



HM Government

Industrial Strategy: government and industry in partnership



Lifting Off – Implementing the Strategic Vision for UK Aerospace



Aerospace Growth Partnership

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Foreword

Chancellor of the Exchequer The Rt Hon George Osborne MP



I have seen firsthand the contribution that the aerospace sector makes in helping the UK realise its industrial ambition. Last year I opened the new GKN aerostructures factory outside Bristol and the state-of-the-art Rolls-Royce apprenticeship

academy in Derby, and I visited the Airbus wing factory at Broughton in North Wales.

Aerospace is a national economic asset to be supported.

The Government is delivering an ambitious programme of reforms to equip the UK for success in the global race. An important part of this is improving our business environment, which is why we are taking decisive action to cut our Corporation Tax to the lowest in the G7 by 2014, to invest in growing a flexible and skilled labour force, and to further reduce the burden of regulation. But we must not stop there.

As well as providing the best possible conditions for private sector growth, we are engaging directly in supporting UK businesses to succeed in global markets.

The strategic partnerships that the Government is developing with industry as part of the Industrial Strategy will ensure that policy is driven by the needs of those businesses.

It is estimated that there will be global demand for 27,000 new passenger aircraft, worth around \$3.7 trillion, by 2030. The UK has the second largest aerospace sector in the world and we are well placed to compete for this new business. I am committed to ensuring that the UK continues to be a world leader in this sector.

We must continue to identify Britain's strengths and reinforce them, backing industries like aerospace. This is a deliberate strategy to create a more balanced national economy. So we are investing alongside business to create the Aerospace Technology Institute. The Institute will support the R&D investment that is crucial for creating an internationally competitive economy driven by strong and sustainable private sector led growth. Providing certainty on government support will give industry the long-term stability the sector needs to develop and commercialise the next generation of aircraft technologies in the UK.

Secretary of State for Business, Innovation and Skills The Rt Hon Dr. Vince Cable MP



Partnership with business is the basis of the Government's approach to industrial strategy, combined with a long-term approach to build confidence for investment in the UK economy.

This is crucial in a global sector such as aerospace where growing international competition to attract private-sector investment means that the UK cannot afford to be complacent. It can take up to fifteen years to develop a new aircraft. Companies have business plans that set out their priorities for 5,10,15 years ahead. Our industrial strategy aims to create durable structures working beyond political cycles to give businesses the confidence to invest and create jobs for the long term.

We established the Aerospace Growth Partnership to keep the UK firmly at the forefront of world aerospace manufacturing. There is a huge prize here as current planes are replaced by the next generation

of aircraft. However, new manufacturing processes, new skills and a flexible and adaptable supply chain will be critical if we are to grasp these opportunities. This strategy, which builds on the Strategic Vision we published at the Farnborough Air Show last July, sets out how we will work together to address these challenges. A step change in technology is needed if these aircraft are going to deliver the improvements in efficiency and environmental performance needed to make air travel sustainable. The UK is well placed to lead on developing many of these technologies, but we need to start now if we are to have the right capabilities in place. This is why we have announced the creation of a new Aerospace Technology Institute. Over the next seven years the Government will invest £1 billion in this initiative, a commitment that industry has pledged to match. This is a major investment by any standards. It is at the heart of our long term strategy for aerospace and is critical to securing the future security and growth of a sector that employs 230,000 people across the UK.

Minister of State for Business and Enterprise The Rt Hon Michael Fallon MP



Aerospace is one of our most important manufacturing industries. We have world-leading capability in some of the most advanced parts of modern aircraft - in wings, engines, aero-structures, and advanced systems.

This Strategy sets out our ambition to grow our aerospace industry in these high value areas and to widen our customer base internationally. In the face of increasingly stiff global competition, this represents a major challenge. However, my

experience of working with this industry - including through chairing the Aerospace Growth Partnership, jointly with Marcus Bryson of GKN - gives me every confidence that this ambition can be realised.

We have already started to implement the actions set out in this Strategy. Our industry will lead the way on this work, with the strong support of this Government. I am determined to see that the UK is recognised the best place in the world for aerospace businesses to invest, design, manufacture and export.

CEO of GKN Aerospace Marcus Bryson



The announcement of the Aerospace Technology Institute and the publication of “Lifting Off - Implementing the Strategic Vision for UK Aerospace” sees the culmination of the activities under the Aerospace Growth Partnership (AGP). It has

been an honour and a pleasure to co-chair the AGP with Michael Fallon and play my part in creating a true partnership between ministers, civil servants, academics, ADS and industry. AGP has been a real team effort with

the simple shared goal of creating a business environment that keeps the UK aerospace industry at the forefront of the global aerospace industry.

Having produced a strategy and created the ATI under the AGP, we now need to deliver the technologies, skills, capabilities and investment at a pace that allows us to win strategic packages of work on the tens of thousands of aircraft that need to be built over the next twenty years. There is much to do but the prizes are huge and, if we get this right, the nation will benefit for decades to come.

Industry Commitment to the Aerospace Industrial Strategy

The UK aerospace sector is the European leader and global number two. Its world class capabilities in the manufacture of some of the most sophisticated and high value parts of modern aircraft has created a high-tech and high-skill industry of 3,000 companies and 230,000 employees in the UK that creates massive UK economic benefits.

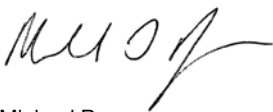
The industry has received support from the Government and that investment is already producing a step-change in the UK aerospace industry’s competitiveness. The twin opportunities of a forecast for 27,000 new passenger aircraft in addition to 40,000 commercial helicopters and the demand for greener, more fuel efficient aircraft, presents a challenge to which the UK aerospace industry must respond. The Aerospace Industrial Strategy sets out the strategic vision for the sector; a UK Aerospace Technology Institute (ATI) will be its Research and Technology focal point.

The ATI will represent a joint industry and Government investment of £2 billion across the next seven years to give certainty and stability for technology and innovation. It will strengthen the way in which we work in partnership to deliver benefits for the UK.

Industry is committed to the Aerospace Industrial Strategy and the ATI. Together they can make a material difference to the sector’s investment decisions and the future of the UK as a globally competitive home for the aerospace sector.




Tom Williams
AIRBUS – Executive Vice President, Programmes and Senior National Representative, UK

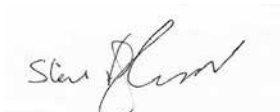
Michael Ryan
BOMBARDIER AEROSPACE, Belfast Vice-President and General Manager




Alberto de Benedictis – FINMECCANICA UK Chief Executive

Marcus Bryson
GKN Aerospace and Land Systems CEO; AGP Industry Co-Chair

Stephen Fitzgerald
MARSHALL AEROSPACE & DEFENCE GROUP Chief Executive




John Rishton
ROLLS-ROYCE Chief Executive




David Oldroyd
SAFRAN Country Delegate, UK




Scott McLarty
SPIRIT AEROSYSTEMS Vice President UK Operations





Industry Commitment to the Aerospace Industrial Strategy

The Aerospace Members Committee of ADS represents the UK aerospace industry's small and medium sized enterprises engaged in the provision of components, systems and services within the aerospace supply chain. Some of our companies export directly, while others supply highly successful primes such as Airbus and Rolls-Royce, and many do both.

In addition to those we employ directly, the wealth we create supports many more jobs in the economy, through those who supply goods and services to our businesses, and through the taxes we contribute to the UK exchequer.

The Aerospace Members Committee has participated in, and strongly supports, the Aerospace Growth Partnership (AGP). This engagement with the government has taken important steps to identify and address the barriers to growth for small and medium size enterprises of the aerospace supply chain.

The need for an Aerospace Technology Institute (ATI), as identified by the AGP, to gather and exploit the UK's assets and capabilities, has never been greater. Timely access to the key technologies required for the next generation aircraft is critical to companies of the size of our members if we are to grow, create new jobs and generate increased wealth in the economy.

Discussion with supply chain companies leads us to believe that this additional investment will improve the competitive position of the UK aerospace sector, and further deliver the economic growth that the UK needs, not just in the future, but in the short to medium term.

The UK aerospace sector is a successful, high value, high technology engineering, manufacturing and service industry. We have world-leading strengths in areas such as design & manufacture of large aircraft wings; aircraft engines; helicopters; landing gear and advanced systems.

The Aerospace Industrial Strategy sets out a clear programme of action, including increased investment in our sector, from which the UK aerospace supply chain stands to gain. Our members are well positioned to benefit from the continued rapid growth in the global aerospace market.

Yours sincerely

A handwritten signature in black ink, appearing to be 'D Nutton', written over a horizontal line.

David Nutton
CEO RLC (UK) & Chairman ADS Aerospace Members Committee



ADS Aerospace Members Committee:

Mr R Martin	ADEPT NX Ltd
Mr J Smith	Aeromet International Plc
Dr D Clutterbuck	Altran UK Ltd
Mr P Inness	Axis Electronics Ltd
Mr S Beech	Bulwell Precision Engineers Ltd
Mr B Austin	Castle Metals Aerospace
Mr O McFarlane	CAV Aerospace Ltd
Mr C Melrose	Daher Aerospace
Mr R Herman-Smith	Darchem Engineering Ltd
Mr D Skinner	Farsound Engineering Ltd
Mr N Guttridge	Gardner Group Ltd
Mr D Danger	HS Marston Aerospace Ltd
Mr A Churchill	JJ Churchill Ltd
Mr G Bellamy	KPMG
Mr S Boyd	Marshall Advanced Composites
Mr K Gardner	Micro Spring & Presswork
Mr M Pedley	Middleton Sheet Metal Co. Ltd.
Mr A Poeton	Poeton Industries Ltd
Mr D Nutton	RLC Ltd
Mr S Hayter	Rockford Components Ltd
Mr T de Bouillane	Specialist Technologies Ltd
Mr I Hodges	Timet UK Ltd
Mr D Snelson	Waer Systems Ltd



Rolls-Royce Trent 1000 designed and manufactured in Derby



“The ambition of the AGP is to enable companies to take the decisions that will lead to growth, wealth and job creation.”

Michael Ryan CBE

Vice-President and General Manager, Bombardier Aerospace, Belfast

“The AGP has allowed UK aerospace companies representing all levels of the supply chain to come together collectively to maintain the UK’s position as a world leader in aerospace.”

Robin Southwell

CEO of EADS UK and President of ADS trade association





EXECUTIVE SUMMARY

By working together in the Aerospace Growth Partnership (AGP), Government and industry have developed a shared vision for UK's aerospace industry to:

- ensure that the UK remains Europe's number one aerospace manufacturer and that it remains second only to the United States globally. This is an ambitious and challenging goal, given intensifying international competition and the rapid pace of innovation in the sector
- support UK companies at all levels of the supply chain to broaden and diversify their global customer base. This will be critical given the entry into the market of new manufacturers of large civil aircraft across the world
- provide long-term certainty and stability to encourage industry to develop the technologies for the next generation of aircraft in the UK. To this end, Government and industry have agreed to fund jointly the creation of a UK Aerospace Technology Institute. This brings the opportunity to secure up to 115,000 jobs in aerospace and its supply chain in the long term.

Achieving economic growth is a key priority for Government and the aerospace industry, as an integral part of advanced manufacturing, has significant scope to help rebalance the economy. The UK aerospace industry is expected to grow at a rate of 6.8% over the next few years¹. This is driven by a global increase in air traffic, which is expected to be sustained at a rate of 4.7% per annum between now and 2030², meaning a doubling in air traffic in the next 15 years. CBI analysis indicates that just by maintaining our current market share, air traffic growth in Asia alone has the potential to contribute an extra £4.7 billion in UK exports annually in the next ten years, adding 20,000 high-value jobs³.

Aerospace is one of the jewels in the crown of the UK's advanced manufacturing sector. The UK designs, manufactures and assembles some of the most technologically complex and valuable parts of today's airliners, including the wings, engines, aerostructures and advanced aircraft systems. We are also one of only a handful of nations with the capability to design and manufacture advanced helicopters. The sector benefits from having a strong lead trade association – ADS – that has helped bring the industry together to facilitate engagement with Government.



A350 XWB wing manufacture, Broughton, Wales.

The UK is the number one aerospace industry in Europe and globally we are second only to the US. The sector supports more than 3,000 companies distributed across the UK, employing around 230,000 people (direct and indirect). It is a high value-added, research and development (R&D) intensive sector, where investment can bring benefits in anchoring output and jobs for decades to come.

Working with the UK aerospace industry, the coalition Government established the AGP in 2010 as a way to tackle barriers to growth, boost exports and grow the number of high value jobs in the UK. This document sets out the Aerospace Industrial Strategy to achieve this vision. Its publication follows more than two years of substantial work by the AGP. Over 80 senior executives from across the sector have committed time

and resources from their companies to working with Government to support the work. It builds on “Reach for the Skies - A Strategic Vision for UK Aerospace”, which was launched by industry and Government at the Farnborough International Airshow in July 2012 and provides an update on the progress we have already made.

Our strategy is based on the analysis that despite growing international competition, the UK has developed a strong comparative advantage in the four key, high-value, highly complex areas of modern aircraft – wings, engines, aerostructures and advanced systems – stemming from its highly skilled workforce, institutional knowledge and strong science and research base. Barriers to entry in these areas are high. Despite this, the UK’s incumbent position is at risk as the next generation of aircraft will

feature substantially different product and manufacturing technologies from those used today. The UK needs to be positioned at the forefront of these new technologies. In the current economic circumstances our strategy is based on focusing investment on those areas where the UK has particular strengths, rather than simply trying to match the investment of other nations. With the right actions by Government and industry the UK can realistically build on its position to secure jobs and generate significant UK economic value from major programmes, including the next generation of aircraft and new variants of existing models, such as the Boeing 777.

If we succeed, the prize will be substantial. Between now and 2031, for example, there is a global requirement for over 27,000 new passenger aircraft worth circa \$3.7 trillion⁵. Over the same time period, the global market demand for new commercial helicopters is expected to be in excess of 40,000 units, worth circa \$165 billion. Capturing this opportunity is critical to our aspiration to create thousands of additional, high-value and sustainable jobs.

As outlined in this document, we have already begun to implement some of the key measures identified in the early stages of the AGP's work. This includes an investment, announced in the 2012 Budget, of £60 million to create a new UK Aerodynamics Centre, with a commitment from industry to invest an additional £40 million to support the Centre's R&D programmes.

