sciences Research Council (EPSRC). It ensures access to a network of industry, government and academic experts for independent strategic advice and allows industry a channel to the national aerospace and defence agendas. The Network brings together partners in this global aerospace industry to advance the UK's world-class manufacturing and supply chain. We are currently looking at how the KTN and the Aerospace Innovation Networks can be more closely integrated

### **National Aerospace Strategy Group**

9. The National Aerospace Strategy Group was created to provide high level co-ordination of the various funding streams from across government required to allow the National Aerospace Technology Strategy to proceed. It is chaired by the Minister for Science and Innovation (currently Malcolm Wicks, previously Lord Sainsbury). The Group has met four times. The Ministry of Defence (MoD) is represented by the Minister for Defence Procurement (currently Lord Drayson). An early action was to set up a regional forum to assist the engagement of the Regional Development Agencies (RDAs) and Devolved Administrations (DAs) with NATS (see paragraph 13). There has been significant progress with securing funding from DTI, RDAs and DAs. However, progress has been slower with identifying NATS-related MoD spend and officials in both departments are working with industry to identify common ground between the MoD and civil aerospace programmes (see paragraph 20). Engagement with EPSRC is progressing and funding from EPSRC is captured via the Technology

Programme for academic aspects of programmes where the science is seen by EPSRC as world class. Further interaction is however required to encourage EPSRC to contribute more to high quality academic work within the National Aerospace Technology Strategy.

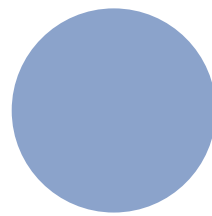
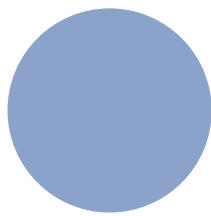
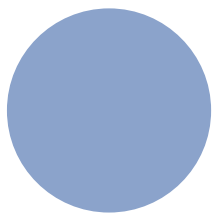
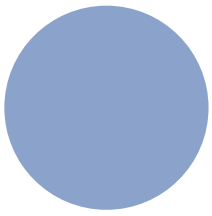
### **Aerospace Technology Steering Group**

10. Coordination and delivery of the strategy at working level is taken forward by the Aerospace Technology Steering Group (ATSG), chaired by Ken Maciver (former President and CEO of TRW Aerospace). This group comprises representatives from industry, DTI, MoD, EPSRC, Regional Development Agencies and academia. It meets monthly to oversee the implementation of the NATS programmes, and reports up to the UK Aerospace Innovation & Growth Leadership Council. In order to focus on particular aspects of delivery, the steering group has created two task forces: one to undertake detailed programme coordination of NATS projects, and the other a Commercial Task Force. The Commercial Task Force has developed a Model Collaboration Agreement, based on the DTI's own 'sample agreement', to be adopted by all participants across all the programmes to speed up the process of agreeing collaboration between the consortia partners and hence launching projects. The ATSG also provides input to the DTI consultations on the needs of the Aerospace industry in the Technology Programme, covering both content and mechanisms.

### **Progress**

11. The AeIGT report envisaged a substantial research and technology acquisition programme covering civil and defence aerospace technology with public and private funding together totalling some £300m per year. Within this total, Government funding for civil R&D was anticipated to increase to around £70m per year, Government funding for defence-related aerospace research was expected to remain at around £92 million per year, and industry was expected to contribute over £140m.

