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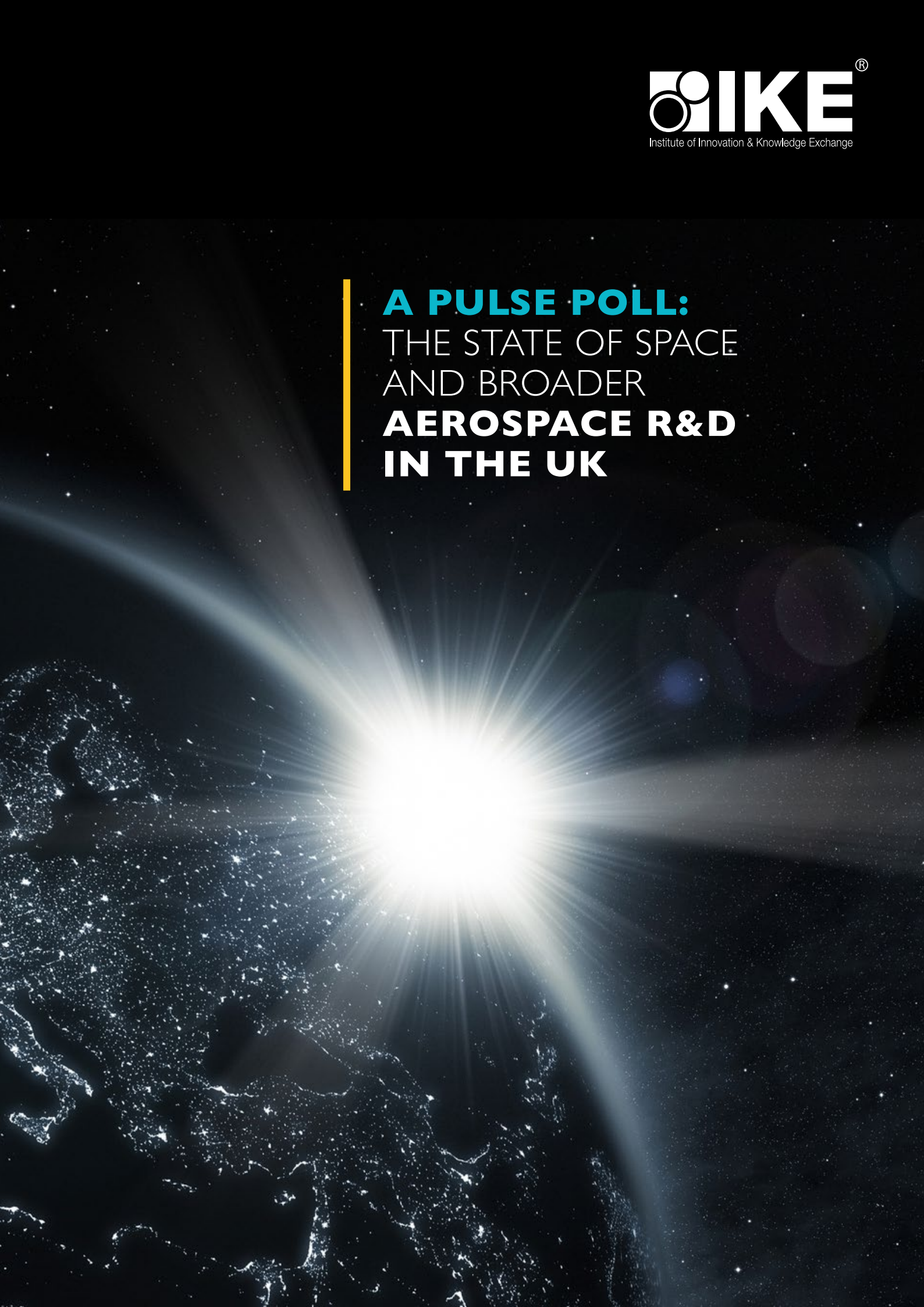

A PULSE POLL: THE STATE OF SPACE AND BROADER AEROSPACE R&D IN THE UK

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INTRODUCTION

> Imagine those packages that today are delivered by plane or truck could be delivered by rocket. Instead of Mauritius, think of the Moon as a luxury resort. Well, with the advancements and innovations in rocketry science, rocket delivery systems and private space travel could make these things a reality.

The space sector, as described by NASA, is an industry that refers to economic activities related to the manufacturing of components that go into Earth's orbit or beyond.

