

INSIGHT

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Introduction

The Aerospace Technology Institute (ATI) mission is: through strategic investment into differentiating technologies, the ATI aims to secure the full economic potential of the UK civil aerospace sector. The level R&D expenditure is a lead potential indicator of the industry's innovation performance and future market performance. Technological leadership is crucial to securing future contracts on new aircraft platforms – the benefits of which are long-lasting.

By boosting R&T investment through the ATI, the UK offers companies aspiring to the frontier of innovation an opportunity to accelerate progress in advance of the next wave of programmes. This study set out to understand the aerospace R&D landscape and how it has evolved. This includes an extensive and detailed review of international and UK aerospace company accounts, to identify global trends and which companies are growing their international and UK R&D footprint.

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The Economics of Aerospace: **THE EVOLVING AEROSPACE R&D LANDSCAPE**

EXECUTIVE SUMMARY

The UK Aerospace sector is healthy. This is evidenced by a strong aircraft order backlog; as well as UK aerospace turnover, value added and investment reaching an all-time high in 2016. But it is no time for complacency - aerospace growth is strong throughout the world and opportunities are on the horizon that will materially alter global market share. UK businesses need to keep investing to maintain their advantage.

Innovation is the most crucial factor in driving productivity and economic growth. Relative to peers, the UK underinvests in R&D, a fact behind Government's target to increase UK R&D to 2.4% of GDP by 2027. Achieving this depends on companies choosing to invest much larger amounts in R&D. Government research funding helps this happen by accelerating technology for exploitation in the development of new products, attracting much larger private investment and creating competitive advantage.

The aerospace industry is experiencing a lull in aircraft development following recent new product launches. While this cycle puts downward pressure on R&D overall, it is an ideal time to undertake ambitious technology research and develop future capabilities. This is central to ATI's mission. The fruits of these investments will only be fully realised when major programmes are launched.

Given the market context, importance of R&D to the economy and importance of ATI's role, this study set out to understand the aerospace R&D landscape and how it has evolved. A review of more than 3,000 global and UK aerospace company accounts found:

- The top-10 global aerospace companies all have UK operations, each employing over 1,500 people.
- The level of self-funded R&D conducted by the top-10 aerospace companies varies greatly.
- Several global aerospace companies have visibly increased their UK self-funded R&D footprints including Thales, Boeing, Rolls-Royce and Meggitt, with substantial investments in UK facilities.
- Over 450 UK aerospace companies conduct R&D, exceeding £2 billion in self-funding in 2016.
- Over 60% of supply chain R&D was attributable to companies with a primary sector classification of aerospace, indicating the potential for technology spillover.
- Self-funded R&D from the top-15 UK aerospace companies totalled £1.3 billion, indicating a relatively high-level of concentration of sector R&D
- R&D intensity (R&D/sales) varies significantly in the top-15 UK aerospace companies: Rolls-Royce, Bombardier, General Electric, Thales and Zodiac invest over 8% of UK sales on R&D.
- Several high R&D-intensity aerospace companies were identified including Hybrid Air Vehicles, XMOS, Bladon Jets, Metalysis, Ilika Technologies and Oxis Energy which all invest over 20% of their UK sales in R&D.

Most of the companies identified in the study as performing significant levels of UK aerospace R&D, access some level of UK government grant funding for R&D. However, the analysis has also identified companies with relatively low-levels of UK R&D that are failing to exploit the UK's exceptional innovation ecosystem and develop global technological advantage. This could present further opportunity for ATI to extend the impact and influence of UK research and the UK Aerospace R&T programme.

The real test of UK success will come in securing high-value content on the next wave of big programmes, the first impact of which will be much higher levels of R&D activity to service those opportunities. These programmes will be built of the back of new research and technology, underscoring the importance of technological leadership and competency.

INTRODUCTION AND METHODOLOGY

The ATI's mission is: through strategic Investment into differentiating technologies, the ATI aims to secure the full economic potential of the UK civil aerospace sector. The level and nature of R&D is one potential indicator of the industry's innovation performance, influence of ATI and is a leading indicator of market performance. In aerospace, technological leadership is crucial to securing future contracts on new aircraft platforms – the benefits of which are long-lasting.

Today, the industry cycle is between major aircraft programmes, a time when R&D expenditure might normally decline. By boosting aerospace R&T investment, the UK offers companies aspiring to the frontier of innovation an opportunity to accelerate progress in advance of the next wave of programmes.

Given the market context, importance of R&D to the economy and dependency on ATI's role, this study set out to understand the aerospace R&D landscape and how it has evolved. This includes an extensive and detailed review of international and UK aerospace company accounts, to identify global trends and which companies are growing their international and UK R&D footprint.

With the support of Bespoke Benchmarking Limited during 2018, more than 3,000 relevant company accounts were scanned to identify how many were conducting and reporting self-funded R&D investment. The 30 most significant companies were selected for more detailed time series analysis. This focused on self-funded R&D expenditure, as this data is widely reported in companies' annual accounts. Some companies also report customer or government funded R&D, but not routinely.

The aerospace relevant R&D covered in this paper includes both civil and defence aerospace; as well as space. However, ATI and the associated UK Aerospace R&T funding, is specifically focused on civil aerospace technology, including technologies with multi-sector use. Other reports, such as the EU Industrial R&D Investment Scoreboard¹ or the PWC Global Innovation 1000 Study², exist but are not aerospace specific.