At the Farnborough International Airshow in July 2012, we announced a further £100 million of investments by Government and industry in low carbon aeroengine

technology and other innovative aerospace technology projects. In addition, the AGP has launched a new initiative, jointly funded by Government and industry, to train 500 new aerospace engineers to Masters level over three years. Aerospace projects have also been supported with funding from the Government's Regional Growth Fund and Advanced Manufacturing Supply Chain Initiative.

Just as significant, the AGP has been successful in bringing the UK aerospace companies together to find solutions to common problems. This includes longer-term work to identify and address skills issues as well as initiatives aimed at further enhancing the competitiveness of the UK supply chain. Working with the banks, professional services firms and aerospace companies, the AGP has created an Aerospace Finance Forum to help address sector-specific issues relating to access to finance. This has already delivered a commitment from one of the major banks to create a network of regional aerospace finance specialists.

Industry and Government together recognise that the UK needs to do more if it is to retain its attractiveness as a location for future aerospace manufacturing and reverse recent trends, which have shown a progressive reduction in UK content on new aircraft programmes.

At the top end, the sector is dominated by a small number of multi-national prime contractors, whose investments are mobile and whose decisions affect companies across all tiers of the supply chain. For example, each sale of an Airbus aircraft or an aircraft powered by Rolls-Royce

engines currently supports approximately 1,700 UK companies for Airbus and 3,000 for Rolls-Royce in their respective supply chains⁶. We are entering a critical stage in the evolution of the sector as these prime contractor companies start to take decisions on the design and manufacture of the next generation of aircraft and engines, which in some cases will replace platforms that were originally introduced thirty years ago.

Pressure from airlines to reduce operating costs, combined with the need to reduce the environmental impact of aircraft, means that new aircraft will be based on very different product and manufacturing technologies from those that are currently in use. The ability of UK industry to develop and apply these technologies will be crucial to the future of the sector. Failure to achieve this will make it impossible for the UK to generate the right skills and capabilities to secure a meaningful share of work on future aircraft.

Given the long development times for new aircraft and the scale of investment required, industry has indicated the crucial need for long-term certainty from the Government on the availability of public sector R&D funding. The Government, for its part, recognises the need to improve the way R&D funding is matched to the specific needs of a very long-cycle sector such as aerospace so that it compares more favourably with the approach taken elsewhere in Europe and beyond.

To address this, the Government and industry have agreed to create a new UK Aerospace Technology Institute (ATI) and to support a long-term, targeted technology strategy. Government funding for the ATI will reach £150 million annually by 2014/15 and will be committed for a seven-year period. Industry

is committed to matching this investment. This new policy framework provides the aerospace industry with the certainty it needs to be able to invest in developing new technology and manufacturing activities in the UK.

This is a substantial commitment by both Government and industry in a difficult economic climate and a demonstration of a joint willingness to take a longer term view where this is necessary to deliver growth. The ATI creates a programme with the scale to deliver the new technology capabilities that will be needed for the UK to retain its strong position globally. Based on the UK's potential to develop technology to sustain and grow its future market share in aerospace the ATI could secure up to 115,000 jobs in the sector and its supply chains in the long term.

This document sets out a challenging but essential programme to secure the future of the UK's aerospace industry over the next decade and beyond and to capture the huge market opportunities that exist as a result of global growth in air travel. The ATI is at the heart of this strategy and will position the UK for opportunities in the near, medium and far term. Capitalising on the opportunities that the ATI will generate will require close and continuing engagement between Government and all tiers of the aerospace industry.



Drawing from the programme for each of the AGP working groups, the next priorities are:

TECHNOLOGY:

- Deliver the ATI
- Strengthen the links between industry and academia
- Maximise opportunities for UK industry to gain access to European programmes

MANUFACTURING:

- Embed world-class manufacturing processes and systems throughout the supply chain
- Develop the aerospace Manufacturing Accelerator Programme (MAP)

SKILLS AND ENGAGEMENT:

- Build on the progress already made between industry, Government, Semta (the Sector Skills Council for Science, Engineering and Manufacturing Technologies) and UK Commission for Employment and Skills (UKCES) to help secure the next generation of talent for aerospace
- Industry to work with Government to promote the benefits of investment in training and skills, make best use of available funding schemes and look at the scope to develop a sector wide Industrial Partnership on skills
- Improve the image of aerospace as a career choice and increase the diversity of its workforce

SUPPLY CHAIN COMPETITIVENESS:

- Take forward new ideas to accelerate technology exploitation within the supply chain
- Develop a more strategic approach with UKTI to identifying and pursuing opportunities in overseas target markets
- Work closely with UKTI to carry out capability analysis to enable more strategic targeting of inward investment opportunities
- Tackle access to finance issues through the newly created Aerospace Finance Forum
- Enhance leadership and build best practice in supply chain management
- Encourage increased collaborative working between prime manufacturers and suppliers to create strategic supply chains and clusters of companies, including SMEs

The AGP has already made substantial progress. Government and industry will continue to work together to deliver the ambitious programme set out above.

The success of the strategy will be measured by considering performance against milestones and indicators detailed in Annex A.



A320 wing sharklet designed in Filton, Bristol



“The UK’s strong position in the global market place and the certainty of joint Government-industry support provided by the AGP allows companies to take decisions that benefit the UK industry.”

Tom Williams
Executive VP Programmes, Airbus

“It’s great to see a strategic vision being put forward that looks out as far as 20 years and beyond. This type of approach provides companies with confidence to invest in the UK.”

Andrew Churchill
Managing Director, JJ Churchill Ltd (SME)

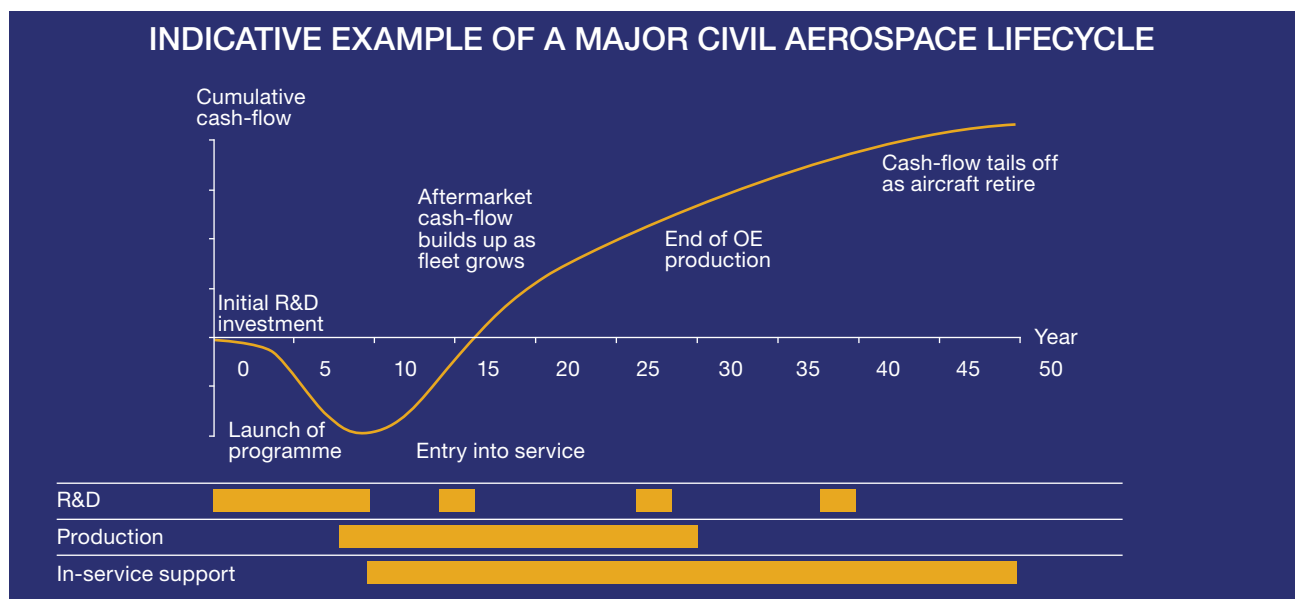


STRATEGIC CONTEXT

UK aerospace has a 17% global market share, making it the number one aerospace industry in Europe and globally second only to the United States. The sector creates annual revenues of over £24 billion and exports circa 75% of what it produces, making a positive contribution to the UK's trade balance. The sector supports more than 3,000 companies distributed across the UK, directly employing 100,000 people and supporting an additional 130,000 jobs indirectly. A characteristic of the industry is its large-scale need for a broad range of high-value skills and disciplines, including engineering, science, project management, production, service, training and finance.

Developing a new aircraft is a complex enterprise involving an investment of billions of pounds. The commercial and technological risks are high and the uncertain and long payback periods are unattractive to many commercial investors. There are important spill-over effects as new technologies and processes developed in the aerospace sector have applications in other manufacturing sectors, notably defence, marine, offshore wind and automotive. In addition, there are significant wider social benefits such as reduced emissions. For these reasons, governments across the world play an active role in supporting the development of their aerospace industries.

INDICATIVE EXAMPLE OF A MAJOR CIVIL AEROSPACE LIFECYCLE





GKN's fixed trailing edge assembly and integration jig, Western Approach, Bristol

The Aerospace Growth Partnership

The Aerospace Industrial Strategy has been developed jointly by Government and industry working together through the Aerospace Growth Partnership (AGP). The AGP's scope is civil aerospace: from business jets to the very largest twin aisle passenger aircraft and from helicopters to advanced turbo props; it also considers areas where the potential for technology synergies exist between aerospace and other sectors. The AGP has not only led to a step change in the relationship between Government and industry, it has also encouraged UK companies to co-operate more closely in

addressing problems that affect the sector as a whole. The approach adopted within the AGP represents a new model for the joint development of industrial strategy. It is not about the Government seeking to impose a strategy on the sector; its goal is instead to work closely with business to understand the opportunities, threats and barriers to growth that exist and to identify where Government has a legitimate role in helping to create long-term, sustainable value for the industry and for the wider UK economy. Industry is committed to delivering its side of the partnership by investing alongside Government in R&D in the UK and in actions such as the creation of the 500 new aerospace Masters places, encouraging developments in skills and apprenticeships

and providing greater collaboration with companies throughout the supply chain.

The AGP is jointly chaired by Michael Fallon, Minister of State at the Department for Business, Innovation & Skills (BIS), and Marcus Bryson, CEO of GKN Aerospace and ADS Vice President for civil aerospace. It has been established as a partnership between industry and Government to create a vision and strategy for the future of the UK aerospace industry for the next 20 years and beyond.

The AGP's work programme has secured the commitment of over 80 senior business leaders including representatives of the regional trade associations. The work is supported by the specialist and experienced aerospace team working within BIS together with eight full-time secondees from industry.

Between now and 2031 the civil aerospace

sector is forecast to grow strongly, generating opportunities worth billions of pounds for the UK. The anticipated growth in the sales of new aircraft is driven by airlines seeking more efficient aircraft, governments demanding less noise and lower emissions, and rising incomes in emerging markets that will open air travel to a much larger number of people. However, unless we act now, the UK will not be well-positioned to benefit from these opportunities.

The UK's success on current generations of aircraft draws heavily on investment made in developing technologies in the 1970s and 1980s. However, recent trends have shown that UK content on new aircraft is in decline and that, without action, this will accelerate as new generations of aircraft are introduced. This document sets out what Government and industry believe is realistic and achievable to reverse this decline and to sustain and grow the value of the sector and the employment it creates.

Challenge and Opportunity

There are huge market opportunities in civil aerospace.

MARKET OPPORTUNITIES IN CIVIL AEROSPACE

27,000 100+ seat aircraft by 2031, worth **\$3.7tr**

24,000 business jets by 2031, worth **\$648bn**

40,000 helicopters by 2031, worth **\$165bn**

Total civil aerospace market in excess of **\$4.5tr**

Over the next twenty years, there is a global requirement for over 27,000 new passenger aircraft worth circa \$3.7 trillion. If the UK is to address the challenges from growing international competition and seize these opportunities, then the deep and substantial engagement between Government and industry that has been developed through the AGP will need to be sustained. By working together on strategy, we are able jointly to identify the priorities for actions and to take real steps to help address these challenges. The AGP work has identified a set of short, medium and long-term market opportunities shown in the diagram below.

International aerospace markets are evolving and competition will be even more intense in the future. Governments across the world, with their own domestic industries, are responding to the longer-term opportunities

and threats, and to immediate pressures for economic growth, both within Europe and elsewhere. It is vital that the wider UK environment for business should remain competitive.

This Aerospace Industrial Strategy is a critical part of ensuring that we control our own destiny and are not simply driven by our competitors' strategies. Our strategy is based on an analysis that despite growing international competition, the UK has developed a strong comparative advantage in the four key, high-value, highly complex areas of modern aircraft – wings, engines, aerostructures and advanced systems. Barriers to entry in these areas are high. Despite this, the UK's incumbent position is at risk as the next generation of aircraft will feature substantially different product and manufacturing technologies from those used

Programme opportunities for short, medium and long term growth



today. The UK needs to be positioned at the forefront of these new technologies. In the current economic circumstances, our strategy is based on focusing investment on those areas where the UK has particular strengths, rather than simply trying to match the investment of other nations. With the right actions by Government and industry, the UK can build on its position to secure jobs and generate substantial UK economic value from major programmes, including the next generation of aircraft and new variants of existing models such as the Boeing 777, and the Airbus A320 neo.

The Government's network, particularly UKTI's commercial staff based in embassies in the established and emerging aerospace markets, provides a strong platform from which to pursue business opportunities.

It is clear that there are some areas where current UK capabilities are becoming increasingly fragmented and fragile as a result of decades of under-investment and the past lack of a long-term strategy supported by both industry and Government. This has got to change.

