HM Government

Industrial Strategy

Aerospace Sector Deal

INDUSTRIAL STRATEGY

Foreword

The UK's aerospace sector is a world leader in developing new technologies, generating well-paid jobs and sustainable growth across the country.

The sector is hugely important to the UK economy. It provides over 120,000 highly skilled jobs, most of these outside London and the south east. The sector has an annual turnover of £35bn, the majority of which comes from exports to the rest of the world. This is a world-leading industry, driving growth and prosperity across the UK, supporting jobs that pay 40 per cent above the national average.

Building on the long-established and successful partnership between the aerospace sector and government, we are looking to the future; with 38,000 large passenger aircraft worth around £4.65tn needed globally over the next 20 years, this is a market with huge growth potential for UK aerospace suppliers of all sizes.

Developing and taking commercial advantage of the future technologies that will shape the aerospace sector in the years ahead will be key to ensuring this established UK success story continues.

Through the Future Flight programme, which will receive up to £125m from the Industrial Strategy Challenge Fund, which industry will match, we will enable innovation in technologies that allow for clean growth and which meet future mobility needs.

Environmentally friendly aircraft will increasingly incorporate electric technologies, and we anticipate more aircraft operating autonomously in the future. New markets for drones and Urban Air Mobility vehicles will be developed. We want the UK to be at the cutting edge of these exciting developments much as we were when Sir Frank Whittle developed the world's first jet engine.

We are working in partnership with industry to boost its technological advantage, become more competitive and ensure a future pipeline of talented people are ready and able to work in this sector.

We support industry's actions to make the sector more diverse and for looking to work more collaboratively with academia through the newly created UK Aerospace Research Consortium.

A new supply chain competitiveness programme will support small and medium sized enterprises to increase productivity and the National Aerospace Technology Exploitation Programme will help small and medium sized employers across the UK become more innovative. We want more companies like Aeromet, based in Kent and Worcester, which, with the support of the government, has secured significant orders from Airbus and Boeing.

This Sector Deal will benefit the entire UK aerospace community, companies both large and small, in all parts of the UK. It is a commitment by the sector to work collectively, with support from the government, to deliver the industrial strategy, and to drive clean growth and the future of mobility in the economy.

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

Colin Smith
Chair, Aerospace Growth Partnership

Executive Summary

At the Farnborough International Airshow in July the Prime Minister called for industry to work with government on an ambitious civil aerospace Sector Deal.

This deal, she said, should build on the strong relationship government has with industry through the Aerospace Growth Partnership and support the Industrial Strategy's Grand Challenges, regional prosperity and the delivery of the government's skills priorities. She also called on the sector to embed a Women in Aviation and Aerospace Charter[1] to bring greater gender equality to the industry. This Sector Deal delivers on the Prime Minister's announcement.

Civil aerospace is a high-growth sector and one in which the United Kingdom has a competitive advantage; the UK is a world leader in the design, manufacture and support of engines, wings and advanced systems. It is a sector that has a strong record of working in close partnership with government to boost that competitive advantage – indeed the success of this relationship has informed the development of Sector Deals with other parts of the economy.

This Deal looks to build on our successes by positioning the UK to take advantage of the global move towards hybrid-electric and electric propulsion and to exploit related new markets – drones and Urban Air Mobility vehicles.

The rest of the world is accelerating towards a more electric future; large government-backed investments are being made today in the US, Germany, France, China and Japan.

This Sector Deal signals the government's intention to position the UK at the forefront of valuable emerging markets. It will do this by:

- Boosting innovation through a joint industry and government investment in the Future Flight challenge, with up to £125m (subject to business case) of funding from the Industrial Strategy Challenge Fund, which industry will match. This programme will invest in developing demonstrators of new aircraft (such as drones and other electric aircraft), new models of airspace management, new approaches to ground support infrastructure and new markets for aircraft in local areas.
- Expanding our successful National Aerospace Technology Exploitation Programme with joint funding from government and industry to boost research and development (R&D) projects led by small and medium sized enterprises (SMEs).
- Supporting SMEs in the UK aerospace supply chain to boost their competitiveness through a new productivity improvement programme.
- Committing the industry to embed a Women in Aviation and Aerospace Charter to increase diversity and inclusion in the sector.
- Enhancing the joint working between the aerospace industry and education providers to ensure a strong future pipeline of talented people are available to ensure the UK aerospace sector remains globally competitive.

These activities, jointly funded with industry, will support the government's ambition to increase R&D spend to 2.4 per cent of GDP by 2027[2] and will deliver on three Industrial Strategy Grand Challenges, the Future of Mobility, the move to Clean Growth and the transition to an economy supported by Artificial Intelligence and Data.

Future of mobility. We are on the cusp of a profound change in how people, goods and services move around our towns, cities and countryside, driven by extraordinary engineering and technology innovations. The Future of Mobility Grand Challenge will stimulate innovation, create new markets and secure a 21st Century transport system. Just as we are investing in electric and autonomous road vehicles, this Sector Deal announces a package of measures to put the UK at the forefront of the electrified air transport revolution by 2025.

Clean growth. The global shift to clean growth will transform many sectors of the economy, including power, construction, energy-intensive industries, agriculture and transport, including air transportation. We have committed to supporting UK businesses take full advantage of this opportunity, and this Sector Deal does just that. By supporting the UK supply chain to develop new hybrid-electric and electric technologies the supply chain will be well positioned to access new market opportunities.

AI and Data Economy. Through the Future Flight programme, industry will revolutionise complex airspace management to enable drones and Urban Air Mobility vehicles to utilise airspace in conjunction with conventional large commercial aircraft. This may use advanced sensing capability to securely gather data both onboard the air vehicle and associated ground infrastructure.

Advanced artificial intelligence approaches including machine learning and data analytics will enable the aviation system to deliver breakthroughs in future mobility and support priorities on clean growth.

The Industrial Strategy White Paper set out five foundations of productivity that underpin a successful economy. These foundations align to the government's vision of a transformed economy and are ones that the aerospace sector is well placed to contribute to.

Ideas

The ambitions set out in the Industrial Strategy White Paper[3] are underpinned by a commitment to world-class innovation. The strategy announced a further cross-sectoral increase in investment of £2.3bn in 2021/22, raising total public investment in R&D from £9.5bn to £12.5bn, as well as a commitment to work with industry to boost spending on R&D to 2.4 per cent of GDP by 2027. This will increase to 3 per cent over the longer term.

This Sector Deal demonstrates how the aerospace sector can play an important part in meeting this commitment by investing in the development of technologies for the next generation of aircraft, our existing joint commitments of £3.9bn over a thirteen-year period to 2026[4], a newly established UK Aerospace Research Consortium to increase collaboration between universities, academia and industry to deliver better coordinated and more effective aerospace research and development and the expansion of the National Aerospace Technology Exploitation Programme.

People

In the Industrial Strategy, the government set out its vision to create good jobs and greater earning power for all. To do this, we need to make sure that we are equipping citizens for jobs shaped by the next generation of technology.

