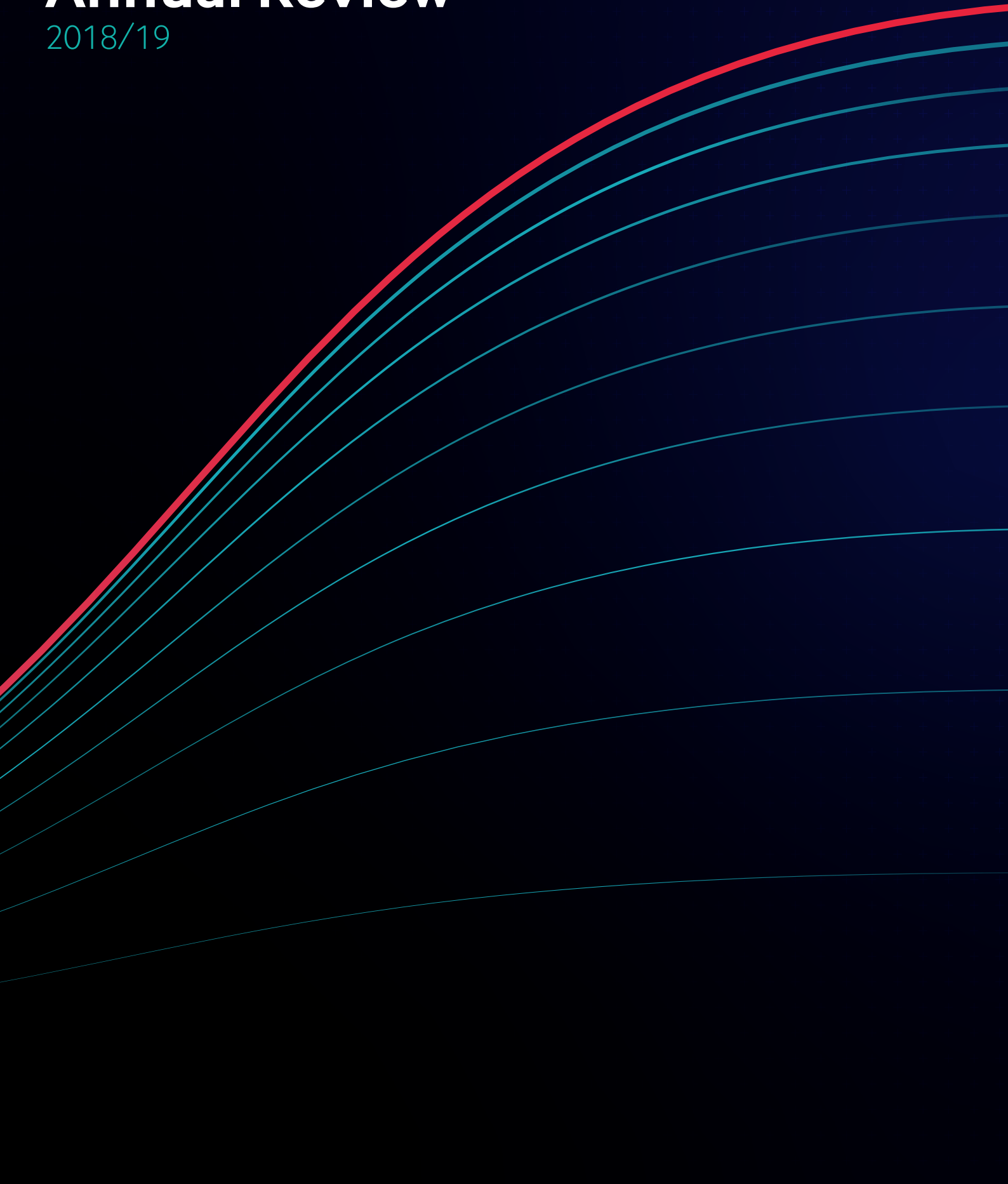


Annual Review

2018/19



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INTRODUCTION

The Aerospace Technology Institute was created in 2013 and began operations in 2014. The ATI's role as a neutral presence between government and industry is to establish a challenging technology strategy for the sector, and to develop a portfolio of research and development (R&D) activity to realise the strategy, exploiting the sector's strengths to the full and creating new capabilities for the markets of the future. These activities are carried out in industry, academia, and other research establishments. The ATI Programme is administered through close collaboration with Innovate UK and the Department for Business, Energy and Industrial Strategy (BEIS). Government and industry have agreed jointly to commit up to £300m per year in technology out to 2026, creating a total potential investment of £3.9bn.

The Institute supports the Aerospace Growth Partnership - a joint government and industry forum created to bolster the UK civil aerospace industry and enable it to reach its full economic potential in the global market.

The ATI's technology strategy is set out in Accelerating Ambition and other publications including its growing series of INSIGHT papers which explore individual technologies in more depth (see page 25 for a full list of these). The ATI also publishes INSIGHT papers on the economics of aerospace technology. The portfolio of R&D activities is summarised in a project directory. All these resources are available on the website at www.ati.org.uk.

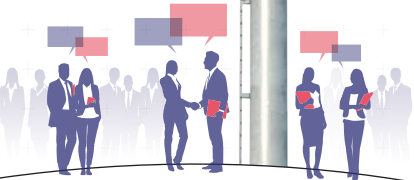
The ATI is a non-public body operating in a complex environment with many partners and stakeholders in industry, academia, and government, based in the UK and overseas. The ATI board reflects this, drawing on the private and public sectors, and led by an independent non-executive chair. It is funded equally by BEIS and by industrial recipients of project grants who pay a small levy. Its running costs total around £5m per year.

Note:

The Aerospace Technology Institute (ATI) believes the content of this report to be correct as at the date of writing. The opinions contained in this report, except where specifically attributed, are those of ATI, based upon the information that was available to us at the time of writing. We are always pleased to receive updated information and opposing opinions about any of the content. The content reflects the status of ATI-supported projects, the R&D landscape and economy during the ATI's 2018-19 financial year. At date of publication, the full impact of the COVID-19 pandemic on the aerospace sector was yet to be quantified.

HIGHLIGHTS OF THE YEAR

PORTFOLIO REACHED
£2.5 BILLION



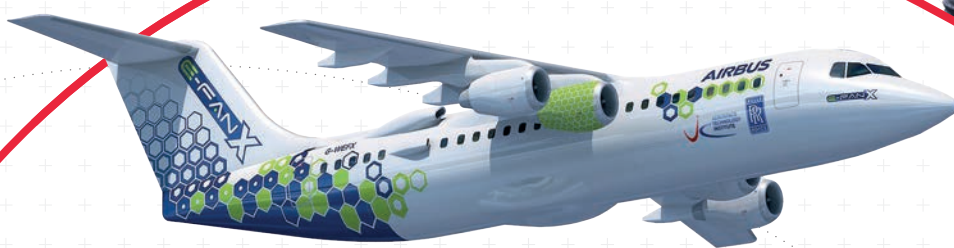
ATI Portfolio
The ATI Programme reached a total value of £2.5bn and we unveiled further radical projects in electrification.



Scenario Planning
Our strategy team devised three potential futures to challenge our assumptions about what the sector will look like in 2050.



UK-Sweden Bilateral
Four successful projects emerged from this international funding call, and a second call was launched in 2020.



E-Fan X Supply Chain Event
Partnering with Airbus, we invited SMEs with relevant technologies to get involved in the E-Fan X project.



ATI Boeing Accelerator
In a global first, we launched an accelerator to propel start-ups with sustainability and industry 4.0 enabling technologies into the supply chain.



Ground-breaking Thought Leadership
Three INSIGHTs were published on economic spillovers, the evolving R&D landscape and global aerospace patents.



Paris Airshow CTO Joint Statement
We welcomed the landmark statement on the environment made by CTOs of the world's largest aerospace companies.



Women in Aviation and Aerospace Charter
We continued to support and promote the initiative to even the gender balance in the sector.



Aero Guru
We connect start-ups with the brightest and best from the UK aerospace and investment communities.



Accelerating Ambition
We updated the technology strategy for the UK aerospace sector, published in November 2019.