As we celebrated on July 20th this year half a century of human space exploration, there seems to be a renewed investment interest in space. This interest is extending beyond manned Low-Earth orbit missions and unmanned scientific exploration, and is undoubtedly fuelled by the growth in downstream space activities such as the provision of satellite technology, signals, and Artificial Intelligence (AI) and IoT-based services.

Many applications are, by definition reliant on having a space infrastructure being set up by public and/or private actors. They include services and products for consumers using satellite capacity, such as communications, satellite television services, geospatial products, meteorology and location-based services (e.g. a navigation device using satellite positioning signals from publicly funded space infrastructure, like the United States GPS, the European Galileo or the Chinese Beidou systems).

The actual value creation and revenue generation is often far removed from the initial investments according to an OECD report—The Space Economy in Figures- How Space Contributes to the Global Economy, 2019. Whilst many national and industry associations have conducted surveys to identify activities and growth profiles, comparable data to quantify in detail the different segments of the space economy in different countries still remains very limited.

Recent initiatives by large public and private firms suggest that space is an area where we will see significant developments, potentially enhancing the US technological leadership and addressing opportunities and vulnerabilities in surveillance, mission deployment, cyber, and AI. Worldwide, and again particularly in the U.S., this has led to a growth in business R&D funding and investment. Although often this business R&D investment has been funded by an expansion of state support for space R&D. Climate change concerns have also led to a growth in earth observation satellites with associated, and often combined, public and private sector R&D funding.

An emerging area is the development of large constellations of micro-satellites mainly performing earth observation or broadband communications. According to Morgan Stanley's Space Report, July 2019, the estimated global space industry could generate more than $1 trillion by 2040 in annual revenue, up from the current position of $350 billion. A parliamentary Space Industry Act was also published in 2018 to support growth in the UK space sector, which currently is worth some £15.5bn.

So, where is the UK in this picture of tantalising opportunities?

Setting the Scene

This report by the IKE Institute seeks to use available data to explore the nature and recent dynamics of the UK's space sector's R&D. This report is set against the background of the global space R&D position, however, due to the fact that the data is only available at the aerospace level, the R&D component is examined in this context.

A GLOBALLY GROWING SECTOR

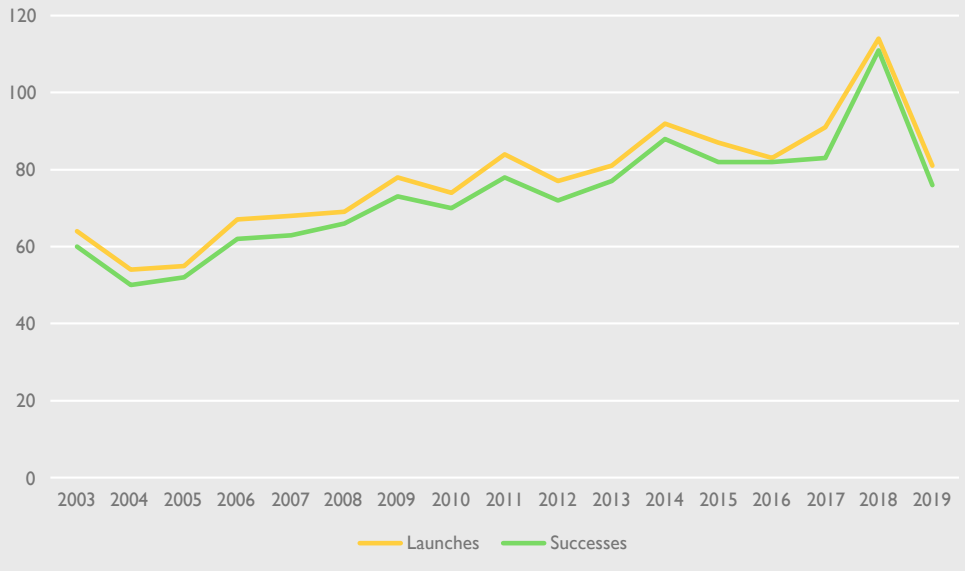
This section examines the global space sector as sales are international and the UK space sector operates within this global system.

Global Space Launches 2003 to 2019

Figure 1 shows that the last decade has seen a fairly steady increase in the number of space-launches a simple metric of activity by the sector. Launches appear to have peaked in 2018 when the new American commercial launch systems became finally proved. This peak might have reduced the 2019 activity which was sharply down on 2018.