The Aerospace Sector Deal will support the delivery of this vision through increasing industry's engagement with the Department for Education and the Institute for Apprenticeships to support apprenticeships, T levels and other educational qualifications, the development of an industry-led skills mapping exercise to scope the sector's skills needs in the coming years and increasing diversity in the sector through a Women in Aviation and Aerospace Charter[5].

Infrastructure

As set out in the Industrial Strategy White Paper, having modern and accessible infrastructure throughout the country is essential to our future growth and prosperity.

The government announced an increase in the National Productivity Investment Fund to £37bn[6] to increase investment further in areas that are important for economic growth.

Through the Future Flight challenge the Deal supports the development of new ground infrastructure and better connectivity links and follow on infrastructure investments. As technology development moves to manufacture and commercialisation it will continue to be supported through our joint commitment to the Aerospace Technology Institute.

Business Environment

The Industrial Strategy White Paper sets out the government's ambition to make the UK the best place to start and grow a business[7].

Through this Sector Deal, the government is proposing to commit £10m, matched by industry, to implement a new supply chain productivity improvement programme Supply Chain 21 Competitiveness and Growth programme, which is subject to business case consideration. This programme will raise productivity levels by providing bespoke training and putting streamlined business processes in place for over 70 small and medium sized UK aerospace companies.

To build on existing strengths as an exporting sector, the government will look to the aerospace industry to deliver the government's new Export Strategy and champion the benefits of exporting to other sectors that have potential to realise the benefits but are not seizing them, acting as and working with Export Champions.

Places

The Industrial Strategy sets out our goal of having prosperous communities across the UK. Every region in the UK has a role to play in boosting the national economy.

We will continue to work in partnership with local leaders to drive productivity.

The UK's aerospace community is geographically spread across the whole of the UK with clusters outside London in the south west, midlands and north west of England, Scotland, Wales and Northern Ireland – 92 per cent of the UK's aerospace sector is based outside of London and the south east.

National and local businesses are engaging with Local Enterprise Partnerships (LEPs) to ensure they contribute to the development of Local Industrial Strategies. This activity builds on previous aerospace sector engagement with LEPs put in place by the Aerospace Growth Partnership. The government and industry are keen to ensure that local areas and regions secure the benefits of the aerospace sector's growth wherever possible through collaboration and investment. This Sector Deal seeks to embed that across the UK.

We see this partnership between the aerospace sector and the UK government as one that will continue to evolve and deepen. This Deal does not mark the end of our joint working and both business and government are committed to continue our discussions to ensure the UK aerospace sector continues to be a world leader.

Industry action to support the aerospace sector

Ideas

Research and technology grant support

- Match funding of government's £1.95bn R&D programme to 2026. Industry will match fund government grant support to take forward R&D. Projects that show a clear path to further private research or commercial exploitation will be prioritised. This will deliver increased economic benefits and more jobs across the UK.

Electrification and autonomy

- Industry will co-fund government's support of up to £125m for the Future Flight programme.

National Aerospace Technology Exploitation Programme

- Industry commit to match funding of £10m and delivery of high valued jobs in the long term.
- Prime, Tier 1s and other larger companies will provide support to assist SMEs in the co-funded development of technologies towards commercialisation.
- Industry will encourage greater participation in the National Aerospace Technology Exploitation Programme from companies in the devolved administrations.

Government action to support the aerospace sector

Ideas

Research and technology grant support

- Match funding R&D programme support of £1.95bn between 2013-2026.
- The government will look to work with industry to consider how best to take forward R&D and improving the effectiveness of supply chains as the aerospace sector moves towards more disruptive technologies.

Electrification and autonomy

- Up to £125m Industrial Strategy Challenge Fund funding for the Future Flight programme which will implement activities to deliver a more electric, autonomous and environmentally friendly aviation and aerospace sector. It will offer new options for how people and goods could move around in the future and showcase the UK as driving new mobility solutions.

SME engagement in R&D activities

- SMEs already benefit from R&D funding support through the Aerospace Technology Institute programme. To complement this and encourage more SMEs to undertakeR&D, further Aerospace Technology Institute R&D support is offered for 'open calls'.
- £13.7m funding from the wider Aerospace R&T programme for further rounds of the National Aerospace Technology Exploitation Programme to bring SMEs and customer companies together to help SMEs develop technologies and bring them to market.

UK Aerospace Research Consortium

- UK Aerospace Research Consortium will work in partnership with industry, the Aerospace Technology Institute, research councils and the government to seek to create a UK-wide infrastructure of accessible, integrated and world-class university strategic facilities that align with industry's priorities.

People

Women in Aviation and Aerospace Charter

Key activities include:

- Committing to the progression of women in to senior roles.
- Having one member of the Senior Executive responsible for gender diversity and inclusion.
- Setting internal targets (where appropriate) for gender diversity in senior management.
- Publishing progress against targets annually.
- Industry commits to publicly reporting on the implementation of the Charter.

UK Aerospace Research Consortium

- The government welcomes the establishment of this consortium which will bring a more coherent approach to university research in the UK and better align R&D activities with industry.

Cyber and digital security

- The government welcomes the ongoing activity the UK aerospace sector has undertaken around cyber security, data and digital connectivity, and encourages the sector to progress this work further.

Delivery of apprenticeship standards

- Industry commits to working with the Institute for Apprenticeships and devolved administrations to deliver apprenticeship level 3, 4 and 5 standards and develop clear progression routes.
- Industry commits to identifying its current apprenticeship cohort and maximising the number of apprenticeship starts.
- Industry will engage in the review of level 4/5 training and provide evidence as appropriate.
- Building on the current suite of activities industry already carries out commits to helping design a programme of school-based employer encounters and set out a programme of short-term work placements.
- Industry will commit to the development of T level standards appropriate to the activities of the sector.
- Industry will provide industry placements (number to be agreed).

Infrastructure

- Industry commits to increase investment to commercialise R&D and related activities and/or productivity improvement activities.

People

Women in Aviation and Aerospace Charter

- The aviation and aerospace industry, supported by the Department for Business, Energy and Industrial Strategy and the Department for Transport, has developed a charter that commits them to work together to increase the levels of diversity and gender balance in their companies.

Development of apprenticeship standards

- The government and the devolved administrations are keen that people have the right skills to secure high-paying jobs. To that end the Institute for Apprenticeships is working with Trailblazer Groups to put in place apprenticeship standards. These will help deliver the skilled individuals needed by the UK for it to prosper.
- The government will work with employers to monitor the impact of the apprenticeship levy and continue to analyse all apprenticeship starts.
- The government is putting in place school-based employer encounters and short-term work placements so that school children are introduced to industry at an early age to better inform them about career choices.

Business Environment

Supply chain spend

- Industry aspires to raise annual growth in the UK supply chain spend from 1 per cent towards 4 per cent[8] (closer to the most recent global average spend rate).

New supply chain competitiveness programme

- Industry commit to match government support up to £10m.

Promotion of structured support activity

- Industry commits to promoting structured activity building on the aerospace Supply Chain Charter and helping SMEs to strategically exploit the support available through Aerospace Growth Partnership activities (competency analysis and productivity improvement programmes for example).

Implementation of the government's Export Strategy

- Industry commits to working with Department for International Trade and Department for Business, Energy and Industrial Strategy to support the government's Export Strategy including identifying sectoral Export Champions to help promote the benefits of exporting to others.