UK-Canada Collaboration
We signed an agreement of intent for future R&T collaboration with Canada's National Research Council.



CHAIRMAN'S REPORT

This is my last annual report as chair, and I would like to reflect on the five years that I have been in post since the inception of the ATI in 2014. Creating a new organisation is fascinating and exciting, if sometimes uncertain. Launching the ATI was no exception, particularly given the high expectations of our stakeholders in government and industry to bring about a step change in both the level of civil aerospace R&D in the UK, and the way that it is planned and carried out.

Five years on, I am delighted with what we have achieved. The ATI now reaches into industry, academia, and government, bringing organisations together, building a common technology agenda, and creating ambitious projects to drive the significant advances required for the next generation of aircraft. The ATI is part of a complex R&D ecosystem and the board has been keen to ensure that we develop constructive relationships with other organisations and initiatives such as the Future Flight Challenge, Driving the Electric Revolution, and the Faraday Challenge, led out of UK Research and Innovation (UKRI). Relationships with government have also broadened; as well as daily contact with our sponsor department, BEIS, and Innovate UK, the ATI works closely with the Departments for Transport and International Trade, and a number of the government's chief scientific advisors. The ATI's links with overseas organisations and initiatives have also grown, creating opportunities for international activities.

The ATI has responded with agility to the changing context for aerospace. Formed in the expectation of a new single aisle aircraft being launched by 2020, the agenda is now dominated by the need for a dramatic reduction in the environmental footprint of aviation, accompanied by the possibilities of new technology to deliver entirely new air services. The ATI has kept pace with this, conceptualising what has become the Future Flight Challenge, and creating a raft of world-leading R&D projects on different aspects of electrification and autonomy, as well as encouraging potentially disruptive technologies, often being developed by smaller companies.

I want to thank the ATI's staff and my colleagues on the board for their work in the past year and for all the support they have offered me during my tenure.

It has been a great privilege to lead the ATI for the first five years of its existence. My successor, Stephen Ball, took over the role in January 2020, and I wish him all success in taking the organisation into its next phase of development.



Stephen Henwood CBE

CHIEF EXECUTIVE'S REPORT

Last year's annual report showed the ATI beginning to complement its core R&D activities with initiatives aimed at the supply chain, international collaboration, and disruptive technologies. 2018/19 saw this come to fruition.

Most significantly, we launched with our partners Boeing and GKN an accelerator programme to bring forward new start-ups, offering them capital, mentoring, and exposure to the leading companies in global aerospace; we hope that this exciting initiative (described more fully on p19) will create new ways of bringing technology into the sector. Still on start-ups, we have created a platform called Aero Guru to enable aerospace entrepreneurs to pitch their ideas to experts from industry, academia and the financial world, and to receive feedback. For the broader supply chain, projects began in our collaborative R&D call (now renamed 'R&D for Smaller Business'), in the latest phase of the National Aerospace Technology Exploitation Programme (NATEP), and in the first bilateral call with Sweden.

At the same time, activity in our core strategic R&D programme did not stand still. We continued our drive into sustainable technologies, building a comprehensive approach to the low-emission aircraft of the future with initiatives such as Fresson and HyFlyer, joining the E-Fan X and ACCEL projects already underway. This creates a portfolio of projects dealing with different aspects of electric propulsion – a key capability needed for the zero-emission era. The case studies in this report describe some of our main projects, demonstrating amongst other things our approach of focusing on the market and supporting ambitious projects that create the major building blocks for future success.

Significant effort during the year went into preparing our new technology strategy *Accelerating Ambition*, launched in November 2019 at the second ATI conference in Birmingham. This prioritises three vital issues for aerospace:

- **Sustainability**
reducing the environmental impact of aviation
- **Mobility**
exploiting the opportunities for new aviation services afforded by advances in automation and electrification technology
- **Competitiveness**
driving greater efficiency and capability into UK aerospace through better design and manufacturing technology and techniques.

In addition to its core R&D activities, the Institute supports industry, academia and government with analysis and by adding its expertise to policy discussions. One highlight here was our INSIGHT paper into the spillover benefits of aerospace research to the rest of the economy; this demonstrated that four times as much benefit goes to other sectors such as automotive, rail and materials as to aerospace itself. This reveals the previously hidden extent of the economic value our work generates. We have also contributed to numerous consultations over the year, including Professor Sir Adrian Smith's review into international collaboration after Brexit.

Internally, we welcomed many new staff in 2018/19 and have focused on building the team, extending training opportunities, and improving our office space. My thanks go to the board and the staff of the ATI for their input this year, as well as to the many industry and academic contacts who work with us on our advisory groups and in other ways, bringing challenge and fresh perspectives to us. Many thanks must go to Stephen Henwood for his chairmanship, support and championing of the ATI over the past five years. He departs with good wishes from everyone at the Institute; and I wish him well for the future. Finally, my thanks to our partners in government at BEIS and Innovate UK for their commitment and engagement.



Gary Elliott

TECHNOLOGY STRATEGY

The ATI creates and maintains the technology strategy for the UK's commercial aerospace sector. Much of 2018/19 was taken up with preparing a renewed strategy, *Accelerating Ambition* launched in November 2019.

Download at www.ati.org.uk

It focuses on sustainability, mobility and competitiveness, and addresses the new agendas of aviation in a zero-carbon world, and new aviation markets such as urban air mobility made possible by developments in autonomy and electrification. At the same time, the sector in the UK constantly needs to improve its competitiveness, not only because of fierce competition from overseas, but to meet customer demand for ever more complex and capable products at reasonable prices.

As with previous ATI strategies, *Accelerating Ambition* is market-focused, and highlights areas where the UK leads the world; but it also identifies

technologies that the UK will need to master in order to retain its global position. The Institute bolsters the central strategy with its series of INSIGHT papers, publications on detailed aspects of aerospace technology and markets. Three papers were published in 2018/19 (see Communications Report on p22 for details).

The Institute realises its strategy by promoting R&D throughout the sector and in academia through its strategic research programme and smaller programmes aimed at the supply chain and at fostering international collaboration.

Strategic Programme



NATEP
(National Aerospace
Technology Exploitation
Programme)

NATEP

The government invests around £150m per year in these programmes, matched by industry, and activities are carried out in companies and research organisations.

**ATI
Boeing
Accelerator**



R&D for Smaller Business

(formerly Collaborative R&D)



International



The UK's catapult centres are particularly heavily involved in the programme.

In addition, the ATI operates two initiatives to support business development for start-ups.