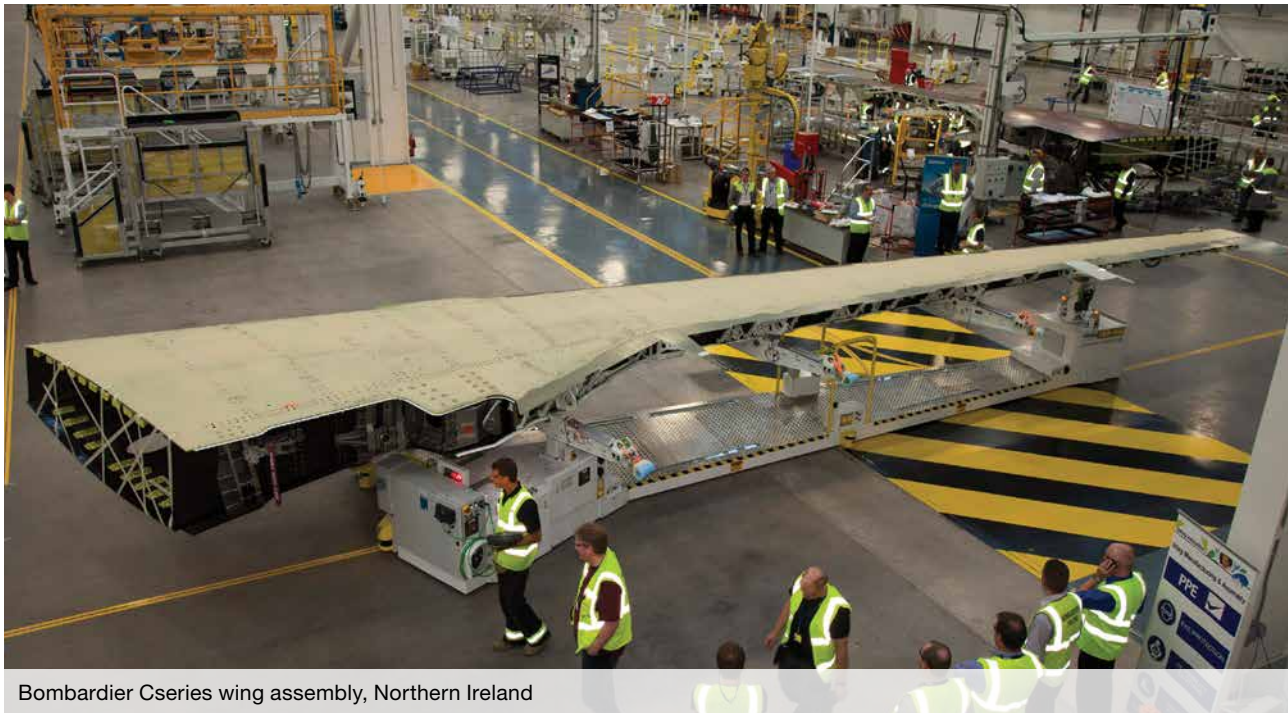
Government and industry are working together to contribute to delivering the ACARE goals⁷. Global growth in air travel will only be sustainable if future aircraft deliver substantial improvements in environmental performance, in particular noise and carbon emissions and reductions in operating costs of at least 20%. Achieving these will be essential for the reputation of the sector as well as for future competitiveness. It can only be achieved with radical design changes and new manufacturing methods. Industry is already taking decisions on where to carry out the R&D activities that will shape these

aircraft. The boundaries between research, design, development and manufacturing are becoming increasingly blurred and so ensuring that key capabilities are developed and anchored in the UK is critical to the long-term future of our aerospace manufacturing sector.

The development of a new aircraft takes 10-15 years, and so work is already starting on these programmes. There is a short window within which to act if these decisions are to be influenced in the UK's favour. Industry has made it clear that long-term predictability and stability of Government funding for R&D is a key factor in determining where it chooses to invest and that the UK needs to do better in this respect. Now is the time to prevent any further decline in the UK's aerospace sector through investment in next generation aircraft technology. This is critical if we are to secure work on aircraft upgrade and engine refresh programmes and on the next generation of aircraft. The Government has indicated that it understands the need to address this.

Government and industry in partnership across the UK

The sector benefits from a strong, single, national trade association: ADS. It is supported by an energetic network of regional aerospace trade associations in England, Scotland, Wales and Northern Ireland. Our aerospace industry spans most of the UK, with large geographical clusters mainly centred around companies in the North West, Midlands, South West, and South East of England; in Wales (Broughton); in Scotland (Prestwick and Glasgow); and in Northern Ireland (Belfast). These clusters benefit from the availability of large and



Bombardier Cseries wing assembly, Northern Ireland

sufficiently skilled labour forces, easy access to suppliers, and knowledge spill-overs⁸.

To ensure this UK-wide Aerospace Industrial Strategy is consistently implemented, we will continue to work in partnership with each of the devolved administrations in Scotland, Wales and Northern Ireland, and their territorial offices. This will ensure that wherever possible their policies and business support activities are aligned with the aims and objectives of the Aerospace Industrial Strategy.

The aim will be to co-create solutions that deliver maximum benefit to companies throughout the UK. We have already successfully demonstrated this close collaborative working through the Aerospace MSc Bursary scheme, which will operate throughout the whole of the UK later this year.

AEROSPACE IN NORTHERN IRELAND

Northern Ireland is proud of its long and prestigious history in the aerospace industry. Today, local companies supply high-technology aerostructures in metal and advanced composites to the world's leading aircraft programmes, and are actively engaged in national and European R&D projects. The region has benefited from a legacy of engineering excellence in aerospace, employing more than 8,000 people and generating over £900 million per year for the local economy.

The Northern Ireland Executive continues to invest in companies and the skills required to build on this position and to secure a transition to higher-value products and services. Investment in the SC21 (21st Century Supply Chains) programme



A380's inner outboard fixed leading edge wing assembly, produced at Spirit AeroSystems' site Prestwick, Scotland

is an indication of this commitment to improving companies' performance and ability. Investment in academia and young people through the MSc Aerospace initiative, additional PhD places and increased undergraduate places in STEM subjects underpins the region's resolve to compete effectively in a global marketplace, grow its export market and create more jobs. The combination of a highly-skilled workforce, collaborative projects, advanced technological capability and the Executive's commitment to excellence has, and will continue to attract major players to invest in Northern Ireland's aerospace industry.

"I welcome the joint approach being taken by industry and government to implement this AGP industrial strategy. I have confidence that Northern Ireland will continue making a vital contribution to sustaining the UK aerospace's position at the forefront of technology development

and I look forward to seeing strong growth in the coming years." Arlene Foster, MLA Minister for Enterprise, Trade and Investment, Northern Ireland.

AEROSPACE IN SCOTLAND

The Scottish aerospace industry is mostly focused on the civil aerospace market with over 160 companies in the sector and its immediate supply chain. These companies employ over 8,000 people with sales of circa £1.6 billion per year. Maintenance, repair and overhaul activity on both engines and aerostructures form a large part of these sales.

"Aerospace is a significant element of Scotland's high value engineering sector and the Scottish Government and its agencies are committed to sustaining and growing the sector through a range



Cardiff University Morgan-Botti Lightning Laboratory, tests composite materials including those on the A350 XWB wing

of programmes and mechanisms which support company growth, research and development, skills development and international trade and investment. This work is shaped through close cooperation with a Scottish industry leadership group, further enhancing the close cooperation between industry and government that is seen in the Aerospace Growth Partnership.” Fergus Ewing MSP, Minister for Energy, Enterprise and Tourism, Scotland.

AEROSPACE IN WALES

Wales has a proud and successful heritage in the aerospace industry with key strengths in manufacturing, maintenance, repair and overhaul, unmanned systems

and associated supply chains as well as contributing to leading edge research through its academic institutions. Wales remains an integral part of the UK industry, underpinning its global competitive advantage in this key sector.

“Wales has, and will continue to support, national aerospace programmes and strategies to secure economic advantage through collaboration with key stakeholders, both in the public and private sectors. I welcome this strategy and the opportunity to work in partnership with the UK to remove barriers to growth and enhance the competitiveness of the sector.” Edwina Hart MBE OStJ AM, Minister for Business Enterprise, Technology and Science, Welsh Government.

Taking action together

In “Reach for the Skies - A Strategic Vision for UK Aerospace”, the AGP identified the UK’s strong comparative advantage in the four key, high-value, highly complex areas of modern aircraft – wings, engines, aerostructures and advanced systems.

It also set out a PEP (Protect, Exploit and Position) model as a strategy for identifying and prioritising the actions needed to support the delivery of the Aerospace Industrial Strategy and capture the opportunities for short, medium and long term growth.

PROTECT (0-5 years):

Looking at the capabilities we need to have now – identifying what currently exists in the UK and what actions may be necessary to make these fit for purpose to support the overall strategy.

EXPLOIT (up to 2025):

Working together to identify programmes for UK industry, primarily on upgrades to existing aircraft and systems.

POSITION (2025 and beyond):

Taking action now to position the UK to be as competitive as possible for the all-new aircraft that will enter service in the mid 2020s.

A detailed description of what has been done to date and the next set of actions is detailed in the subsequent sections of this document.

The work to date includes an investment announced in the 2012 Budget of £60 million to create a new UK Aerodynamics Centre, with a commitment from industry to invest £40 million to support the Centre’s research and technology programmes. At the Farnborough International Airshow in July 2012, the AGP announced a further £95 million of investments by Government and industry in low carbon aeroengine technology and other innovative aerospace technology projects. We also announced a new initiative, jointly funded by Government and industry, to train 500 new aerospace engineers to Masters level over three years. Aerospace projects have also been supported with funding from the Government’s Regional Growth Fund (RGF) and the Advanced Manufacturing Supply Chain Initiative (AMSCI).



STRATEGIC ACTION FOR LONG-TERM COMPETITIVENESS

The actions we are taking together are widely welcomed. However, we recognise that the UK needs to do more if it is to retain its attractiveness as a location for future aerospace manufacturing and reverse recent trends which have shown a progressive reduction in UK content on new aircraft programmes.

Given the long lead times involved, companies are starting to make decisions on where to carry out the R&D programmes that will shape the technologies and manufacturing processes for the next generation of aircraft. These technologies will need to have reached high levels of readiness and been appropriately demonstrated and de-risked by as early as 2018.

Unless the UK protects and positions its capabilities immediately, it could find itself with a restricted and diminishing market over the next 20-30 years, with severe difficulties in re-entering aerospace sectors once vacated.

Industry has indicated the crucial need for long term certainty from the Government on the availability of public sector R&D funding. Industry is ideally looking for stability that

goes beyond the life of a single government spending review round or even a single Parliamentary term. The Government, for its part, recognises the need to improve the way R&D funding is matched to the specific needs of a very long-cycle sector such as aerospace so that it compares more favourably with the approach taken elsewhere in Europe and beyond. To address this, the Government and industry have agreed to create a new UK Aerospace Technology Institute (ATI) and to support a long-term, targeted technology strategy. Government funding for the ATI will reach £150 million annually by 2014/15 and will be committed for a seven-year period. Industry is committed to matching this investment. Based on the potential for technology to sustain or grow the UK's future market share, and taking into account industry's estimates of future revenues, the ATI and the associated increased investment in R&D could deliver significant net benefits to the UK and secure between 45,000 to 115,000 more jobs in aerospace and its supply chain by 2030⁹. The alternative would be a significant decline in UK market share and employment.

Setting up the ATI is critical to sustaining the UK's competitiveness. In the next ten years we have the opportunity to gain a



GKN, automated fibre placement on A350 rear wing spar, Filton, Bristol

competitive edge in the UK by developing the key technologies to make aircraft quieter, more environmentally friendly and cheaper to manufacture and operate.

The ATI will provide the focus to bring together the industry and academic communities. It is a key element in delivering the long-term strategic vision set out in this document. It will play a critical role in ensuring that the UK is the preferred supplier globally for aircraft and engine manufacturers and provides industry with the longer term certainty and stability needed to attract investment to the UK.

In line with our strategy of focusing on the high value, technologically sophisticated parts of the aircraft where the UK can maintain a sustainable competitive advantage, the ATI will focus on four areas:

- Aerodynamics
- Propulsion
- Aerostructures
- Advanced Systems

Improvements enabled by the ATI are expected to lead to a reduction in CO₂ emissions of more than 100 million tonnes each year from next generation

aircraft - equivalent to taking 20 million cars off the road around the world.

Although new materials such as composites are being increasingly used in aerospace, the initial approach has been to incorporate them within traditional aircraft designs. The industry has yet to take full advantage of the properties that these materials offer to open up radical new design options. It also needs to optimise manufacturing processes to allow structures using these materials to be made cheaply at high production rates. The ATI will play a key role in these developments.

The ATI will consist of a small core team (probably 30-50 staff) primarily seconded from industry and academia. Their role will be to lead on the development of the strategy, prioritise areas for work, scope programmes, map where capabilities exist across the UK, assess the actions needed to make these fit for purpose and carry out small-scale capability building activities.

As part of the work within the AGP companies have worked together to identify the project themes that would be included within each of the four areas covered by the ATI. These are set out in more detail in the Technology section of this document.



Composite fan blade, designed and developed in the UK



Using the ATI to secure key R&D projects and their resulting intellectual property is critical to anchoring future design, development and manufacturing in the UK.

The long-term stability of aerospace R&D that the ATI provides also generates a substantial demand signal to the UK academic research and higher education systems with important implications for the availability of capable people for the next generation of aerospace programmes.

Working with the existing R&D infrastructure

The ATI will need to draw from the other

elements of the UK R&D ecosystem to develop early stage technologies through to the level of maturity needed to support future applications in aerospace.