This study's analysis includes companies such as General Electric, GKN and Honeywell – sometimes overlooked in aerospace specific reports, due to their significant revenues in non-aerospace divisions. The analysis attempts to break out the aerospace content from the company annual accounts, as much as possible, from other corporate divisions as diverse as energy, medical, rail, automotive, and industrial machinery, and even the non-aerospace defence and security activities³. This Insight Paper aims to understand the detailed trends in global and UK aerospace R&D investments, thereby:

- putting the UK aerospace sector picture into a global context
- identifying the drivers behind major R&D investments
- identifying the companies that are significantly increasing their R&D investments
- understanding the UK aerospace R&D investment landscape
- informing recommendations on how to further develop the UK aerospace sector

¹The EU Industrial R&D Investment Scoreboard 2017 provides a ranking for self-funded R&D investment for the top 2500 companies in the world and top 1000 companies in the EU; <http://iri.jrc.ec.europa.eu/scoreboard17.html>

²The PWC Global Innovation study looks at the 1000 largest R&D spenders <https://www.strategyand.pwc.com/innovation1000>

³Some companies such as General Electric, Leonardo Rolls-Royce report separate divisional data for aerospace R&D, but for United Technologies, Honeywell, Bombardier and Lockheed Martin this has been estimated from the sales breakdown. Note: Rolls-Royce does not provide a detailed geographical breakdown in its accounts, so the UK share has been estimated.

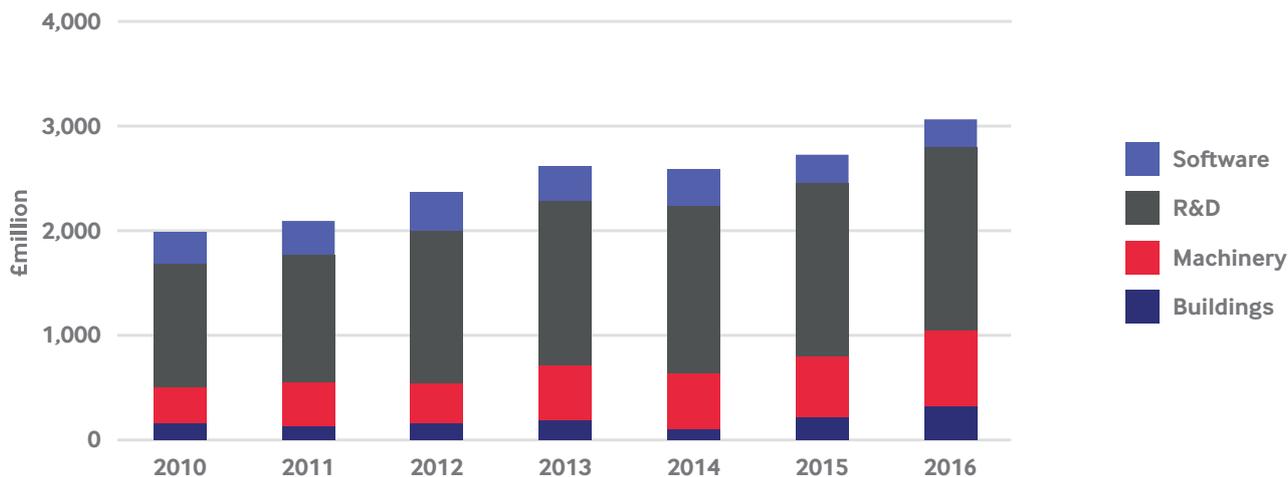
1: The UK Aerospace Sector is healthy, but global competition and risk has intensified

Driven by strong economic growth in emerging markets, demand for global air travel is on the rise. There are over 20,000 commercial aircraft and 15,000 business jets currently in operation globally, and this fleet is expected to double over the next 20 years. The estimated value of new deliveries (between 2014 and 2035) totals US\$6.2 trillion, with a further US\$1.9 trillion of associated through-life-support opportunities⁴. More than 80% of the market value is for wide and narrow body aircraft.

With a significant aircraft order backlog for wide and narrow bodies, and their associated components, the UK aerospace sector has continued to grow. UK aerospace turnover and value-add reached almost £35 billion and £12 billion respectively in 2016⁵. The UK has one of the largest aerospace sectors in the world and value added for the UK aerospace sector has grown by almost 9% per year between 2010 and 2016. However, global aerospace sector growth is strong, and a higher rate of growth is needed to increase the UK's market share.

UK aerospace sector investment hit an all-time high in 2016, reaching £3 billion for the first time, growing at 7.5% per year since 2010 (Figure 1). Investment in 'intangible' assets, such as R&D and software, accounts for almost two thirds of total UK aerospace sector investment, with R&D itself representing over half of the total alone. It is worth noting that many of the major aerospace companies based in the UK (and around half of the total amount invested) are multi-nationals able to invest anywhere in the world.

Figure 1: UK Aerospace Sector Investment, 2010-2016, £ million



Source: ATI Analysis of ONS Gross Fixed Capital Formation Data, 2016

Note: Data is for the 'other transport equipment' sector, but excludes MRO

Underpinning this growth in UK aerospace activity is the desire of global companies to invest in the UK. Despite the current uncertainty associated with the implications of Brexit on the future business environment (EASA, trade, customs, R&D participation), the UK remains an attractive place to invest. Other competitive threats include the rise of China and growing tensions around trade being driven out of the US.