12. Until April 2004, DTI funding for aerospace research was channelled through a sector-specific aerospace programme called Civil Aircraft Research and Demonstration (CARAD). Whilst some legacy CARAD projects are still underway, all new funding is provided through the DTI's overall Technology Programme. This is directed by the business-led Technology



Strategy Board, established in October 2004, to advise the Secretary of State for Trade and Industry on business research, technology and innovation priorities for the UK, the allocation of funding across these priorities and the most appropriate ways to address them. The Technology Programme provides all business sectors with access to support for collaborative research and development for UK wealth creation. The programme runs competitive calls for proposals in priority technology areas. This ensures that the winning bids from whatever sector are of high quality and likely to have significant business benefit and economic impact. With its history of successful collaboration under CARAD, the aerospace sector has also been very successful in the Technology Programme competitions to date. It has bid for projects of varying size in the competitions and won the following support to date:

- April 2004: £17.2m plus £12.3m regional support
- November 2004: £16.2m plus £11.1m regional support
- April 2005: £7.8m for applied research, plus £45.8m and £23.2m regional support for large projects (including £4m potential support from MoD)
- November 2005: £6.3m
- April 2006: £16.2m

This therefore constitutes attracting support of some £153m from Government sources (£110m from DTI and £43m from the regions) during the first 2½ years of the Technology Programme competitions which will be spread over three to five years of project execution. This level of support stems mainly from the success of the large ATVPs project bids, starting with the Validation of Complex Systems mechanism in the April 2005 competition. Most of the ATVP topics in NATS have now been started. It is also through these large projects that all the regional funding has been attracted to the programme. This has resulted in Aerospace currently receiving about £45m per year. This represents

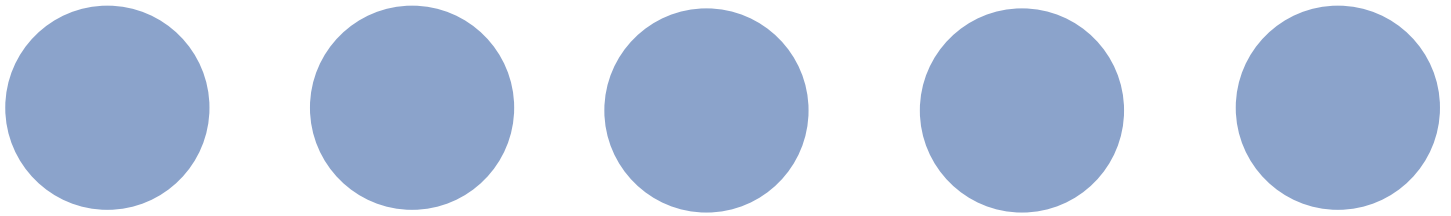
major progress compared to funding levels of around £20m per annum under CARAD. Overall aerospace has won over 25% of the DTI Technology Programme funding with additional funding from the regions. The challenge for the industry is to continue to secure a similar level of funding into the future, including large validation projects, in an increasingly competitive environment.

13. As can be seen from the above, the Regional Development Agencies in England and the Devolved Administrations in Scotland, Wales and Northern Ireland are full partners in the National Aerospace Technology Strategy. At the top level participation is encouraged and coordinated through the National Aerospace Strategy Group at Ministerial level. To date, the RDAs/DAs have committed around £43m to NATS technology validation programmes. Work is also underway between industry, DTI and regional partners to make processes for companies obtaining such funds less burdensome. This is being led by a Regional/ National Aerospace Forum, chaired by Jeff Alexander, an executive director at the South East Economic Development Agency, reporting to the National Aerospace Strategy Group.

### Key Programmes Underway

#### ASTRAEA (Autonomous Systems Technology Related Airborne Evaluation and Assessment)

14. This £32m programme represents the first stage of the Autonomous Systems Technology Validation Programme, which is of significant importance to establishing the UK's credentials in the rapidly growing field of Uninhabited Aerial Vehicle (UAV) development. It will strengthen collaboration across industry, universities, and regulatory authorities, positioning the UK amongst the world's leaders in UAV technology. The collaborating consortium is made up of Agent Oriented Software, BAE Systems, EADS UK, Flight Refuelling, QinetiQ, Rolls-Royce and Thales UK, together with the Universities of Bath, Cranfield, Lancaster, Leicester, Loughborough,



Aberystwyth, West of England and Sheffield. Industry funding is being matched by support from DTI and the Regional Development Agencies in the South West, South East and North West, and the Devolved Administrations in Scotland and Wales.