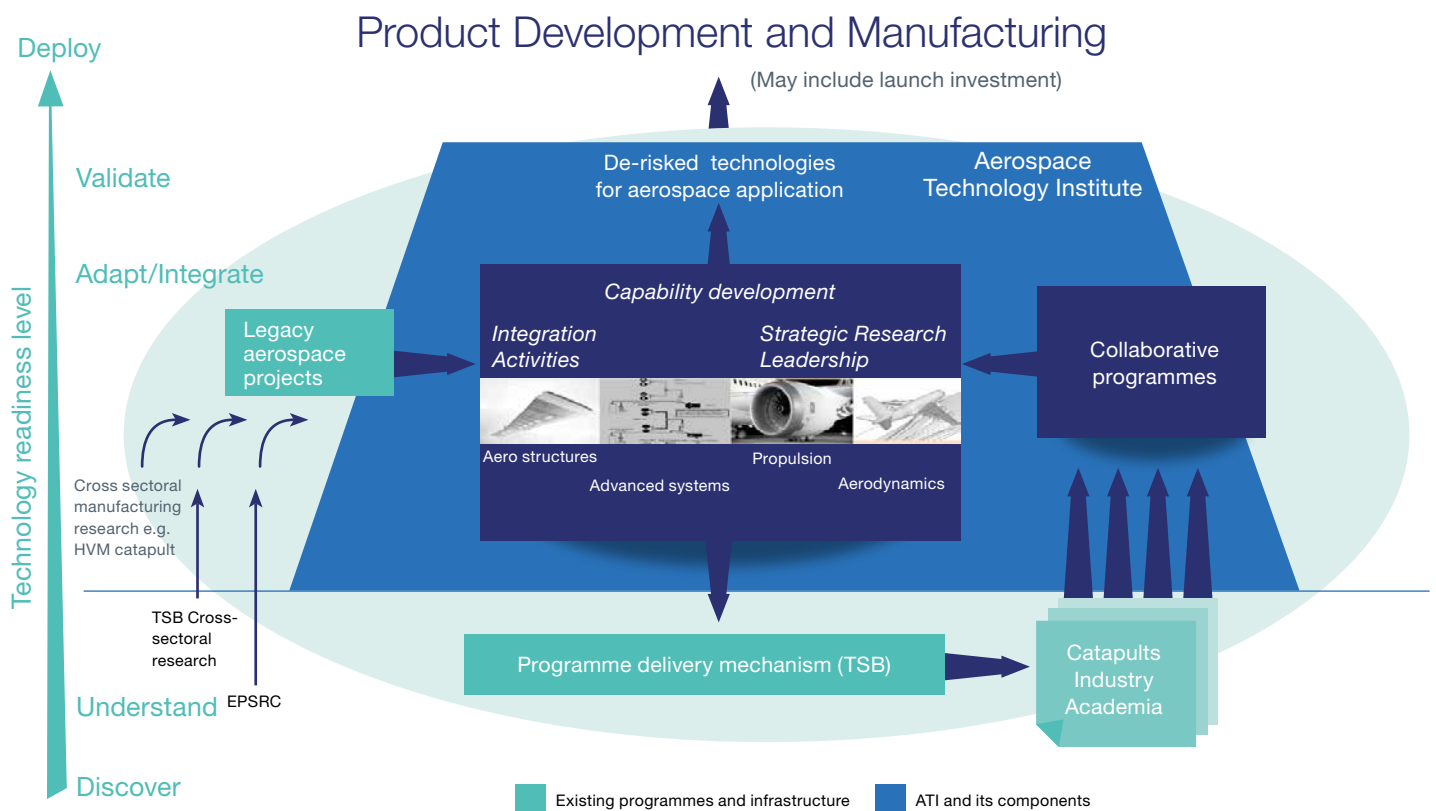
The ATI will provide better alignment between early research (such as that supported by the Engineering and Physical Sciences Research Council) and cross-sectoral R&D innovation, delivered through the Technology Strategy Board. It will also provide the foundation for large-scale technology demonstration – currently a gap in terms of available public support.

The UK aerospace industry welcomes the creation of the High Value Manufacturing Catapult, which brings together seven

institutions¹⁰ of excellence across a broad range of sectors to support UK manufacturing in the commercialisation of cutting-edge technologies. This accelerates the development and adoption of more capable and productive manufacturing processes and provides a vehicle for greater collaboration within industry and with universities. The larger-scale projects will be delivered through the Technology Strategy Board by collaborative groups from industry and academia. Much of the ATI research activity will be carried out in the High Value Manufacturing Catapult centres, maximising

the return on the Government's investment in these facilities.

The European Union funds a number of long-term cooperative aerospace R&D programmes such as Clean Sky¹¹. Previously, the lack of certainty around UK public funding for aerospace programmes has made it hard for the UK to gain maximum benefit from participation in these activities. The long-term nature of the ATI commitment will allow the UK to play a much greater role in these programmes in the future.



The ATI: drawing from the other elements of the UK R&D ecosystem to develop early stage technologies through to the level of maturity needed to support future applications in aerospace.



Moyola Precision Engineering in Northern Ireland



“As a major inward investor in the UK, the AGP is of huge importance to us, particularly in relation to AgustaWestland, our helicopter manufacturer. While any Government action to stimulate growth is welcome, the focus on skills development and on research and technology provides the seed-corn of long-term sustainability.”

Alberto de Benedictis
CEO, Finmeccanica UK

“The AGP has transformed the way in which we work with the UK aerospace sector. It continues to gain momentum and grow in ambition. It has allowed us to give Ministers a real insight into the challenges facing businesses in the sector and to identify how Government and industry can genuinely work together to support growth and create jobs.”

Huw Walters
Head of Aerospace, Marine & Defence,
Department for Business, Innovation and Skills





TECHNOLOGY: Creating the right environment for research and technology in the UK

WHAT HAVE WE ACHIEVED?

- We have identified the technologies that are of strategic importance to the success of the sector and which fall within four main areas – aerodynamics, propulsion, aerostructures and advanced systems with regard to both product and manufacturing technologies.
- We have agreed to establish and jointly fund the UK Aerospace Technology Institute (ATI), which will ensure that the UK's R&D efforts in each of the above key areas are strategically focused and make best use of available funding.
- We have quickly established the UK Aerodynamics Centre, which was announced by the Chancellor in March 2012 and we have already identified, structured and started work on the initial projects.

WHAT ARE WE DOING NEXT?

- We will establish the ATI with pace and launch the first set of priority programmes in the areas of aerodynamics, propulsion, aerostructures and advanced systems. As part of this, we will incorporate the UK Aerodynamics Centre into the ATI structure to maximise opportunities for synergies with other areas of technology and to ensure its long term sustainability.
- We will deliver the UK Aerodynamics Centre debut projects and invest in new projects.
- We will strengthen the links between industry and academia to work collaboratively.
- We will maximise the opportunities for UK participation in European programmes.

Critical importance of R&D

Aerospace is the cornerstone of UK high-value manufacturing: it is home to a highly-skilled, well-remunerated workforce and creates long-term, sustainable jobs and careers for over 230,000 people. Moreover, aerospace is a highly R&D intensive industry with annual R&D spend of some £1.4 billion¹² representing circa 12% of total R&D spending in UK manufacturing. It delivers significant technological spill-over benefits to the economy, drives world-leading improvements in productivity year-on-year, sustains an advantage over international competitors and is positioned to lead the way to a greener, low-carbon aviation future, contributing to meeting the ACARE goals.

Aircraft manufacturers want better environmental performance to satisfy legislative and public demand. To be leaner and greener new generations of aircraft will need to incorporate radically different technologies. This can be achieved by changing the way we design and manufacture wings, engines, aerostructures and advanced systems and equipment, including key helicopter technologies such as rotor blades.

Fortunately, these are the key areas on which the UK has built its current strengths in aerospace design, engineering and manufacturing, maintaining its position as number two in the world. But that status cannot be taken for granted.

The most significant high volume opportunities for UK industry will be the all-new single-aisle aircraft from Airbus and Boeing, which are widely expected to enter

service between 2025 and 2030. Nearer-term opportunities also exist to exploit and de-risk emerging technologies where aircraft are upgraded or have new engines such as the Boeing 777 twin-aisle.

CASE STUDY: MAKING AIRCRAFT LEANER AND GREENER



Bombardier CSeries, wing designed and manufactured in Northern Ireland

On entry into service, Bombardier's new CSeries commercial aircraft will deliver significant environmental benefits through its technological advancements – delivering reduced emissions and noise. This will help the sustainability and growth of the airlines that acquire the aircraft.

The CSeries aircraft has significant UK content, primarily through the advanced composite wings that have been designed and are being manufactured by Bombardier Aerospace in Belfast. The wings incorporate an innovative Resin Transfer Infusion technology – taking the use of lightweight composites to even greater levels of complexity and structural performance.

Not only is this technology delivering growth to the company's operation in Belfast, but it also helps position it for increased future business with new customers, consistent with the AGP's strategic aim of broadening the UK's customer base.

In addition to the 800 jobs which will be involved in the project in Belfast when it reaches full production, the C Series programme is supporting a further 2,000 jobs in the supply chain.

Partnership in technology development

Industry continues to invest in technology development globally. However, key capabilities in the UK cannot be sustained without a joint industry and Government approach. The timescales for a return on investment and the associated risks are too great for companies to bear on their own and even harder to bear lower down the supply chain.

"Reach for the Skies - A Strategic Vision for UK Aerospace" emphasised that a strategic, long-term partnership with Government is crucial to securing aerospace manufacturing work and high-value jobs in the UK.

Delivery of a sector-level approach to R&D is only possible if industry and Government can combine consistent, long-term investment cycles. This is the key to the sector's technology planning. The AGP is developing an R&D plan across all levels of the supply chain. The ATI provides the means to implement these plans.

A strategic approach to investment in aerospace technology

The UK's future competitive success will depend on its ability to stay at the leading edge on four key areas of technology. These are reflected in the four pillars of the ATI – aerodynamics, propulsion, aerostructures and advanced systems. These are described in more detail below.

AERODYNAMICS

Since the UK Aerodynamics Centre was announced in March 2012 considerable progress has been made in advancing its aims which are to:

- achieve a step change in the UK's capability in complex aerodynamics by creating a virtual centre to develop and deploy the UK's strategy for aerodynamics
- bring greater coherence to the UK's existing aerodynamics capabilities across industry and academia
- push the technological boundaries of aerodynamics by channelling funds to those best placed to execute R&D
- showcase the UK's capabilities in complex aerodynamics to the global market and to demonstrate the UK as an attractive location to carry out activities requiring strong aerodynamics capabilities.

Advanced aerodynamics will be critical to achieving a step change in performance of tomorrow's aircraft. Smoother wings



Rolls-Royce engine mounted on airframe



with new aerodynamic shapes will enable smoother, 'laminar' flow with reduced drag to take aircraft to new levels of aerodynamic efficiency.

Future aircraft configurations will also need to have new aerodynamic shapes that are highly developed to deliver unprecedented levels of performance and efficiency from the time they are introduced to the market.

- To get the full benefits of laminar flow aerodynamic improvements, there is a read-across to aerostructures to give improved build tolerances and new joining technologies. Laminar flow requires surfaces that are smoother, with fewer steps, gaps or contamination than the surfaces that can typically

be manufactured currently. Even the countersunk rivets and bolts that are commonly used today cannot be relied upon to deliver the consistent, repeatable levels of smoothness required.

- New aircraft configurations will demand sophisticated aerodynamic concepts with a high level of integration and functionality.

Project Themes:

- Development of high fidelity aerodynamic models of new configurations using high performance computing to de-risk novel engine and airframe concepts.
- UK future wing design and manufacture to integrate new product concepts and enabling technologies.

- Integrated and multifunctional aerodynamic de-risking demonstrators.

These themes are reflected in the following projects which are now up and running following the creation of the UK Aerodynamics Centre:

- Advanced Integrated Wing Optimisation
- Structural Technology Maturity
- Integrated Turboprop Propulsion Systems
- Experimental Aerodynamics
- Aircraft Research Association Research & Development
- Aircraft Research Association Capital Equipment

PROPULSION

The ATI will accelerate the introduction of revolutionary new engine technologies that will:

- Reduce fuel emissions by 20% over the next 20 years
- Make an aircraft taking off quieter than the traffic around an airport
- Enable future aircraft to carry 20% more passengers for the same amount of fuel as today

Revolutionary engine technologies will require radically different manufacturing technologies that will build on core skills and know-how already being developed in the Advanced Manufacturing Research Centre, Advanced Forming Research Centre, National

Composites Centre and Manufacturing Technology Centre of the High Value Manufacturing Catapult.

Initial Project Themes:

Next generation engine core demonstrator engine incorporating:

- Product technologies: high efficiency, high temperature compressor and turbine, low emissions combustor, low loss air system, high temperature materials
- High Value Manufacturing: 2nd generation composite fan, additive machining
- Virtual engine simulation on a world-class high-performance computing facility.

AEROSTRUCTURES

The next generation of aircraft will require radically different shapes and airframe technologies to unlock the performance, cost and weight improvements the market is demanding:

- Improved build tolerances and new joining technologies to enable achievement of the full benefits of aerodynamic improvements
- New aircraft configurations will demand sophisticated structural concepts with a high level of integration and functionality
 - Moving from structural concepts developed in metal and adapted for composites to tailored structures that place each fibre of the carbon material exactly where it is needed to optimise properties. This will lead to further step changes in weight reduction and fuel burn
- New materials and manufacturing



Airbus A330 main landing gear, designed and manufactured by Messier-Bugatti-Dowty, Gloucester Image © Messier-Bugatti-Dowty

- processes that do not exist today.
- Nanotechnology including carbon nanotubes, graphene and other new materials need to be developed from promising laboratory experiments to deliver real products that will be the foundation of a new materials-led industry sector
- Green manufacturing technologies to be developed include out-of-autoclave technologies such as microwave curing that will dramatically reduce energy usage and improve UK competitiveness
- Advanced high-rate airframe manufacturing systems that optimise and integrate all the individual specialities together
- Market projections for the next generation single aisle sector indicate world-wide demand of up to one hundred aircraft per month, requiring production rates for complex new technology aircraft parts well in excess of rates seen today. UK suppliers will be an integral part of global supply chains and manufacturing systems. New manufacturing technologies will be needed to integrate with supply chain management and parts logistics technologies that can locate any component part in any part of the worldwide manufacturing supply chain at any time of the day or night

Initial Project Themes:

- UK future wing design and manufacture to integrate new product concepts and enabling technologies
- Integrated and multifunctional structural technologies to produce de-risking demonstrators
- Environmentally efficient manufacturing technologies to industrialise new manufacturing capability for the UK
- Integrated manufacturing and supply systems to link all enabling technologies and supply chains in the UK

ADVANCED SYSTEMS

The ATI will innovate the world's smartest systems and equipment technology.

- Highly efficient operation to reduce fuel burn by innovative thermal and electrical management and advanced avionics systems
- Aircraft systems that are more connected, more interactive and increasingly wireless, like the smart TVs in our homes today
- New materials to allow equipment to operate robustly in the harshest environments

Initial Project Themes:

- Harsh environment electronics to support the more-electric aircraft and ultimately all-electric-aircraft concepts foreseen for the next generation single aisle platform
- Highly efficient and reliable electrical actuation

- Advanced power generation & distribution for greener aircraft
- Advanced systems integration
- Advanced health management and intelligent systems

Advanced manufacturing techniques that will be required to deliver new systems technologies will be developed in collaboration with the High Value Manufacturing Catapult Centres, in particular the Manufacturing Technology Centre in Ansty.