Aero Guru



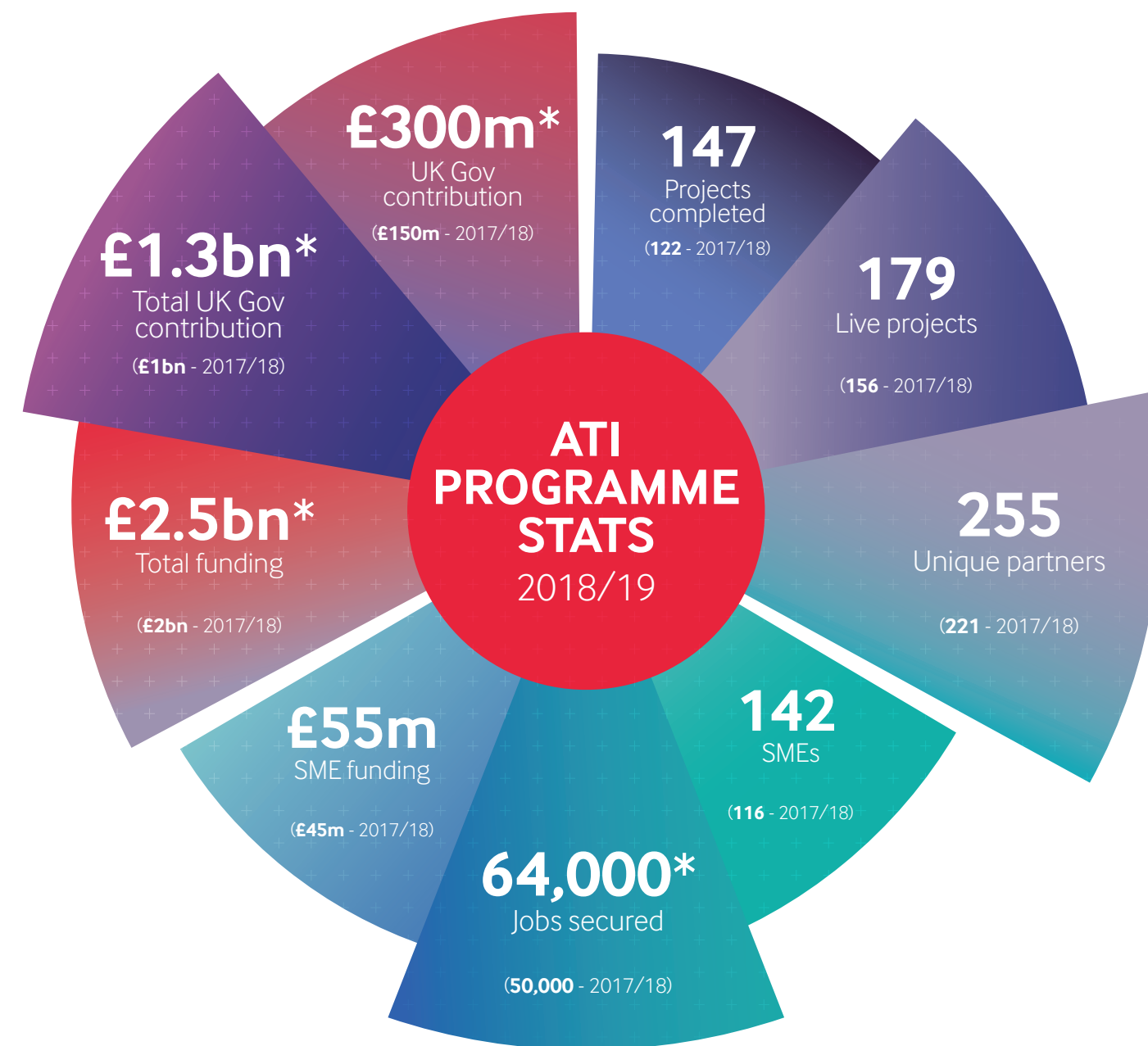
Technology Programmes

During 2018/19 the technology portfolio grew by some £500m to reach £2.5bn. The government share of this was around £300m, making its contribution to the total portfolio about £1.3bn. The number of live projects increased by 25 to 179. In total, almost 150 ATI projects have been completed since operations commenced in 2013. The number of unique participants in the portfolio increased to over 250, including the addition of a further 26 SMEs, taking their number up to 142 and accounting for £55m of funding (up by £10m).

In other respects the portfolio remained stable with good levels of collaboration, and a continued focus on ambitious projects in the strategic programme.

2018/19 saw renewed activity in NATEP with a call in July 2019, and commencement of projects in the first UK/Sweden bilateral call. The R&D for Smaller Business funding stream (formerly known as Collaborative R&D) was also launched.

Year on Year

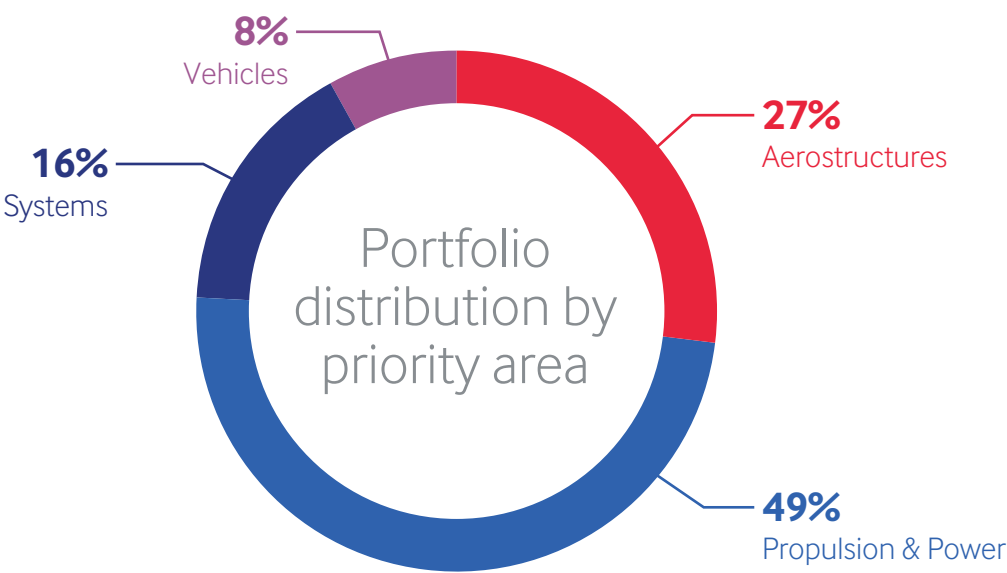


* includes NATEP

The following sections look in more detail at the individual elements of the R&T portfolio

Strategic Programme

The strategic programme is made up of four priority technology areas. These are: [Propulsion and Power](#), [Aerostructures](#), [Systems](#), and [Vehicles](#)



Propulsion and Power

Propulsion and power is the largest area of activity for the ATI, accounting for around half of portfolio investment. This reflects the scale of UK aerospace turnover contributed by propulsion and power companies. These technologies can make the greatest contribution to decarbonising the sector. Hybrid and electric propulsion technologies therefore continue to grow in the ATI portfolio, creating a group of large projects examining different challenges in electric flight. Alongside the drive towards electrification, much work continues in improving gas turbine technology. Some significant projects were completed during the year, including important research infrastructure investments at Loughborough and Nottingham Universities and the National Composites Centre that will support many future projects. Rolls-Royce completed its CTI Composite Fan Technology project, committing to onward investment in composite blade manufacture in the UK.

ATI continued to work with Rolls-Royce and the UK supply chain on the next generation ultra-high bypass ratio turbofan engine and associated Advance 3 core, where the partners achieved significant milestones in design reviews and demonstrations. These large programmes, designed to transform gas turbine performance, represent the exploitation route for many of the propulsion projects currently underway, embracing manufacturing and materials technology, optimised integration of systems, noise reduction, and engine efficiency. At the same time, research into improved propellers is taking place through GE Dowty’s Digiprop project. Looking forward, the propulsion element of the ATI’s refreshed technology strategy *Accelerating Ambition* identifies the following priority areas:

- Large ultra-high bypass ratio turbofan capability
- Hybrid gas turbine electric propulsion
- All-electric battery and fuel cell propulsion

CASE STUDY

Four Projects in Electric Flight

Rising concerns about the environment require the aerospace industry to intensify progress towards more electric propulsion and power systems. The ATI is supporting projects taking different approaches to this challenge - both hybrid and fully electric – and proving them through flying demonstrators.



E-Fan X is a flying hybrid-electric demonstrator - a converted regional jet with one of its engines swapped for an electric motor and fan. Airbus leads the overall integration of these systems into the aircraft, along with the power distribution centre, flight deck displays, lithium-ion batteries and other controls. Rolls-Royce provides the turbine, the powerful 2MW generator, power electronics, the electric motor and fan.

Rolls-Royce’s ACCEL aims to be the world’s fastest all-electric aircraft. It is planned to fly in 2020, reaching airspeeds of 300mph. YASA is developing lightweight, high power electric motors and controllers, and Electroflight will focus on the powertrain including innovative energy storage systems.

FRESSON, named after Scottish aviator Ted Fresson, will demonstrate all-electric flight for short routes, such as those in the Scottish Highlands and Islands. Led by Cranfield Aerospace Solutions, FRESSON will integrate a hybrid-electric powertrain onto a Britten Norman Islander aircraft. Other consortium partners are Rolls-Royce (power management system), Denis Ferranti Group

(electric motors), Delta Motorsport (battery packs), and the Warwick Manufacturing Group (battery testing).

HyFlyer is researching hydrogen fuel cell technology for zero-emission aviation. US-based start-up ZeroAvia has set up in the UK

“We’re gaining the know-how to not only pioneer the field of electric-powered, zero-emissions aviation - but to lead it. At this point, our confidence is sky high.”