### Integrated Wing

15. The first phase of the Integrated Wing Aerospace Technology Validation Programme lasts 3 years, and has a total budget of £34m. The programme will develop key wing technologies and optimise and validate their application on various advanced wing configurations. High risk/high potential technologies are being considered and the cost-benefits will be assessed across the complete product life-cycle. This approach to integrated technology validation will ensure that UK industry is well placed to contribute to future civil transport aircraft programmes, which will have to meet very challenging environmental and business targets. The programme brings together 17 partners – Airbus UK, BAE Systems, QinetiQ, Bombardier Aerospace, GKN Aerospace, Messier-Dowty, Ultra Electronics, Smiths Aerospace, Aerostructures Hamble, AMRC, FR Hi-Temp, TWI, ETCE and the Universities of Aston, Bath, Sheffield and Queens Belfast. Industry funding is being matched by support from DTI, the Regional Development Agencies in the South West and South East, and the Devolved Administrations of Northern Ireland and Wales.

### Environmentally Friendly Engine (EFE)

16. This Technology Validation Programme is a large (£95m) collaborative programme involving UK aerospace companies, UK universities and the wider UK supply base. It is a key technology validation programme for improving aero-engines in the progress towards achieving the challenging environmental targets set by the Advisory Council for Aeronautics Research in Europe (ACARE) by the year 2020. The programme brings together Rolls-Royce, Bombardier Aerospace, Goodrich Control Systems, HS

Marston Aerospace, Smiths Aerospace Components and the Universities of Cambridge, Oxford, Belfast, Sheffield, Birmingham and Loughborough. Industry funding is being matched by support from DTI, the Regional Development Agencies in the South West, North West, East Midlands, West Midlands, the Devolved Administration of Northern Ireland and the Ministry of Defence. State Aid clearance has been received from the European Commission and the support from the regional bodies is being finalised.

### More Electric Aircraft

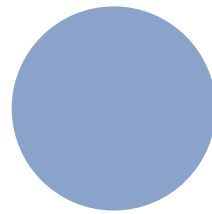
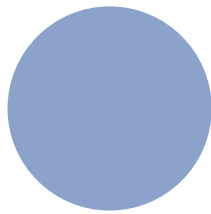
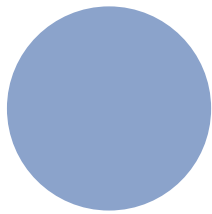
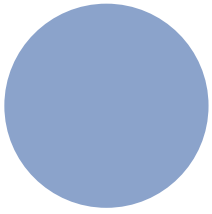
17. There are two Aerospace Technology Validation Programmes in the More Electric Aircraft area. One large project (ELGEAR) has been launched on electronic landing gear control. This is led by Airbus UK, but the major part of the work involves Messier-Dowty, Smiths and their suppliers. This project has attracted support from DTI of £4.5m. A second project on power generation and management, has been agreed with support of £2m from DTI.

### Centre for Fluid Mechanics Simulation (CFMS)

18. The Centre for Fluid Mechanics Simulation is a large project which is seeking to improve simulation capability in the UK at least one thousand fold. This involves companies from a number of industrial sectors including aerospace, marine and automotive, as well as Hewlett Packard and Microsoft on the software side. £8.8m of DTI funding has recently been approved for this project.

### National Composites Network

19. Aerospace benefits substantially from the support for the National Composites Network, a node of the Materials Knowledge Transfer Network, to which DTI is providing funding of £4.75m and the regions are providing £12.3m. The £30m network will disseminate lighter, stronger composites technologies for aerospace, automotive, marine and other industries.



