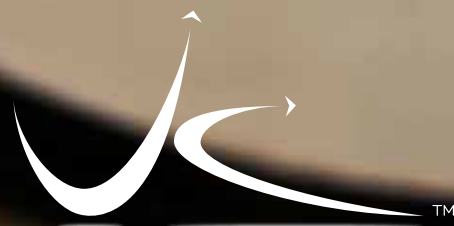


# Means of Ascent

The Aerospace Growth Partnership's  
Industrial Strategy for UK Aerospace 2016



AGP

Aerospace Growth Partnership





The Aerospace Growth Partnership is a strategic partnership between Government and industry which has been established to *secure the future of the UK aerospace industry* for the next 20 years and beyond.

It was established in 2010 as a vehicle to tackle barriers to growth, boost exports and grow high value jobs in the UK.

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 challenges that affect the sector as a whole.

To do this, the AGP is identifying the market failures that form barriers to growth and is developing initiatives to address these specific challenges.

The AGP's work programme has secured the commitment of over 100 senior business leaders.

The work is supported by a team of full-time secondees from industry.



# Contents

Forewords	vi
Continued Industry Commitment to AGP	1
Summary	2
1: Staying Ahead: Strategic Challenges for UK Aerospace	5
2: UK Supply Chain: Collaboration and Competitiveness	10
3: Technology: Driving Innovation	20
4. Skills: Investing in Talent	26
5. Manufacturing: Expanding Capacity and Capability	30
Appendix	34



Secretary of State for Business,  
Energy and Industrial Strategy  
The Rt Hon Greg Clark MP



I was delighted to find that one of my first visits as Secretary of State for Business, Energy and Industrial Strategy was to the Farnborough Air Show to meet representatives from the Aerospace Growth Partnership (AGP). The AGP has rightly built a reputation as an exemplar of successful engagement between industry and Government.

The UK's aerospace sector isn't just a world-leader in a highly competitive global market– it also makes a significant contribution to our nation's economy. Last year, the sector was responsible for £27 billion worth of exports. It has a presence right across the UK, in England, Scotland, Northern Ireland and Wales and strong local clusters. And over the past six years productivity growth in the industry has been six times more than in the economy as a whole.

This strategy shows that the sector is serious about maintaining this success for many years to come. From focussing on investment in research and technology, to developing the skilled workforce of tomorrow through use of apprenticeships and the industrial cadet scheme, the measures in this report will help keep UK aerospace at the leading edge of the sector.

Aerospace is the kind of forward-thinking, innovative sector that shows what the future of British manufacturing can look like, so I'm delighted to be working with the Aerospace Growth Partnership to help our aerospace companies thrive.

## Colin Smith

*Group President, Rolls-Royce*

### Industry Chair of the Aerospace Growth Partnership



It is a great honour to be taking over the role of industry Chair of the Aerospace Growth Partnership. That the AGP is still going so strong after six years is testimony to the wise and strong leadership shown by my predecessor Marcus Bryson.

The collaboration between the sector and the Government has been transformed during this period. For example, as I know from my previous role heading Rolls-Royce's engineering and technology programmes, the Government and industry together are investing more in aerospace R&D than has happened since the 1970s, supported by the creation of the Aerospace Technology Institute.

The Government listened to why we needed a more certain investment climate for R&D and has backed us for the long-term. We have also seen industry work collectively to create new programmes to help drive productivity and supplier performance, and to build and retain vital skills. These things wouldn't have happened without the AGP.

The UK therefore has incredibly strong foundations in aerospace on which to build a bright future. I am determined to keep that momentum going. I want to see our industry focus even more sharply on improving its productivity and competitiveness and to consistently develop the world-class level of skills we need.

The UK Aerospace Supply Chain Competitiveness Charter underlines industry's commitment to this challenge. Business will lead on implementing the actions set out in this document, and through the AGP.

I know that Government will continue to listen and to support the joint ambition we have for UK aerospace to sustain its prominence in the world market, and so contribute strongly to increased national prosperity.



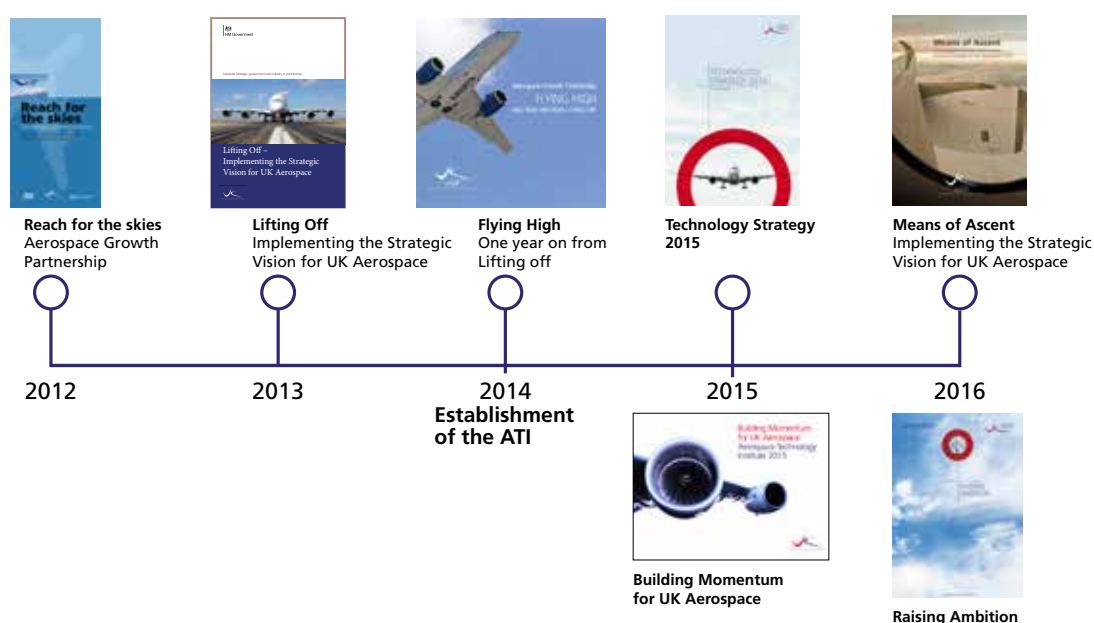




## Continued Industry Commitment to AGP

This review outlines the outstanding progress made under the Aerospace Growth Partnership and its plan for moving forward.

The UK aerospace industry will continue to work with Government and academia to implement this strategy and ensure it meets the objectives of creating long-term growth, productivity and skilled jobs for the nation.



**"ADS Aerospace Members Committee"**  
(see Appendix for list of members)

# Summary

## The Aerospace Growth Partnership

The AGP is a partnership between Government and industry. Our goals are to secure our country's current share of the global market and exploit the enormous opportunities for growth. We have generated R&D funding, driven innovation and best practice, and transformed relationships within the industry.

## Success, Opportunity, Challenge

UK aerospace is the **powerhouse of our advanced manufacturing sector**. We are Europe's leading aerospace manufacturing nation and second only to the United States. **Productivity has grown by 39% since 2010 with exports earning £27 billion a year**. The industry directly employs over 128,000 people.

Greener, quieter and more economical aircraft worth over **\$5.5 trillion** will be required over the next 20 years. This is a great opportunity given our leading capability in complex, high value components and emerging technologies.

In order to seize this opportunity, we need to invest even more in the next generation skills, in truly radical technologies and processes and in increased productivity and competitiveness throughout the supply chain.

## Strategic Actions

### *R&D Funding*

Government has shown unprecedented commitment to the aerospace sector. R&D funding for 2013-26 now totals £1.95 billion – matched 100% by the industry for a **combined total of £3.9 billion**. This provides the industry with the certainty it needs to invest.

## Supply Chain: Collaboration and Competitiveness

However, we cannot afford to be complacent. International competition is intensifying and the nature of our strategic challenge has changed since the inception of the AGP. In particular, the UK has a strong position on the brand new Bombardier C-Series aircraft, which will enter service this year. However, the launch of other new narrow bodies has been pushed back to 2030, with Airbus and Boeing developing aircraft derivatives using upgraded engine technologies.

This has limited the scope to pull through other new systems on the aircraft while intensifying the focus on competitiveness of existing products as production rates increase. This competitiveness challenge is particularly acute for companies within the supply chain.

In order to seize this opportunity and overcome these challenges, we need to invest even more in technology, manufacturing capability, competitiveness and skills.

The AGP has:

- Launched the **UK Aerospace Supply Chain Competitiveness Charter**. Prime and Tier 1 companies commit to promoting structured continuous improvement programmes, sharing growth opportunities with suppliers, and supporting dissemination of innovative technology
- Increased supplier involvement in the 'Supply Chains for the 21st Century' (SC21) operational excellence programme - now with 450 corporate participants. **We plan to build on its success via a 'SC21 Competitiveness & Growth' programme to drive increased productivity and competitiveness**
- **Supported expansion of the 'Sharing in Growth' (SiG) intensive performance improvement programme** to over 60 companies, securing some £5 billion of contracts and 10,000 jobs by 2022
- Encouraged innovation in SMEs via the National Aerospace Technology Exploitation Programme (NATEP), supporting 114 collaborative projects in over 250 companies, particularly helping those with no, or limited, R&D experience. **The plan is for NATEP to continue, supported by the Aerospace Technology Institute.**

## Technology: Driving Innovation

The Aerospace Technology Institute (ATI) works to fulfil the AGP's technology strategy by launching transformative R&T projects. Founded in 2010, it has awarded £1.2 billion to date to 188 organisations.