Matheu Parr
Rolls-Royce ACCEL Project Manager.

to pursue this research, which will culminate in a UK-based 250-300 nautical mile flight on a Piper M-class aircraft. HyFlyer is a key step towards the company’s vision of supplying 10 to 20-seat regional aircraft with a range of up to 500 miles.

Aerostructures

Aerostructures account for approximately 25% of the research portfolio. New materials can create new aerodynamic shapes and lighter, more environmentally friendly and safer aircraft. They can integrate the systems within an aircraft more effectively, decluttering the vehicle, reducing hazards, and optimising the space on board. Alongside the opportunities of exploiting new materials, a range of revolutionary manufacturing processes such as additive manufacturing is coming on stream, transforming the way things are made and the operation of supply chains.

The ATI programme has driven these trends significantly in the past year with numerous projects to help companies digitalise and automate their manufacturing. Airbus's Wing of Tomorrow programme, combining a number of large projects into a holistic approach to future wing manufacture, has reached a critical stage of maturity. A composite manufacturing pilot line has been commissioned in the National Composites Centre (NCC), and the first manufacturing demonstrators have been designed and produced in ATI-supported facilities in the Advanced Wing Integration Centre at Filton and the recently opened Advanced Manufacturing Research Centre Cymru in Broughton, North Wales.

Outside the strategic programme, Industry 4.0 has also been a critical focus for some of the start-ups in the ATI Boeing Accelerator (see p19), echoing the sector's desire to become more digital, connected and automated.

During 2018/19 the ATI worked with the Aerospace Growth Partnership (AGP) manufacturing and supply chain working group to identify gaps in UK capability. This led to several proposals from eight major companies for research, innovation, infrastructure, capital and skills to secure future manufacturing in the UK.

The priority actions for aerostructures identified in the technology strategy are as follows:

- **Advance world-class capabilities for future integrated structures**
- **Grow capability in complex multi-functional structures**
- **Design the next generation of smart assembly processes and tools**

Systems

Systems constitutes around 15% of the portfolio and embraces capabilities ranging from landing gears and fuel systems, through mechanical actuators, cockpit displays and communication technologies to in-flight entertainment and cabin interiors. The increasing focus on decarbonising air travel has major implications for systems technologies, particularly in electrification.

To facilitate the introduction of new technology, the ATI has created a Systems Virtual Validation Platform (SVVP). This significant new offering, which will be available to UK industry and academia, builds on the ATI's whole aircraft modelling capability. It can determine the impact of size, weight and power of new complex systems at whole aircraft level. Thermal management can be explored at system level enabling disruptive technologies such as electric and hybrid electric propulsion to be analysed. It will enable new systems technologies to be optimised and assessed in integrated aircraft concepts and less conventional systems. The SVVP is now in use with aerospace company Onsystems, and industry demand for access to the platform is building.

The year also saw considerable movement on various projects, including the completion of SECT-AIR (Software

Engineering Costs and Timescales – Aerospace Initiative for Reduction) – a broad consortium convened by the ATI to develop affordable safety critical software. The success of this project has led to the launch of a scaled-up successor called HICLASS (High-Integrity, Complex, LArge, Software and Electronic Systems).

The sector continued to make good progress on a number of large strategic projects aimed at enhancing some the UK's critical capabilities, including landing gear, flight deck, equipment health management, and communications.

Further systems projects were launched through the UK-Sweden bilateral funding competition and in particular the ATI's R&D for Smaller Business funding stream.

Systems priorities identified in the technology strategy are as follows:

- **Light efficient and reliable systems and equipment**
- **Smart connectivity for cabin and cockpit**
- **Autonomy for on-ground and in-flight operation**

CASE STUDY

DRAMA (Digital Reconfigurable Additive Manufacturing facilities for Aerospace)

Aerospace is leading the adoption of metal additive manufacturing, exploiting its potential for delivering better products, reducing time to market, and simplifying the supply chain by reducing the part count and consolidating assembly processes.

DRAMA supports the wider UK aerospace supply chain in adopting the technology, positioning the UK as a global leader in metal additive manufacturing. Led by the Manufacturing Technology Centre – home to the UK's National Centre for Additive Manufacturing (NCAM) – the project involves a broad consortium from the aerospace, machinery, software, and materials industries alongside academia and research organisations.

As a result of DRAMA, NCAM now provides an online reference library, training courses and support packages for the supply chain. In October 2019 it opened a custom-built open-access facility with state-of-the-art digital infrastructure for companies to visit, learn about additive manufacturing and gain hands-on experience.



“DRAMA is opening up the possibilities of this transformative technology to companies up and down the supply chain. Our facilities are second to none and we are helping secure the UK's continued place at the forefront of aerospace.”

Dr. Katy Milne
Chief Engineer, DRAMA.



CASE STUDY

SECT-AIR/HICLASS

SECT-AIR and HICLASS demonstrate how the ATI's convening power and technical expertise can solve persistent and expensive industry-wide problems by bringing many partners together. SECT-AIR, launched in 2016 and led by Rolls-Royce with 12 other partners, aimed to reduce software development costs through increased automation, greater reuse of artefacts and methods, and reducing software obsolescence.

The SECT-AIR consortium represented around 50% of the aerospace sector and delivered some of the most complex software-intensive, safe and cyber-secure systems in the world. It is driving new technologies and best practice throughout the UK aerospace supply chain.

HICLASS will build on SECT-AIR, allowing development of new, secure, complex, intelligent and internet-connected electronic products that can be affordably certified. It will be three times larger than SECT-AIR and involve twice the number of partners.

Mike Bennett, technology manager at Rolls-Royce: “The ATI's role made SECT-



AIR a game changer, creating a powerful consortium that we could not have formed acting alone as industry. It allowed us to leverage expertise throughout the industry and academia and deliver globally best-in-class solutions to a range of problems faced by the different partners. The collaborative approach has proved invaluable, and I look forward to developing it further in HICLASS.”

Vehicles

The ATI's whole aircraft capability ensures that the UK remains able to understand which technologies to develop and how these may be integrated into a vehicle. Aircraft are becoming more complex and the full potential of new technologies will only be realised through early consideration of their impact at the whole aircraft level. The UK also has real opportunities to design and make new air vehicles for emerging sub-regional and urban markets.

ATI has continued to build its whole aircraft modelling capability, improving access to it and developing its capabilities, for example by incorporating updated and radically new aircraft designs in addition to legacy aircraft.

Aerodynamics has been a strong area. NASA's common reference model aircraft underwent high lift testing at Farnborough, and the EMPAS project (Electric Motor Powered Aero-engine Simulation of Aircraft Models in Wind Tunnels), which introduces an electrically-driven fan to simulate a gas turbine on a model aircraft, also brought Boeing to Farnborough. There has been an increase in projects involving disruptive types of aircraft for example new regional and eVTOL.

Interest in high-value design remains strong. The GEMinIDS project was completed, delivering geometry handling and meshing technology including into integrated design systems. This recognises the increasing commercial demands for higher performing products, requiring more design iterations and simulation. The APROCONE project (Advanced Product Concept Analysis Environment) continued to perform well, improving collaboration and clarity between key players at an earlier stage.

The three priorities for vehicles contained in the technology strategy are:

- **Retain and grow whole aircraft design and analysis capability**
- **Be a key player in the delivery of future sustainable commercial aircraft**
- **Lead the way for sustainable air vehicles for urban and regional markets.**

CASE STUDY

APROCONE

APROCONE (Advanced Product Concept Analysis Environment) is led by Airbus in partnership with Rolls-Royce and GKN. The consortium partners also include Cranfield University, CFMS, the University of Cambridge and MSc Software.

Future aircraft will need to meet higher performance and environmental targets, whilst ensuring that development costs remain affordable. This more challenging market will necessitate new product architectures and many novel technologies.

Transformational change to the design environment in which complex products are defined and evaluated will be required. APROCONE is a key step towards this, providing the basis for significant improvements in development cost and product performance. The project consortium, drawn from experts in aerospace, software industries and academia, has created enhanced design processes and demonstrated such capability in studies into innovative aircraft wing and turbofan engine concepts.