Figure 1

Space Launches and Successful Launches 2003 to 2019



Source: Wikipedia Space Timeline

Global Space Launches by Country

Table 1 shows that China, the United States and the Russian Federation accounted for nearly 84 per cent of all space launches in 2019. With Europe and its aging Ariane 5 rocket only accounting for five launches or just over 6 per cent of all launches. The UK has only once launched a satellite using a nationally developed rocket in 1971 when the Prospero satellite was launched into low earth orbit using and Black Arrow rocket.

China, the United States and the Russian Federation accounted for

nearly 84%

of all space launches in 2019

Table 1

Global Space Launches by Country - 2019

	2019 Launches	2019 Successes
China	26	24
United State	23	23
Russia	19	19
Europe	5	4
India	4	4
Iran	2	0
Japan	2	2
	81	**76**

Source: Wikipedia Space timeline

Mature Global Space Markets

Table 2 examines the various existing global space markets by size, potential for growth and the extent of barriers to entry. This shows that the three largest markets are satellite TV, satellite navigation devices and other consumer ground equipment. Using the statistical concept of the space sector these would be excluded. However, the next big market is satellite manufacturing where the UK specialises.

The next big market is
satellite manufacturing
where the UK specialises

Table 2

Mature Global Space Markets by Size, Growth Potential and Barriers to Entry

Market	Existing Market Size (US $ B)	Growth Trend	Barriers to Entry
Satellite DTH TV	$98B	=	Medium
GNSS Devices, Chipsets and Applications	$31B	++	Medium
Consumer Ground Equipment	$19B	-	Medium
Satellite Manufacturing	$14B	+	High
FSS Transponder Leasing	$11B	-	Medium
Network Ground Equipment	$10B	+	Medium
Launch Services	$6B	+	High
FSS Managed Services	$6B+	++	Medium
Satellite Radio	$5B	++	Medium
Mobile Communications	$4B	+	High
Satellite Broadband	$2B	++	Medium
Earth Observation	$2B	++	High

Source: Space Industry Dynamics, Research Paper for Australian Government, Department of Industry Innovation and Science by Bryce Space and Technology, LLC – Table 1

Emerging Global Space Markets

As well as examining existing markets the report for the Australian Government also examined emerging space markers as shown in Table 3. The two largest emerging markets global broadband services and suborbital human spaceflight have high required investments and high barriers to entry, but global broadband had high growth potential. Earth Observation (EO) using large numbers of small satellites and EO Data driven analytics both had high growth potential and medium barriers to market entry. Smallsat manufacturing had moderate growth potential but the lowest investment required per venture of about $1 million and above while also having low marker entry barriers. This suggests that the UK's lead in smallsats could be challenged by new entrants to the market.

Smallsat manufacturing had moderate growth potential but the lowest investment required per venture of about **$1 million** and above while also having low marker entry barriers

Table 3

Emerging Global Space Markets

Markets	Growth Trend	Investment Required per Venture	Barriers to Entry
Ubiquitous Global Broadband	++	~$3B+	High
Suborbital Human Spaceflight	+	~$1B	High
Satellite Servicing	+	~$500M+	High
EO Smallest Constellations	++	~$100M+	Low
Dedicated Smallsat Launch	+	~$100M+	Medium
EO-Driven Data Analytics	++	~$10M+	Low
Commercial SSA	+	~$10M+	Medium
Smallsat Manufacturing	+	~$1M+	Low

Source: Space Industry Dynamics, Research Paper for Australian Government, Department of Industry Innovation and Science by Bryce Space and Technology, LLC – Table 2

Global Satellite Revenue

Apart from designing and building launch vehicles the design and manufacture of various sorts of satellites is a critical component of the global space sector.

Figure 2 provides data on the global satellite market by converting all revenues into billions of US dollars. This shows that the global satellite market grew from $246 billion in 2014 to $277 billion in 2018. The annual growth rates were 3.7% in 2014-15, 2.4% in 2015-16, 3.1% in 2016-17 and 3.0% in 2017-18.