ATI invests in facilities and infrastructure needed to secure the UK's leading position, for example, a national centre of excellence in gas turbine combustion systems at Loughborough.

The Institute will:

- Capitalise on the certainty of the investment horizon out to 2026 by developing ambitious programmes on integrated complex technologies for future turbo-fan engines, wings and advanced aircraft systems
- Initiate major cross-cutting projects to plug existing gaps and to master transformational technologies. These include high-value design, the digital economy, additive manufacturing and through-life services
- Strengthen engagement with aerospace companies and research organisations in the UK and abroad.

## Skills: Investing in Talent

The AGP Skills Working Group (SWG) helps aerospace companies identify and invest in skills needs. The AGP has:

- Jointly sponsored 500 Aerospace Engineering MSc bursaries
- Helped employers make the most of the Government's 'Trailblazer' initiative for designing high quality apprenticeships
- Created an Aerospace Employer Ownership Pilot to tackle skills gaps, for example by MSc level training courses
- Supported industry-wide mentoring schemes for women and company-run diversity schemes.

The AGP will:

- Identify and articulate longer-term digital, engineering and management skills needs.
- Create a single Aerospace Industrial Cadets Programme for school pupils in 2016-17.
- Launch the Jon Dennison Bursary Fund to help disadvantaged young people progress their interest in engineering.
- Sharpen careers messaging for pupils and teachers.

## Manufacturing: Expanding Capacity and Capability

The AGP's Manufacturing Working Group is tasked with accelerating improvements in productivity. The AGP has:

- Developed a Manufacturing Accelerator Programme to speed the supply chain's adoption of best practice and new technologies
- Improved access to the High Value Manufacturing (HVM) Catapult via 'Reach', a programme encouraging SMEs to improve their manufacturing processes
- Inaugurated an Aerospace Research Centre within the Manufacturing Technology Centre (MTC) at Ansty Park which has expanded the UK's manufacturing innovation capacity

The AGP will:

- Map manufacturing requirements and work with the ATI to promote their adoption across the supply chain
- Grow HVM Catapult and regional capacity to facilitate uptake of best practice, investment in manufacturing productivity and adoption of Smart Digital Manufacturing
- Explore the potential of an Aerospace Manufacturers Collaboration Programme to connect companies looking to adopt best practices with those who have already successfully implemented them.





# 1: Staying Ahead: Strategic Challenges for UK Aerospace

UK aerospace is the powerhouse of our advanced manufacturing sector. Europe’s leading aerospace manufacturing nation, second only to the United States supplying high-value, high-tech components for almost every major aircraft platform.

With almost 3,000 companies across the breadth of the UK, our aerospace sector makes a significant contribution to the UK economy. In particular, it:

- Generates over £31 billion in turnover<sup>1</sup>
- Exports over 90% of its production, earning Britain £27 billion a year
- Directly employs over 128,000 people – 26,000 in research, design and engineering – and supports an additional 154,000 jobs
- Pays an average salary of £40,500<sup>2</sup>.

<sup>1</sup> ADS Facts and Figures 2016  
<sup>2</sup> ADS Aerospace Outlook 2015  
<sup>3</sup> BEIS Global Aerospace Outlook 2016

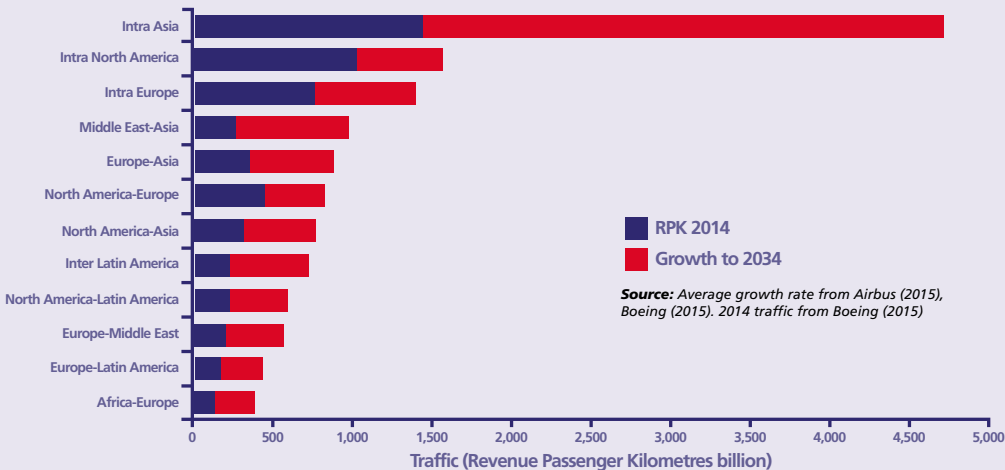
## Solid Orders, Burgeoning Markets

The prospects for UK aerospace are great and growing. The current backlog of over 13,000 aircraft is worth some nine years work in hand and is valued at almost £200 billion. The latest BEIS Global Aerospace Outlook reflects a consensus that global demand for air travel will grow at around 5% year-on-year into the mid-2030’s – a rate which has held steady for several decades. This compound growth rate would see the sector more than double in size over that period.

New aircraft must be greener, quieter and more economical to run than those they replace. This represents a great opportunity for the UK given our leading capability in complex, high value components and in emerging technologies.

By 2034 it is estimated that over 38,000 fixed-wing new passenger aircraft, worth US\$5.5 trillion, will be needed; and in a similar time scale the global requirement for new helicopters is expected to be in excess of 40,000 units, worth circa \$165 billion. Demand for 9,000 business jets worth \$267 billion is also anticipated over the next ten years<sup>3</sup>.

This demand for air transport is linked to overall economic conditions and these affect sub-sectors differently. The post-2014 fall in oil prices helped airlines but hurt helicopter manufacturers and servicers since these have significant work with the oil and gas industry. And, as the aerospace market trades in US dollars, exchange rate variations can have a significant effect on UK companies.



## Competition Abroad, Transformation at Home

Great industries have withered through failing to anticipate change and both UK aerospace and Government are alert to the range of emerging challenges at home and abroad. Our aerospace industry is experiencing significant growth but that growth is not keeping pace with the expansion of the global market.

In parallel, the nature of new product development has been evolving. The Airbus A320 and Boeing B737 families have been refreshed by installing new, more fuel efficient engines. And Bombardier's new C Series aircraft, aimed at the lower end of the narrowbody market, is the first clean sheet design in many years. These developments have pushed back the timing of the next brand new aircraft in the upper end of the narrow body market to around 2030. However, this has increased the drive to pull through new technologies on other aircraft systems and intensified the efforts on driving costs down on existing products, as the industry looks to focus on competitiveness and productivity to build a sound platform to explore longer term developments for the future.

Industry requires the flexibility to seek applications on other platforms (such as business, general aviation and regional aircraft) as well as focusing technology development on projects which will help reduce production costs. Additional opportunities may lie with new wide-body aircraft, including a one being considered jointly by the Chinese and Russians, which would follow on from the Chinese C919 narrow body.



Aerospace in the UK benefits from an unusually close degree of co-operation between industry and government thanks to the Aerospace Growth Partnership. It's clear that the aviation sector can continue to be a powerful engine of productivity and employment for the UK for many years to come. ”

**Fabrice Brégier,**  
President and CEO Airbus

## Commercial Helicopters in the UK

The UK's Industrial presence in the commercial helicopter sector is growing in breadth and depth, including every aspect of design, manufacture, assembly, test, delivery, maintenance and support of commercial helicopters. Sustaining our world-leading capability in rotor systems and transmissions is a particular priority.

This capability is supported by the presence of a significant number of first and second tier suppliers making a wide range of systems, components and equipment in the UK as well as other major markets. The commercial rotary wing sector in the UK now accounts for around 8% of the UK aerospace footprint.

The UK has the largest commercial helicopter fleet in Europe, providing a range of essential economic and social services to the UK economy from support to the oil and gas and utilities industries through police, medical and search and rescue services. This is underpinned by a strong MRO activity which supports the whole of the UK supply chain.

## The Fight for Market Share

International competition remains formidable, including from countries with a smaller share of the global market which nonetheless outspend the UK in aerospace-related research and development (R&D).

New national players are entering every level of the supply chain. Governments worldwide are anxious to grow a sector offering well-paid jobs, high-technology and national prestige and invest accordingly. The AGP's achievements have attracted considerable international interest and are being emulated by some of our competitors.