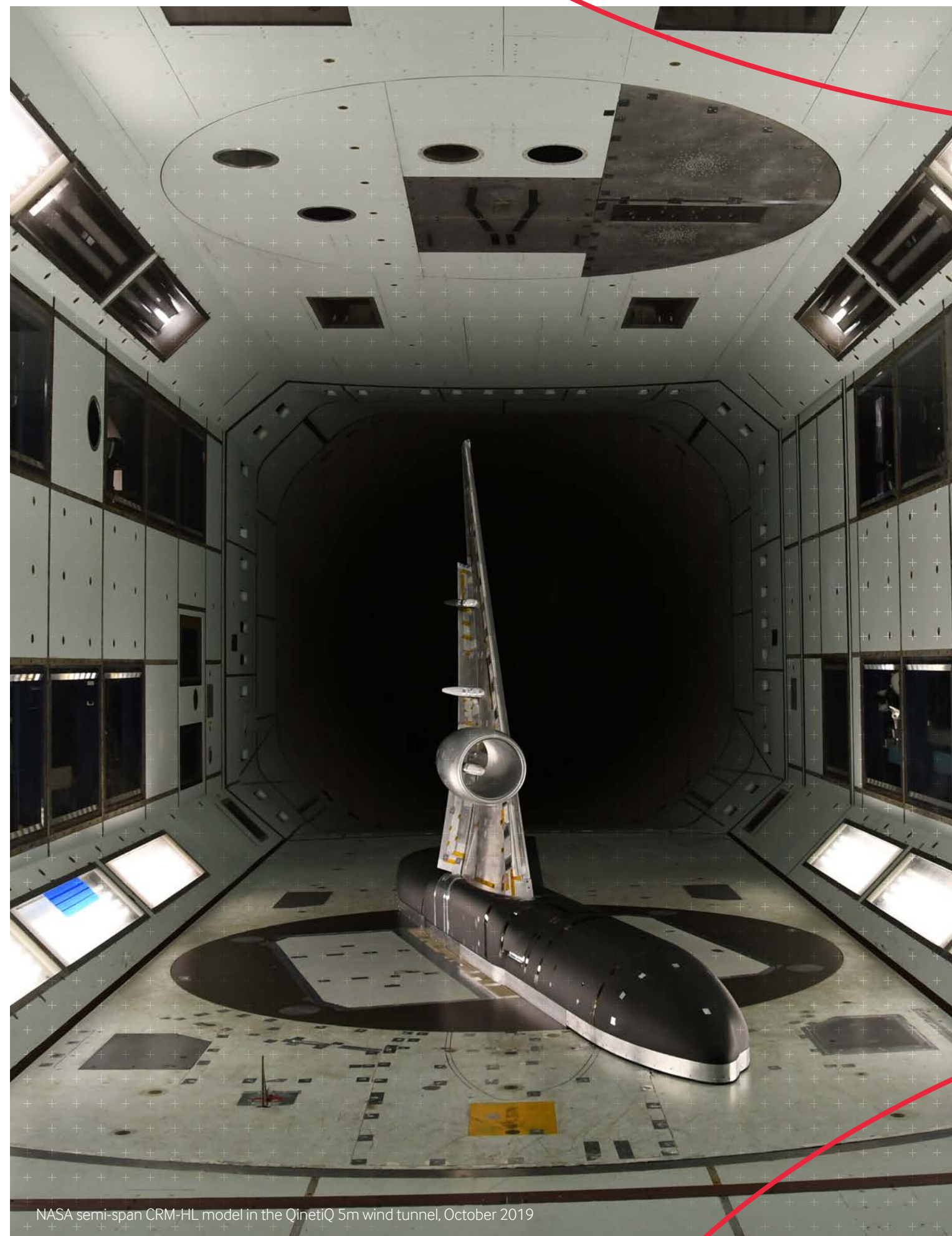
Through a number of realistic use cases, the project has demonstrated significant potential benefits, including:

- **an innovative approach to initial aircraft/engine sizing that is at least ten times faster and could deliver significant fuel burn savings;**
- **manufacturing cost savings without penalising aircraft performance through greater understanding of trades between production tolerances and aerodynamic performance delivered through rapid analysis tools, machine learning, and innovative visual and data analytics;**
- **rapid exploration of whole design spaces (particularly important for clean sheet designs and less-conventional concepts) using innovative design systems to evaluate sets of possible solutions rather than point-based design methods.**

In addition to improving inter-organisational collaboration, APROCONE has also increased efficiency within organisations through innovative ways of working, data sharing and traceability between departments.

“High-value design is undergoing a revolution throughout industry. APROCONE is charting the way for aerospace, proving the power of collaboration, and opening up ambitious new possibilities for future products.”

Martin Aston
Senior Manager at Airbus.



NASA semi-span CRM-HL model in the QinetiQ 5m wind tunnel, October 2019

THE ATI'S IMPACT

Through its aerospace R&T funding programmes, the ATI demonstrates impact in the following areas:

Technology

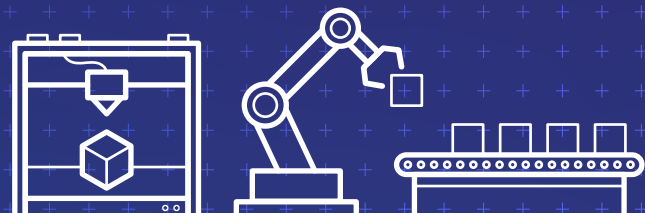


enable sustainable growth of air transport

ATI projects will deliver greener, safer and affordable aircraft to enable more people to benefit from air transport

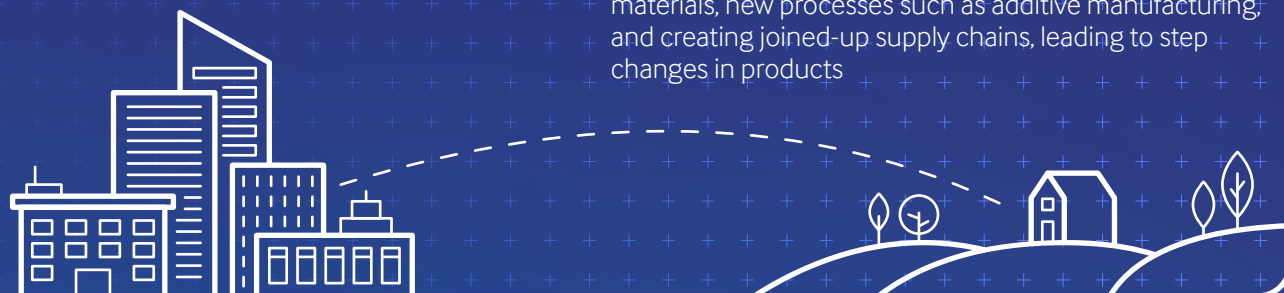
increase the safety of air transport

better technology for product design, communications, sensors, cockpit controls and displays, structures and manufacturing are driving up safety in the skies



enable better products and processes in aerospace

the ATI programme is pioneering new lightweight materials, new processes such as additive manufacturing and creating joined-up supply chains, leading to step changes in products



enable new markets in air transport

developments in autonomy and electrification make new forms of air transport possible, potentially revolutionising urban and regional mobility



exploit technology developed in other sectors and create technology useful to other sectors

ATI projects involve companies from automotive, software and other sectors as well as universities and research organisations



other sectors benefit four times more from aerospace R&D than aerospace itself does

Sustainability

Developing greener aircraft and manufacturing processes

Rolls-Royce's Ultrafan gas turbine will achieve a 10% reduction in greenhouse gas emissions over previous generations of engines

ATI's E Fan-X, HyFlyer, ACCEL and FRESSION projects will usher in electric flight

90% of the ATI's projects are promoting sustainability



Economy



increasing activity in a high-value sector

the ATI programme will create 95k jobs and generate a return of £114bn by 2035

reducing regional economic disparities

90% of aerospace is based outside London and South East. ATI projects are carried out all around the country from Inverness to Plymouth



increasing productivity in the economy

aerospace productivity over the 10 years 2009-19 has grown by 28.6% compared with 8.8% in manufacturing and 7.7% for the whole economy. Aerospace growth is around 3 times higher than manufacturing and the whole economy over this 10 year period. The ATI programme will grow the workforce and deliver higher-value products.