2: R&D is critical to UK economic success, and a thriving aerospace sector will boost it

Innovation is the most important factor in driving productivity and economic growth. The UK urgently needs to boost its productivity, which has flatlined since 2008, widening the gap to peer countries⁶. Without growth in productivity, UK living standards cannot increase in the long-term.

It can be thought of as the third factor of production: the accumulation of innovations over time is like the stock of knowledge – the intellectual capital – that has been built up across the economy. This enables companies to combine labour and capital with increasing efficiency, leading to increased production. Innovation is a process, starting with the generation of ideas, evolving through the embedding of those ideas in technology, and bringing those ideas to market in the form of new or improved products or services. Innovation also includes changes to manufacturing processes, culture and business models.

Innovation in its broadest sense – measured by growth in total factor productivity (TFP) – is estimated to account for 70% of long-run economic growth⁷. Other studies seek to understand the impact of investment in research and innovation versus other intangible capital investment (brands, competences, training etc.) and find that 40% of UK productivity growth comes from research and innovation⁸.

The returns to innovation can be very large. However, most of the returns to investments in innovation accrue not to the original innovator, but to the wider economy. The evidence shows that the social returns to innovation are typically 2-3 times larger than the private returns⁹. Aerospace examples of this in practice are composites, additive manufacturing and electrical systems – all with very widespread potential applications, both within aerospace – and in a variety of industrial sectors. This phenomenon is known as technology spillover and is a "market failure", meaning companies tend to underinvest in innovation in the absence of government incentives since they do not account for the wider economic returns generated by their investments.

⁴Source: ATI Market Opportunity Analysis, 2016

⁵ATI Analysis of ONS Annual Business Survey and National Accounts Data, 2016

⁶HM Treasury (July 2015), *Fixing the Foundations: Creating a More Prosperous Nation*

⁷ATI (2016), *Raising Ambition for UK Industrial Strategy – Lessons from Innovation in Aerospace*

⁸European Commission (2017), *The Economic Rationale for Public R&I Funding and its Impact*

⁹Fathom Consulting (2015), *How Government can make a difference – assessing the potential impact on the UK economy of investing in UK Aerospace Technology, through the ATI*

The UK is generally thought of highly as a country that is strong for its innovation and competitiveness. It currently ranks 7th on the World Economic Forum (WEF) Global Competitiveness Index for 2017-2018¹⁰ and 5th on the World Intellectual Property Organization (WIPO) 2017 Global Innovation Index¹¹. The UK consistently scores well for its technological readiness, business tax regulations, quality of government institutions, availability of human capital and having a sophisticated business sector.

But, as identified in the UK Government's Industrial Strategy White Paper, the UK underinvests in R&D relative to international peers. In 2015, the UK invested around 1.7% of its GDP in R&D, putting it in 20th position in the OECD and well below the OECD average. As part of the White Paper, the UK Government set a target to increase UK R&D investment to 2.4% of UK GDP by 2027, a longer-term target of 3% and announced £7 billion of additional government funding over 5 years to support this aim. However, greater government funding for R&D alone is not going to achieve this goal – it requires private companies to invest much larger amounts in R&D, as this paper will show.

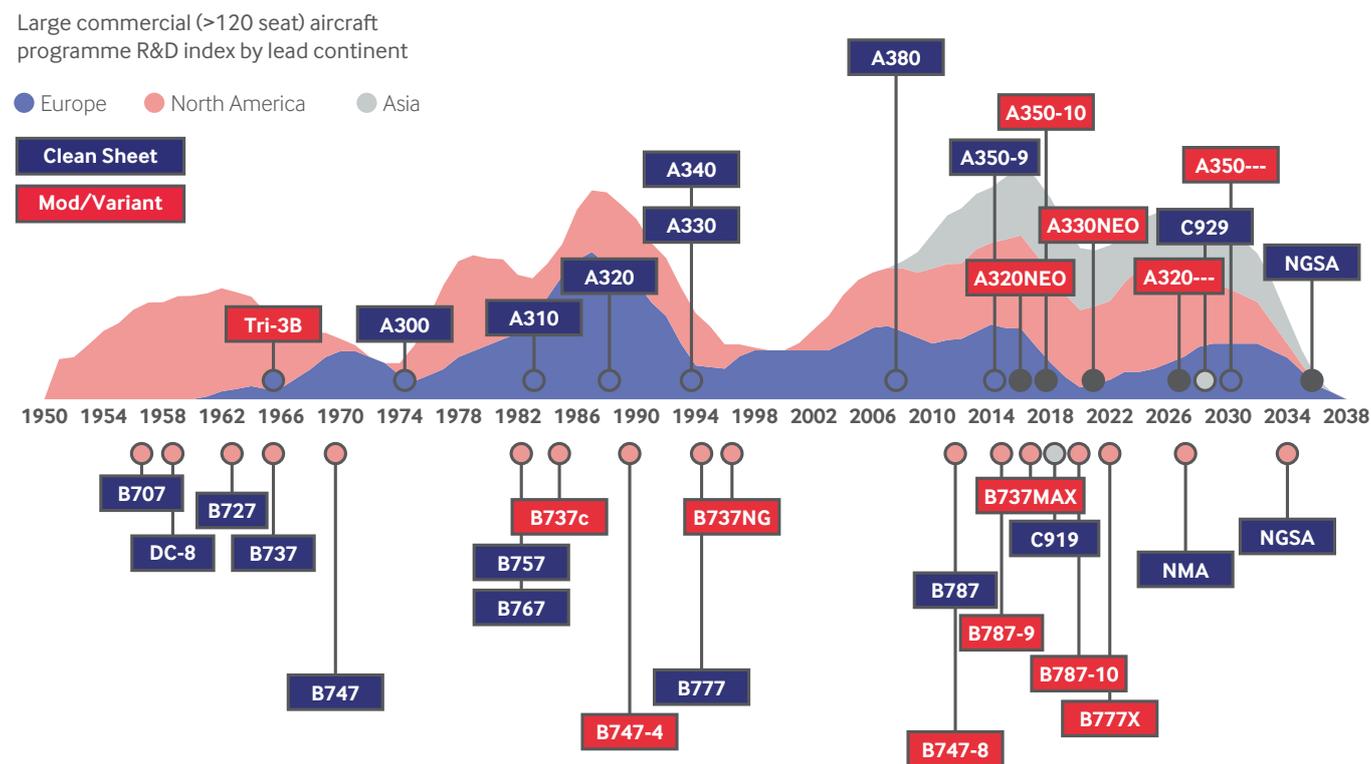
It is clearly encouraging to see strongly positive trends in UK aerospace sector turnover, value added and R&D investment, but it is difficult to attribute this to the impact of the UK Aerospace R&T Programme. Nonetheless, several companies testify to the impact that multi-year grant-funded R&T projects have on securing internal corporate commitments to build UK industrial and technological capabilities.