## Capacity Challenges

Competition is increasingly intense within the UK industry from lower-cost overseas competitors. Price pressures flow down the supply chain and can deter productive investment. Airframe manufacturers must continually assess the price of systems and components and consider putting projects out for new bidding rounds. This in turn makes the supply chain cautious about long-term commitments to new technologies, training, plant and equipment in case work is re-sourced before an adequate return can be realised.

Such problems are multiplying as aerospace adapts to what's being called 'Industry 4.0'. The rapid, capital intensive, shift to robotics, the Internet of Things, cyber-physical systems and 3D printing is transforming techniques and markets. Large and small companies need to look well beyond current methods and established practices.

A recent survey of the UK supply chain (discussed in more detail in Chapter 2) uncovered widespread concerns about current and future capacity:

- Many companies have shortages in advanced technology and manufacturing skills
- Shortcomings in advanced manufacturing and lean supply chain management are impeding global competitiveness
- Lower-tier companies may lack the management structures and processes required to achieve growth.

### Improving Competitiveness by Saving Energy Bombardier, Belfast

Energy costs in Northern Ireland are significantly higher than in the rest of the country. Bombardier's Belfast operation is turning to alternative sources, deploying onsite biogas, creating one of the UK's largest rooftop solar installations and constructing an energy from waste plant (with residual energy sold to the local Grid). 70% of its energy will soon come from alternative sources. The projects are substantially reducing both the company's carbon footprint and the amount of waste going to landfill.

## UK open for business

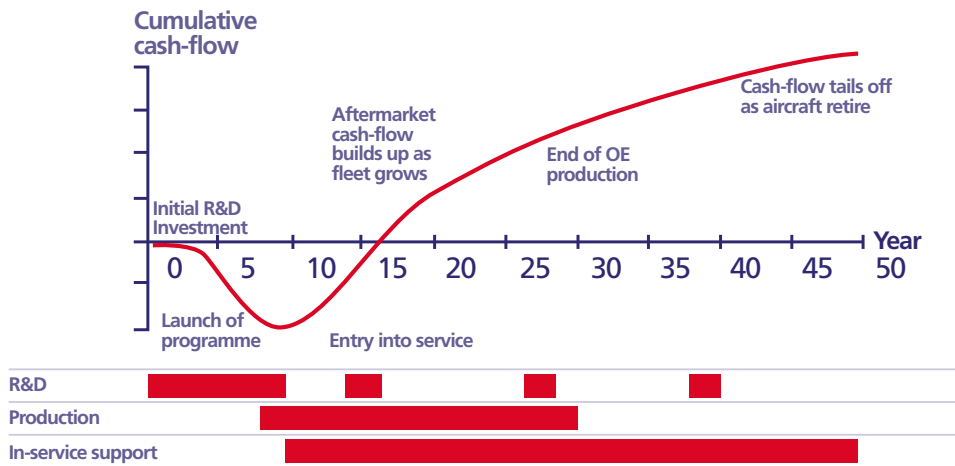
On 23 June 2016 the UK electorate voted to leave the European Union. Industry, through the AGP, will work closely with Government to make sure that our aerospace industry can continue to tackle the challenges it will face, make best use of all future international trade opportunities, and continue to grow high value jobs in the light of the referendum result.

We should take confidence from the fact that Britain is ready to confront what the future holds from a position of strength and remains open for business.

The UK remains a great place to do business and invest:

- The UK is the fifth largest economy in the world and was the fastest growing economy in the G7 in 2015
- It is the highest ranked major economy in terms of ease of doing business, ranked higher than the USA
- The World Economic Forum Competitiveness Report assesses the UK to be in the top ten for global competitiveness
- We are home to 18 of the world's top 100 universities, and four of the top ten
- The UK's corporation tax rate of 20 percent is the lowest in the G7 and joint lowest in the G20 and will fall to 17 percent by 2020
- The UK has the best superfast broadband coverage of any major European economy
- The UK has a large, integrated transport system. This includes the second largest ports industry in Europe; the largest air transport system in Europe and the most improved rail network
- The UK is the largest exporter of financial and related professional services in the world
- The Patent Box gives a ten percent rate of corporation tax on profits that are earned in the UK from patents and other similar types of intellectual property (IP)
- The UK actively welcomes entrepreneurs and has visas for those who wish to invest in the UK and their families.

Indicative example of a major aerospace lifecycle:



Since 2013, the AGP has taken strategic action to support the long-term success of the UK aerospace industry.

Key developments include:

(i) Growth and Assurance in R&D Funding

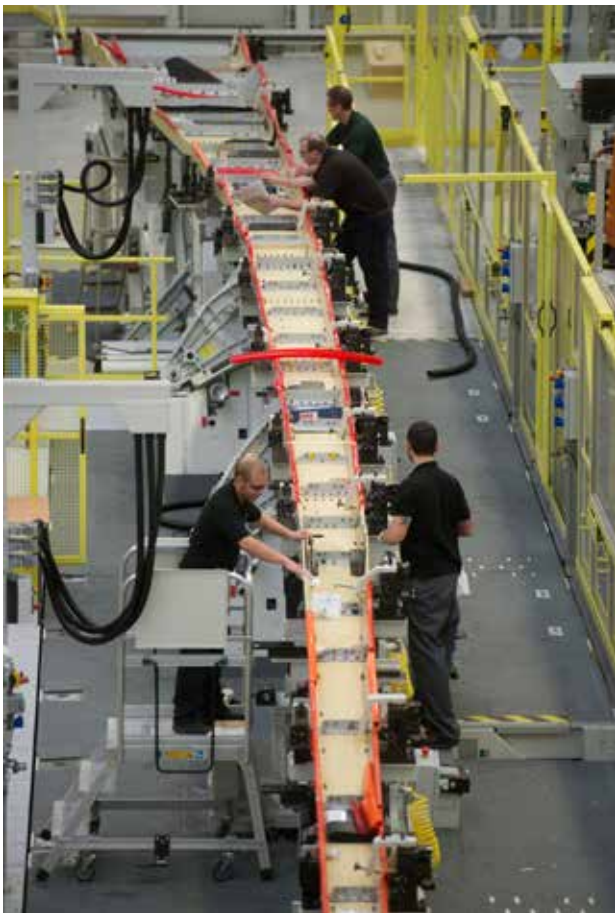
The development of a new aircraft takes 10-15 years so predictable, long-term and stable R&D funding is a key factor in deciding whether, and where, investments are made.

Government has shown unprecedented commitment to the aerospace sector. The Aerospace Technology Institute (ATI) has been established to make sure that this investment delivers the best economic value for the UK.

This new policy framework provides UK aerospace industry with the certainty it needs to invest in developing new technology and manufacturing activities here at home.

(ii) Improved Supply Chain Competitiveness

The AGP, backed by strong Government funding, has put in place a wide range of specific support programmes to help companies improve their competitiveness. These include SC21 and Sharing in Growth (continuous performance improvement programmes), NATEP (innovation for SMEs through mentoring) and 500 new masters level places.



### (iii) The Aerospace Hub

UK aerospace exports over 90% of its production. Increasing the volume and value of exports is vital to the sector's future success. There's a particular need to grow market share in new aircraft programmes.

Support from the Department for Business, Energy and Industrial Strategy (BEIS) and Department for International Trade (DIT) underpins the industry's ability to export. The Government has now enhanced that support by establishing a UK Aerospace Hub, with strategic guidance from the AGP. The Hub (chaired by Marcus Bryson, formerly CEO GKN Aerospace) brings together policy teams in BEIS and DIT.

The Hub, in concert with the AGP, will bring together the best of public and private sector experience to target priority markets and export opportunities. It is at the heart of a coordinated cross-governmental network, including worldwide Foreign and Commonwealth Office and DIT teams plus domestic trade and investment advisors.

This unique body will leverage our unrivalled ties with nations around the world, providing a better service for business by utilising Whitehall's deep sectoral knowledge. The Hub will focus its energy on what matters most – economic growth, supporting UK exporters and attracting inward investment.

Specialists are being employed to identify opportunities with aircraft manufacturers and their leading domestic suppliers in markets such as the United States, China and Europe. They will work with ADS to match opportunities to the right British companies. Exporters will continue to be backed by UK Export Finance (UKEF) which provided almost £4 billion of finance and insurance in 2012-15. Close attention will be paid to measuring the volume and value of exports delivered.

The Hub and the AGP, will adopt a strategic approach to attracting new inward investment by identifying capability gaps and targeting relevant companies to fill them. It will also work with UK companies that are headquartered overseas to grow their business in the UK.





## 2: UK Supply Chain: Collaboration and Competitiveness

### What Have We Achieved?

- Provision of long-term R&D funding to help companies develop new or enhanced product and manufacturing technologies
- Commissioned a comprehensive survey of UK suppliers highlighting their needs and priorities
- Encouraged innovation via the National Aerospace Technology Exploitation Programme (NATEP) – supporting 114 collaborative projects in over 250 companies, particularly helping those with no, or limited, R&D experience
- Supported expansion of the 'Sharing in Growth' intensive performance improvement programme to over 60 companies, raising productivity and capability to globally competitive levels
- Increased supplier involvement in the industry 'Supply Chains for the 21st Century' (SC21) operational excellence programme, now with 450 corporate participants
- Launched an 'Export For Success' programme identifying opportunities for SMEs.