Infrastructure

Future Flight Industrial Strategy Challenge Fund programme

- As a result of the funding provided by the government to help industry deliver the Future Flight Challenge we expect there to be investments in infrastructure and equipment.

Business Environment

SMEs and customer engagement in productivity improvement programmes

- The government is supporting the implementation of a new supply chain competitiveness programme to assist small and medium sized enterprises who want to improve productivity and competitiveness.

Implementation of the government's Export Strategy

- The government has published its Export Strategy, which sets out measures to encourage, inform, connect and finance UK firms to export. It is looking to business to support this by contributing to the development and promotion of export related activities.
- Through UK Export Finance, ensure that no viable UK export fails for lack of finance or insurance from the private sector, helping businesses address lack of access to finance and manage the risks of exporting.

Places

Local Industrial Strategies

- Industry will work with local and national government to deliver Local Industrial Strategies that assist the sector in becoming more productive and competitive.

Devolved administrations

- Industry will continue to engage with the devolved administrations encouraging them to support and participate in Aerospace Growth Partnership supported activities.

Places

Local Industrial Strategies

- Local authorities and LEPs have been commissioned to develop and agree investment strategies for their areas that set out how they propose to attract and develop investments in their areas.

Devolved administrations

- The government seeks to build on its strong relationship with the devolved administrations to ensure a coherent approach to business support activities for aerospace across the UK, including delivery of the UK Aerospace Strategy.

Ideas

The government and industry, through this Sector Deal, will continue to work in partnership to secure maximum benefits for the UK as the global aerospace sector moves towards a more autonomous, electrified future.

The UK aerospace industry is at the forefront of tackling the Grand Challenges set out in the government's modern Industrial Strategy. Delivering a method of transport that addresses future mobility demands through cleaner growth and employing more electric and autonomous technologies are all central to the sector's aspirations. We want to make sure the UK sector can lead the world in these new developments, building on first rate research, much as we led the way when Sir Frank Whittle developed the first turbo jet engine.

The government is committed to increasing the UK's investment in R&D to 2.4 per cent of GDP by 2027. This will require greater efforts by both the government and industry. The Future Flight Challenge will help achieve this supported by the government and industry's £3.9bn match-funded commitment for the aerospace research and technology programme, supported by the Aerospace Technology Institute. This investment in new product and manufacturing technologies is helping UK industry develop world leading capabilities and increasing productivity, delivering economic benefits across the whole of the UK.

Moving towards hybrid-electric

Hybrid and fully electric aircraft have the potential to transform parts of the UK's transport market. New air mobility solutions have the potential to support new or different transport options between regions. These aircraft could open urban air services that provide greater options on how people and goods can move around, opening up mobility, helping to tackle problems such as congestion and bringing higher national productivity. The Future Mobility Grand Challenge aims to support the emergence of these new technologies to come to market, decreasing congestion and increasing productivity for the UK.

Increased international interest in more electric aviation – including hybrid electric propulsion — is being driven by a combination of technical innovation, fuel costs and environmental targets on greenhouse gas emissions, air pollutants and noise.

Meeting environmental targets is essential. Air travel around the globe is expected to continue to rise in the foreseeable future by between four and five per cent annually – meaning that the sector doubles in size around

every 15 years[9]. As a result, there is increasing demand to build new airports, and upgrade existing ones, to handle this increased capacity. Levels of noise and emissions are important considerations when decisions are taken where to locate new airports or where additional runway capacity can be created. As a result, governments around the world continue to partner with the aerospace industry to develop technology to reduce environmental impacts.

The pace of R&D towards hybrid-electric and electric aviation is increasing as is global competition to get a lead in these areas, often backed with national overseas government support.

The adoption of more electric aerospace technologies could see some transformative changes in aviation, including in the industrial landscape, with new suppliers and organisations entering the sector. The move to more electric propulsion is becoming more feasible with the development of new battery technologies driven by the automotive sector.

The shift could see significant redesign of aircraft and propulsion systems architectures, and aviation infrastructure.

The UK has an opportunity to stake a leading position in the development of drones and wider Urban Air Mobility vehicles through hybrid-electric propulsion, power electronics, aero-structures and systems integration. This will also lead to spill over benefits in other sectors, such as defence, nuclear, oil and gas and automotive.

According to the Aerospace Technology Institute, it is expected that over the long term the conventional aircraft market will continue to retain the largest market share. However, this share is expected to gradually decline in volume and value with the electric aircraft, drone and Urban Air Vehicle market growing.

International Civil Aviation Organisation (ICAO)

The International Civil Aviation Organisation (ICAO) is seeking to achieve global fuel efficiency improvement rates of 2 per cent per annum from 2021 to 2050[10]. ICAO is also striving to achieve a collective medium term global aspirational goal of keeping the global net carbon emissions from international aviation from 2020 at the same level.

The Advisory Council for Aviation Research and Innovation in Europe (ACARE) have set targets to reduce CO2 by 75 per cent, NOx by 90 per cent and noise by 65 per cent by 2050 relative to 2000[11].

Technology availability could also see the introduction of all electric, less than 20 seat, sub-regional aircraft, which could open valuable new regional air travel routes.

The development in hybrid-electric aerospace research and technology provides a significant opportunity for the UK to take a market lead. The government and industry are already investing in these new technologies through the Aerospace Technology Institute programme.

Case Study: Digital Aviation Research and Technology Centre

The Digital Aviation Research and Technology Centre (DARTeC), scheduled for opening in 2020, is being built at Cranfield University and will spearhead the UK's research into digital aviation technology.

DARTeC is an exciting opportunity to bring together sector leads from across the aviation industry (airspace management, airport, airline and aircraft) in a collaborative research environment to create, experiment and challenge the digital status quo through accelerating digital systems integration. DARTeC, co-funded by Research England, an industry consortium of leading aviation organisations (including Thales, Raytheon and SAAB) and Cranfield University, is a £67m investment in state-of-the-art facilities that will leverage both the University's airport and its newly opened autonomous vehicle research facility[12].

DARTeC will initially focus on five primary research challenges:

- Connected systems (air-to-air/air-to-ground operations)
- Unmanned traffic management
- Seamless passenger experience (city integration, flow optimisation)
- Distributed airport and airspace management
- Conscious aircraft (self-monitoring, self-learning)

DARTeC will provide a fantastic environment to accelerate the delivery of the ambition laid out in the Future Flight Challenge.

Electrification and autonomy – Future Flight Challenge

The Future Flight Challenge will open new aviation markets through demonstration of aviation systems, incorporating low environmental impact, autonomous air vehicles and airspace management by 2025.

The challenge will transform connectivity, boost UK exports, productivity and enrich lives through increased mobility. Through the development of drones and Urban Air Vehicles, ultimately this work will lead to transformational electrically powered passenger aircraft and the supporting infrastructure and systems required – delivering the Future Mobility Grand Challenge.

This could include more electric vehicles as well as a more electric and autonomous airport networks that seek to optimise existing infrastructure and inter-modal links. Anticipated outcomes include simulations of future airspace models to demonstrate how a more autonomous aviation sector could operate – possibly including both air freight and passenger activities and new aircraft designs featuring autonomous and electrical technologies that would produce cleaner, quieter and more cost-effective aircraft.