Whilst the UK Aerospace R&T Programme has already invested £2 billion since 2013, it is still quite early to witness the full impact of this in companies' self-funded R&D investments. This is because relatively smaller investments in R&T proceed the larger investments in self-funded R&D, much of which is also contingent on the launch of major international aircraft programmes with uncertain timing. ATI analysis reveals that R&T is typically around 5-10% of a company's self-funded R&D expenditure. Some UK Aerospace R&T projects that have now closed are already driving further self-funded R&D. However, much of the portfolio consists of live projects still in progress that are focused on programmes yet to launch. Most of these projects target opportunities around 2025-2030, for new aircraft and engine programmes.

The length of time between all-new civil aircraft programmes has been increasing, from around 8 years in the 1960s and 1980s to 12 years in the 2000s as illustrated in Figure 2. Instead of developing all new aircraft, airframers have been able to meet market needs by technology insertion (e.g. new engines, winglets) or creating variants (e.g. stretch fuselages, long-range).

The development costs associated with these programmes are much lower than all new aircraft. Clean-sheet aircraft programmes typically cost between \$10 and \$15 billion, whereas variants and new engine adaptation cost between \$1 and \$5 billion. The analysis shown in figure 2 indicates a trending down of large civil aircraft programme R&D through to 2020, recovering and rising through to around 2026 to support new projects. The analysis also suggests a shift in this programme activity from Europe to North America and Asia, that rebalances in 2030. This raises several important implications for UK aerospace such as capability sustainment, increased commercial significance of new programmes, greater delay and risk to realising returns from research, and shift in trade geographies for example.

Figure 2: Overview of historical and future large civil aircraft development programmes



Source: ATI analysis of historical large civil aircraft programmes and future market speculation (Future speculation includes modifications and clean sheet designs by Boeing and Airbus beyond 2022)

The ATI's goal is to help UK aerospace companies prepare technologies for future aircraft programmes that are competitive and secure future contracts for the UK and lead to greater economic activity for the UK aerospace sector. These can have very long-lasting benefits. Given that the industry is currently between new aircraft platforms, it is an ideal time to undertake ambitious R&T activity, to position the sector for future platforms.

¹⁰World Economic Forum (2017), *The Global Competitiveness Report 2017-2018*

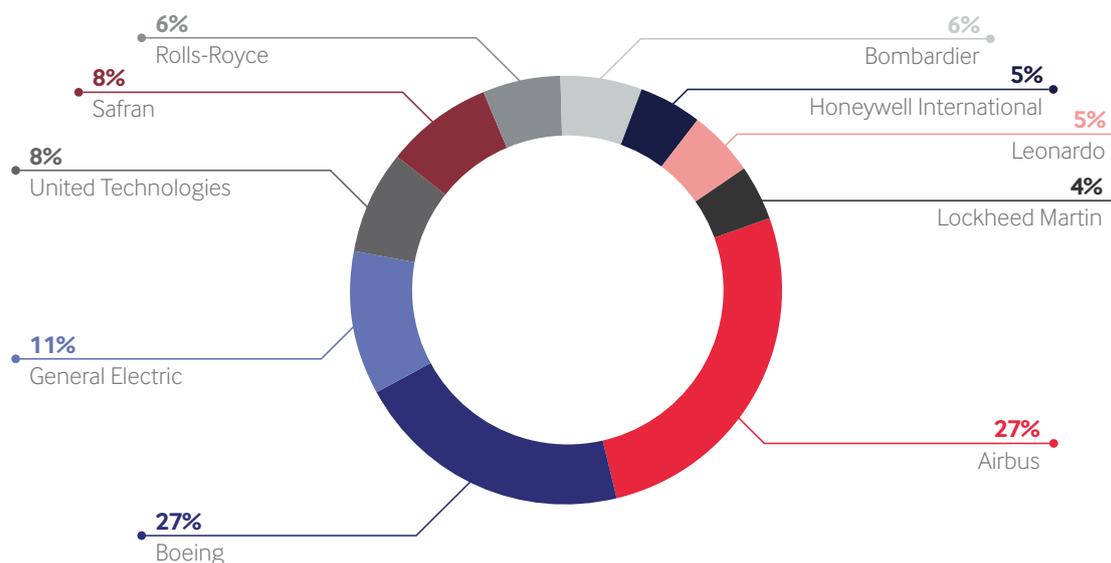
¹¹Cornell University, INSEAD, and WIPO (2017), *The Global Innovation Index 2017*