### What Will We Do Next?

- Strengthen supply chain relationships and competitiveness by launching and implementing a UK Aerospace Supply Chain Competitiveness Charter
- Build on the success of SC21 via a follow-on programme to drive increased productivity and competitiveness
- Recruit the next wave of ambitious companies for 'Sharing in Growth' and create a cadre of leading aerospace suppliers
- Continue to support innovation in the supply chain through NATEP with the support of the Aerospace Technology Institute
- Work with the BEIS/DIT Aerospace Hub to strengthen specialist support for exporters in key markets
- Develop new strategically important opportunities for the UK supply chain using the Strategic Competency Analysis.



the AGP is important to Rolls-Royce as it cements the critical government-aerospace industry relationship that can deliver long-term sustainable policy and direction for this sector in the UK. We are proud to be involved in the AGP and for what it has – and will in the future – deliver for the benefit of the UK economy. At this time of uncertainty it is more important than ever that the Government fully engages with strategic industries like aerospace to create a stable climate for long-term investments. ”

**Warren East**  
CEO, Rolls-Royce

## Active Helicopter Rotors – ‘Jet Smooth Ride’ Future of Helicopters

Active rotor technology represents the next big step in helicopter capability enhancement, providing the ability to improve helicopter performance and comfort.

Supported by the AGP and the ATI, Leonardo Helicopters is nearing the end of the second collaborative Rotorcraft Technology Validation Programme (RTVP). Building on previous active rotor programmes, a range of new technologies have been developed to enable flight demonstration of this emerging capability. The design and manufacturing phases have presented several challenges but with many important lessons learnt, the active rotor is now undergoing a programme of ground testing to clear the final design for flight in 2016.

The RTVP task is tailored to de-risk new technologies, enabling future cost effective exploitation in production. Improved rotor performance will always be a welcome development, but providing a ‘jet smooth’ ride for future customers is also a key aim of the technology.

## Defining the Challenge: The Supply Chain Survey

In 2015 the AGP commissioned Ricardo Energy and Environment to undertake a comprehensive survey of the civil aerospace supply chain in order to gain a clear understanding of its needs and priorities. This examined management, products and customers, spend profiles, skills, funding and technology. The full document is already informing AGP strategy.

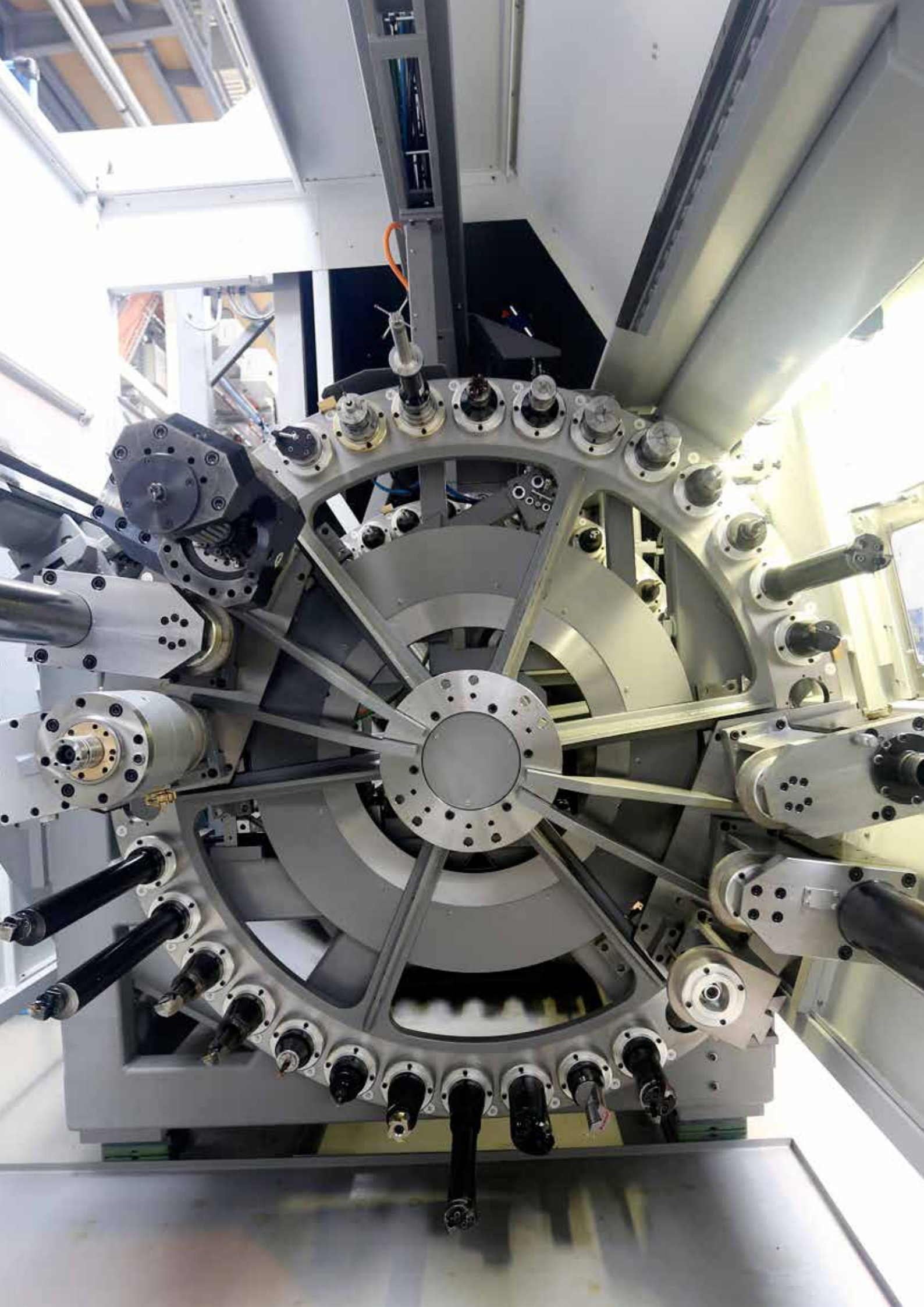
### *Key findings:*

- The industry recognises the importance of continuous improvement in the face of increasingly capable competition.
- Many businesses are increasing capability and capacity to meet record demand
- Yet our overall growth rate is slower than that of the global market.
- A shortage of skills in advanced manufacturing, lean supply management and advanced technology are inhibiting the industry's grasp of a bigger share of new aircraft programmes
- Lower tier companies consider themselves ready to secure new technology and opportunities.
- Primes see them as burdened by inadequate management structure and manufacturing processes



The AGP's investments in technologies, in skills and in supply chain development is ensuring we retain a strong and healthy industrial base. In today's global corporate environment this strength continues to create opportunities for the UK sector to be a partner of choice ”

**John Ponsonby,**  
Managing Director,  
Leonardo Helicopter Division (UK)







## The Supply Chain Charter

Poor supply chain management is a barrier to productivity and growth. Improved mutual understanding and co-operation between suppliers and higher tier customers will break down that barrier.

This means more than prime and tier 1 companies telling UK suppliers what they want. It also entails suppliers benefiting from the information, skills and technologies usually available to their customers alone. Improved inter-company relationships and communication will build commitment to continuous improvement and drive positive change throughout the chain.

The UK Aerospace Supply Chain Competitiveness Charter, reflects the refreshed focus of the Aerospace Industrial Strategy. Designed to accelerate improvements in productivity, skills and innovation the Charter builds on the success of SC21 in demonstrating the commitment of prime and tier 1 companies' to their UK suppliers.



The Aerospace Growth Partnership ticks two vital boxes for United Technologies Aerospace Systems – it provides a clear vision of long-term government support to the UK aerospace industry and helps us develop the cutting edge technologies, skills and supply chain to compete in the global market place. ”

**Gareth Morris,**  
General Manager,  
UTAS Motor Drive Systems, UK



# The UK Aerospace Supply Chain Competitiveness Charter

As a signatory to the UK aerospace supply chain competitiveness charter, we commit to:

- > Promote wider participation in structured continuous improvement programmes, such as SC21 and Sharing in Growth, providing informed and ongoing guidance to assist in setting performance targets
- > Provide visibility of future growth opportunities and share with appropriate candidate suppliers
- > Support the focused development and dissemination of technology to radically improve product performance and manufacturing productivity
- > Facilitate access to sources of support, e.g. financial institutions, HVM Catapult, research institutions, government departments
- > Invest in the development of skills and apprentices in order to have the resources, capabilities and experience needed to improve productivity and meet future demand
- > Build long-term relationships with globally-competitive suppliers.

We expect that our UK suppliers will:

- > Engage actively in structured continuous improvement programmes, such as SC21 and Sharing in Growth, to become sustainably globally competitive
- > Invest in technology to radically improve product performance and manufacturing productivity
- > Invest in the development of skills and apprentices in order to have the resources, capabilities and experience needed to improve productivity and meet future demand
- > Invest for growth
- > Build long-term relationships with us.