The move to a more electric and autonomous eco-system will be important as the use of regional and urban air travel increases. Cleaner and potentially quieter aircraft will assist this move as they will be more acceptable to the surrounding areas.

Through the Future Flight Challenge, the UK will be well placed to create and lead new markets in the UK for electric aviation. Projects that show a clear path to further private

Case Study: Hybrid Propulsion – E-Fan X

The E-Fan X project, supported by the government, aims to position the UK as a market leader for hybrid propulsion, power electronics, aero-structures and systems integration.

The next generation of aircraft using hybrid-electric technology will pose a significant change to the propulsion systems and power electronics, wing, fuel and landing gear systems. Engagement in E-Fan X will ensure that the UK develops the skill sets needed to be positioned at the forefront of hybrid-electric aero-technologies. Potential product exploitation opportunities expected to flow from the demonstrator project include the application of hybrid-electric technology to vertical take-off and landing and both single aisle and regional fixed wing commercial aircraft.

research or commercial exploitation will be prioritised. This will deliver increased economic benefits and more jobs across the UK.

UK Aerospace Research Consortium

The UK academic community has strong links with the global aerospace industry and is involved in a range of collaborative projects and programmes. Relationships have focused on the development and exploitation of expertise through company and research specific activity. The emergence of the Aerospace Growth Partnership and the Aerospace Technology Institute has helped broaden these relationships, but more can be done to align industry and the academic community.

The establishment of a UK Aerospace Research Consortium, bringing together universities and research institutes to better co-ordinate and collaborate on the technology and capability challenges facing the UK aerospace industry, will increase the effectiveness of investment and create clearer pathways from foundational science to industrial exploitation. This will assist the UK aerospace sector as it moves towards the hybrid-electric and autonomous future.

A number of universities, including Cranfield, Nottingham, Manchester, Sheffield, and Strathclyde are already engaged, particularly around future propulsion. The establishment and coordinating arrangements linking the UK Aerospace Research Consortium directly to the Aerospace Growth Partnership leadership and the Aerospace Technology Institute will encourage wider participation, with an emphasis on an inclusive approach across aerospace related universities, and the creation of an active research agenda.

The UK Aerospace Research Consortium will co-ordinate and support research across air vehicle design, aero structures, propulsion, advanced systems, wings and design and test infrastructure. In addition, the consortium will look to bring insights and access to the linked areas of autonomy, artificial intelligence, robotics and digitisation developing in adjacent sectors.

People

The Aerospace Growth Partnership is committed to supporting the development of skills in the UK's aerospace industry at all levels of the supply chain, from micro-sized employers to multinationals.

In order to deliver on the education and skills requirements of this Sector Deal, industry needs to better understand their current activities in this area. To achieve this, industry is currently mapping the future skills needs of the sector. This will help with the challenge of agreeing how to make sure there is a pipeline of talented people in place to meet future needs.

The fourth industrial revolution is set to sweep through all advanced manufacturing and engineering sectors, including aerospace, with a resultant shift in the necessary skills profile away from conventional hand skills and towards automation and electrification.

Advanced technical skills, especially in large scale integration projects, are what have historically given the UK its competitive advantage, but these must be developed to ensure this is maintained in the future.

Currently, apprenticeships are being used to meet immediate work place demands but there is an increasing view that the future skills requirements of the sector need greater attention, especially around electrification and autonomation. To tackle this, the government expects industry to work with the Institute of Apprenticeships to develop the future educational standards needed by the aerospace sector.

The proposals in this Sector Deal will provide the skills needed in the sector to deliver on four of the five focus areas identified in the Department for Education's Social Mobility Action Plan: career encounters, technical education, apprenticeships, and social mobility.

Recognising the highly technical activities that take place in the UK aerospace sector, the sector will take a leading role in helping deliver future educational standards such as apprenticeships, T levels and broader level three, four and five standards to ensure the sector has access to the skills it requires going forward.

Once the skills mapping exercise is completed industry will be better positioned to help develop apprenticeship standards for current and future roles. Similarly, it would help the sector identify where apprenticeship levy funding is best spent both by levy paying companies and in non-levy paying supply chain companies in respect of levy transfers.

Building on its current delivery of apprenticeship placements, industry commits to working with the government and the devolved administrations to maximise the number of apprenticeship starts. To implement and monitor this, further analysis is required to establish a baseline for the current situation. The government will work with employers to monitor the impact of the apprenticeship levy and continue to analyse all apprenticeship starts. Industry will also put in place clear progression routes from apprenticeship starts through to completion of the apprenticeship and attainment of full qualifications.

Recognising the importance of T level qualifications and supporting its work on apprenticeships, industry has committed to engage in the development of T levels. It is likely that the sector will participate through the development of engineering and manufacturing T level panels that have been established.

Industry has committed to engage further with schools and colleges through the careers and enterprise company to help design programmes for school-based employer encounters and appropriate short-term work placements. This will help to tackle the aging demographic of the UK's aerospace sector with 53 per cent of the current workforce aged over 45, and 23 per cent aged over 55[13].

Women in Aviation and Aerospace Charter

The Women in Aviation and Aerospace Charter was launched at Farnborough Airshow and pledges organisations and companies within the aviation and aerospace industry to work towards a more balanced and fair industry for women. The Charter now has 75 signatories and supporting organisations, an increase of 19 since its initial launch at Farnborough Airshow. The First Steering Board of the Charter was held in September 2018, bringing together volunteers from signatory organisations to meet and discuss plans for progressing the Charter

The Steering Board is responsible for driving progress through four pillars:

- Engagement – socialising and sharing the message of women in aviation and aerospace
- Networking – bringing together women in aviation and aerospace
- Sharing Best Practice – what are other organisations doing to drive through gender equality
- Driving the Charter – gaining more signatories and measuring successes in building a more balanced and fairer industry for women

The Steering Board has also held a seminar for 40 members of signatory organisations in order to share information on and discuss:

- Best practice
- Barriers to diversity
- Targets vs legislations
- Expectations of leaders

Looking ahead, the Steering Board will be looking to increase the number of signatories to the charter as well as work towards a communications plan for the Charter, including:

- All signatory organisations have been encouraged to discuss the Charter with their contacts to promote the Charter and increase the signatories.
- A newsletter has been launched for communicating the activities associated with the charter more widely. It is currently circulated to current signatories but will later be expanded.
- In line with this, the Steering Group is working on a bespoke website for the charter as well as social media activity.

The Steering Board has also agreed to produce a report on the current state of diversity for the two industries. This will enable the Board to establish what more can be done so that Charter signatories can make a step change in how their industries are balanced and fair for women and enable a yearly review of progress.

Infrastructure

Investment in infrastructure is a critical factor in the success of the UK aerospace sector. Investment in new facilities and machinery or upgrading of existing facilities is key to ensuring the UK retains its global competitive position.

This is central to tackling the UK's productivity puzzle. Investment in new, technologically advanced and increasingly automated machines will help the UK increase its Gross Value Added (GVA) and its ability to compete for work on the global stage.