¹²UK Government (2017), *Industrial Strategy Building a Britain fit for the future*

3: The top-10 global aerospace companies all have UK operations, with indications of growing preferences to invest in the UK's R&D ecosystem

From analysis of more than 3,000 global and UK aerospace companies self-funded R&D expenditure, ATI created a top-10 global aerospace ranking shown in Figure 3. Airbus and Boeing are firmly in first and second place respectively for global self-funded aerospace R&D, accounting for almost 50% of the total self-funded R&D conducted in the top-10. For most of these top-10 companies, self-funded aerospace R&D expenditure is around 4-6% of total sales.

Figure 3: Top-10 Company Global Total R&D self-funded, £ million, Aerospace Level, 2016



Source: ATI Analysis of Aerospace Companies Global Accounts, 2016

All of the top-10 companies in figure 3 have a UK footprint (Figure 4), employing more than 1,500 people each in their UK aerospace operations. All of these companies are investing in aerospace R&D within the UK, although this varies greatly by company between 3% and 6% of sales but also across years (Figure 5).

Whilst, Rolls-Royce conducts over 80% of its global R&D activity in the UK, the figure is much lower for the rest of the top-10. Airbus is next, with around 12% of its global R&D footprint based in the UK, followed by Bombardier (8.6%), United Technologies (6%), Leonardo (5%) and General Electric Aviation (4%). In contrast, for Boeing, Honeywell and Lockheed Martin, the UK share of self-funded R&D is less than 1%.

Unsurprisingly, Rolls-Royce and Airbus dominate the UK aerospace self-funded R&D expenditure list, with over 80% of the total. However, overall for these companies, the UK accounts for just over 10% of the global self-funded R&D total. It is also notable that R&D expenditure is twice the level of CAPEX.

Figure 4: Top-10 Company Global Total Aerospace R&D, £ million, and UK footprint, 2016

#	Name	HQ	Global Aero R&D £M	Global R&D (% of sales)	UK Aero R&D £M	UK Aero R&D (% global)	UK Capex £M	UK Based Employees
1	Airbus	NL	2,917	4.9%	353	12.1%	171	11,863
2	Boeing	US	2,297	3.3%	11	0.5%	5	2,205
3	General Electric	US	1,180	6.1%	50	4.2%	29	3,091
4	United Technologies	US	886	4.1%	54	6.1%	21	3,008
5	Safran	FR	860	6.1%	20	2.3%	18	2,219
6	Rolls-Royce	UK	639	6.9%	531	83.1%	278	13,832
7	Bombardier	CA	612	9.1%	53	8.6%	7	4,558
8	Honeywell	US	595	5.5%	5	0.9%	5	2,268
9	Leonardo	IT	495	8.2%	25	5.1%	16	4,256
10	Lockheed Martin	US	483	2.1%	3	0.6%	3	1,626
Total/Average			10,946	4.6%	1,105	10.1%	553	48,926

Source: ATI Analysis of Aerospace Companies Global and UK Accounts, 2016

A detailed time series analysis of the self-funded aerospace R&D revealed some interesting insights (Figure 5):

The effect of specific aircraft programmes is noticeable across some companies R&D spend. For example, Bombardier's group and UK spend rose and shrank between 2010 and 2015 to deliver the C-Series aircraft, with self-funded R&D up significantly both for the group and at Short Brothers in the UK between 2010 and 2015, although it has since dropped off following the completion of this aircraft development programme. This trend is also apparent in data for GE Aviation, where GE delivered Gulfstream system upgrades in the UK between 2013 and 2015.