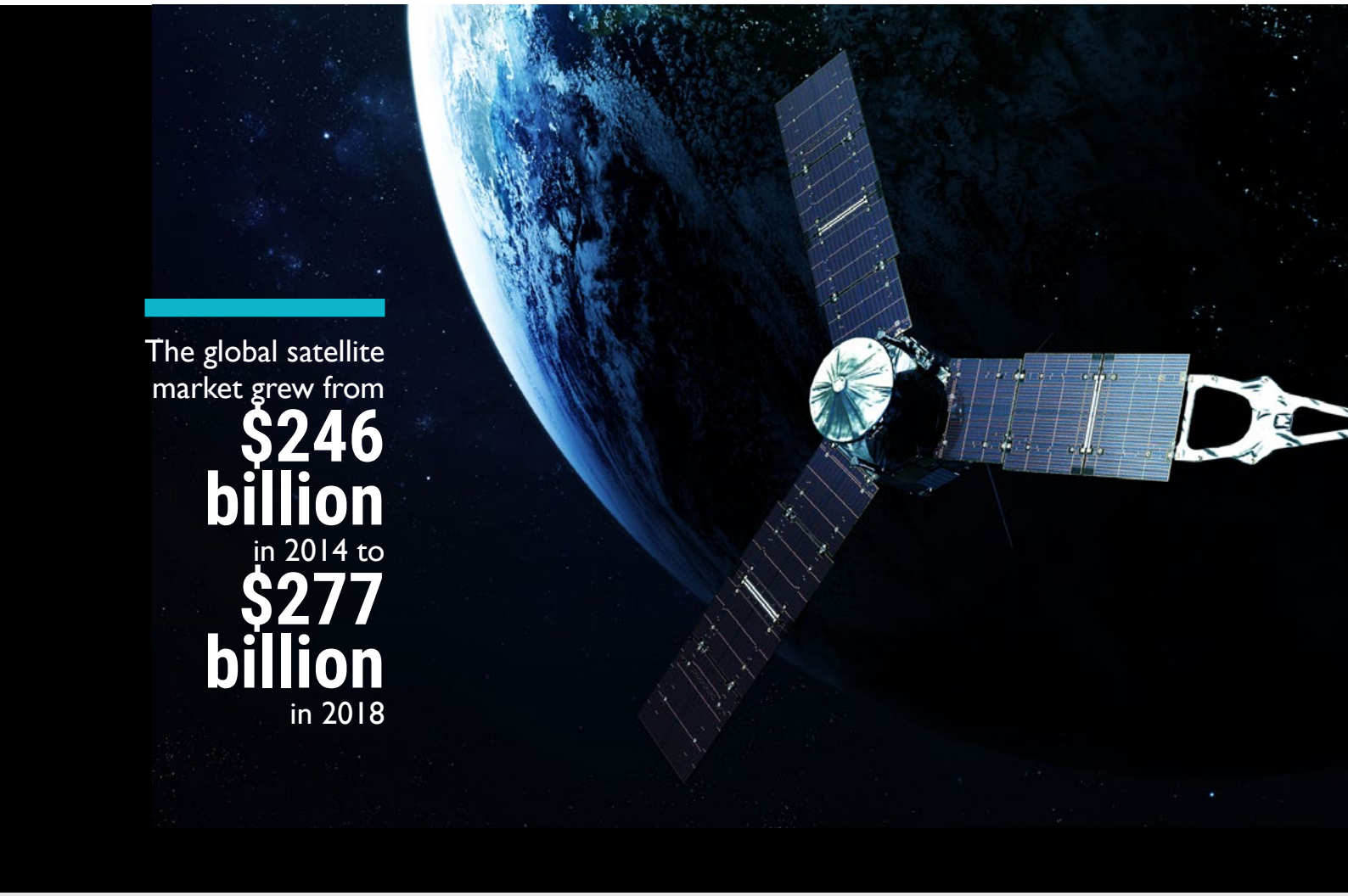
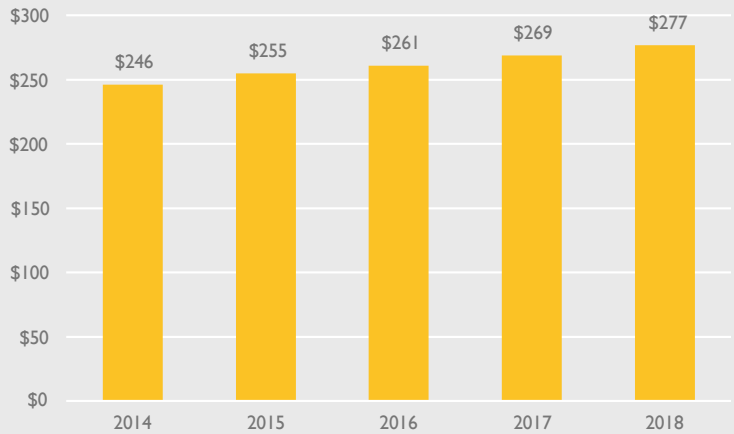