increasing exports and inward investment

UK aerospace exports over 90% of its output. The ATI programme is developing future products for the global industry



attracting inward investment by positioning the UK as a hub for aerospace R&D

the world's leading aerospace firms are participating in the ATI programme and investing in the UK



increasing levels of R&D in the UK

the government's investment of £150m per year in the ATI programme leverages seven to 12 times as much investment from industry



increasing skills levels in the UK

the ATI programme involves highly skilled engineers and scientists, throughout industry and academia, generating future work for the sector's expert workforce



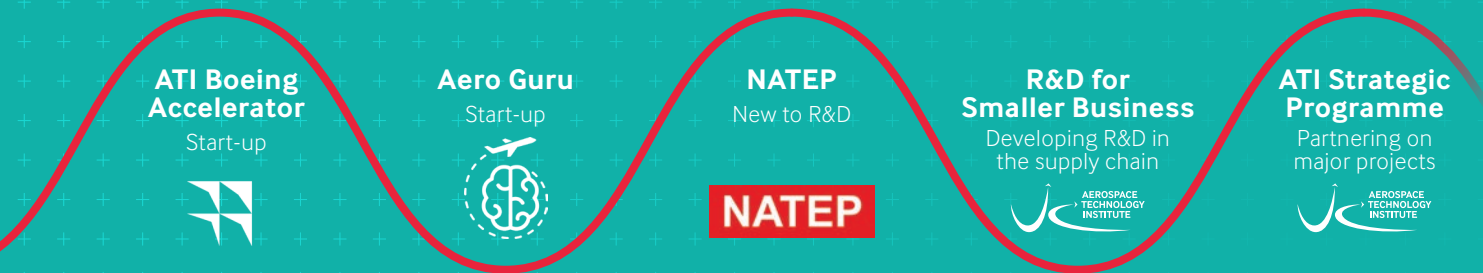
expanding the capabilities of small and medium-sized firms

142 SMEs are engaged in ATI projects

SUPPLY CHAIN

A healthy supply chain is critical to realising the ATI's mission. New capabilities established through technology projects need to flow through the sector and into other sectors if they are to be exploited effectively and deliver their full economic value.

Working with the supply chain is therefore an important part of the Institute's activity and achieved greater prominence in 2018/19 through two new initiatives – the ATI Boeing Accelerator, and Aero Guru. With these initiatives, the ATI portfolio of support covers companies ranging from start-up phase to fully-fledged partners in major projects.



E-Fan X supply chain event



Supply chain consortium-building event

ATI Boeing Accelerator

One of the most significant events of 2018/19, the Institute teamed up with Boeing and GKN to launch a two-year programme to support the growth of start-ups in the UK aerospace industry. The programme is highly competitive and intensive. Based in central London, the accelerator's first cohort will consist of nine companies who will be together from January to April 2020.

They will be mentored by leaders from Boeing, the ATI and sponsoring partners on how to grow their businesses and develop their skills, including connecting them with funding opportunities and routes to commercialising their ideas. The themes for the first cohort are Industry 4.0 and sustainability. The companies selected have the option to receive up to £100,000 in equity funding.



This initiative generated huge interest amongst start-ups, with fewer than one in ten applicants being selected for the programme. The successful companies represent a broad spectrum of capabilities; they come from all around the UK and from overseas. Early indications are that both participants and sponsoring companies have gained significant insights into new ways of introducing innovation into aerospace.



Aero Guru

Starting in July 2019, the Institute launched a series of events entitled "Aero Guru" for aerospace entrepreneurs to present their ideas to a panel of experts drawn from potential customer organisations as well as from disciplines relevant to business development such as finance and technology. Taking place in an informal and supportive atmosphere, the presenters receive feedback on their ideas and suggestions as to how to develop them.

The events introduce the Institute and other panel members to potential new entrants to the sector and highlight less visible areas of technology activity that may be important in the future. Events have occasionally focused on particular themes such as start-ups, and businesses founded by women.



NATEP (National Aerospace Technology Exploitation Programme) targets companies inexperienced at R&D. It helps fund small projects and provides in-kind support to set up and run them. It also engages potential customers (or end users) interested in exploiting the resulting technology. NATEP ran initially from 2013 to 2017, after which a second phase worth £8m was announced. This phase resulted in 35 projects in multiple product areas involving 96 funded partners and 53 end users across England and Scotland.

These projects are now complete, coming in on time and budget, and exceeding the targets for contributions by end users as well as jobs secured.

A third phase of the NATEP programme was launched in August 2019 with £10m public support through the ATI budget. This phase will consist of several calls, two of which have already opened, and it aims to create over 60 projects over four years.



CASE STUDY
Breakthrough in High-Strength Additive Manufacturing Powder

Aeromet with partners Phoenix Scientific Instruments (PSI), Renishaw and Rolls-Royce as the end user, has propelled an advanced aluminium powder from early-stage development into the additive manufacturing (AM) market.

Now the innovative high-strength A20X powder is poised for use in serial production with aerospace OEMs and Tier 1 suppliers. A20X has a refined microstructure and unique solidification mechanism for greater strength and better fatigue and thermal characteristics. The project set out to optimise the casting alloy into a powder to maintain the alloy's advanced properties at room temperatures and above.

PSI contributed its knowledge of processing and handling aluminium powders for AM, converting the alloy through vacuum induction melting (VIM) furnaces with inert gas atomisation. The powder was further developed using Renishaw's AM systems.

Aeromet has set up a business unit specifically to exploit this alloy and the project has enabled them to work with the right people and technologies, speeding up progress.

"Rolls-Royce is excited to participate in this project and contribute to the development of this promising new aluminium alloy. NATEP is a proven programme with a strong track record of supporting innovation in the UK aerospace supply chain." - Paul Murray, Principal Materials Engineer at Rolls-Royce.

"The progress we've made under NATEP has rapidly moved our concept from developing a metal power for the AM industry to commercialisation. Powder is the key to our growth into high-tech manufacturing and AM. NATEP has been a wonderful vehicle for moving us forward."

Mike Bond
Director of Advanced Material Technology for Aeromet.

R&D for Smaller Business (formerly Collaborative R&D)

The first call for applications was launched in October 2018, with the aim of providing smaller businesses with a sizeable fund.

Thirty-seven applications were received, of which 16 were awarded funding. Further calls will follow.

Successful projects progressed to contract in spring 2019.

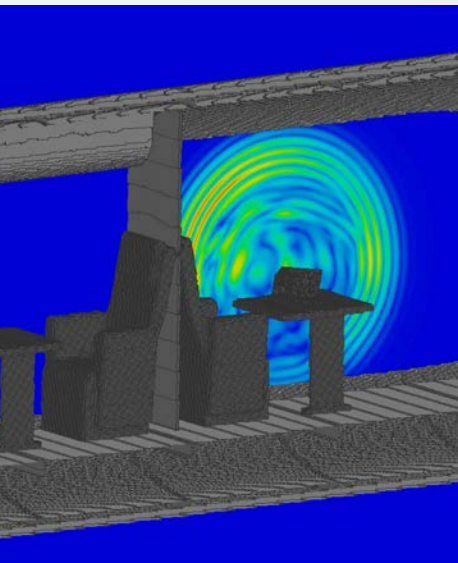
- Three priority areas were identified:
- **Collaborative fast-track – to support SMEs to develop and accelerate technologies with near-term application**
 - **Collaborative R&D – for longer term R&D projects**
 - **Collaborative feasibility studies – for new, disruptive or radical concepts**

The ATI exists to boost UK aerospace and the UK economy. International collaboration however is essential in a global industry, particularly where, as in the UK, much of the industry is headquartered overseas.