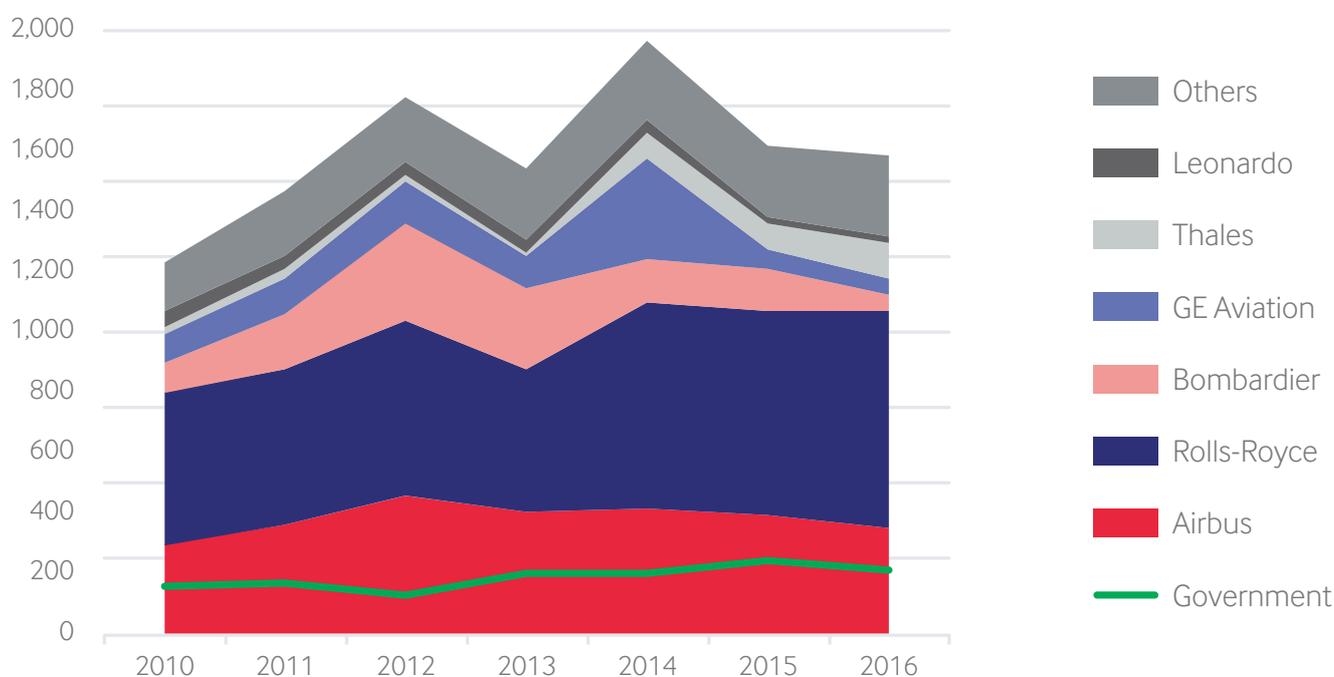
New aircraft programmes are a major driver for self-funded R&D for all companies, so a reduction or gap in the number of new programmes can have a significant effect on self-funded R&D. This is especially true in the defence sector for BAE Systems and Leonardo, but also probable in the case of Airbus, where fewer development programmes has meant Airbus UK self-funded R&D has flattened and declined.

Some global aerospace companies have visibly increased their UK self-funded R&D footprints. The most striking example of this is Thales UK, whose self-funded R&D has increased from £10m in 2007 to more than £100m in 2016 (across all of its divisions, not just aerospace). As part of this, Thales UK has opened a new UK headquarters in Reading, announcing a specific commitment to further R&D in the UK¹³.

Other specific examples include:

- Boeing investing in R&D and a new UK site to manufacture wing actuation components¹⁴
- Rolls-Royce announcing it will invest £150m in UK aerospace facilities, securing 7,000 UK jobs¹⁵
- Meggitt announcing a of £130 million investment in a facility in the West Midlands¹⁶

Figure 5: UK Self-funded R&D expenditure for selected companies, £ million, 2010-2016



Source: ATI Analysis of Aerospace Companies UK Accounts & ONS Business Expenditure on R&D data for government funding

Note: Above chart shows total UK R&D for selected companies, not only the aerospace relevant portion

Total aerospace self-funded R&D has grown at more than 4% per year for the companies shown in Figure 5. As can be seen from Figure 5, government funding for aerospace R&D has averaged around £200m per year since 2013 versus almost £1,700 million for total self-funded R&D investment. This is indicative of the leveraging effect of government funding. Within the UK Aerospace R&T programme, each £1 of government grant funding, on average, leads to more than £7 of private investment. Other studies, including work by the OECD, highlight the leveraging effect of government funding for R&D on boosting private sector investment¹⁷.

¹³See Thales UK press release (February 2018), New Thales UK Headquarters Opened by Prime Minister Theresa May

¹⁴See Boeing press release: Boeing Expands Production with Investment in New UK Site and US Facility (February 2017)

¹⁵See Rolls-Royce press release: Rolls-Royce announces £150m investment in UK aerospace facilities (June 2017)

¹⁶See Meggitt press release (November 2017), £130 million investment in facility in the Midlands announced