To help the UK become more competitive through development of new manufacturing processes, the government has invested heavily in the High Value Manufacturing Catapult network. These facilities have provided open access to cutting edge machinery and knowledge which has allowed companies to develop new manufacturing processes and methods, resulting in many significant increases in productivity and competitiveness in the aerospace sector. It is anticipated that, as a result of these gains, industry will increase levels of private investment in new manufacturing processes.

Case Study: Airbus Advanced Wing Integration Centre

Airbus has invested £27m to develop a new Advanced Wing Integration Centre with UK support from the government[14].

The new facility, based at Filton, will be an advanced testing centre for large structural components and will focus on improving the UK's capability around the design and testing of wings.

The facility will house around 250 engineers and will become a flagship open-access facility for the UK to lead all future work on wing and associated systems for Airbus.

Case Study: Welsh Government £20m investment in the Advanced Manufacturing Research Facility

In 2016 the Welsh Government announced the development of a new Advanced Manufacturing and Research Facility at Broughton, and its investment of £20m, which will increase the support on offer to businesses[15].

It will be operated on behalf of the Welsh Government by the Sheffield University Advanced Manufacturing Research Centre and will provide a catalyst for economic growth through increased productivity, commercialisation, innovation and skills development to ensure a thriving, competitive industry base across multiple sectors including nuclear, automotive and aerospace.

As part of this long term and sustainable approach, this facility will work collaboratively with further education and higher education institutions to support the development of skills from apprentice to PhD level.

Airbus have already committed to be the first major anchor tenant in developing next generation wing technology at the Advanced Manufacturing Research Facility through their global research and development investment programme 'Wing of Tomorrow'.

Where industry makes a strong business case for infrastructure investment to support R&D activities the government is prepared to help.

Building on the existing support measures, the government also expect there to be investments in infrastructure as a result of funding the Future Flight Challenge. Industry commits to supporting the development of new transport models that will provide better access to all regions of the UK.

Investment in infrastructure by companies, such as in modern factories with increased automation and new manufacturing processes, will help them meet the near-mid term demands for higher production rates and increase prospects of winning future work through increased capability and competitiveness.

Digital connectivity and aerospace

Advances in technology – many of them digital – have the power to improve productivity and efficiency of manufacturing operations in the UK. The government has recognised this and through the announcement at Budget 2018[16] is supporting the Made Smarter proposal with £121m through the Industrial Strategy Challenge Fund process.

As Industry 4.0 makes data, connectivity and automation increasingly available to companies, manufacturers will need to embrace changes in structure, strategy and execution. The benefits of Industry 4.0 go beyond production and planning processes, impacting everything from product design and development, sales, supply chains, delivery, and in some cases, entire business models.

The Made Smarter Review of 2017[17] identified that industrial digitalisation could be worth as much as £455bn to Britain's manufacturers over the next decade. Adoption was identified as one of the key enablers to making the UK a world leader in the so-called Fourth Industrial Revolution. For the aerospace sector, digitalisation needs to permeate the entire supply chain to deliver industry-wide productivity gains.

The 2018 Farnborough International Airshow hosted a showcase of aerospace Industry 4.0 activities, including workshops, panel discussions and exhibitions, and a session by the national trade body, ADS, on 'Cyber security in the aerospace industry'. This addresses issues relating to the current cyber trends and challenges facing the sector as well as future areas of potential innovation and growth.

Industry is also working with the National Cyber Security Centre (NCSC) to ensure aerospace companies are aware of cyber threats in real time. Hosted by the NCSC, the Cyber-security Information Sharing Partnership (CiSP) is a joint industry and government initiative set up to exchange cyber threat information in real time, in a secure, confidential and dynamic environment, increasing situational awareness and reducing the impact on UK business.

CiSP allows companies, including in the aerospace sector, to share information about any cyber threats and attacks that they have experienced.

As part of industry's work on cybersecurity issues, ADS is exploring the possibility of providing sector-specific briefing sessions with the NCSC to improve understanding of the range of cyber threats in the aerospace sector.

Business Environment

Manufacturing is crucial to the UK economy, employing 2.7million people[18], providing 10 per cent[19] of the UK's GVA in 2017 and accounts for 69 per cent of all business expenditure on UK R&D[20].

The UK's aerospace sector makes up a substantial part of this. However, if it is to fend off increasing global competition and new players and build upon its existing platform the sector needs to continue to improve productivity and become globally competitive.

Supply chain competitiveness and productivity improvement

The UK aerospace supply chain is a collection of almost 3,000 companies with varying sizes and capabilities to grow.

Support for SMEs

The government recognises the value of a strong, innovative, competitive supply chain. In the UK aerospace sector there are 3,000 companies, the majority of which are SMEs[21].

Building on the government's support through the £3.9bn joint research programme, government supported programmes targeted at the UK's SME aerospace community includes:

- **Sharing in Growth:** £250m to 2021[22]
- **National Aerospace Technology Exploitation Programme:** almost £44m over three rounds since 2013 (rounds 2 & 3 supported by the £3.9bn joint programme)
- **Open R&D Call:** £40m over three years[23] (supported by the £3.9bn joint programme)
- **New Supply Chain Competitiveness Programme:** £20m (subject to business case)
- Support for implementation of an **Aerospace Supply Chain Charter**
- **Accessibility to UK Export Finance** products
- Customer company's promotion and adoption of the **Prompt Payment code**
- **Department for International Trade's overseas missions promoting exports** to non-UK based customers

The Department for Business, Energy and Industrial Strategy's 2016 UK Aerospace Supply Chain[24] Study of aerospace Prime and Tier One spend in the UK, as compared to the rest of the world, illustrated that growth in the UK spend (circa one per cent) had not kept pace with spend in the rest of the world (circa five per cent).

In order, for UK supply chain companies to improve the current position, it is imperative that they become more competitive, especially if they are to meet the growing rate of demand from aerospace manufacturing Primes in addition to securing future opportunities around the move to more electric aircraft. Activities that can help achieve this are improving productivity, increasing exports, investing in R&D and investing in people.

For many of these companies, the interventions would have to deliver improvements of around 20 per cent[25] in productivity for them to be globally competitive, a figure that would be highly challenging for any company to deliver in-house.

To help tackle this, the Sector Deal is putting in place a new productivity improvement programme, as a next step up from the industry funded Supply Chain 21 programme.

Supply Chain 21

Supply Chain 21 is funded by industry and by Invest Northern Ireland in Northern Ireland.

It is a voluntary programme for improving operational effectiveness and achieving supply chain excellence. It follows a simple four stage process: engagement, diagnostic, improvement, and recognition, and is the primary route on the aerospace and defence supply chain improvement ladder. Companies can join the scheme at no cost.

Companies participating in Supply Chain 21 commit to developing a working culture that includes focusing on accreditation, development, performance and supply chain relationships. There are currently 700 companies on this programme[26].

A new supply chain competitiveness programme

A new supply chain competitiveness programme will build on the success of the 'entry level' Supply Chain 21 programme and focus on improving a company's competitiveness and organisational capability in the eyes of its customers.

It is a more intensive programme that aims to put in place structured improvement activities. Participation in the programme will last between 6 and 36 months depending on the identified level of improvements needed and is part-funded by government.