Figure 2

Global Satellite Industry Revenue billions of US dollars, 2014 - 2018



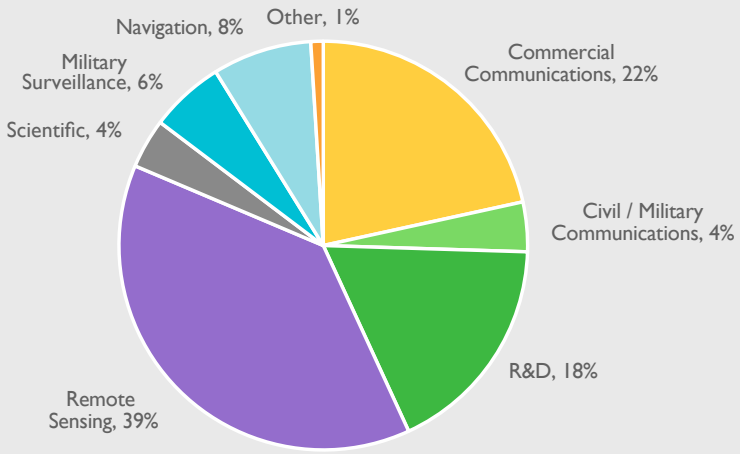
Source: SIA (2019) 2019 State of the Satellite Industry

Global Satellite Launches

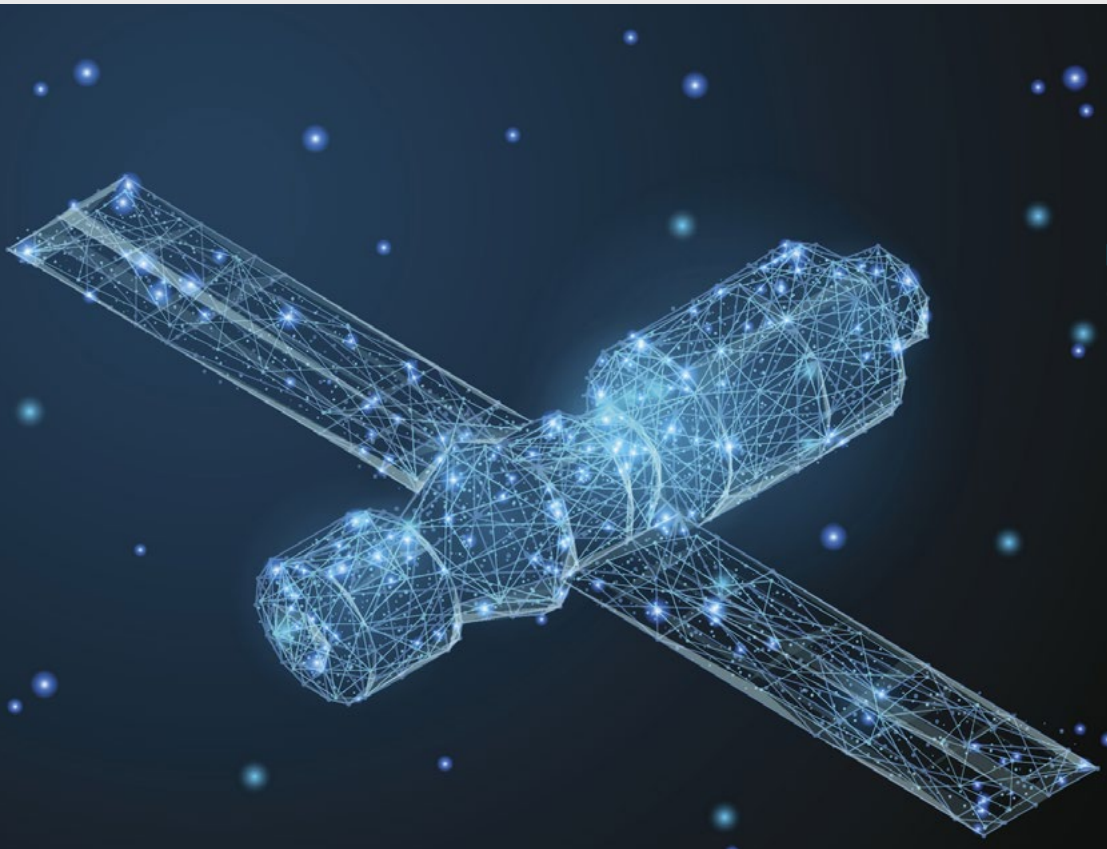
The nature of the satellite launches is shown in Figure 3 which breaks the satellite launches down by type. The most satellites, or 39% of all of them were for remote sensing. A further 22% of satellite launches were dedicated to commercial communications. Only 6% were for military surveillance and 4% for civil or military communications. Nearly one in five, or 18%, were for Research and Development.