## Ministry of Defence

20. Officials from both DTI and the MoD have been working with industry to identify opportunities for joint programmes under NATS. Officials of both Departments have also been discussing areas of joint MoD/DTI interest in relation to the Technology Programme, and have been addressing closer alignment of research Intellectual Property Rights (IPR) policy between MoD and DTI. MoD spends about £80m on aerospace defence research, together with large amounts in related areas such as sensors. It is estimated that the objectives of current MoD programmes worth £30-40m are directly related to NATS AINs and ATVPs. It is also anticipated that MoD will place an increasing proportion of its investment in aerospace R&T direct with industry (up to about 80% by 2008). Better alignment of this work, and of future projects, to NATS is being sought so that industry can bid to both DTI and MoD in a co-ordinated way. The MoD published its Defence Industrial Strategy in December 2005 and followed this up with a Defence Technology Strategy (DTS) in October 2006, both of which make the case for industry and MoD to work more closely together on future requirements. The ATSG has been involved in the development of the Fixed Wing element of the DTS, and it will be important to ensure that the implementation of the DTS remains well aligned with NATS to set the agenda for future collaborative programmes. The MoD is also involved with DTI in jointly funding the Aerospace and Defence Knowledge Transfer Network (KTN).

## Technology Strategy Board

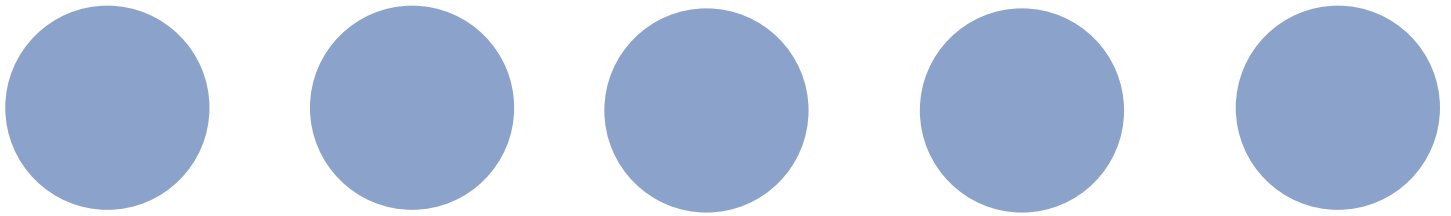
21. Whilst the aerospace industry has achieved a broad measure of success under the Technology Programme and has begun to tap funding also from regional and MoD sources, the system has presented difficulties. In particular, there is not always a good match between the technology areas that the Technology Programme focuses on in its six-monthly calls for research bids and the technology areas identified by the aerospace

industry as strategically important. In addition, there remains a challenge for Government to simplify the processes in order to reduce the cost involved in bringing together bids for the programme, many of which do not succeed (the success rate is about one in three for these bids), and to reduce the burden involved in bringing the regional funding through the Technology Programme bids. These concerns are recognised and officials are working with industry to try to mesh NATS and the Technology Programme's planning cycle more effectively, as well as to reduce the overhead inherent in the system at present.

22. The Technology Strategy Board (TSB) has expressed a wish to develop a number of large "Innovation Platforms" to address broad societal challenges where UK business is potentially capable of offering innovative solutions. To date two pilot Platforms have been launched in the areas of Intelligent Transport Systems and Services, and Network Security. These bring together a number of government departments and agencies, business and the research base to develop innovative solutions drawing on the full range of potential interventions: collaborative R&D, networks, standards and technical regulation, metrology, and innovative government procurement. The approach could be helpful in addressing issues relating to the aerospace sector, particularly the environmental aspects.