The programme will adopt entry criteria to consider if a company is one that should be supported. It will also assess company's existing performance and activities and work with customer companies to identify where the supplier should look to make improvement. These could include activities such as organisational structure, manufacturing processes, company strategy, leadership and management and financial management activities.

Whilst increasing participating companies' competitiveness, the programme will also show the company how to 'sell' themselves better to customers as well as financial backers. This will help increase contract wins and reduce potential financial charges on investments as the company will be better able to set out their strategy which should help improve confidence in any investment request.

The programme will follow a similar structure and approach to that of Sharing in Growth, but with a mid-level intervention for companies that wouldn't yet have the capacity to participate in the programme. The government is supporting the programme with £10m funding (subject to business case) which industry will at least match fund. The government would expect that as a result of support for this programme there would also be follow-on investment in infrastructure and people.

Sharing in Growth

Sharing in growth is an industry led training and development initiative that provides a highly intensive, multiyear programme. Sharing in Growth is targeted at companies that have sufficient scale to be able to actively engage in the process and are willing and prepared to commit the high level of resources required to benefit from the programme. The government funding for the existing Sharing in Growth participants runs to 2021.

Sharing in Growth is typically aimed at SMEs that work directly with Prime, OEM (Original Equipment Manufacturer) or Tier One companies. It looks to improve competitiveness by evaluating and improving all elements of the company from governance and leadership to manufacturing processes.

The existing programme has delivered over 2 million hours of training supporting 63 companies and is recognised as being extremely successful: so far companies on the programme have secured £2.9bn of contracts, which they attribute to the result of their improvement from having been on the Sharing in Growth programme. Sharing in Growth analysis of the programme contends that 70 per cent of Sharing in Growth companies are growing at around 12 per cent compared to the industry average of circa four per cent[27].

The Export Strategy

The UK's aerospace sector is an exemplar of the benefits of exporting. As a result, the government is asking the sector to champion the benefits of exporting to other sectors that have this potential to export as well as encourage SMEs in the sector who do not currently export but serve mainly a domestic market.

The aerospace sector has a strong pool of role-models, from large companies to SMEs, that know what it means to export to all parts of the globe. The government would like to see industry committing to support the Export Champions initiative, informing and advising businesses in other, less export-orientated, sectors.

Export Champions will provide guidance to companies new to exporting. They will set out their experiences, share their ideas and experience for overcoming the challenges and demonstrate the impact that successful exporting can have on growth and connecting companies where possible.

The government is asking industry to participate in the development of the great.gov.uk website, providing case studies and experiences of successful exporting.

The government has also launched a National Trade Academy, which will offer learning opportunities to build new international trade and investment skills for businesses, academics and students and engender a culture of exporting.

Building on the UK aerospace sector's knowledge and experience, the government is looking for industry to contribute to the content of the Academy programme.

JJ Churchill Ltd
PRECISION ENGINEERING

JJ Churchill Ltd

JJ Churchill Ltd is an engineering company based in Coventry and services aerospace, defence, power generation, diesel and nuclear markets. JJ Churchill recently completed their four-year journey on the Sharing in Growth productivity support programme.

In 2017/ 18 their turnover was ~£16m: in 2019/20 this is expected to increase to ~£31m. Over the last 12 months they have grown from 130 employees to 160 and are planning to increase their shop floor space from 54,000 sq ft to 74,000 sq ft.

As a result of participating in Sharing in Growth, and the resultant turnover growth, JJ Churchill are able to invest for the future. Part of this growth will be focussed on bringing in equipment to aid automation and robotics as well as bring in-house technologies that they currently buy in.

Places

The Industrial Strategy aims to boost the productivity and earning power of people throughout the UK. The UK's aerospace sector is widely spread across the UK with clusters outside London in the south west, midlands and north west of England as well as in Scotland, Wales and Northern Ireland.

Given the majority of aerospace jobs are located outside of the south east of England, the economic benefits delivered by the sector help provide a balanced economy across the UK and deliver the Industrial Strategy aim to have prosperous communities thought the UK.

Where advanced manufacturing activities take place, areas are economically better off than elsewhere. For example, in the south west, where Airbus is located, 44 per cent of the population is educated to degree levels compared to 36.9 per cent UK wide[28] and wage levels in the aerospace sector are (in 2017) £33,800[29] compared to the national average manufacturing wage (2017) of £29,200[30].

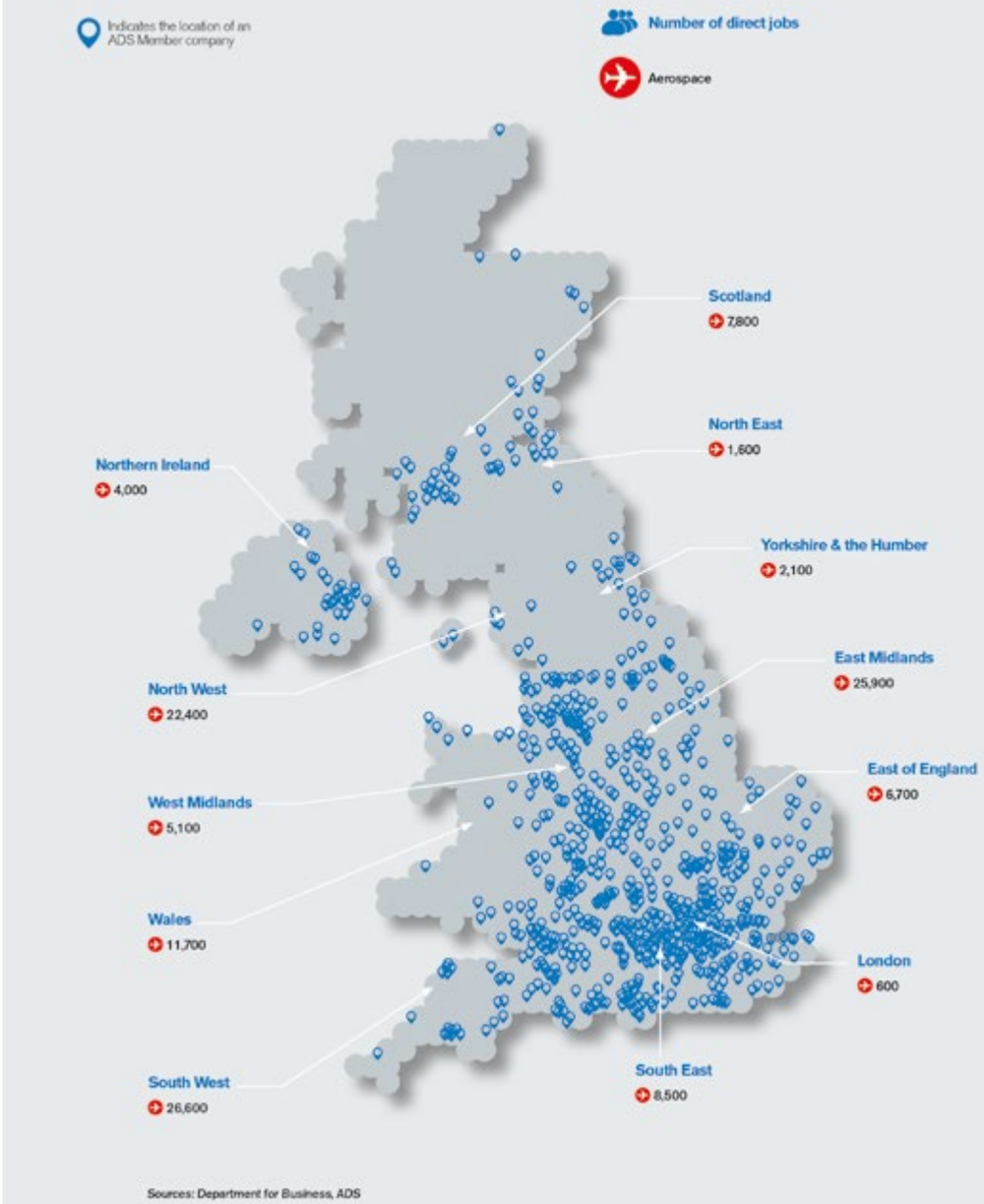
Employment in the aerospace sector therefore helps drive local growth. Where there are clusters of advanced manufacturing activities, the higher than average wage helps drive demand for housing, support services, retail, leisure and all other services that enable communities to prosper and grow.