As well as its many connections with overseas companies, the ATI engages with various organisations to understand, influence, and facilitate UK participation in the international aerospace research agenda. These include the Advisory Committee on Aviation Research and Innovation in Europe (ACARE), the Science and Technology Commission led by the European trade association ASD, the Group for Aerospace Research and Technology in Europe (GARTEUR), and the International Forum for Aviation Research (IFAR). We maintain close links with international aerospace research organisations such as NASA and Germany's DLR.

The bulk of international R&D collaboration in aerospace takes place under the European Union's Framework programmes. Brexit has therefore been an important focus for the ATI; the Institute urges continued UK participation in EU initiatives after the transitional period ends in December 2020. The Institute contributed to the review by Professor Sir Adrian Smith and Professor Graeme Reid on future frameworks for international collaboration on research and innovation; this recognised the value of initiatives such as the EU's Clean Sky joint undertaking.

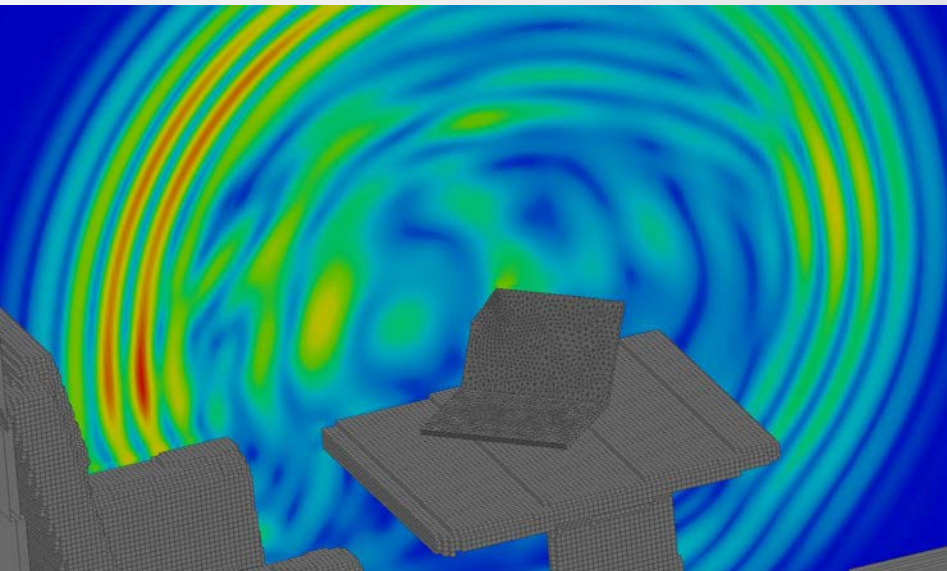
On bilateral collaborations, a joint UK-Sweden Eureka call took place resulting in four projects. A small-scale initiative, this nevertheless proved the feasibility of the approach. It brought new players together, covered ambitious topics, and demonstrated mutual benefit between the countries. A further call with Sweden has been launched, and work progresses towards a call with Canada.



CASE STUDY
EMSCAT

EMSCAT (ElectroMagnetic Analysis of the Smart and Connected Aircraft) is a partnership between ESI Nordics and International TechneGroup Ltd (ITI). It aims to develop a suite of leading-edge software tools for the computational electromagnetic analysis of integrated sensors and electronic components within an aircraft.

Testing electromagnetic interference and compatibility (EMI/EMC) for electronic components in an aircraft is costly and complex, hence the high level of interest in simulation-based solutions.



"There is a clear benefit from working with the Swedish project partner. Our respective technologies are dependent upon each other for eventual commercialisation and this project enables us to work together to ensure future success. Our Swedish partner is effectively the end-user and route to market for the new technology that ITI is developing, and the project collaboration brings the benefit of jointly defined requirements and proactive feedback from domain experts as the technology matures."

Andy Chinn
MD, ITI

COMMUNICATIONS AND OPERATIONS REPORT

Innovative disruption was a key theme for the ATI’s communications and engagement activities during the year, building on the Institute’s work to drive innovation at the heart of traditional markets. The success of the Aero Guru events helped pave the way towards the establishment of the ATI Boeing Accelerator, by demonstrating to the industry how start-ups could help deliver commercial opportunities to larger businesses.

Against the backdrop of a rapidly changing world, the ATI also focused on driving interactions which could have a tangible and positive impact on the aerospace industry, including solutions to the global challenges of sustainability, mobility and competitiveness. The landmark CTO statement from the Paris Airshow ensured that sustainability became a leading driver for positive change, and the ATI’s latest technology strategy for UK aerospace reinforces this.

The strategy, *Accelerating Ambition*, was developed during the year and published at the ATI Conference in November 2019. Alongside the strategy, development work began on the ATI’s website to better reflect the organisation and its mission and allow users to more easily navigate their way through funding governance, publications and updates from the ATI.

The following three INSIGHT papers were published and can be downloaded from www.ati.org.uk



PERSONNEL

This year the ATI welcomed new colleagues into all business functions including two new heads of technology in our vehicles and aerostructures teams, and two heads of strategy who focus the ATI effort in engaging the supply chain and bringing the innovation strategy to life. We also saw change in the communications and finance teams, bringing the total number of employees to 32, with a 60:40 male:female gender balance. Those joining the ATI bring significant skills and experience from multiple sectors

including aerospace, defence, education, automotive and consultancy. This creates diverse ways of thinking within the team. Many staff have been through training schemes including apprenticeships and graduate schemes, and often give back to those communities through mentoring and STEM initiatives. We continue to support the Women in Aviation and Aerospace Charter initiative, and career opportunities with the ATI continue to attract high calibre candidates from an array of backgrounds.