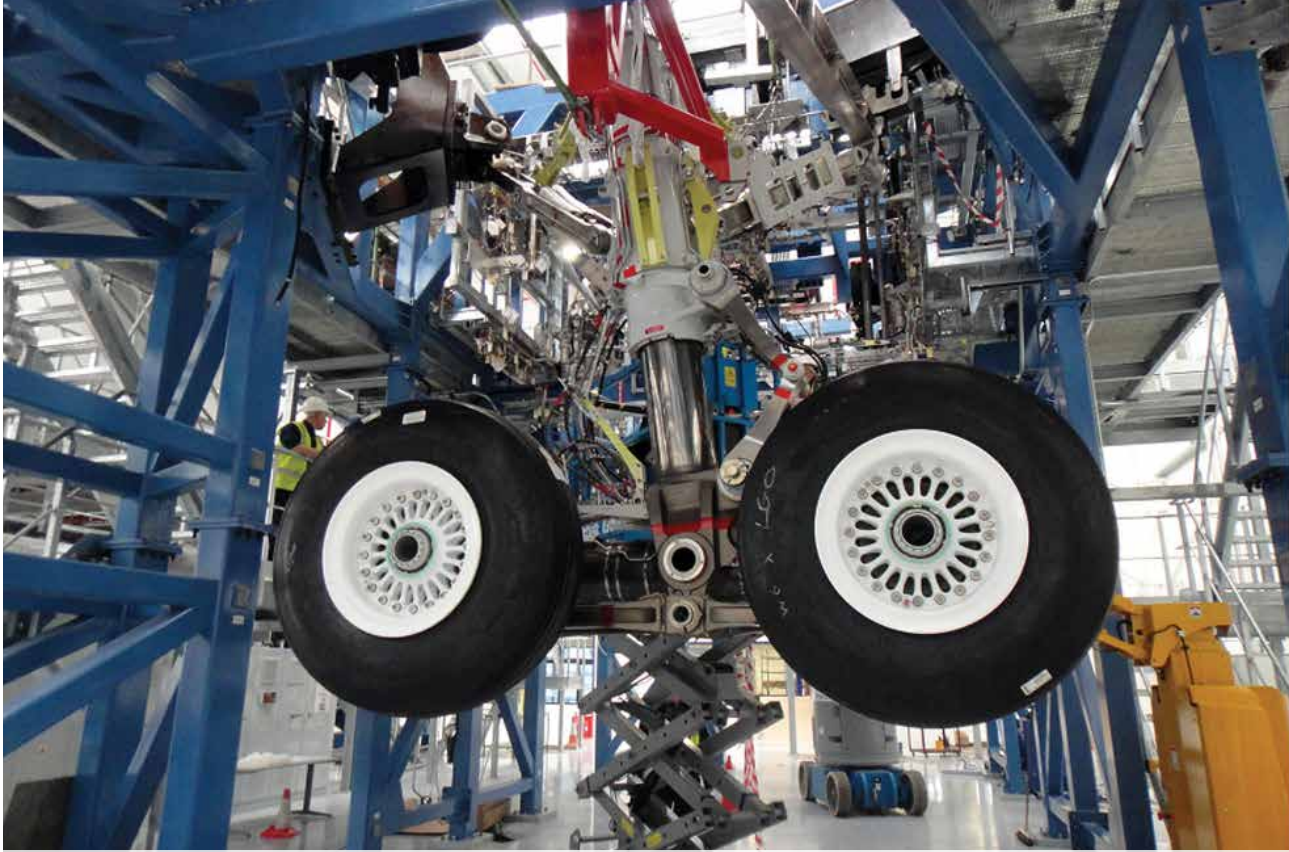
CASE STUDY: MESSIER-BUGATTI-DOWTY (MBD) LANDING GEAR AND THE UNIVERSITY OF SHEFFIELD ADVANCED MANUFACTURING RESEARCH CENTRE (AMRC)

MBD and the Government invested in new titanium machining processes at the AMRC, part of the High Value Manufacturing Catapult, thereby building a competitive advantage in a key area of technical challenge for new aircraft.

MBD was selected in March 2004 by Boeing to supply the main and nose landing gear structure for the new 787 Dreamliner commercial jet. This is the first time Boeing has ever subcontracted a landing gear work package.

Although composites are used for the braces of the Dreamliner landing gear, these new materials were still not strong enough to hold all of the weight of the aircraft.

Researchers at the AMRC worked with engineers at MBD to develop the unique



Messier-Bugatti-Dowty A350 XWB main landing gear, designed and manufactured in Gloucester, installed in Airbus systems test rig

titanium machining processes. This enabled an increased use of weight-saving titanium on the main landing gear, including a titanium inner cylinder, which is an industry first.

Winning this work positioned the UK MBD office as a centre specialising in titanium structures for landing gears and as a consequence the company has kept A350 XWB primary structure manufacture and full gear assembly at Gloucester.

AGUSTAWESTLAND IN THE UK: DRIVING ROTARY WING GROWTH THROUGH TECHNOLOGY AND INNOVATION

In October 2012, AgustaWestland and the Government announced the launch of new investments in next generation Tiltrotor aircraft. The Tiltrotor will fly twice as high and twice as fast as current helicopters.

The investments will develop, manufacture and test the new rotor blades, yoke, and undercarriage for the AW609 Tiltrotor and will include work with Liverpool University on advanced mathematical modelling techniques to aid optimal fuselage design.

This is a combined Regional Growth Fund and AgustaWestland investment of more than £100 million over the next three years and will leverage the advanced design capabilities of the UK supply base and major research centres such as the National Composites Centre in Bristol.

AgustaWestland, in collaboration with the Technology Strategy Board and the European Union, are also working on: 'Active Rotors' and vibration reduction; additive materials and manufacturing simulation; and drag reduction and more-electric platforms.



AW189, search and rescue helicopters manufactured in the UK



Airbus state of the art composite wing manufacturing facility in Broughton, Wales



“The Aerospace Members Committee of ADS are confident that participation in the AGP will enable SMEs to grow and develop their companies in this highly competitive and global aerospace market.”

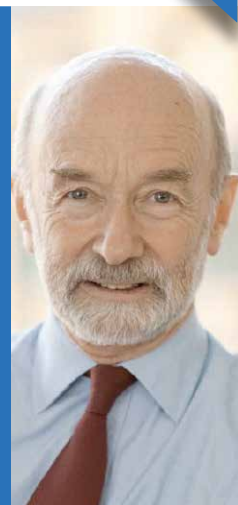
David Nutton

CEO of RLC Engineering Group and Chair of the AMC
Aerospace Members Committee of ADS, representing SMEs

“It’s been an excellent experience working on the AGP which has systematically identified key themes which will enable industry and academia to work together even more closely. Focusing, translating and applying science and technology to support this key industry is vital for the economy.”

Professor Sir Mike Gregory

Head of the Institute for Manufacturing





MANUFACTURING CAPABILITY: Mapping the future for UK manufacturing

WHAT HAVE WE ACHIEVED?

- We have completed a study of the UK aerospace industry's capabilities in manufacturing processes and systems.
- We have developed the idea of a Manufacturing Accelerator Programme (MAP) to speed up the transfer of manufacturing technology, know-how and best practice from academia and into industry, making best use of the High Value Manufacturing Catapult centres, in order to help the supply chain bring products to market faster and more efficiently.

WHAT WILL WE DO NEXT?

- Recognising that the MAP is at an early stage, we will need to carry out further work to see how this can be taken forward to embed best practice on new technology and manufacturing processes throughout the supply chain.

The future growth in civil aerospace globally will create increasing demands on the labour market. In addition, legislation, together with the continuous drive to reduce costs, makes it necessary for manufacturers not only to seek innovative solutions to make aircraft leaner and greener but also to make their means of production more energy efficient. Energy efficiency will play a critical role in UK manufacturing's cost competitiveness.

CASE STUDY: LEAN, GREEN MANUFACTURING

The new 46,000 sq. metre Airbus North Factory at Broughton in North Wales is an industry-Government investment of over £400 million. The factory produces world leading composite wings for the new A350 XWB aircraft, which incorporates the latest in aerodynamics and design to deliver significant improvements in fuel efficiency.



Solar panels at Airbus eco-efficient wing manufacturing site, Broughton, Wales

A pioneering energy efficient building, the factory has been awarded the internationally recognised BREEAM 'Excellent' rating for best practice in environmental standards. The environmentally friendly features have substantially reduced carbon output compared to a similar sized building with equivalent function.

The factory's power comes in part from three large solar tracking arrays and a wood pellet biomass power plant boiler. The energy efficient design of the factory complements the Airbus Global Vision to reduce aerospace manufacturing CO₂ emissions by 50% and energy consumption by 30% by the year 2020.

Manufacturing systems

In an increasingly global manufacturing environment, although companies around the world have access to a similar range of production plant and equipment, in many emerging markets competitor businesses are able to supplement this with lower operating labour costs.

However, UK suppliers can differentiate themselves and remain globally competitive in a number of ways. They can be more innovative in the application of materials, technology, production equipment and processes into their manufacturing systems. They can also optimise transport and logistics networks to secure efficiencies in the flow of materials and components.

To do this, manufacturers at all levels of the supply chain will need to have ready access to world-class production knowledge and to be able to rapidly integrate this knowledge into high-performing operations, stimulating radical innovation in the UK aerospace manufacturing base.

The Government, working with academia and business, has already taken significant steps to ensure that manufacturing research can best assist the competitiveness of UK business - notably through the creation of specialist advanced manufacturing research centres across the UK, many of which have now been brought together as the High Value Manufacturing Catapult Centre. The Engineering and Physical Sciences Research Council's Centres for Innovative Manufacturing and the new UK Aerodynamics Centre further enhance this manufacturing research and technology ecosystem. These facilities are already making a difference for some UK companies, mainly at the top of the supply chain and we now wish to build on this progress by ensuring that these benefits can be applied more widely in the supply chain.

The substantial growth within the aerospace sector over the next 20 years will involve step-change increases in aerospace production volumes. Suppliers need to be able to respond quickly to changing circumstances and customer demand. So, to remain competitive, there is an urgent need to boost capacity within the supply chain.

A Manufacturing Accelerator Programme (MAP) for aerospace is therefore proposed. This would involve the development of industry-standard best practice toolkits for

the design, location and creation of new or upgraded production facilities. These toolkits would be embedded throughout the supply chain to support the design and ramp-up of production capabilities ahead of the competition. The MAP will incorporate detail on how companies can innovate their manufacturing processes, building on the investment already made in facilities such as Catapult Centres.

To be successful, the programme would need to have access to specific expertise in the following areas:

- manufacturing research and technology including automation, assembly and component manufacture
- information system architectures for efficient design and manufacture
- people, culture, employment practices and regulations
- facilities layout and standards
- production systems and 'Design for Manufacture'

The MAP would work in partnership with academia, the High Value Manufacturing Catapult, industry and trade associations to deliver best practice to the supply chain and will involve new and enhanced methods for manufacturing system design including:

- network analysis tools to identify global value capture opportunities and competitors
- visibility of world-leading aerospace practices in the UK and overseas
- cross-industry capability studies to provide relevant expertise from other sectors
- system design and modelling routines to demonstrate production capabilities at industrial scale



AMRC, Rolls-Royce and Sheffield University

- routines, stimuli and environments to encourage radical manufacturing innovation

The MAP would build on the experience of some of the larger aerospace companies in creating new facilities in the UK in recent years. The aim is to spread this best practice throughout the supply chain.

CASE STUDY: SMARTER WAYS OF MAKING COMPONENTS – ROLLS-ROYCE AND THE CATAPULT

Advanced Manufacturing Research Centre (AMRC)

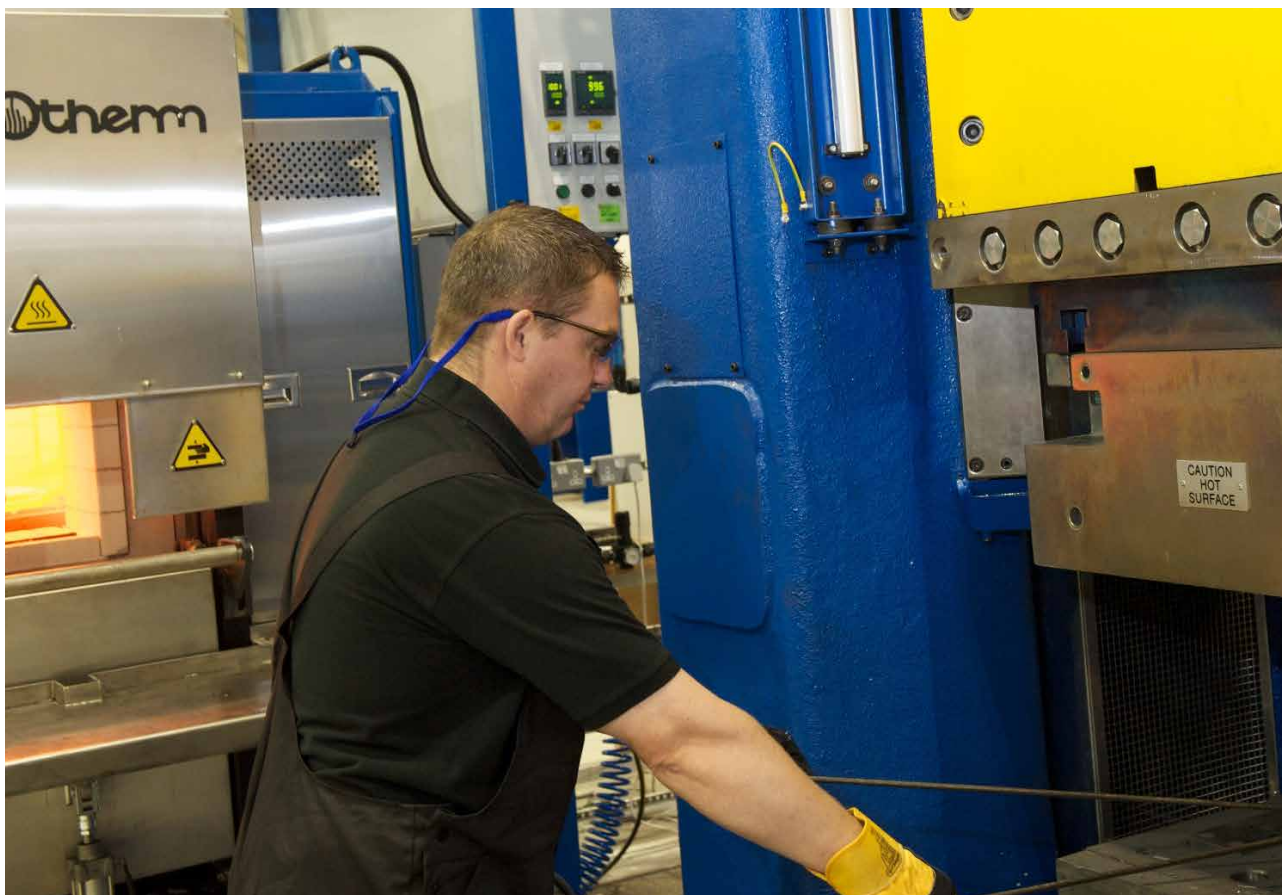
A joint Rolls-Royce / AMRC team used cutting edge machining, tooling and modelling technologies to deliver a step change improvement to work content, productivity and quality. The manufacture of full scale gas turbine disc demonstrator components at the AMRC validated the new approach in readiness for the launch of a new disc factory at Washington Tyne and Weir in the North East of England that will open towards the end of 2013.