Continued success in the UK's aerospace sector will therefore help drive economic growth above national averages.

As part of this deal, industry has committed to increase its relationship with organisations at local levels and, where appropriate, deliver Local Industrial Strategies and economic strategies more widely for the rest of the UK. Local Industrial Strategies aim to increase regional economic productivity.

A positive example of engagement at national and local level resulted in the construction of an International Exhibition and Conference centre at Farnborough Airport.

Aerospace company location (ADS members)



Case Study: Farnborough International Exhibition Hall

The Farnborough International Exhibition and Conference Centre has been built to support the future of the Farnborough International Airshow by providing a permanent exhibition and conference facility that will enable the show to grow and compete against other air shows across the world.

The new facility is the largest exhibition space in the south east outside of London and cost £32m to build. As part of the financing for the Centre, Farnborough International Limited secured a £12m loan from Barclays Bank and support from local partners:

- A £5m loan from EnterpriseM3 (Local Growth Fund);
- A £5m loan from Hampshire County Council;
- A £5m loan from Rushmore Borough Council;

The Farnborough International Airshow has a huge impact on the local economy, which is estimated as £36m within a 25-mile radius of Farnborough. The new state of the art conference and exhibition space will mean that the Airshow can maintain its position as a world-leading event while providing the opportunity for other events to launch, develop and grow, or relocate to these facilities. Plans are also being developed to establish an initial show for the new aviation vehicles that are anticipated to come forward as a result of the Future Flight Challenge.

The delivery of the national aerospace strategy is supported by activities of the Regional Aerospace Alliances across the UK: Aerospace Wales, Aerospace, Defence and Security Scotland & Northern Ireland, Farnborough Aerospace Consortium, Midlands Aerospace Alliance, North West Aerospace Alliance, and the West of England Aerospace Forum.

There are also investment bodies in the devolved administrations – Scottish Enterprise, Invest Northern Ireland and the Welsh Government – who help secure investment and trade opportunities for their regions. Their respective manufacturing strategies are aligned to the industrial strategy for UK aerospace and the initiatives developed through the Aerospace Growth Partnership.

The government research and technology programme for aerospace, supported by the Aerospace Technology Institute, is UK-wide thereby driving collaboration, spillover and economic benefits across England, Northern Ireland, Scotland and Wales.

Wales

Wales is home to significant operations in the aerospace sector, including half of the top 10 aerospace companies globally (Airbus GE Aviation, Raytheon, BAE Systems and Safran). In total there are 150 aerospace companies.

The Welsh Government's Economic Action Plan 2017 is well aligned to the UK Industrial Strategy with clear connections between Grand Challenges and the Economic Action Plan's Calls to Action. There is also a clear link between the Economic Action Plan and the UK Aerospace Strategy with 'threads' of connectivity around improving productivity, skills and innovation.

Supporting these companies are eight universities and many more further education facilities including an Advanced Manufacturing Research Facility and the Compound Semiconductor Applications Centre. These facilities will help develop and support the aerospace and advanced manufacturing sector. The two new Centres are assets that will bring benefits to the whole UK. The Welsh Government recognises that driving increased SME productivity and competitiveness is not curtailed by geographical borders and is keen to realise benefits across the UK.

The Welsh Government has a priority to invest in higher level skills, particularly science, technology, engineering and maths related, and has been working closely with the Higher Education Funding Centre for Wales to pilot degree apprenticeships. The Welsh Government is delivering these priorities by investing £116m in apprenticeships delivery during 2018/19 and remains on track to meet their target of 100,000 all-age quality apprenticeships by the end of 2021.

Case Study: Dennison Advanced Materials Centre

The Dennison Advanced Materials Centre (DAMC), located at Blaenau Gwent Learning Zone in Ebbw Vale, was officially opened on 27 September 2018.

It is the first training centre in Wales to offer Advanced Composites Training as devised by the National Composites Centre (NCC). The initial impetus for the centre was to service the needs of Zodiac Seats which located to Cwmbran in 2001. The company has now become one of Wales' premier manufacturing facilities, employing over 1,300 staff. The company is increasingly focussed on using composites in their product range and needed to upskill and retrain their staff. The Welsh Government worked with the local further education provider, Coleg Gwent, to create DAMC on a former steel works site in Ebbw Vale.

The college will also be looking to offer training to the Welsh automotive and construction sectors.

The vision is to create a centre which will not only serve the needs of Welsh industry now and in the future but will become a UK skills centre of excellence, attracting high value manufacturing companies to the area. The college is currently working with the NCC and the Welsh maintenance, repair and overhaul sector to devise a composite repair training module.

Since its launch the centre has already gained interest from companies looking to locate to the area.

Scotland

The aerospace sector in Scotland is a mature and highly developed industry largely focused on maintenance, repair and overhaul activities in Prestwick and the surrounding areas.

The sector in Scotland has annual sales of £1.6bn and well over 8,000 direct aerospace employees. It plays a substantial part in the UK's share of the global aerospace market.

To deliver this, the Scottish Government has put in place a national strategy for Aerospace, Defence, Marine & Security (ADMS) which was published by the Aerospace, Defence, Marine & Space Industry Leadership Group (ADMS-ILG) in March 2016. This strategy connects directly with Scotland's manufacturing action plan, 'A Manufacturing Future for Scotland', with key activities into the development of the manufacturing supply chain to engage with the aerospace market and the use of the latest equipment and processes to increase productivity, sustainability and reduce costs aimed at parallel delivery of both strategies.

Case Study: Spirit AeroSystems Aerospace Innovation Centre

Supported by £4.8m investment by Scottish Enterprise and creating over 40 jobs, the SAAIC is an open access innovation centre focussing on the technologies required for large scale composites manufacture primarily for Aerospace but with applications in other sectors such as renewables, automotive and rail.

The centre alongside Spirit AeroSystems allows the equipment and expertise that it will develop to be accessible by a number of other parties whose own capabilities and projects will expand the benefits and economic impact.