Figure 3

Satellites Launched in 2019 by Type



Source: SIA (2019) State of the Satellite Industry, Satellite Industry Association (SIA)



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UK SPACE AND AEROSPACE SECTOR

The UK space market is more export led than the size of the domestic market would suggest. This is despite the UK having no domestic space launch vehicles and relatively low governmental support for aerospace R&D.

The UK Aerospace Sector in A Global Context

Table 4 provides details of the aerospace trade balances, that is exports minus imports, and the percentage of global export markets that each country achieves. This shows that the UK has the fourth largest balance of trade at US$ 11,269 million and 10.69 per cent of the global aerospace export market.

Table 4

Aerospace Balance of Trade and Export Market Share, 2017

	Trade Balance (current US$ millions)	Suppliers of equipment, materials, services or software (percentage)
United States	$81,626.6	31.91
France	$19,700.5	15.02
Germany	$22,054.3	11.81
United Kingdom	$11,269.5	10.69
Canada	$2,285.6	2.23
Spain	$401.0	1.96
China	$-23,523.3	1.74
Italy	$2,995.1	1.45
Russian Federation	$-2,945.5	0.91

Source: OECD (2019) Main Science and Technology Indicators

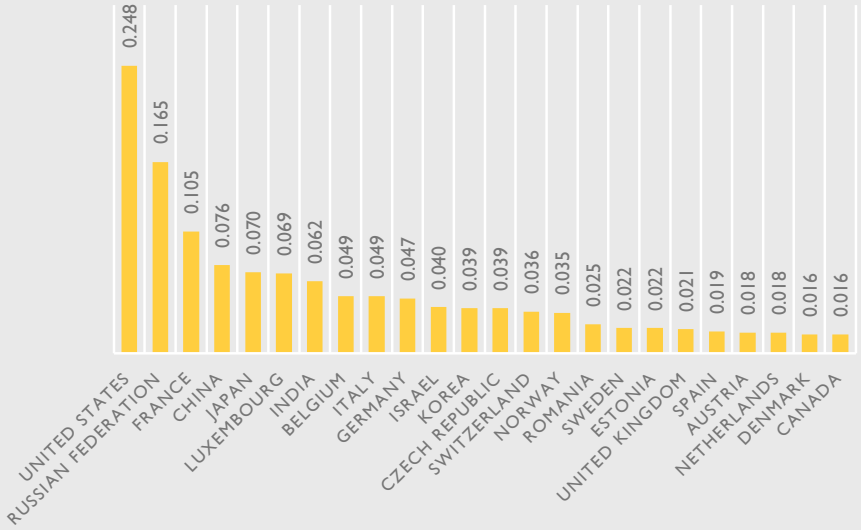
Government Space Budgets as a Percentage of GDP

A particular feature of UK space sector is the relatively low level of government support for the sector. This makes the UK space sector more dependent on ESA and EU funds for support of fundamental R&D than other EU countries. Figure 4 shows government expenditure on space as a proportion of the country's GDP. This shows the relative importance shown by the government for the sector. As might be expected both the United States and the Russian Federation show relative high levels of support at 0.248 per cent and 0.165 per cent respectively. Strikingly, the level of UK Government support for the sector is much lower as a proportion of GDP than many other countries including many with weaker space sectors. The UK Government support amounts to 0.021 per cent of GDP which is over ten times less than the level of support from the United States. The level of UK support is also less than that from the Czech Government which provided 0.039 per cent of GDP, the Romanian Government that provided 0.025 per cent of GDP and the Estonian Government that provided 0.022 per cent of admittedly smaller GDP.