## From SC21 to SC21 Competitiveness & Growth

SC21 Operational Excellence is a well supported industry programme for aerospace companies seeking improvements in basic processes, quality and delivery performance. However there is a big gap between this foundation level and the intensive Sharing in Growth programme. The AGP is therefore developing an intermediate stage – 'SC21 Competitiveness & Growth'. This will provide tailored plans for progressive levels of structured improvement in competitiveness, addressing factors such as operations, cost and innovation. 'SC21 Competition & Growth' will be available to a significant number of suppliers. AGP will be pursuing funding opportunities from regional and devolved authorities to support the delivery of the programme.



### MEP Ltd, Aylesford, Kent

"From implementing leaner processes to changing the culture of the business, SC21 has fundamentally changed the way we operate across the board" says Phil Hart, MEP's Managing Director.

"The support and guidance we've received from our SC21 clients, and the wider SC21 community, has enabled us to improve quality and delivery performance, and made us more competitive. We now have stronger, more collaborative relationships with our clients and suppliers – and not just in aerospace. We've won 6 awards, and risen from Bronze to Silver performance in the process"

## Sharing in Growth

Launched in 2013, with £50 million public funding won competitively through the Regional Growth Fund (RGF), SiG provides a sustainable and cohesive four year training and transformation programme. Delivered by a 100-strong team of industry specialists, it is on track to exceed commitments and is recognised by the City as making a positive contribution to reducing financial risk.

Boosted with an further £30 million award of funding from the RGF in 2015, plus private in-kind support, SiG is now a £250 million programme guiding implementation of best practice in leadership and management, lean operations, manufacturing engineering, procurement and value engineering. It delivers sustainable improvement in leadership, culture and operational excellence.

The first participating cohort of 25 companies has secured contracts worth over £1 billion accounting for some 1,600 jobs. Contracts valued at over £50 million have been won back from low-cost foreign competitors.

The expanded programme will now support up to 64 participating companies.

## National Aerospace Technology Exploitation Programme

Established in 2013, NATEP is a £40 million programme supported by £23 million public funding won competitively. Targeting small and medium size enterprises, the programme's ambition is to deliver 100 plus new technologies by bringing the most innovative suppliers together with universities and Catapult centres. It provides high calibre technical and management mentoring resource to accelerate technology to market readiness.

Supplier generated ideas are judged on their potential to deliver jobs, with winners receiving grants averaging £150,000 over 18 months. The programme has generated a wide range of innovations and is set to exceed targets, creating or sustaining 220 jobs by March 2017 and 1,200 by 2022. The support of overseas customer companies enhances the opportunity for strong exports.

NATEP will run in its present form until September 2017, but discussions are underway to continue this successful programme with support from the Aerospace Technology Institute.



## Export for Success

DIT has invested in specialist resource in key overseas markets (such as the United States and China) to boost export opportunities for UK suppliers. ADS has also employed a specialist Aerospace Operations and Business Development Manager to match suppliers to these international business opportunities. AGP has assisted in the creation of the BEIS/DIT Aerospace Hub and is working with it to strengthen support for exporters.

## Finance for Growth

The AGP has built on the original Finance Forum and launched a Finance for Growth project to study how supply chain companies can access the funding they need invest, grow and meet future demand. The Finance for Growth team, supported by the ATI and BEIS, will model the investment required to achieve growth potential and work with financial circles to help ensure that appropriate and affordable funding is made available.



Everyone can work in Aerospace and we need to shout about it to attract the best and most diverse talent. It's so important to invest to do this well. The AGP understands this. The work of the AGP in close partnership with the industry has supported many high quality apprenticeships, creating the UK leaders of the future. AGP programmes to attract and coach women and improve diversity across the entirety of the workforce have been vital. We're proud to belong to the AGP and to play our part in the ongoing investment in the future of UK Aerospace. ”

**La-Chun Lindsay,**  
Managing Director, GE Aviation Wales

## ELE Advanced Technologies, Colne, Lancashire

ELE joined SiG to grow the aerospace side of its business and attain a £20 million turnover by 2020. Employees have been trained in lean production and directed to eliminating waste and non-value added work. This has resulted in an extra £1 million of contracts to date via an 115% productivity improvement, a 20% cost-reduction for a key product and reducing machine set up time by 75%.

Dave Dudley, Technical Director, reports that “Working with SiG has allowed us to develop a more competitive approach to securing new business and retaining existing work. Applied learning has led to improved working practices which are now part of our daily routine.”

## Winbro Group Technologies Ltd, Coalville, Leicestershire

Winbro has won contracts estimated at £88 million since commencing the SiG programme in 2014. “We’d invested in new equipment and facilities but lacked the know-how to develop our people at the same pace. SiG is upskilling our people, underpinning our growth and making that growth sustainable over the long term.” *Andy Lawson, COO*

## AGC AeroComposites, Yeovil-Derby

AGC has completed a NATEP supported project developing cutting edge composite joining technology. A novel welding technique allows rapid joining of high performance thermoplastic composites components to aerospace standards, using low cost equipment and materials.

Industry adoption of thermoplastic composites has been constrained by lack of appropriate joining techniques. This disruptive technology produces components with a typically 15-20% weight saving, together with strength and fatigue properties significantly superior to those assembled by traditional mechanical methods.

Lead project partners AGC AeroComposites work with the National Composites Centre and Nottingham-based TenCate Advanced Composites, with support from Rolls-Royce.

## Aeromet International, Worcester, Sittingbourne and Rochester

Aeromet International Ltd is a leading British manufacturer of premium aluminium, magnesium sand and investment castings. Through long term investment and support from the ATI and NATEP, Aeromet has developed and commercialised a family of innovative high performance aluminium-based metal matrix composite alloys, branded A20X.

In both cast and 3D printed formats A20X matches or excels the strength, stiffness and operating temperature limits of the most advanced alternative products available. The ability to produce complex geometries spells significant reductions in cost and environmental footprint. When combined with state of the art methods for structural optimisation it opens hitherto unavailable design space for product designers.

Embracing continuous improvement programmes like SiG and SC21 has enabled Aeromet to focus on operational excellence and bring its world class product offering to the global market.



The Aerospace Growth Partnership is making a material difference in growing the UK's aerospace capabilities throughout the entire supply chain and ensuring the UK remains a globally competitive hub for this hugely important sector. ”

**Michael Ryan,**  
Vice-President and General Manager,  
Bombardier Belfast





### 3: Technology: Driving Innovation

#### What Have We Achieved?

- Published the first UK technology strategy for aerospace in 2015
- Linked up with over 200 senior technology experts, keeping the ATI in the vanguard of thinking in the sector and enabling us to push R&T boundaries
- Launched a portfolio of 149 projects, worth £1.2 billion, involving 188 partners, including 100 SMEs
- Focused on large strategic projects, positioning the UK as the optimum location to carry out major aerospace programmes for the global market.

#### What Will We Do Next?

- Capitalise on the certainty of our investment horizon out to 2026 by developing ambitious programmes on integrated complex technologies for future turbo-fan engines, wings and advanced aircraft systems
- Initiate major cross-cutting projects to plug existing gaps and to master transformational technologies. These include high-value design, the digital economy, additive manufacturing, autonomy, and through-life services
- Strengthen engagement with aerospace companies and research organisations in the UK and abroad
- Support the UK Aerospace Supply Chain Competitiveness Charter.

Coinciding with this document, ATI has published "Raising Ambition", an update to its 2015 strategy. This provides new insight into the Institute's technology themes .





## About the ATI

The Aerospace Technology Institute (ATI) was launched in 2013 to guide government and industry on future aerospace research and technology (R&T) funding in the UK. It delivers the technology aims of the Aerospace Growth Partnership, aiming to secure the full economic potential of the sector through strategic technology investment.

The Government committed £1.05 billion in 2013 and a further £900 million in the 2015 comprehensive spending review, extending the programme out to 2026. Industry's matching contribution brings the total to £3.9 billion, creating long-term certainty for investment decisions.

## ATI's goals

Beneath its overarching economic remit, the Institute focuses on four objectives:

- Provide Technology Leadership
- Maximise Funding Impact
- Convene Strategic Partnerships
- Elevate the UK's international technology profile.

## Provide Technology Leadership

The Institute launched a technology strategy in July 2015 – an overarching document accompanied by a market outlook and nine detailed papers. It identifies four strategic market aligned technology themes:

- Aircraft of the future
- Aerostructures of the future
- Propulsion of the future
- Smart, connected and more electric aircraft.

## Maximise Funding Impact

The ATI maximises the UK's potential for participation in future aerospace programmes by launching transformative R&T projects. Its strategic review committee shapes projects and the portfolio to optimise the commercial impact of public investment. So far £1.2 billion has been awarded to 188 organisations made up of aerospace companies and cross-sector industrials (including 100 SMEs), research organisations and universities. It will promote increased participation by SMEs, improving the overall productivity and competitiveness of the sector.