The centre was developed in close partnership with Spirit AeroSystems to address the strong growth in global aerospace and the shift in materials from metal to composites in aerostructures which will characterise the next generation of commercial aircraft.

The centre sits alongside other investments by the Scottish Government such as the National Manufacturing Institute for Scotland and the Lightweight Manufacturing Centre which demonstrate willingness and commitment to support manufacturing in Scotland alongside the UK Catapult network.

Scotland's aerospace sector is attracting and retaining talented people with a high proportion of graduates. The close geographical location of academic infrastructure such as Glasgow and Strathclyde universities to manufacturing businesses assists with this, encouraging more collaborative working. This, alongside the offers of Perth and Ayrshire colleges for further education, helps provide a real platform upon which to deliver the skilled people needed for the future aerospace sector.

Building on its strong relationship with industry already, Scotland is looking to do more beyond partnerships with Airbus and Boeing and companies who have already invested in Scotland (Rolls-Royce, GE, UTC and BAE).

Northern Ireland

In 2014, Northern Ireland was the first devolved administration to publish its 10 year aerospace and defence strategy[31] aligned to the UK's Aerospace Strategy.

Today, the region is a leading hub in the UK aerospace supply chain – indeed, one third of the world's aircraft seats are manufactured in Northern Ireland[32].

Traditionally, there has been a focus on the supply chain meeting the needs of Bombardier, however, through a focussed approach, investment in skills and capabilities and support from Bombardier and Invest Northern Ireland, the supply chain has successfully extended its customer and market reach. For example, the historic focus on providing structural products is now being complemented through an expanding aircraft interiors market led by firms such as Rockwell Collins.

Allied sectors such as defence and space, where Thales is the regional prime, are also benefiting from a more capable and competitive supply chain.

Northern Ireland has achieved this through intensive implementation of the Supply Chain 21 programme with support from Bombardier, Rockwell Collins, Thales, Invest Northern Ireland and others. Through Supply Chain 21, companies realise the benefits to be gained through investments in technology, people, skills and research and development and how this helps expand their opportunities into wider aerospace programmes.

Queen's University, including its specialised facility, the Northern Ireland Technology Centre; Ulster University, with expertise in advanced materials and composites, along with the Northern Ireland Advanced Composites and Engineering Centre and the Centre for Secure IT are supporting the expansion and diversification of Northern Ireland Aerospace.

Industry has also committed to set out a plan of engagement with the devolved administrations to encourage participation in Aerospace Growth Partnership supply chain activities.

Case Study: Boeing Gear and Actuation Manufacturing Facility – Sheffield

Boeing are investing £40m in a new civil aerospace manufacturing factory at Sheffield – its first civil aerospace factory in Europe.

The facility will develop and manufacture new actuation and gear components. The facility opened on 25 October 2018 in Sheffield.

Boeing Sheffield will make more than 100 different high-tech actuation system components for the 737 and 767, from raw materials sourced in the UK. These components will be used on the trailing edge of the wings. Trailing edge actuation systems are responsible for extending and retracting the wing's flaps during different phases of flight. The flaps add lift to enable take-off and landing at lower speeds and provide drag to help slow the aircraft.

The 6,200-square-metre facility represents a Boeing investment of more than £40m. It is part of a broader plan by Boeing to vertically integrate and begin in-house manufacturing of key actuation components and systems in the US and the UK, enhancing production efficiency and reducing cost in its supply chain.

Implementation plans

Key deal activities

Date	Milestone
December 2018	Aerospace Sector Deal launched
Early 2019	New supply chain competitiveness programme launched
Early 2019	National Aerospace Technology Exploitation Plan launched
April 2019	Future Flight Challenge launched
January 2020	Annual Review of Aerospace Sector Deal
2020	Airbus, Rolls-Royce & Siemen's E-Fan X Hybrid electric technology scheduled for maiden flight

Governance

Implementation of the Aerospace Sector Deal will be overseen by the Aerospace Growth Partnership, which will review progress against delivery of programmes and objectives at bi-annual meetings.

Separate governance groups will be/have been put in place for the Future Flight Challenge, National Aerospace Technology Exploitation Programme, supply chain programme, UK Aerospace Research Consortium and the Women in Aviation and Aerospace Charter. Activities not overseen by separate governance groups, such as delivery of the skills agenda, will be monitored by the AGP working groups.

Once the Sector Deal enters the implementation phase, bi-annual reports will be provided for ministers in the Department for Business, Energy and Industrial Strategy.

The Aerospace Growth Partnership will be subject to challenge sessions from government ministers on an annual basis as part of the overall Sector Deal programme.

References

1. www.gov.uk/government/publications/women-in-aviation-and-aerospace-charter
2. https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future
3. https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future
4. https://www.gov.uk/government/news/department-for-business-innovation-and-skills-settlement-at-the-spending-review-2015
5. https://www.gov.uk/government/publications/women-in-aviation-and-aerospace-charter
6. https://www.gov.uk/government/publications/productivity-budget-2018-brief
7. https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future
8. numbers derived from the BEIS UK Aerospace supply chain survey 2016
9. https://www.airbus.com/aircraft/market/global-market-forecast.html
10. https://www.icao.int/environmental-protection/Documents/ICAO%20Environmental%20Report%202016.pdf
11. https://www.acare4europe.org/sria/flightpath-2050-goals/protecting-environment-and-energy-supply-0
12. https://www.cranfield.ac.uk/centres/digital-aviation-research-and-technology-centre
13. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/adhocs/008439employmntbydetailedoccupationandindustrybysexandageforgreatbritainukandconstituentcountries
14. https://www.airbus.com/newsroom/news/en/2016/01/investing-in-the-future-airbus-announces-new-uk-wing-development-and-test-centre.html
15. https://gov.wales/newsroom/businessandeconomy/2018/180516-construction-begins-on-advanced-manufacturing-research-institute-in-broughton/?lang=en
16. https://www.gov.uk/government/topical-events/budget-2018
17. https://www.gov.uk/government/publications/made-smarter-review
18. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/workforcejobsbyindustryjobs02
19. Derived from ONS GDP Low Level Aggregates and EuroStat National Accounts data
20. ONS BERD
21. ONS Data
22. https://www.sig-uk.org/
23. https://www.ati.org.uk/funding/research-technology-funding-opportunities/collaborative-r-and-d-competition/
24. https://www.gov.uk/government/publications/uk-aerospace-supply-chain
25. https://www.sig-uk.org/
26. https://www.adsgroup.org.uk/membership/my-sectors/aerospace/sc21/
27. https://www.sig-uk.org/
28. South West England and South East Wales Science & Innovation Audit 2017
29. Labour Insight / Burning Glass – based on a sample size of 579 with available information provided
30. ONS Annual Survey of Hours and Earnings
31. https://secure.investni.com/static/library/invest-ni/documents/northern-ireland-partnering-for-growth-together-growing-the-northern-ireland-aerospace-defence-security-and-space-industry.pdf
32. https://www.investni.com/invest-in-northern-ireland/aerospace-and-defence.html

This publication is available from: www.gov.uk/beis

Contact us if you have any enquiries about this publication, including requests for alternative formats, at: enquiries@beis.gov.uk