Manufacturing Technology Centre (MTC)

An integrated Rolls-Royce / MTC team have established a pre-production cell to prove technologies that will deliver significant productivity improvements in the manufacture of single crystal turbine blades. These technologies will be deployed into Rolls-Royce's new Advanced Blade Casting Facility which is currently under construction at the Advanced Manufacturing Park, South Yorkshire. When completed, this facility will employ 150 staff and deliver 100,000 castings a year.

Advanced Forming Research Centre (AFRC)

Rolls-Royce has worked with the AFRC to improve the manufacturing method for compressor aerofoils by extending the life of dies used in the hot forging process. A team of Rolls-Royce and AFRC engineers has developed a die life prediction model which has guided improvement activities at Rolls-Royce. The improvements resulted in a doubling of die life which has reduced production costs and increased production capacity. The new capabilities have been implemented at the Rolls-Royce Inchinnan Compressor Facility in Glasgow.



Advanced Forming Research Centre, collaborative enterprise between academia, industry and government



Inlet cowl on IAE V2500 engine, for the A320 aircraft, designed and manufactured by Bombardier, in Northern Ireland



“I’m really pleased to be involved with the AGP and it’s great to see this industry-government partnership preparing UK companies to compete more effectively overseas and, equally importantly, creating an environment in the UK that attracts inward investment from overseas companies.”

Carole Sweeney

UKTI, Director of Advanced Manufacturing

“The AGP has brought together companies from all parts of the UK aerospace supply chain focused on identifying and implementing real performance and service improvements to ensure future sustainability and growth.”

Neil McManus

Vice President and Managing Director – Spirit AeroSystems (Europe) Ltd.





SUPPLY CHAIN COMPETITIVENESS: Enhancing supply chain performance, capacity and manufacturing innovation

WHAT HAVE WE ACHIEVED?

- We have created an Aerospace Finance Forum and have already secured commitment from a major bank to set up a network of regional aerospace specialists.
- We have developed a national technology exploitation programme to accelerate innovation in the supply chain.
- We have agreed to run a UKTI-industry marketing pilot in the US to trial new marketing concepts to access opportunities from priority platforms and boost exports.

WHAT WILL WE DO NEXT?

- We will look for opportunities to attract new and existing business to the UK and will collaborate with customers and suppliers to create strategic supply chains.
- We will identify how we can further strengthen UK supply chain competitiveness through the Advanced Manufacturing Supply Chain Initiative which was extended in the 2012 Autumn Statement.
- We will take further action to embed world-leading continuous improvement methods, supply chain management and collaborative practices throughout the UK supply chain.
- We will foster increased commitment from leading UK aerospace companies to providing Supply Chain Finance.



Access to finance

Access to finance represents a risk to the industry. The nature of aerospace programmes, with heavy, up-front investment costs and long timescales to make a return, makes it hard for finance providers to understand risk and deters them from lending. SMEs are likely to struggle, particularly at the start of a period of potential growth, because they lack the cash to invest at that point. It is clear that industry needs a greater understanding of the types and availability of finance available to support business.

Banks and financiers also need a better understanding of the changing

business models in the sector, with prime manufacturers and first tier suppliers increasingly passing more risk down the supply chain, which impacts on the overall risk profile of those suppliers. This has been a particular problem with banks at local level, where aerospace companies have noticed a reduction in understanding of the sector amongst managers.

To develop better mutual understanding and strengthen relationships between banks and aerospace supply chain businesses, the AGP - supported by UK Export Finance (formerly known as ECGD) - has created an Aerospace Finance Forum. This will identify and address access to finance issues faced by UK aerospace suppliers.

The forum's focus will be on:

- **Capital Investment:** access to funding for investment in long term programmes where there is a degree of timing and volume risk around cash flows at a point which may be some years in advance
- **Working Capital:** support for smaller businesses throughout the cycle. It has been identified that SMEs are likely to struggle the most at the start of an upswing because they lack the cash to invest at that point
- **Sector knowledge:** to encourage the banks to identify individuals in their organisation who possess knowledge and experience of dealing with firms in the aerospace sector
- **Support:** access to financial professionals who can offer advice and support in all areas of finance including Government initiatives, equity funding, export credit guarantees and grants

The Aerospace Finance Forum will gather evidence on these issues and identify and implement solutions through appropriate capital structures and financial products, to meet the specific needs of the UK aerospace suppliers at different levels. An early achievement from the Forum is the agreement from one major bank to put in place a network of regional aerospace specialists. We will look to build on this success quickly.

Through the Forum, the AGP will promote prompt payment practices and the Supply Chain Finance scheme announced by the Prime Minister last autumn. We will also ensure that UK aerospace companies

understand the opportunities provided by the Business Bank. This Bank is being created by the Government to consolidate and boost business finance interventions. This will not replace the private market but will seek to amplify the impact of private sector initiatives, for example, by co-investing in new finance products for small and mid-size companies alongside private investors.

Supply chain finance

UK aerospace companies are playing an important part in this scheme. Building on the commitments already made by UK aerospace companies including Rolls-Royce, BAE Systems, Finmeccanica, GKN and Thales, the AGP will encourage further top tier companies to put in place Supply Chain Finance schemes.

Major UK companies generally have strong credit ratings and excellent access to finance. This contrasts with their SME suppliers who often have relatively more expensive finance and more limited access to equity capital.

With Supply Chain Finance, a bank is notified by a large company that an invoice has been approved for payment; the bank is then able to offer a 100% immediate advance to the supplier at lower interest rates based upon their customer's credit rating (i.e. the major UK company), knowing the invoice will be paid.

The benefits of Supply Chain Finance are that:

- It provides cheap funding to suppliers based on the credit quality of their customers.

- It allows suppliers to receive 100% of the invoice value, less a small finance fee, rather than the 70% to 90% generally offered through traditional finance products for SMEs. This can help free up money for growth, boost cash-flow or allow businesses to refinance existing debt.
- It can help supply chains to become more efficient as the overall cost of finance is reduced.
- It allows banks to provide finance to SMEs in a significantly more capital efficient manner (which will unlock capital for them to potentially provide more lending to SMEs).

New product R&D in the aerospace supply chain

The AGP recognises that the larger companies acting alone will not be able to make the product technology advances required to sustain the UK's market position in global aerospace markets.

To remain competitive, many companies in the supply chain need to move up the value chain and innovate new product technologies at a rate greater than our competitors.

The AGP aims to create, within the supply chain, an increased availability of market-ready, innovative technologies for prime and first tier manufacturers to incorporate into future aircraft and engines.

A step change towards an 'R&D supply chain' is required. However, the market is not creating this with sufficient urgency.

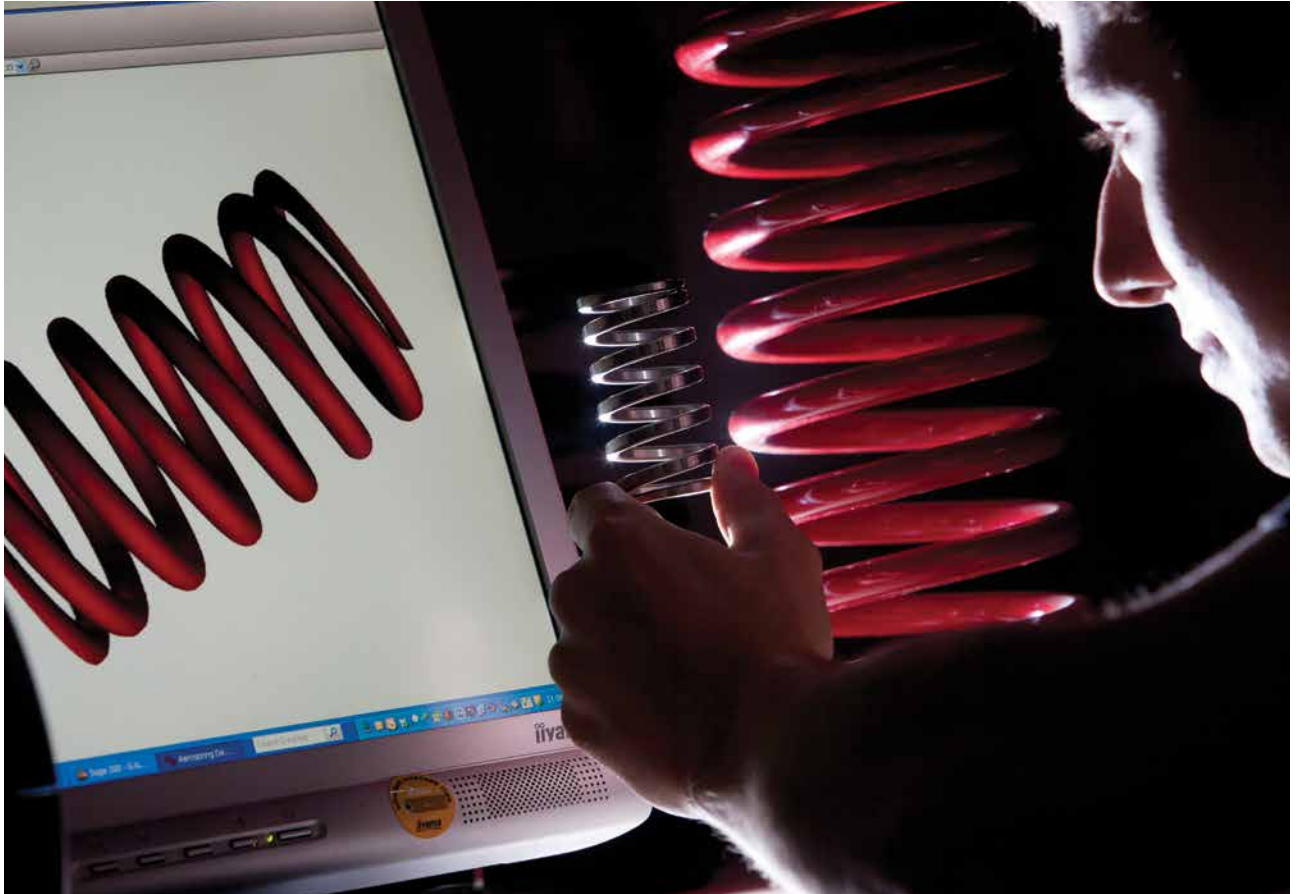
To counter this, the AGP believes that by bringing together industry and Government we can foster the development of new technologies, while industry provides other forms of support and mentoring to encourage innovation from within the supply chain, especially SMEs.

By developing a supply chain with a high rate of innovation, rich in new technologies, the UK will be better able to offer the right products and services, at the right time and ahead of competition. This will ensure that, to the maximum extent, market opportunities are exploited with high value manufacturing work retained in the UK.

The AGP has developed a National Aerospace Technology Exploitation Programme (NATEP) aimed at small and medium sized suppliers to help them develop their own innovative technologies to increase their ability to win new business with higher tier companies anywhere in the world. This builds on the successful regional technology exploitation programme previously run in the Midlands. The Government's Advanced Manufacturing Supply Chain Initiative provides the opportunity to take this forward.

CASE STUDY: NEW CAPABILITIES SPRING INTO ACTION IN THE AEROSPACE SUPPLY CHAIN – G&O SPRINGS

Springs play an integral role in today's advanced aircraft systems, yet spring manufacturers have traditionally had no input into the design of those systems. This has led to sub-optimal systems design and systems that are larger and heavier than they need to be.



New design knowledge at G&O Springs, Midlands

G&O Springs took advantage of R&D funding offered through the Midlands Aerospace Alliance's Aerospace Technology Exploitation Programme to collaboratively research more effective product solutions. They brought together Reliable Spring and Manufacturing Co (a fellow local spring maker), Alloy Wire (a material provider), the Institute of Spring Technology, together with Aero Engine Controls and BAE Systems as customer advisors.

Between 2009 and 2011, the team manufactured a large number of springs in ten different titanium and exotic alloy

grades and tested them rigorously. The results were fed into computer models to project how springs would perform.

As a result, aircraft systems makers can now be provided with data needed to design the optimal spring for their systems, allowing them to make significant reductions in spring and system size without compromising on performance and reliability.

This has enabled G&O Springs and its supply chain to move up the value chain, now possessing differentiating intellectual property and design expertise.

Market development opportunities

International markets offer significant growth. The AGP is working with UK Trade & Investment (UKTI) to develop a more strategic approach to identifying and pursuing opportunities in overseas target markets.

This new approach will see Government working more closely with UK suppliers to help them broaden their customer base and win major programme work with overseas-based aerospace manufacturers in strategically important markets.

We will take action to improve the promotion of UK aerospace capabilities overseas, better identify new contract opportunities for industry, and ensure that UK businesses can deliver market-ready solutions to meet customer requirements. This will provide new opportunities for UK companies, including at SME level, to achieve growth through exports.

UKTI's new focus on campaigning can be utilised to support businesses to pursue priority global opportunities across the world. ADS and UKTI are working together on an early pilot in the US which will better position UKTI commercial officers to identify opportunities and match them to UK suppliers. In addition UKTI will showcase overseas the capability of the UK aerospace industry as part of the GREAT campaign.