As well as advancing product technologies, ATI invests in facilities and infrastructure needed to secure the UK's leading position, for example:

- An aerospace research centre at the Manufacturing Technology Centre in Coventry
- A Wing Integration facility at Filton
- A national centre of excellence in gas turbine combustion systems at Loughborough.

Demand for ATI support is increasing, indicating that the Institute is attracting investment into the UK. ATI projects are securing thousands of high-value jobs, increasing competitiveness, and contributing to the economy through high-intensity R&D and associated spill-over benefits.

The Government's commitment to the ATI is designed to drive a reciprocal investment by companies in the UK. This is beginning, but there remains significant potential for leading companies to work with others within the supply chain and address market opportunities through collaborative technology development.

The ATI has also established a whole aircraft modelling expertise, helping UK suppliers understand the impact of technologies at platform level, and conferring an important advantage on them in articulating the benefits of their products and services to global customers.

## Convene Strategic Partnerships

The ATI has established 11 advisory groups bringing together some 200 specialists from industry and academia. They help the Institute remain at the forefront of thinking on aerospace technology whilst maintaining a commercial focus. They also help shape the technology agenda and initiate new strategic project ideas (for example on future software development) to improve productivity and reduce development timeframes.

## Raise UK's International Technology Profile

The ATI's international work reflects the global nature of aerospace. The recent vote to leave the European Union clearly impacts on this activity. Whilst the UK remains in the EU, it will continue to engage in EU fora and programmes, while striving to ensure optimum arrangements post-departure, in the mutual interests of the UK and EU.

The UK now Chairs GARTEUR, an organization for European aeronautics research collaboration. The Institute is making the most of bilateral R&D opportunities, establishing working relationships with Sweden, Canada and Germany.

## Moving forward

Over the next year the Institute will address five priority areas:

- Further maximise the impact of technology programmes
- Initiate ambitious new programmes on integrated technology validation
- Investigate major cross-cutting technology agendas
- Strengthen engagement with other organisations in aerospace and beyond
- Improve UK participation in European research and build international collaboration.

## Maximise impact of the technology programme

The 2015 strategy shows the need to improve productivity and reduce costs across all strategic technology themes. The ATI is helping achieve this via a series of projects, many involving the High Value Manufacturing Catapult centres. Within the individual technology themes, there are major potential opportunities from aircraft updates and new aircraft programmes. The Institute will address these as follows:

- Aircraft of the future: further developing whole aircraft design and integration capability through improved modelling, design processes and experimental facilities. This will embrace radical new designs
- Smart, connected and more electric aircraft: systems will play a greater role in future air transport, and account for more value on an aircraft. The Institute will concentrate on electric controls and high power transmission, software-driven secure systems and communications, lighter and lower-cost landing gear, and smarter health management systems
- Aerostructures of the future: maintaining the UK as a leader in large complex structures, particularly wings, by promoting enhanced integration of engines and wings, improved aerodynamics, and processes to support faster and cheaper transition to new designs
- Propulsion of the future: technologies for more efficient ultra-high bypass engines, and new concepts for distributed hybrid turbo-electric propulsion.

### Raytheon

The AGP initiative assisted Raytheon in collaborating with UK partners and universities to develop novel power conversion systems. Raytheon's exploitation of its Glenrothes based Silicon Carbide foundry and engineering design for the core elements of primary power delivery has been successfully demonstrated in a 100kW bi-directional converter, offering high efficiency performance installed in harsh environments. Raytheon's close UK partnerships will continue to enable power conversion capabilities which directly support the More Electric Aircraft horizon and bolster the UK's export strength under the Advanced Systems pillar.

## Validating Radical New Technologies

To capture priority opportunities, the Institute will work with industry on ambitious initiatives to mature, integrate and validate a wide range of technologies in each strategic theme, including:

- Ultra-high bypass ratio (UHBR) turbofan: an entirely new engine architecture, with composite fan, power gearbox, high pressure core and accompanying manufacturing technologies. Testing will investigate how to effectively integrate this new generation of efficient engine onto aircraft
- Future wing: the next generation of high efficiency wing and associated high productivity manufacturing systems
- Integrated complex systems: a virtual whole aircraft environment for testing the integration of UK advanced systems

Each initiative will progress design and manufacturing capabilities alongside system and component technologies. Some of the expertise and delivery methods required can already be found in ATI's R&T portfolio.



The continued investment in the Aerospace Technology Institute (ATI) by both Government and Industry underlines the combined commitment made through the AGP to support growth of Aerospace in the UK – securing its future and the jobs that depend on it. ”

**Steve Fitz-Gerald,**  
Chief Executive, Marshall Aerospace  
and Defence Group

## Investigating Cross-Cutting Technologies

The ATI and its advisory groups have identified several significant and challenging cross-cutting topics, requiring liaison with organisations outside the aerospace industry.

- High Value Design (HVD): roles, tools, activities and facilities deployed in design and engineering. HVD is essential to high value manufacturing
- Digital: connectivity, new business models and lower-cost high-performance computing
- Additive Manufacturing (AM): aerospace's relatively low production volumes particularly lend themselves to AM, but there are significant challenges in increasing production rates and standardising production machinery and materials
- Autonomy: autonomous systems can reduce aircrew workload and enable safer and higher capacity air transport. The Government has challenged the industry to accelerate the introduction and integration of autonomous remotely piloted air vehicles into controlled airspace
- Through Life Services: priority technologies to reduce cost and improve in-service availability include integrated vehicle health management (IVHM), and repair and inspection. Recycling and disposing of composite materials will also require new technologies.

## Engaging with Organisations in Aerospace and beyond

ATI is underpinned by close relationships with companies and organisations, technical and market advisory groups and the AGP. It will continue to gain insight by:

- Developing stronger engagement with the largest 15 UK industrial aerospace organisations
- Embedding a new market and economics advisory group tasked with challenging the sector's market and business outlook, and helping to alignment technology with future business opportunities
- Enhancing existing advisory networks via contact with expert opinion outside the industry (such as airlines and organisations focused on digital issues), paying particular attention to customer requirements and new economic models for the aviation industry.

## Participating in International Research

The Institute will seek to expand opportunities for UK-based firms to participate in international research, including establishing mutually beneficial arrangements with the EU post-departure. It will deepen existing relationships with Sweden, Canada and Germany.



This trusted partnership between Government and Industry combined with the focus on UK Aerospace competitive strength is a contributor to Raytheon's continued progress. Due to the Government's commitment to securing a leadership position as a global aerospace exporter, we are confident that our long term investments are well placed here in the UK. The combined AGP leadership and Aerospace Technical Institutes' strategy for R&T, coupled with our R&D investments have enabled Raytheon to bring unique technology and products to market several years earlier. Exploitation of Silicon Carbide devices, improved product power densities, and reduced reliance on external cooling systems are great examples. These are the ingredients for the industry's demand for smaller, lighter and more efficient power systems. ”

**Richard Daniel,**  
CEO, Raytheon UK



## Protest

Carbon fibre composites are increasingly used in aircraft; they're lighter, stronger, and improve overall platform efficiency. But they have the defect of being ineffective lightning conductors.

The £2.6 million Protection of Structures from Lightning Strike (PROTEST) programme is led by Airbus with Cardiff University, Hexcel Composites and the National Composites Centre. "This is a key project for the industry, allowing us to enhance our fundamental understanding of what happens during a lightning strike on a composite aircraft structure," said Ian Risk, Head of Airbus Group Innovations UK. "It brings together our supplier, our customer and core research partners into a team which can design, build and test the necessary components. The test programme has proved successful and has already resulted in a first patent."

## HEEDS

HEEDS (Harsh Environment Electronic Device Systems) is a collaborative programme between Rolls-Royce, Raytheon, Cobham, BAE Systems and the Manufacturing Technology Centre (MTC).

The project is developing electronic equipment that can operate in harsh environments; including at temperatures of up to 250°C compared to the current 95°C. This will enable Rolls-Royce to move electronic equipment from the engine fan case to the core as part of the Advance and UltraFan™ engine programmes - creating savings in cost, weight and build time by reducing the need for complex pipework.

The Rolls-Royce element of the HEEDS project will be based at its new £60m facility in Solihull. Such technology will have benefits in other industries such as oil and gas and submarines, where similar requirements exist.





## 4: Skills: Investing in Talent

### What Have We Achieved?

- Advised on best use of existing skills development schemes for all parts of the workforce
- Jointly sponsored 500 Aerospace Engineering MSc bursaries
- Took a leading role in helping companies take advantage of the Government's 'Trailblazer' initiative for designing high quality apprenticeships
- Created an Aerospace Employer Ownership Pilot to tackle skills gaps, for example via MSc level training courses
- Supported the 'Women in Aviation Mentoring Scheme', the International Aviation Womens' Association, RAeS Women in Aerospace Committee and company-run diversity schemes.

### What Will We Do Next?

- Identify and articulate the sector's skills needs
- Help employers prepare for the Apprenticeship Levy
- Create an Aerospace Industrial Cadets Programme
- Launch the Jon Dennison Bursary Fund to give disadvantaged young people a headstart by providing an opportunity for them to spend a week in a university progressing their interest in engineering
- Improve links between employers and University Technical Colleges
- Emphasise SMEs' skill needs and support the UK Aerospace Supply Chain Competitiveness Charter
- Sharpen careers messaging for pupils and teachers, and promote best practice in schools
- Continue to support schemes increasing the supply of talent to the sector.