23. The Technology Strategy Board has identified seven key technology areas which are the focus of the Collaborative R&D Calls. Medium term strategies have been prepared to date for six of these. Those with an asterisk are the main areas covering the future requirements of the aerospace sector. The areas are:

- Advanced Materials\*
- Bioscience and Healthcare
- Information and Communication Technologies\*
- Electronics and Photonics\*
- Emerging Energy Technologies



- Sustainable Production and Consumption
- Design Engineering and Advanced Manufacture\*

The aerospace sector provided comments during the development of the strategies and will continue to attempt to influence the competitions to ensure there are opportunities to bring forward projects from the National Aerospace Technology Strategy. As noted above, there have been issues in aligning the industry's strategic technology objectives with these pillars and in pursuing long term projects as the Technology Strategy Board shifts its focus call by call. However, the Technology Strategy Board has recognised that it is important to continue to recognise and support strengths in important R&D-intensive industries such as pharmaceuticals and aerospace.

### Relationship with Europe

24. The Advisory Council for Aeronautics Research in Europe (ACARE) has published a Strategic Research Agenda setting a series of step-change goals for reducing CO<sub>2</sub> by 50% per passenger km, NO<sub>x</sub> by 80% and noise by 50% – all by 2020 from year 2000 datum. All national programmes recognise this as a planning base.

25. The UK aerospace industry needs to look more broadly than NATS to respond to ACARE and secure its global competitiveness in the future. The industry is seeking to complement the research and technology in

NATS through participation in the European Framework Programmes, and industry has proposed a large scale 'Clean Sky' Joint Technology Initiative (JTI) in Aeronautics and Air Transport in the forthcoming Seventh Framework Programme.

### Next Steps

26. A number of areas have been identified where key actions are required in order to maintain the progress already made towards achieving the NATS targets. These are:

- Growing the overall size of the Technology Programme to allow more headroom for projects
- Continued recognition by the Technology Strategy Board of the key needs of the National Aerospace Technology Strategy and inclusion of the key aerospace topics in the technology programme
- Continued joint action on improving process efficiency
- Agreeing a way forward for environmental technology support in aerospace
- Increasing MoD support for dual-use technology
- Directing funding from EPSRC to NATS related projects in academia

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# Glossary

<b>ACARE</b>	Advisory Council for Aeronautics Research in Europe	<b>EU</b>	European Union
<b>AeIGT</b>	Aerospace Innovation and Growth Team	<b>INFOAir</b>	Information Networks For Operations in the Air
<b>AIN</b>	Aerospace Innovation Network	<b>IPR</b>	Intellectual Property Rights
<b>ASTRAEA</b>	Autonomous Systems Technology Related Airborne Evaluation and Assessment ATVP	<b>IW</b>	Integrated Wing ATVP
<b>ATSG</b>	Aerospace Technology Steering Group of the AeIGT	<b>JTI</b>	Joint Technology Initiative in EU Framework 7
<b>ATVP</b>	Aerospace Technology Validation Programme	<b>KTN</b>	Knowledge Transfer Network
<b>CARAD</b>	Civil Aircraft Research and Demonstration	<b>MoD</b>	Ministry of Defence
<b>CFMS</b>	Centre for Fluid Mechanics Simulation	<b>NATS</b>	National Aerospace Technology Strategy
<b>CO2</b>	Carbon Dioxide	<b>NOx</b>	Oxides of Nitrogen
<b>DA</b>	Devolved Administration in the UK	<b>R&amp;D</b>	Research and Development
<b>DIS</b>	Defence Industrial Strategy	<b>RDA</b>	Regional Development Agency in England
<b>DTI</b>	Department of Trade and Industry	<b>SBAC</b>	Society of British Aircraft Companies
<b>DTS</b>	Defence Technology Strategy	<b>SME</b>	Small or Medium sized Enterprise
<b>EFE</b>	Environmentally Friendly Engine ATVP	<b>TSB</b>	Technology Strategy Board
<b>ELGEAR</b>	Electric Landing Gear ATVP	<b>UAV/UCAV</b>	Uninhabited Air Vehicle/ Uninhabited Combat Air Vehicle
<b>EPSRC</b>	Engineering and Physical Sciences Research Council	<b>UK</b>	United Kingdom