Strikingly, the level of UK Government support for the sector is much lower as a proportion of GDP than many other countries including many with weaker space sectors

Figure 4

Government Space Budgets as a % of GDP, 2017



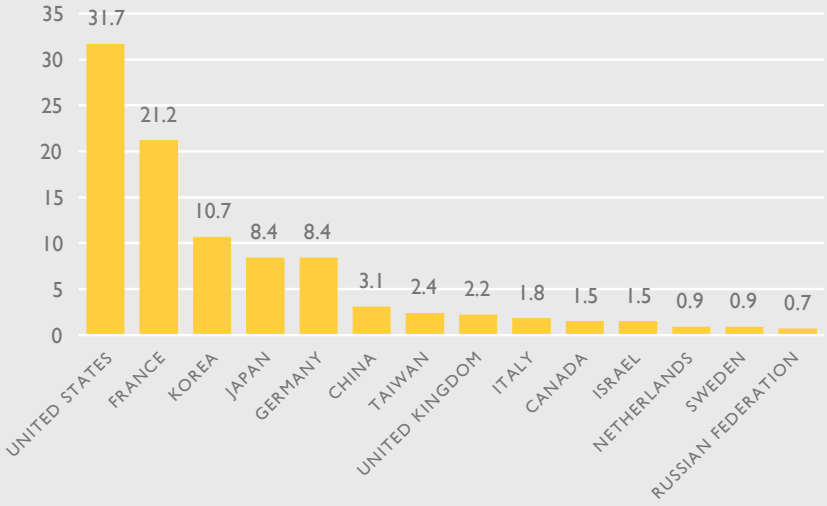
Source: OECD (2019) The Space Economy in Figures: How Space Contributes to the Global Economy, OECD, Paris

Space Related Patents 2012-15

Another way of looking at the historical commitment to the space sector by a country is to examine the number of space related patents held by a country. Figure 5 uses fractional counts of patents covering space-related technologies for the period 2012 to 2015. Although, the space sector does not patent as much as some other sectors patents still represent the extent to which developments in a country are felt to be worth protecting by patenting. This shows that the United States with 31.7 patents has almost fifteen times the 2.2 patents in the UK. At the same time France with 21.2 patents had almost ten times the number in the UK.

Figure 5

Patents for Space-Related Technologies 2012-15



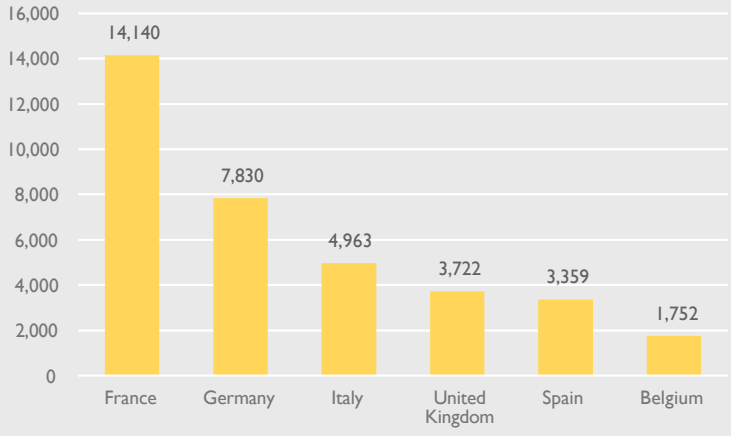
Source: OECD (2019) Space in Figures, OECD, Paris

The UK Space Sector in an European Context

The pattern or employment in the European space sector reflects turnover. However, France appears to be more labour intensive than the UK. This may be because the manufacture of launch vehicles is more labour intensive than the development of satellites.

Figure 6

European Upstream Space Employment 2017 FTE



Source ASD Aerospace (2018) Facts and Figures 2017

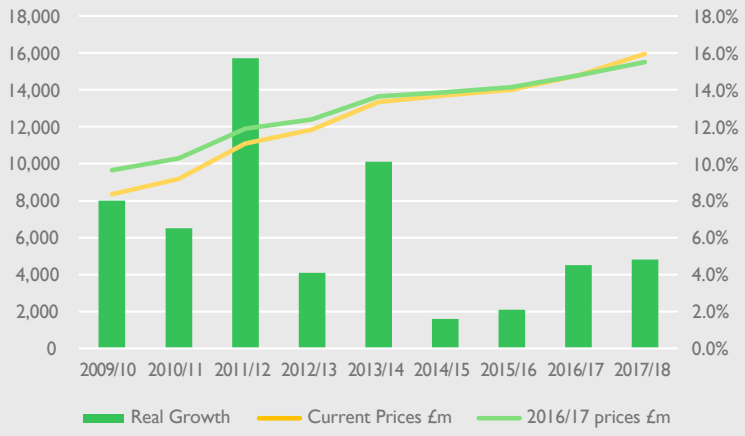
Every year the space sector's growth has exceeded GDP growth