The AGP has enabled Unite members to enjoy a more secure future through its support in facilitating joint industry and government investments in R&T projects. The AGP has also helped to enable Unite members to develop more high valued skills and expertise that will allow them to continue to enjoy a bright future in UK Aerospace. ”

**Ian Waddell,**  
National Officer for Aerospace Unite



## Aerospace Engineering MScs

The Aerospace MSc Bursary Scheme, announced by the Prime Minister at the 2012 Farnborough International Air Show, awarded its 500th bursary last September. Backed by £6 million of industry and government funding the scheme helps address the urgent demand for new aerospace engineers.

Around three quarters of bursary recipients are in full-time employment or studies. 90% of those in employment work in aerospace. "UK aerospace is recognised as being a front-runner in the development of lightweight materials. That makes it the best place to learn and make an impact." Lowri Nicholls, Leeds University, recipient of the 500th Aerospace MSc Bursary."

**The availability and continuous development of skilled workers is the life blood of any industry wanting to hold and grow its market share. Aerospace is pursuing new and highly practical ways to meet the challenge. An example: only 15% of aerospace companies provided apprenticeships and traineeships in 2009: 62% did so in 2015. Degree apprenticeships are an increasingly important part of the industry's offering to new talent.**



## Women in Aerospace

Only 9% of Britain's professional engineers are women. The industry recognises that women are under-represented in critical job functions within every sector. 15% of bursaries awarded by the Aerospace MSc Bursary Scheme have gone to women, significantly higher than other programmes.

## The Gaps

A significant proportion of the industry's employees are over 45 and skills shortages are already apparent in fields such as damage and fatigue tolerance, composites and systems engineering.

Successors must be found but outdated and inaccurate perceptions of manufacturing industry often discourage young people (and their parents and teachers) from exploring opportunities. The situation is exacerbated by a lack of specialist careers advice and support available in schools.

Rapid technological change means our companies will need far more than generic competencies. Robotics, the Internet of Things, cyber-physical systems, 3D printing all require a workforce with the digital skills to engineer in both physical and virtual worlds. And, as manufacturing becomes more digitised, support functions such as cyber-security and data analytics will also grow in importance.

## Changing the Landscape

The AGP Skills Working Group (SWG) helps aerospace obtain, and invest in, the skilled people needed to meet short term demands and benefit from the opportunities created by technological change.





## Current Projects

### Identifying and Articulating Future Skills Needs

The Working Group is building a comprehensive picture of the longer-term digital, engineering and management skills demands requiring investment if the industry is capitalise on emerging technological trends.

### Preparing Employers for the Apprenticeship Levy.

A large number of firms are expected to pay the Levy: increasing their understanding of how it works, and the opportunity it presents, is paramount.

### Promote Aerospace Industrial Cadets Programme.

The AGP aims to further promote the Aerospace Industrial Cadets Programme in 2016-2017 which will introduce more school age talent to the sector and improve school's connection with UK aerospace companies.



### Jon Dennison

Jon made a huge contribution to helping to secure the future of the aerospace sector through his work on the AGP and was passionate about giving young people the opportunity to realise their full potential.

**Launching the Jon Dennison Bursary Fund.** The Fund will help form the next generation of aerospace engineers by offering disadvantaged young people free places on Headstart courses run by STEM education charity EDT. The late Jon Dennison was a driving force behind the AGP and passionate about encouraging young people into the industry.

**Improving Connections between Aerospace Employers and University Technical Colleges.** UTCs are schools for 14-19 year olds. AGP will liaise closely with those dedicating at least 40% of their teaching time to STEM subjects, including engineering and advanced manufacturing. AGP is also collaborating with the Baker Dearing Educational Trust to improve corporate engagement with local UTCs'.

**Engaging with Supply Chain SME's is now a particularly important part of SWG activities.** The SME employers and regional aerospace alliances have recommended channelling help via the planned SC21+programme and the AGP is working accordingly with them and ADS.

## Aerospace Employers Ownership Pilot

The AGP successfully bid for a sector-wide Industrial Partnership under the Employer Ownership Pilot (EOP). Five projects, which secured public funding, are being delivered:

- Master level specialist skills training courses
- Promoting the sector to young people and education providers
- Developing 11 'Trailblazer standards', ranging from Aerospace manufacturing Fitter (Level 3) to Aerospace software development Engineer (Level 6)
- Developing and promoting project management skills through national workshops pioneered by the North West Aerospace Alliance
- Publishing an Aerospace knowledge management toolkit.



## The Productivity Academy

A working group chaired by BAE Systems' Nigel Whitehead has studied the experiences of companies boosting productivity via employee engagement

The group will now launch a 'Productivity Academy' in partnership with Lancashire Enterprise Partnership and Lancaster University. The Academy will provide a resource hub, with online self-assessment tools, directing companies to the most appropriate productivity improvement programme and coaching/consulting services.



## Support for Cross-Sectoral Initiatives

The business-led Talent Retention Solution (TRS) helps industry deploy and retain key advanced manufacturing skills. TRS has been expanded to include engineering students, apprentices and those not selected by the largest companies (given the large number of applications they receive for the small number of positions) in joining top tier suppliers. TRS is particularly valuable to SMEs, which can currently use the system free of charge.

The Engineering and Physical Sciences Research Council's Centres for Doctoral Training (CDTs). CDTs equip engineers and scientists with the skills, knowledge and confidence to tackle evolving issues, create new working cultures, build relationships between universities and forge links with industry.

Financial assistance for recruitment. SMEs can get £1,000 grants from Semta for each unemployed graduate recruited.

Support the Government's drive to increase the number of pupils studying STEM subjects, particularly in A-level maths and physics. Activities include schools' outreach activities and a range of careers related events run by business.

## Motivating Students

Delivering accurate, informed careers advice and additional placement opportunities will yield an increase in the number of young people making aerospace their career choice. The AGP will therefore:

- Sharpen the industry's careers' messaging and hold more high profile events such as 'Futures Day' (held at the Farnborough Air Show) and the 'Big Bang Fair' in areas with key aerospace clusters
- Promote best practice in schools' outreach through programmes such as ADS' UK Rocketry Challenge; the 'Careers in Aerospace' website (which attracted 58,000 unique visitors last year); the Royal Aeronautical Society's 'Build a Plane' competition and 'Cool Aeronautics' primary school outreach programme and the Schools Aerospace Challenge.

## GE Aviation and National Composite Centre

National Composites Centre (NCC) experts collaborated with GE to develop a training programme which will benefit the Company, its customers, suppliers and the composites manufacturing sector.

GE needed to train recruits, and re-skill existing operators, for its new Automated Fibre Placement (AFP) composite manufacturing facility at Hamble. It asked the NCC for a programme which would enable learners to progress from basic to advanced level.

NCC coordinated and facilitated a 4-day course focused on A350 part manufacture. This prepared staff in manual prepreg skills such as lay-up, the principles of 'first time yield', waste reduction, continuous improvement techniques and safe working practices. Training also stressed QCD issues encountered during part manufacture.

The wider objective of this Government funded EOP project was to create a course that would benefit the wider composites manufacturing sector. The generic elements of the training will now be made available to other organisations.



## 5: Manufacturing: Expanding Capacity and Capability

### What Have We Achieved?

- Developed a Manufacturing Accelerator Programme to speed the suppliers adoption of best practice and new technologies
- Improved access to HVM Catapult via 'Reach', a programme giving SMEs access to the full range of its manufacturing innovation capability. Reach is designed to encourage UK SMEs to improve their manufacturing processes
- Inaugurated an Aerospace Research Centre within the Manufacturing Technology Centre (MTC) which has significantly expanded the UK's manufacturing innovation capacity
- Improved contact with the banking sector to increase opportunities for suppliers to access funding
- Helped the Aerospace Technology Institute develop its strategy around manufacturing processes and capabilities.

### What Will We Do Next?

- Map manufacturing requirements arising from the ATI's technology themes and work with the Institute to promote their adoption across the supply chain
- Grow HVM Catapult and regional capacity to facilitate uptake of best practice, investment in manufacturing productivity and adoption of Smart Digital Manufacturing
- Work with the Skills Working Group to identify and close manufacturing skills gaps and support the UK Aerospace Supply Chain Competitiveness Charter
- Explore the potential of an Aerospace Manufacturers Collaboration Programme to connect companies at all levels of the supply chain looking to adopt best practices with those who have already successfully implemented them.



### Airbus Single Aisle Step Change, Broughton, Flintshire

Increasing demand for its A320 aircraft, and the resulting decision to ramp up production to 50 wing sets per month, led Airbus to launch the Single Aisle Step Change project.

A £48 million investment by Airbus and the ATI has replaced a 1980s wing assembly system with state-of-the-art equipment. A simplified system for Single Aisle wing production with a clear product flow has boosted the Broughton factory's capacity and efficiency. The project has also involved further investment in the skilled work force with staff being trained in robotics and automation.