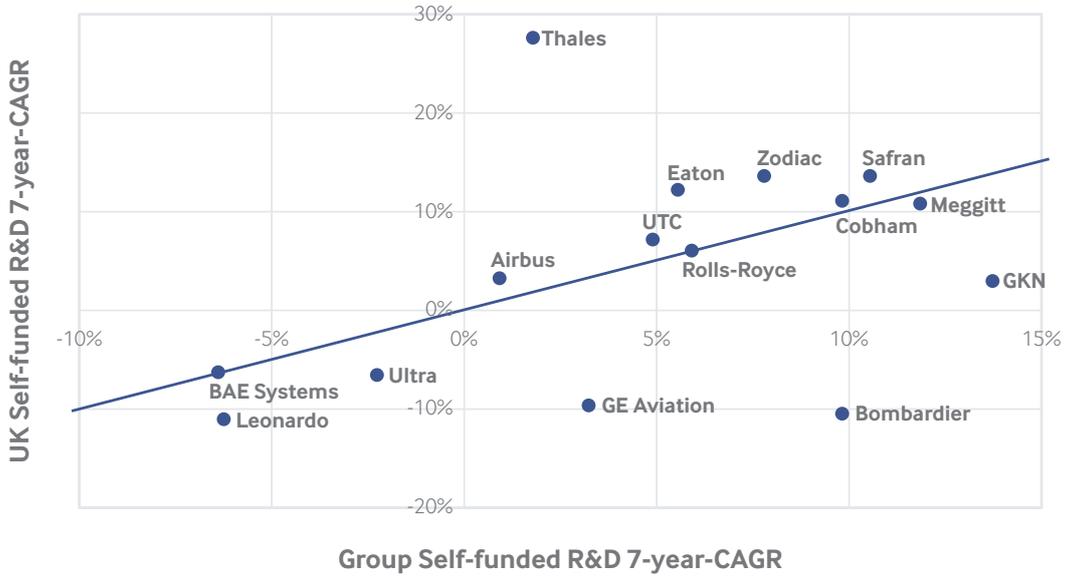
¹⁷See analysis of OECD data in ATI (2016), Raising Ambition for UK Industrial Strategy – Lessons from Innovation in Aerospace

There is a global dynamic to R&D too, since business capabilities and programmes are typically organised to some degree on a geographic basis (e.g. Airbus Wing capabilities are based in the UK, but its propulsion integration capability is based in France). To illustrate this, the scatter diagram in Figure 6 shows the 7-year investment trend for key aerospace companies, showing how growth in UK self-funded R&D investments compares to the growth in their global investments. Those companies above the blue 45° line are increasing their investments in the UK relative to the group.

The companies increasing the UK share of their R&D investments relative to the group include: Thales, Airbus, UTC, Eaton, Zodiac and Safran (Figure 6). Companies reducing their R&D investments include defence companies such as BAE Systems, Leonardo and Ultra; who typically have high-levels of ‘customer’ funded R&D, i.e. government defence, which has been declining.

Whilst, both GE Aviation and Bombardier sit below the 45° line, this analysis ignores the fluctuations that have occurred in between and can be explained to some degree by changes in programme activity across those businesses. This data together with investment trends, suggests some companies are seeing distinct advantages in the UK’s rich environment for research and development.

Figure 6: Comparison of the growth in global and UK-based self-funded aerospace, 2010-2016



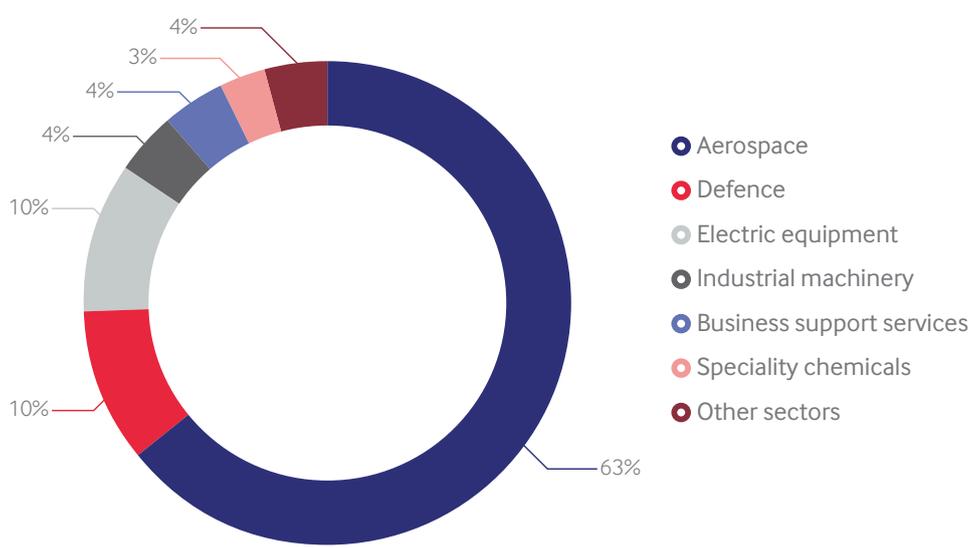
Source: ATI Analysis of Aerospace Companies Global and UK Accounts, 2016

4: Over 450 UK aerospace companies are conducting R&D, driving beneficial spillovers

This study undertook a review of company accounts across the whole UK aerospace supply chain. In total, 250 UK companies of relevance to the UK aerospace supply chain disclosed their UK R&D investment, totalling more than £2 billion of self-funded activity for 2016. Just over 60% of this was attributable to companies with a primary sector classification of aerospace (Figure 7) – around £1.3 billion.

A further 200 companies provided evidence of conducting R&D somewhere within their accounts, giving a total of at least 450 UK companies conducting R&D activity within the UK aerospace supply chain. Many of these supply chain companies will operate across multiple sectors, e.g. selling components and services to automotive, marine, rail, nuclear, defence; as well as the aerospace sector. The overlapping nature of the supply chain is one key mechanism by which technology spillover occurs.