Maintenance, Repair and Overhaul (MRO)

MRO is an area where demand is likely to grow and is a key capability in the UK aerospace sector with services including:

- Composite in-service support repair and disposal: design for supportability; damage assessment and field repair capability; repair methodology and standard repair schemes; advanced material repair for new composite materials.
- Integrated health management technologies: data and information management, closing the loop between data supply and maintenance, so that the data is used pro-actively for fleet operational, reliability and maintenance purposes, as well as for fleet management and trend analysis; inventory reduction and optimisation; enabling technologies.
- Aircraft and equipment recycling and deployment: secure and safe recycling and disposal of airframe, equipment and materials¹³.
- Skills for service: availability of skilled and licensed technicians.

Inward investment opportunities

Arrangements have been put in place for closer working between the aerospace industry and UKTI to deliver a more strategic approach to identifying and pursuing inward investment opportunities. This involves detailed strategic analysis across the main aerospace product groups, led by industry, to identify any strategic areas where the UK does not currently have capability but sees value in acquiring, or where our capability needs to be enhanced. This work will ensure that Government and industry make best use of their resources in pursuing

inward investment opportunities that would deliver the most benefit to UK suppliers and the economy.

Supply chains of the future

This industrial strategy document sets out a number of areas where action is either under way or planned by the AGP to improve the capability and effectiveness of UK supply chains to achieve growth. These include collaborative research projects that will flow from the ATI, technology exploitation, improved access to finance and the embedding of world-class manufacturing processes and continuous improvement methods throughout the supply chain. These build on existing support services available to industry through the Manufacturing Advisory Service and participation in the 21st Century Supply Chain continuous improvement change programme (SC21) run by ADS. These activities are all focused on a supplier's products, processes and manufacturing facilities.

We also need to find a means at national level for companies to enhance the management of their own supply chain and to work collaboratively with their suppliers and peers to boost competitiveness. Through the capability analysis work under way, we will identify those areas of high strategic value and where UK capabilities are at risk. We will then look at all available levers to address those vulnerabilities in order to sustain and grow supply chain workshare in the UK and to attract new customers from overseas. In addition, we will identify opportunities for suppliers to bring high value work to the UK that may currently be overseas.

We will review what can be done to encourage and assist SMEs to develop future production capabilities and efficiency processes through an enhanced SC21 change programme and the role that a national supply chain body could play in embedding best practice and clustering models in the supply chain.

We will put arrangements in place for prime and tier one aerospace manufacturers to provide UK suppliers with a clear vision of their future requirements and the capability and capacity they will need to secure contracts on future programmes. This will go beyond short term cost, quality and delivery considerations.

This activity will build on 'meet the buyer' events already run, for example by UKTI, ADS, and the Regional Trade Associations. It will provide a solid basis for companies to take concerted action, both individually and collectively, to improve competitiveness.

Opportunities currently exist to secure public funding to support private investment in supply chain capability improvement activity – for example, through the competitive Advanced Manufacturing Supply Chain Initiative and the Regional Growth Fund.

At the roots of the UK aerospace supply chain, companies are typically only about 50% dependent on aerospace: therefore not only aerospace customers but also those from other sectors will benefit from the competitiveness improvements we will carry out.



Northern Ireland collaboration, from left to right: David Raymond – MD Sigma Aeronautics, Neil McManus - MD Spirit AeroSystems Europe, Peter Robinson - NI First Minister, Arlene Foster - NI Minister for Enterprise

CASE STUDY: SUPPLY CHAIN COLLABORATION IN NORTHERN IRELAND

Firms in Northern Ireland contributed total sales amounting to some £960 million in 2011, 7.1% of the total UK aerospace output, with another £640 million of orders in the pipeline. Bombardier, BE, Goodrich, RFD Beaufort and Thales all have substantial operations in Northern Ireland that supply many aerospace and defence programmes worldwide.

As part of a new cluster pilot, Sigma Aeronautics is to work alongside Spirit AeroSystems, the world's largest supplier

of commercial aircraft assemblies and components, making fuselages, composites, wings, spares and repairs.

A memorandum of understanding has been signed with Sigma as part of Spirit's strategy to further develop its supply chain within the UK. Sigma represents six aerospace companies located in Northern Ireland.





Apprentices, AgustaWestland, Yeovil



“Like many high tech companies, Rolls-Royce relies on a strong pipeline of people with science and engineering qualifications. Promoting STEM subjects in schools at the earliest age is hugely important in enthusing young people and continuing to develop this talent.”

Colin Smith CBE

Director of Engineering and Technology, Rolls-Royce plc.

“The aerospace sector is essential for the future success of the UK economy and can deliver high value jobs and prosperity for the long-term. The Aerospace Growth Partnership is a fantastic demonstration of what can be achieved when industry and Government work together to build UK competitive advantage and industrial capability.”

Paul Everitt

CEO of ADS trade association



otland

SKILLS AND EXTERNAL ENGAGEMENT: skills for the future of UK aerospace

Rather than duplicate existing structures, the AGP is delivering its skills agenda by working in close collaboration with the Aerospace and Defence Sector Skills Group (ADSSG), jointly managed by Semta (the Sector Skills Council for Science, Engineering and Manufacturing Technologies) and ADS.

WHAT HAVE WE ACHIEVED?

- Increased Masters level graduate provision for aerospace, through an initiative sponsored jointly by business and Government.
- Semta has engaged directly with almost 250 supply chain companies, using a detailed diagnostic to identify skills issues representing major barriers to growth.
- Encouraged industry to make the best use of the schemes that are available to support skills development throughout the workforce. As a result, a range of skills initiatives are already having real impact on the ground in the sector¹⁴.

WHAT WILL WE DO NEXT?

- We will create more effective engagement mechanisms between industry, Government, Semta and UK Commission for Employment and Skills (UKCES), to meet aerospace skills needs.
- A new Aerospace Employer Group will provide a more strategic focus on identifying and tackling skills problems faced by the aerospace industry, with a key aim to develop and implement quick, effective, practical solutions that have sectoral level impact to enhance growth and competitiveness. The Group will work closely with the Devolved Administrations to share best practice with the aim of ensuring effective support for skills development across the breadth of the UK.

- The business members of the group, working collaboratively with Semta, will lead a bid to secure funds to deliver solutions to skills challenges that have sector level impact, through the opportunities offered by the Employer Ownership Pilot.
- Industry will work with Government to promote the benefits of investment in training and skills and highlight where public funding is available to complement private investment in the aerospace sector.
- Industry and Government will also work together to help improve the image of aerospace as a career choice, and to increase the diversity of its workforce.

The current workforce environment

As a ‘blue-chip’, high-technology sector employing over 100,000 people in highly-skilled, long-term jobs across the UK and paying circa 46%¹⁵ above the UK weekly wage (gross mean), securing our current and future skills and competencies is vital to enable the UK to maintain and grow its aerospace footprint.

Through the work of the ADSSG, it is evident that the UK aerospace sector already faces a number of key skills challenges:

- **The industry has problems recruiting as shown by the vacancies currently being carried.** 30% of firms in the aerospace sector have a vacancy, with around 2,000 vacancies, equivalent to 2% of the sector’s direct employment.
- **There are particular problems in attracting certain types of skilled staff.** Areas such as fatigue and damage tolerance, composites, stress and licensed engineers are amongst the key areas of shortages, as reflected in business submissions to the Migration Advisory Committee. Some of the most severe shortages are faced by firms seeking to recruit technicians skilled in working with composite materials, which require different skill sets to those trained and experienced in metallics¹⁶.
- **This challenge will deepen on account of the age profile of the industry.** The aerospace sector has a lower proportion of young people currently working in it than manufacturing as a whole and a greater proportion of those aged 45 plus. It is estimated that over 8,000 people could retire from the sector in the next eight years but only 5,000 young people are likely to be employed based on current employment trends, representing a potential deficit of 3,000 people. In the area of maintenance, repair and overhaul (MRO) only 1,200 MRO licensed engineers are aged 20-30, compared with 3,500 aged over 50¹⁷.
- **The skills levels of existing staff are below what is required and there is a major challenge in up-skilling a large percentage of the workforce.** Currently 40% of the aerospace sector workforce is qualified to N/SVQ level 4+¹⁸; however, the sector’s target is to raise this to 50% by 2022. This target will not be achieved

through employment of graduates alone, but could be reached through an increase in higher apprenticeships to raise the skills of existing workers.

- **The current performance of the UK aerospace industry in investment in skills is below what it should be, and is most pronounced in relation to the use of apprenticeships.** Only 15% of aerospace companies offered apprenticeships in 2009, whereas the UK manufacturing average was 18%¹⁹. A variety of barriers prevent or deter employers from investing in training, including inability to source from local providers the standard of engineering courses required; access to finance to support training; and, in SMEs, the lack of human resources support. Some employers consider recruiting skilled people to be less complicated and resource intensive than training their own workforce; however, this approach does not serve the interests of the sector as a whole and can be counter-productive in harming firms within the same supply chain.

The way ahead to meet current need

Industry and Government will promote the benefits of investment in training and skills; and to highlight where public funding is available to complement private investment - for example, for:

- Apprenticeships
- Leadership and Management (such as the Growth Accelerator, which can support leadership and management training in SMEs at £2,000 per person where this is matched by business),

- Advanced Skills Accreditation Scheme (ASAS) (which provides flexible access to engineering Masters modules through leading universities)

- Manufacturing Advisory Service (MAS)

The sector will pursue new and practical solutions to address skills challenges through sector-wide Industrial Partnership under the Employer Ownership of Skills Pilot Round 2 (EOP), and through similar future funding opportunities. Potential areas for collaboration include:

- **Increasing the number of aerospace companies that recruit apprentices.** The Apprenticeship Ambition launched by Semta with the National Apprenticeship Service (NAS) is aiming to double the number of engineering apprentices at advanced and higher levels by 2016, from 8,000 to 16,000. Many mid and small companies find it much harder than large companies to attract applicants directly. To overcome this a 'Clearing House' is being piloted with BAE Systems and Siemens, to reallocate to supply chain companies the many high quality engineering apprenticeship applicants they attract, but whom they are unable to take on. This model could potentially be expanded, for example to include graduates seeking placements or employment.
- **A Shared Apprenticeship Model.** This would support SMEs in taking on apprentices, drawing on experience in Wales whereby the host employer shares the apprentice with a number of supporting companies (large and small) to broaden their experience. In addition, the sector will explore an Aerospace



Rolls-Royce apprentices in Derby

Traineeship, building on the successful Pathways to Apprenticeships project in Wales.

- **Increasing the supply of apprentices to supply chain companies via training excellence of larger companies.** For example, as is happening with Rolls-Royce.

CASE STUDY: ROLLS-ROYCE'S NEW APPRENTICE ACADEMY

In November 2012, Rolls-Royce opened a new, state-of-the-art Apprentice Academy in Derby.

The facility enables Rolls-Royce to increase the number of apprentices it trains, beyond

its own requirements. On completion of their training, the additional apprentices will find work in the supply chain, providing an additional source of skilled labour to the UK engineering and manufacturing industry.

The facility includes a 1,200 square metre workshop equipped with the latest machines, which enables apprentices to be trained on the same equipment they will be using in the workplace.

98% of the company's apprentices successfully complete their training compared with a 74% national average and many go on to senior roles within the organisation; 20% of current senior managers in the UK started their careers as Rolls-Royce apprentices.

- **Pre-apprenticeship training.** To increase the number of potential entrants to the apprenticeship system, by developing their job skills and trade readiness so that they are best prepared to find work as apprentices.
- **Developing a Centre of Excellence for Learning, Skills and Employment for Aerospace.** This could provide a way of helping people into aerospace jobs by placing them in a training environment underpinned by real aerospace work under the supervision and training of experienced engineers/technicians, aiding their completion of necessary practical aerospace manufacturing skills.

Ensuring we have the skills needed for future growth

The huge growth potential in the sector brings with it a range of challenges requiring development of higher level skills in technologies and manufacturing processes spanning all parts of the sector. These skills needs involve a range of disciplines including materials science, system engineering, robotics and automation, software and additive layer manufacturing.

Between now and 2017 there will be a net recruitment requirement for 7,000 engineers, scientists and technologists (1,400 a year) to cover retirements and employment growth within the UK aerospace sector²⁰. Demand for higher-level technical occupations (N/SVQ Level 4+) will consist of 1,100 managers, 1,700 professionals and 800 technicians. Demand for intermediate and lower-level technical occupations will consist of 1,600 craftspeople (N/SVQ Level 3+) and 1,800

operators (N/SVQ Levels 1/2). In addition, 3,000 people will be required between 2013 and 2017 to fill non-technical roles.

The AGP welcomes the various initiatives underway to bring higher education and business closer together to meet business needs, which it believes will help address future skills needs including:

- The joint public and private investment in Catapult Centres, such as the High Value Manufacturing Catapult network.
- The creation of 500 new Masters level graduate places for aerospace, to be delivered between 2013 and 2017, through a joint industry and Government bursary fund.
- The Higher Apprenticeship in Advanced Manufacturing Engineering, developed by employers to increase the numbers of employees trained to a higher level. Approximately 300 candidates are currently registered on the framework, which not only offers a high quality progression route for those in employment who have completed a Level 3 advanced apprenticeship but also provides an attractive alternative to university for new A-level recruits. The framework operates at Levels 4 and 6 and can lead to Incorporated Engineer status.
- EPSRC's various support routes, and close industrial linkages with aerospace, for PhD level training, in particular through their Centres for Doctoral Training (CDTs). These Centres bring together diverse areas of expertise to train engineers and scientists with the skills, knowledge and confidence to tackle today's evolving issues

and future challenges. They also provide a supportive and exciting environment for students, create new working cultures, build relationships between teams in universities and forge lasting links with industry.

- The financial support available to companies who are developing their future skills, such as: £1,000 grants via Sema for SMEs who recruit an unemployed graduate; and £1,500 grants via the National Apprenticeship Service for employers to take on an apprentice where they have not done so before or within the last 12 months.
- The business-led Talent Retention Solution, which is being expanded from its initial focus on retaining experienced engineers to covering engineering students, apprentices, and those who may be unsuccessful in job applications with top tier suppliers given the high numbers of applicants chasing a small number of jobs. This will assist future skills needs of aerospace companies, particularly SMEs, who should be able to access and recruit the talent they need quickly and easily (and in the case of SMEs at no cost for using the system).

Boosting the number of Masters places for Aerospace

At the Farnborough International Airshow in 2012, the Prime Minister announced a joint industry and Government initiative to create 500 additional Masters level graduate places for aerospace. This is a £6 million programme, sponsored by BIS and leading aerospace businesses, and brings together aerospace industry universities, the Royal

Academy of Engineering and the Royal Aeronautical Society.