**Innovation in products and processes is the path to securing the UK's current share of the global market, and to creating capacity to exploit the enormous opportunities for growth.**

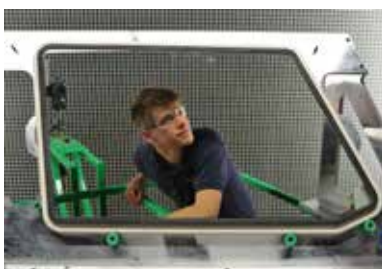
The global aerospace sector is set for substantial expansion over the next twenty years and only radical increases in production volumes and fleet footed suppliers will satisfy demand. High UK productivity growth is already running up against a shortfall in manufacturing capacity. Very significant investment is needed to renew and improve the supply chain asset base.

## Embracing Innovation

Competitive advantage depends in large part on UK suppliers being able to differentiate themselves through design, technology and production, by improvements in the flow of materials, and the skills and knowledge of their staff.

Embracing innovation throughout the supply chain, whether in the form of best practice or leading edge capability, will remain the primary driver of differentiation. Manufacturers at all levels of the supply chain need ready access to world-class manufacturing knowledge, and be able to rapidly and smoothly deploy this into already high-performing operations.

We have already created an Aerospace Research Centre within the MTC which has significantly expanded the UK's capacity to develop innovative projects. It has a close relationship with the Aerospace Technology Institute and helped produce the latter's Manufacturing Strategy. The Working Group will soon begin mapping the manufacturing requirements arising from the ATI's technology themes and work with the Institute to promote their adoption across the supply chain.



Through its support for the industry, the AGP is helping to maintain and develop the UK as a centre of excellence for aeronautical engineering and manufacturing, ensuring that British companies succeed in the global market.

**Nigel Stein,**  
CEO, GKN



## Promoting Value Accelerators

The Working Group has developed a Manufacturing Accelerator Programme to speed the supply chain's adoption of best practice and new technologies through:

- Publication of a 'Change Handbook', written by the Manufacturing Technology Centre (MTC). This examines a range of scenarios companies may face and provides tools, techniques and best practice (such as Value Accelerators) to help obtain best outcomes
- Resourcing SME-aware experts across the HVM Catapult's centres to advise on how to implement Value Accelerators on the shop floor
- Expanding Value Accelerator project portfolios by drawing on the combined Catapults' knowledge and capabilities.

## Accessing High Value Manufacturing Catapult

The MWG has improved access to HVM Catapult via 'Reach', a programme giving SMEs access to the full range of its manufacturing innovation capability. Reach is designed to encourage UK SMEs to improve their manufacturing processes.

The Working Group will also:

- Grow HVM Catapult and regional capacity to facilitate uptake of best practice, investment in manufacturing productivity and adoption of Smart Digital Manufacturing
- Work with the Regional Aerospace Alliances to enhance their members' access to Catapult capabilities.
- Continue to offer its support to the development of a National College for Advanced Manufacturing (NCAM) founded on UK centres of innovation including, but not limited to, HVM Catapult centres, that will deliver advanced level skills.

## Innovation Through Collaboration

Increasing collaboration is crucial for dissemination of knowledge and best practice. There's great potential to encourage partnership amongst companies, and between aerospace and manufacturers from other relevant sectors.

By connecting companies looking to take up best practices with those who have successfully implemented them it's possible to increase the speed of their adoption throughout the supply chain. We will scope an Aerospace Manufacturers' Collaboration Programme aimed at connect in companies wanting to take up best practices with those who've already adopted them.



### Technicut, Sheffield

Tooling company Technicut found its revolutionary titanium cutting tool too powerful for existing machine tool systems. It commissioned Nikken to research, develop and test the TiTan X-Treme Multi-Lock.

The patented X-Treme was adopted by Rolls-Royce and the AMRC (part of the HVM Catapult), achieving a 50% reduction in time required to machine fan discs. It's now deployed at major titanium machine workshops worldwide to cut aerospace-grade titanium 6-4 alloy at super-fast rates.

Rolls-Royce has now established a £100 million advanced aerospace disc manufacturing facility in Washington, County Durham and Japanese owned Nikken have now invested in a European R&D centre in Rotherham.

This is an outstanding example of "sticky technology" – an SME winning global recognition, major inward R&D investment and an important new British manufacturing facility.



## Going Digital

Supply chain companies must be alert to emerging technologies forcing disruption and the emergence of new business models. The step change ahead requires manufacturers, both large and small, to look well beyond current methods and established practices. The Manufacturing Working Group is working with the HVM Catapult to help industry understand and navigate emerging technologies – the wave of change such as digital manufacturing often called 'Industry 4.0'.

Additive layer and near net shape components, together with next generation composite materials, will affect product design, and therefore manufacturing processes and investment. The need for physical prototyping will fade as design, development and proving is increasingly carried out in the virtual world.

But the increasing use of digital data is likely to have the biggest and most immediate impact. The cost of acquiring, storing, and analysing it is falling rapidly. Economical utilisation of big digital data will shape design and production, saving time and resources and reducing errors. Customers will have the assurance that components will be subject to life-time monitoring.

Manufacturers will increasingly move beyond component supply, extending their reach into high value service and support. Through-Life Engineering Services is an emerging field of study evaluating the implications of customers paying for service rather than buying assets. The morphing of manufacturing and service provision (as with Rolls-Royce's 'Power by the Hour') will create new opportunities and demand different skills and capabilities.

### Arrowsmith Engineering, Coventry, Warwickshire

Thread-rolling is a difficult process producing smooth, precise threads on ductile metal. Arrowsmith was experiencing frequent tool failures and faced wider challenges to reposition itself in the market, align its culture with that of its end customer, and develop a centre of innovative excellence.

With support from NATEP, MTC experts began working alongside Arrowsmith's own engineers. The team reviewed and re-designed the manufacturing process from start to finish, developing a mutually supporting set of precision-controlled production techniques. A series of small batch trials led to these being successfully carried over to volume manufacturing.

### Safran, MAXIMAL project with MTC and AMRC

In 2014, Safran Landing Systems was awarded an Innovate UK Grant for the MAXIMAL Project, a 2 years project in partnership with the Manufacturing Technology Centre (MTC) and the Advanced Manufacturing Research Centre (AMRC), aiming at developing key manufacturing technologies to Technology Readiness Level 6 and become a worldwide centre of excellence for titanium machining.

One of the key technologies developed has been around new cutting tools and new machining strategies for the finishing operation of large high strength titanium components for landing gears.

The results of this successful activity were a significant reduction of manufacturing time, the technology being implemented on the shop floor mid-2016.



## Appendix

### ADS Aerospace Members Committee

Richard Martin	ADEPT-NX
Vardhan Rajkumar	Aeromet International Ltd
Alan Jones	AirBorn International Ltd
Chris Melrose	Altec Engineering Ltd
Denton Clutterbuck	Altran UK Holding Ltd
Chris Steel	Avon Valley Precision Engineering Ltd
John Taylor	Beagle Technology Group
Simon Beech	Bulwell Precision Engineers Limited
Owen McFarlane	CAV Ice Protection
Andy Bragg	Darchem Engineering Limited
Robert Herman-Smith	Darchem Engineering Limited
Jeff Smith	Duke Street
David Skinner	Farsound Aviation Limited
Andrew Churchill	JJ Churchill Ltd
Brian Austin	Kiwa Ltd
Glynn Bellamy	KPMG
Phil McKinley	Magellan Aerospace (UK) Limited
Graham Wardlow	Magnesium Elektron
Phil Hart	MEP Limited
Keith Gardner	Micro Spring & Presswork
Michael Pedley	MSM aerospace fabricators
Nick Green	Nicholsons Sealing Technologies Limited
Mike Harvey	On-Systems Limited
Lyndon Follows	Poeton Industries Limited
David Nutton	RLC Engineering Group
Steven Hayter	Rockford Components Limited
Mark Johnson	Sigma Precision Components Limited
Thibaut de Bouillane	Specialist Technologies Limited
David Danger	UTC Aerospace Systems

The AMC comprises 28 ADS Members and is constituted to fairly represent all sizes of company, from SME to large. AMC Members are CEOs, Managing Directors, or other senior executives of companies serving the civil, defence aerospace and space sectors.

### Acknowledgements

**Editorial Committee:** Katherine Bennett, Robert Bishop, Roger Bourne, Jeegar Kakkad and John Warehand

**Writer:** Simon Pearce

**External Reviewer:** Kieran Daly

**Design:** Airbus Graphic Design Services, Filton

**AGP would like to thank the organisations that supplied images**







Pressure Test

Safety Instruction  
Bump Cap  
PPE Required in this area  
Glasses  
No Smoking

Torque Box Lay-off





For further information about the  
Aerospace Growth Partnership,  
please contact:  
ADS +44 (0)20 7091 4500

or go to:

[www.theagp.aero](http://www.theagp.aero)

 @TheAGPUK

**Linked** 