Figure 7: UK Self-funded R&D expenditure in the aerospace supply chain by primary sector classification, £ million, 2016



Source: ATI Analysis of Aerospace Companies Global and UK Accounts, 2016

Figure 8 lists the top-15 UK aerospace companies, ranked by their level of self-funded R&D expenditure in 2016. Many of these companies are the same as those listed in the global top-10 ranking for self-funded R&D expenditure – 8 companies appear on both lists. Surprisingly, major aerospace companies present in the UK such as Honeywell, Spirit AeroSystems and Cobham did not make the top-15 ranking.

Alongside this, the approximate UK Aerospace R&T grant funding for 2016 is listed. Most of the companies identified in the study as performing significant levels of UK aerospace R&D, access some level of UK government grant funding for R&D. However, it is noticeable that some companies such as Zodiac and Senior are conducting significant self-funded R&D in the UK without leveraging grant funding to support their activity. This may point to the distinct dynamics of those sub-sectors or a skewing of R&D to higher-maturity activities that are less dependent or relevant to grant R&D funding.

As a broad comparison, the self-funded R&D from these top-15 UK aerospace companies totals £1.3 billion, versus £1.6 billion of privately funded R&D listed in the ONS Business Expenditure R&D Survey in 2016, indicating that R&D in aerospace is quite highly concentrated among relatively few companies.

Several of the top-15 UK aerospace R&D companies are conducting a relatively high share of R&D compared to their UK sales – Rolls-Royce, Bombardier, General Electric, Thales and Zodiac are all investing more than 8% of UK sales in UK R&D.

Further down the UK aerospace R&D ranking list, the study identified highly innovative companies such as Hybrid Air Vehicles, XMOS, Bladon Jets, Metalysis, Ilika Technologies and Oxis Energy all investing more than 20% of the UK sales in R&D activity.

A significant proportion of the 450 UK companies conducting self-funded R&D activity are already well represented in the UK Aerospace R&T Programme, NATEP (National Aerospace Technology Exploitation Programme), SC21 (21st Century Supply Chains) or SiG (Sharing in Growth). However, the study has also identified some companies that ATI should consider for greater levels of engagement to better understand the extent of their R&D activities and suitability to increase their level of participation.

Figure 8: Top-15 Company UK Aerospace R&D UK footprint, £ million, 2016

Name	HQ	No. of UK Businesses	UK Aero R&D £M	UK R&D (% sales)	Grant Funding £M	UK Capex £M	UK Based Employees
Rolls-Royce	UK	13	531	9.0%	42.6	278	13,832
Airbus	NL	10	353	6.1%	22.7	171	11,863
BAE Systems	UK	2	58	0.9%	0.8	124	19,395
United Technologies	US	12	54	6.4%	1.6	21	3,008
Bombardier	CA	3	53	8.2%	2.5	7	4,558
General Electric	US	4	50	8.5%	3.5	29	3,091
Thales	FR	7	46	9.9%	2.6	11	2,493
Zodiac Aerospace	FR	3	35	17.2%	0.0	3	1,378
Leonardo	IT	8	25	2.5%	0.3	16	4,256
GKN Aerospace	UK	4	24	2.8%	5.6	25	4,295
Meggitt	UK	5	21	5.9%	0.6	16	2,069
Safran	FR	8	20	2.0%	2.2	18	2,219
Senior Aerospace	UK	1	19	2.0%	0.0	51	7,397
Martin-Baker Aircraft	UK	2	16	6.8%	0.0	5	937
Boeing	US	4	11	2.6%	0.0	5	2,205
Total		86	1,316	5.1%	85.0	780	82,996

Source: ATI Analysis of Aerospace Companies Global and UK Accounts, 2016 and Innovate UK Financial Data, 2016

Note: the remaining grant funding is spread between other large companies, SMEs, universities and Catapult Centres

CONCLUDING REMARKS

There are good reasons to be optimistic about the future of UK aerospace. This study demonstrates the significance of the UK to global companies and the strength of the innovation environment. The outlook is challenging, underpinning the need for a bold and strategic approach to research and technology.

Ultimately, the impact of all efforts to improve the competitiveness of UK aerospace will only be fully understood as new programmes and commercial opportunities unfold. R&D is a key leading indicator of this and therefore important to monitor and understand.

ACKNOWLEDGEMENTS

Our sincere thanks go to all the subject matter experts and business development managers from academia, research organisations and industry who were consulted during the course of this work. Notably, we would like to recognise the role of the ATI's Market and Economic Advisory Group in providing comments and feedback to draft presentations of the study's outputs and conclusions.

GLOSSARY

HQ	Headquarters	GDP	Gross Domestic Product
CA	Canada	EASA	European Aviation Safety Agency
FR	France	OECD	Organisation for Economic Co-operation and Development
IT	Italy	ONS	Office for National Statistics
NL	Netherlands	R&D	Research and Development
UK	United Kingdom	R&T	Research and Technology
US	United States	SMEs	Small and Medium Enterprises
CAGR	Compound Annual Growth Rate	TFP	Total Factor Productivity
CAPEX	Capital Expenditure	MRO	Maintenance, Repair and Overhaul

WHO WE ARE

The **Aerospace Technology Institute (ATI)** is the objective convenor and voice of the UK's aerospace technology community. The Institute defines the national aerospace technology strategy that is used to focus the delivery of a £3.9 billion joint government-industry funded aerospace technology programme.

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