The sponsor companies are: BAE Systems, Bombardier Aerospace (Belfast), EADS/Airbus, Finmeccanica UK, GKN, Messier-Bugatti-Dowty, MBDA Missile Systems, Rolls-Royce, and Spirit AeroSystems (Europe).

The scheme provides financial support, through bursaries, to meet Masters (MSc) course fee costs. It is aimed at two principal targets. Firstly, existing aerospace employees who wish to up-skill, either within sponsor companies or in supply chain SMEs (who are able to receive a higher rate of sponsorship). Secondly, it targets students coming through the university system who, but for the bursary, would not otherwise study at Masters level and who commit to seek employment in the aerospace industry. It encourages a more diverse range of people to reach Chartered Engineer status and to work in the aerospace sector.

The scheme strengthens the supply of highly skilled people to the sector, and supports the technology strand of the work of the AGP, by linking research opportunities to key areas of industrial interest, including research being carried out in Catapult centres. University students are also encouraged to make direct links with aerospace businesses to secure work experience and relevant research topics.

The way ahead to meet future need

The availability of these initiatives will be promoted further through the AGP, Sema,

ADS and the regional trade associations as an important part of increasing the future skills capability of the sector. In addition, the industry will work with Government to explore the scope for other ways in which the future skills needs of the sector can be met, for example:

- Identifying and applying best practice approaches to knowledge management from other sectors/organisations, in particular to ensure that the wealth of knowledge from earlier and current aircraft programmes, held by those experienced workers who are close to retirement, is retained for the benefit of future programmes.
- Developing a high quality, employer-led network of specialist technical training providers close to the main industry clusters.
- Enhancing the capability of UK aerospace through up-skilling in extended enterprise and supply chain management, leadership and financial skills, all of which are critical enablers for aerospace companies to compete globally.

Securing the workforce of tomorrow

A career in aerospace is not an automatic choice for many young people. Not all teachers and parents understand the type and range of career opportunities available within the aerospace sector.

Professor Perkins' review of engineering skills has concluded it would benefit the economy to substantially increase the supply and

the quality of engineers entering the labour market, ensuring they have the right mix of skills as sought by employers.

Perkins Review of the Skills Pipeline

Professor John Perkins CBE, the Chief Scientific Adviser for BIS, is looking at the issue of engineering skills supply in the UK. Based upon initial analysis of demands/supply constraints, job market trends for rising skill levels, data on skills gaps and structural supply issues, the Review has concluded that it would benefit the economy to substantially increase the supply and the quality of engineers entering the labour market, ensuring they have the right mix of skills as sought by employers.

The analysis has highlighted six strategic aims:

1. Changing the perception of engineering making it much more accurate and positive, challenging outdated negative views of the profession.
2. Addressing the diversity issues in engineering including the 'gender gap', thereby reaching out to the widest possible talent pool.
3. Encouraging sponsorships and strengthening industrial links to students, thereby making engineering courses more attractive and increasing students' employability.
4. Helping engineers who have left the profession and wish to rejoin it and others who wish to convert to it.

5. Provision of the appropriate education to support engineering careers. Increasing the number of students with the right educational background (maths, physics and design & technology), providing modern educational infrastructure, and giving accurate careers advice.
6. Encouraging and supporting the provision of more engineering apprenticeships, particularly higher level apprenticeships.

Addressing diversity issues in engineering will be increasingly important - for example, today only 9% of professional engineers in the UK are women. The Women in Aviation & Aerospace Committee is looking to improve on this, and the sector needs to do more to reach out to the widest possible talent pool.

Women in aviation and aerospace

The Royal Aeronautical Society's Women in Aviation & Aerospace Committee (WAAC) was established in 2009 to encourage more young women to consider aviation and aerospace as a worthwhile



and exciting career. It also exists to provide support for women already working in all sectors of aviation and aerospace.

Recognising that women are severely under-represented in the critical job functions within all sectors of aviation and aerospace, the Society is committed to encouraging more women into aviation and aerospace.

Through a CEO Charter, awarded by the UK Resource Centre for Women in Science, Engineering and Technology (the lead body working on behalf of women in these sectors) the Society is committed to:

- Actively supporting increased participation, at all levels, of women in Science, Engineering and Technology (SET).
- Developing and communicating the business case for gender equality within their organisation, their supply chain and their wider networks.
- Promoting and showcasing their organisation's approach and examples of best practice at relevant events and forums.
- Developing clearly defined strategies and implementing practices which encourage women to enter and progress in, or return to, SET careers.

Outdated and inaccurate perceptions do not encourage young people to explore the opportunities available. This situation is exacerbated by the lack of specialist careers advice and support currently available within schools.



GKN engaging with local schools

Delivering accurate and informed careers advice and additional placement opportunities in the aerospace sector will result in an increase in the number of young people making this their preferred career choice, thereby creating a diverse talent pipeline of young people entering the sector.

This will also support the Government's drive and policy to increase the number of pupils studying STEM subjects, particularly the supply gap at A-level maths and physics highlighted by Professor Perkins.

Many companies already invest significant resources in promoting the aerospace sector; however we need to do more to build on this success and that of initiatives such as:

- Industry Futures Day at the Farnborough Air Show
- Joint Government-industry Make it in Great Britain
- The Royal Aeronautical Society's 'Build a Plane' and STEM Ambassadors
- See Inside Manufacturing: a programme

to provide opportunities for young people, as well as their teachers and careers advisors, to 'get behind the scenes', visit modern manufacturing operations and see for themselves the excellent career opportunities in manufacturing.

- Engineering UK's 'Big Bang Fair' which inspires the very youngest and involves 170 organisations, with 56,000 people attending the main event in Birmingham
- The Skills Show run by World Skills UK covering 12 engineering competitions
- University Technical Colleges (UTCs)
- The Schools Aerospace Challenge

CASE STUDY: THE SCHOOLS AEROSPACE CHALLENGE – PROMOTING AEROSPACE THROUGH A COMPETITIVE LEARNING ENVIRONMENT

The Schools Aerospace Challenge has been running for 12 years and provides 16-18 year old students, throughout the UK, the opportunity to win a place on a five-night residential course at the School

of Engineering, Cranfield University. This is sponsored widely by Government (through BIS and MoD) and industry.

The Challenge is concerned with increasing awareness of aeronautical engineering and industry programmes. Whilst at Cranfield University, under the stewardship of engineering graduates seconded from industry, the qualifying teams are put through a range of experiences. Classroom work is balanced with practical exercises where students learn to plan strategy, manage resources and achieve an objective. Talks on understanding how both fixed and rotary wing aircraft are designed and operated are complimented by the opportunity to pilot a helicopter.

Over 350 school teams have participated in the competition. More recently overseas students and their teachers from nations sharing close economic ties with UK industry have also shared in this experience.

The way ahead for the image of the industry

In 2013, we will:

- Strengthen the links between education and business to increase the range and type of work placement opportunities for both young people and teachers, and provide a better understanding of the aerospace sector, and the range of career options at different qualification entry levels.
- Attract and develop a more diverse workforce, building on available resources

such as the Advanced Career Progression Vocationally Related Qualification which supports companies in retaining and developing their female talent.

- Identify and implement arrangements to ensure that messages and resources are better aligned across all the organisations which currently supply information on careers in aerospace to maximise impact.
- Increase the number of high profile events such as Futures Day (currently held at Farnborough) and the Big Bang Fair, which attract large numbers of young people and teachers, by expanding these to key aerospace cluster locations.
- Promote best practice in reaching out to schools – for example, using experience, such as that of Bombardier Aerospace.

CASE STUDY: STRENGTHENING LINKS WITH EDUCATION

As the only company in Northern Ireland engaged in the design and manufacture of large aircraft structures, and with no ready supply of local skilled workers, Bombardier has close links with all levels of learning within Northern Ireland. All of its educational initiatives are underpinned by an 'equal opportunities' programme aimed at promoting diversity and addressing the under-representation of specific groups within its workforce.

The company is a strong supporter of STEM in education, and its award-winning educational programme, 'The Flight Experience', is directly linked to the Northern Ireland Schools' Curriculum.

The programme promotes STEM subjects to pupils through a wide variety of practical and interactive initiatives, and highlights the job opportunities available in these subject areas.

As part of its educational programme, Bombardier actively supports the Government's STEMNET initiative, with over 100 employees registered as STEM Ambassadors working with schools to promote STEM. The company has also helped produce a Thematic Unit on 'Flight' with the Northern Ireland Council for the Curriculum, Examinations and Assessment (CCEA).

Other educational initiatives supported by Bombardier include the development of a tailored WISE (Women Into Science, Engineering and Construction) programme, which offers female pupils an insight to the aerospace sector, and engineering skills training for long-term unemployed people. The latter is part of a major employability initiative involving 70 companies, led by Bombardier, which has resulted in approximately 1,400 people in disadvantaged areas of Belfast gaining employment.

In addition, Bombardier's apprenticeship programme has been running for more than 50 years, and the company's strong engineering links with local universities helps provide an annual intake of high-calibre graduates.



ANNEX A - Measuring the strategy's success

We will measure the success of the strategy by considering performance against milestones and indicators. These are set out below.

OUTCOME	THEME	OUTPUT INDICATORS	ACTIVITIES
<p>Workshare on the next generation of aircraft sustains the UK's position as number one aerospace manufacturer in Europe and second in the world.</p> <p>In the meantime, UK aerospace industry turnover (measured each year) is increased, based on supplies to existing aircraft programmes.</p>	Technology	<p>By 2020 key technologies are developed to high technology readiness levels (TRL level 6) in time to be incorporated on next generation aircraft.</p> <p>UK Aerospace Technology Institute (ATI) recognised as providing strategic leadership in technologies for aerodynamics, propulsion, aerostructures and advanced systems.</p>	<p>ATI Options study completed on structure for ATI.</p> <p>ATI is operational by end 2013/14 and initial collaborative projects are underway.</p> <p>A strategic plan and roadmap for technology development is put in place.</p> <p>Projects secure match funding from industry.</p>
	Manufacturing capability	<p>By 2025 UK develops process for cost-effective manufacture of high-technology aircraft components that compare favourably with other nations.</p> <p>In the early 2020s products brought to market faster, and more efficiently, than current practice. (Baseline: Community Innovation Survey²¹).</p>	<p>Industry will scope the business case for a Manufacturing Accelerator Programme by end 2013/14.</p>



Apprentices at AgustaWestland

OUTCOME	THEME	OUTPUT INDICATORS	ACTIVITIES
	Supply chain competitiveness	<p>UK supply chain firms are positioned to gain work on the next generation of aircraft.</p> <p>By 2020 faster rate of product innovation within the aerospace industry. (Baseline: Community Innovation Survey)²².</p> <p>UK aerospace exports to a broader range of strategically important markets, e.g. US (Baseline: HMRC trade data)²³.</p>	<p>During 2013/14 BIS will, via the Aerospace Finance Forum, host regional seminars to explore access to finance issues facing the Aerospace supply chain.</p> <p>Subject to due diligence the Government will support the National Aerospace Technology Exploitation programme for SMEs during 2013/14.</p> <p>UKTI, FCO and BIS to identify commercial opportunities to attract inward investment and broaden the customer base for UK exports.</p>
	Skills and external engagement	<p>Effective delivery of the scheme to create 500 new aerospace engineering Masters places.</p> <p>By 2022 increase the share of workforce with NVQ level 4 and above to 50%. (Baseline: APS)</p>	<p>During 2013/14 BIS will commission a follow up study to identify the destinations of 500 students supported under the Aerospace Masters programme.</p>

Footnotes

1. Lucintel "Opportunities in UK Aerospace and MRO Market: 2011–2016."
2. Airbus Global Market Forecast 2012–2031
3. CBI Playing Our Strongest Hand: Maximising the UK's industrial opportunities
4. ADS 2012 Annual Survey and BIS Economics Paper No.6
5. Airbus Global Market Forecast, 2012-2031
6. Source: UK Export Finance
7. Advisory Council for Aeronautics Research in Europe (<http://www.acare4europe.org/>)
8. For more information see BIS (2010) Understanding local growth BIS Economics Paper No 7 <http://www.bis.gov.uk/assets/biscore/economics-and-statistics/docs/u/10-1226-understanding-local-growth>
9. Analysis based on AGP data.
10. The seven centres are: Advanced Forming Research Centre (University of Strathclyde), Advanced Manufacturing Research Centre (University of Sheffield), Centre for Process Innovation (Wilton & Sedgefield), Manufacturing Technology Centre (Ansty, sponsored by the Universities of Birmingham, Loughborough and Nottingham and by TWI), National Composites Centre (University of Bristol), Nuclear Advanced Manufacturing Research Centre (Universities of Manchester and Sheffield), and Warwick Manufacturing Group (University of Warwick).
11. CleanSky2 is a European aeronautical research programme to develop breakthrough technologies to significantly increase the environmental performances of airplanes and air transport, contributing to Single European Sky environmental objectives.
12. ONS Business Enterprise Research and Development (BERD) Survey 2011, published 20 November 2012
13. Airbus estimates that more than 4,000 commercial aircraft will finish active service between 2004 and 2023, a rate of over 200 aircraft per year, and that between 85% and 95% of their components can easily be recycled, reused, or otherwise recovered.
14. Initiatives which are already benefiting the aerospace industry include:
 - Business skills ambassador outreach activities and a range of careers related events run by business, some with government support
 - Increased support for companies to recruit apprentices
 - Funding support, available in Wales, to increase the numbers of employees trained to a higher level as a pathway to apprenticeships in engineering;
 - grants available to SMEs to recruit unemployed graduates;
 - grants for employers in England to take on apprentices where they have not done so before or within the last 12 months;
15. 2011 UK Aerospace Industry Survey, ADS (BIS analysis)
16. A Study of Technician Duties, Skills, and Training in the UK Aerospace Industry, Lewis 2012
17. Civil Aviation Authority
18. Labour Market Intelligence Factsheet 2010 ,Semta
19. Employers Skills Survey 2009/Employers Perspective Survey 2012 (UKCES)
20. UKCES
21. Proportion of enterprises between 2008-2010 that report improving capacity for producing goods and services or improving flexibility for producing goods and services as significant motivations for innovation.
22. Proportion of enterprises between 2008-2010 that introduced product or process innovations.
23. Growth in UK aerospace exports by market, latest year.



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