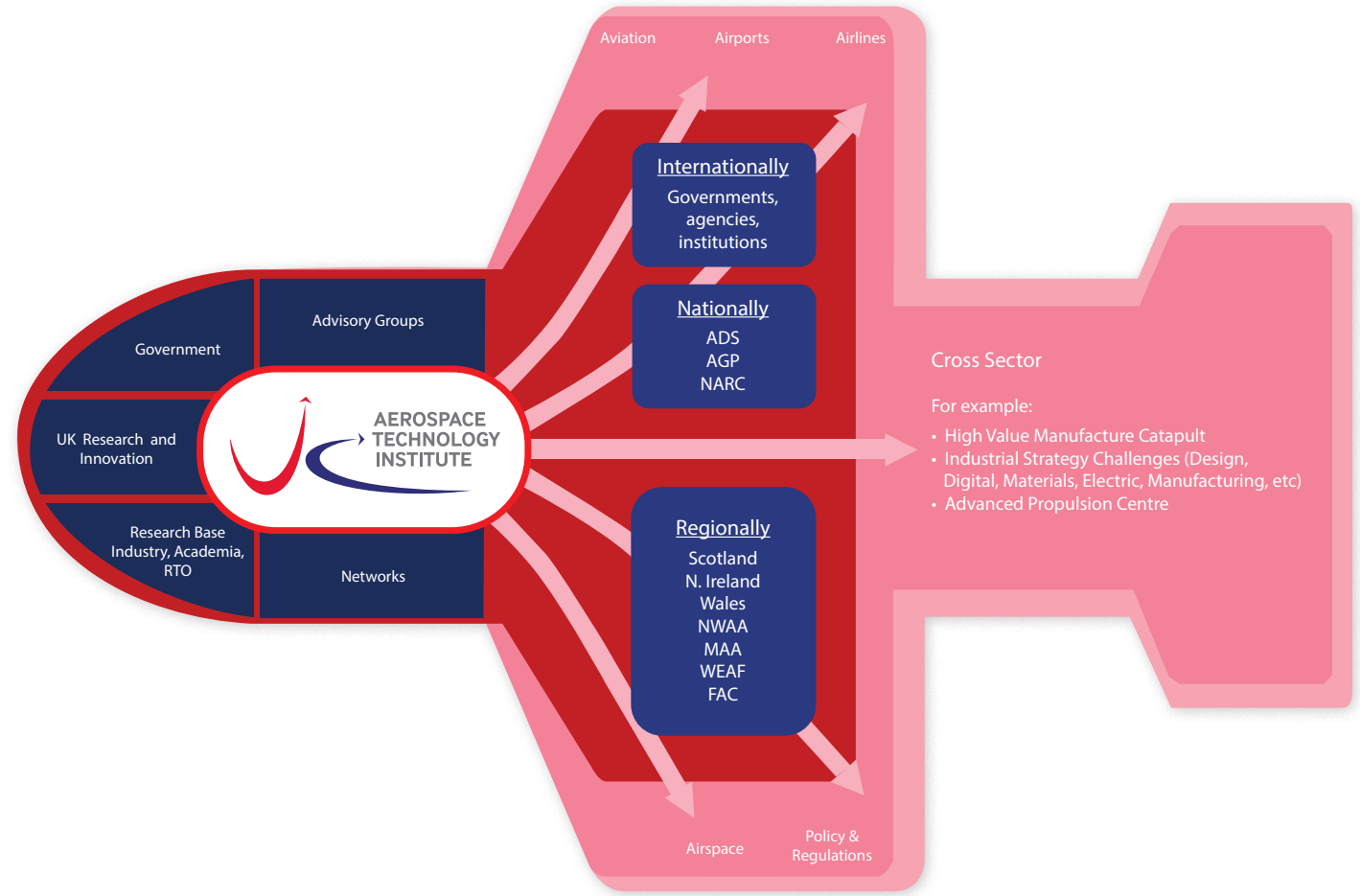
FINANCE

The ATI is a not-for-profit organisation, funded jointly by a government grant and industrial contributions. Total expenditure for the year was £5.163m, covering the costs associated with the ATI’s specialist activities in R&D and stakeholder engagement, personnel and premises.

The total expenditure for 2018/19 represents a saving of nearly £300k from the annual budget, which continues to reflect the ATI’s prudent approach to financial outlay whilst achieving maximum value for money.

ATI STAKEHOLDER ENVIRONMENT

The ATI is a non-public body operating in a complex environment with many partners and stakeholders in industry, academia, and government, based in the UK and overseas.



GLOSSARY

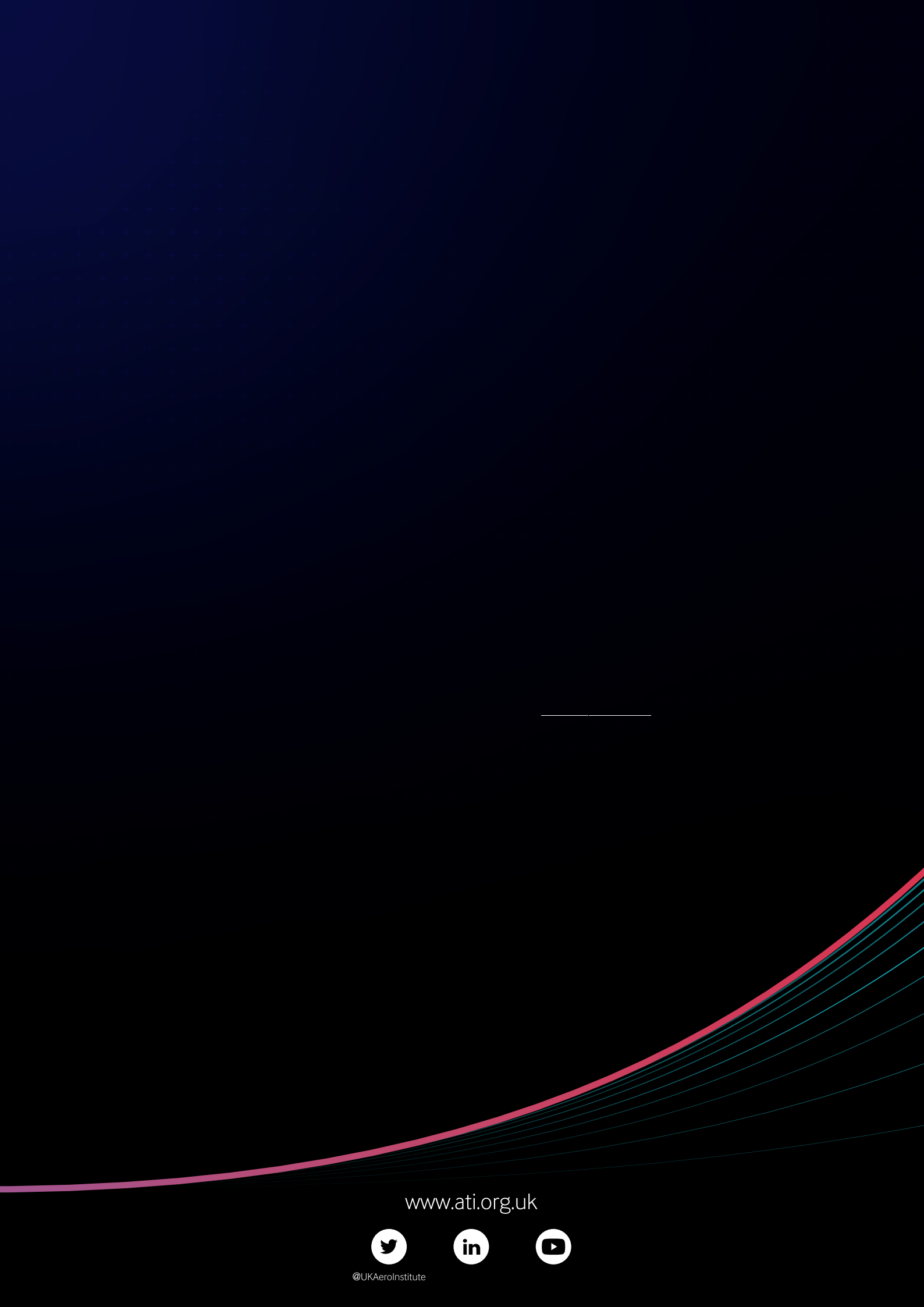
ACARE	Advisory Committee on Aviation Research and Innovation in Europe
ACCEL	ATI-supported project: Accelerating the Electrification of Flight
Advance3	ATI-supported project: an advanced demonstrator engine
AGP	Aerospace Growth Partnership
AM	Additive manufacturing
APROCONE	ATI-supported project: Advanced Product Concept Analysis Environment
ASD	AeroSpace and Defence Industries Association of Europe
ATI	Aerospace Technology Institute
BEIS	Department for Business, Energy and Industrial Strategy
CTI	ATI-supported project: Carbon Titanium Fan
CTO	Chief Technology Officer
DfT	Department for Transport
DigiProp	ATI-supported project: Digital Propulsion
DIT	Department for International Trade
DLR	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Centre)
DRAMA	ATI-supported project: Digital Reconfigurable Additive Manufacturing facilities for Aerospace
E-Fan X	ATI-supported project: hybrid-electric aircraft demonstrator
EMI/EMC	Electromagnetic interference/compatibility
EMPAS	ATI-supported project: Electric Motor Powered Aero-engine Simulation of aircraft models in wind tunnels
EMSCAT	ATI-supported project: ElectroMagnetic Analysis of the Smart and Connected Aircraft
eVTOL	Electric vertical take-off and landing aircraft
FRESSON	ATI-supported project: aiming to design, manufacture and integrate a hybrid-electric propulsion system into a 9-seat Britten-Norman (B-N) Islander aircraft
GARTEUR	Group for Aerospace Research and Technology in Europe
GEMinIDS	ATI-supported project: extending geometry handling and meshing to integrated design systems
HICLASS	ATI-supported project: High-Integrity, Complex, Large, Software and Electronic Systems
HyFlyer	ATI-supported project: a hydrogen fuel cell powertrain for light aircraft
IFAR	International Forum for Aviation Research
Industry 4.0	The fourth industrial revolution, digitalising manufacturing technologies and processes
NATEP	National Aerospace Technology Exploitation Programme
NCC	National Composites Centre
OEM	Original equipment manufacturer
R&D	Research and development
R&T	Research and technology
SECT-AIR	ATI-supported project: Software Engineering Costs and Timescales – Aerospace Initiative for Reduction
SMEs	Small and medium-sized enterprises
SVVP	Systems Virtual Validation Platform
UKRI	UK Research and Innovation
VIM	Vacuum induction melting
WIAA	Women in Aviation and Aerospace

RESOURCES



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