Size and Growth of the UK Space Sector

Figure 7 provides details of the UK Space sectors income in current and in real 2016/17 prices. This shows that at current prices the sector's income grew from £8,334 million in 2009/10 to £15,938 million in 2017/18 almost a doubling. The pattern of real growth shows periods of amazing growth, particularly at the height of the recession with 15.5% real growth recorded between 2010/11 and 2011/12 and 10.1% real growth between 2012/13 and 2013/14. Admittedly, more recently growth has been more subdued, but every year the space sector's growth has exceeded GDP growth.

Figure 7

UK Space Sector Income in Current and 2016/17 prices and real growth rates



Source: London Economics (2019) Size and Health of the UK Space Industry 2018

UK Space Sector by Segment

Figure 8 provides a breakdown of the UK Space sector by sub-markets. What the figure reveals is that 48% of what London Economics considers to be the space sector consists of satellite broadcasters of TV. In practice this in turn is largely Sky TV. The standard statistical classification would consider Sky TV to be a media company rather than a space company. This illustrates the problem with the widespread usage of survey techniques and essentially ad-hoc definitions to examine the 'space sector'.

48% of what London Economics considers to be the space sector consists of satellite broadcasters of TV

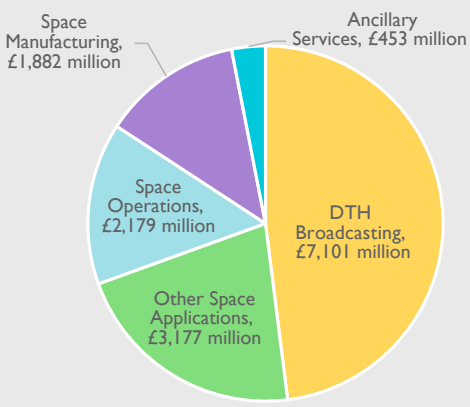
Despite this, Sky TV and the other direct to homes satellite broadcasters are significant users of space technology.

Sky TV and the other direct to homes satellite broadcasters are significant users of space technology

Space manufacturing and Space operations reflecting a definition closer to the statistical concept of the core space sector represent 13% and 15% respectively of the London Economics conception of the sector.

Figure 8

Breakdown of UK Space Sector by Segment



Source: London Economics (2019) Size and Health of the UK Space Industry 2018

23.1%
of business R&D in the aerospace sector is orientated towards defence

The Importance of Defence Spending for UK Aerospace Sector R&D

Table 5 shows that the aerospace sector is the second most intensive in terms of business R&D. 23.1 per cent of business R&D in the aerospace sector is orientated towards defence. This compares with the machinery and equipment sector which had 38.1 per cent oriented towards defence and the telecommunications sector which had only 2.1 for defence. This is common to most countries space sectors, but this provides another route for support for this R&D intensive sector.

Table 5

The importance of Defence R&D for UK Business R&D (£ millions)

	Total	Defence	% Defence
Machinery and equipment	1,037	395	38.1%
Aerospace	1,521	351	23.1%
Electrical equipment	453	74	16.3%
Precision instruments and optical products; Photographic equipment	634	87	13.7%
Miscellaneous business activities; Technical testing and analysis	1,513	109	7.2%
Software development	1,389	98	7.1%
Consumer electronics and communication equipment	821	44	5.4%
Construction	319	13	4.1%
Telecommunications	753	16	2.1%
Other manufactured goods	232	4	1.7%
Research and development services	1,138	19	1.7%
Computers and peripheral equipment 1	438	7	1.6%
Fabricated metal products except machinery and equipment	205	2	1.0%
Other	6,043	384	6.4%
Total	23,685	1,604	6.8%

UK Space Case Studies

Beyond the statistics it is helpful to look at individual companies as this can provide the level of detail that cannot be revealed by the statistics. Critically the first three companies highlighted here Surrey Satellite Technology Ltd, Clyde Space, Alba Orbital and Oxford Space Systems all build small and micro satellite and between them probably build over 40 per cent of the global total of this important and growing niche market. The final case study details the efforts to develop an engine that could drive Mach5 aeroplanes and lift orbital vehicles into space from runways and then return.

Surrey Satellite Technology Ltd

Surrey Satellite Technology Ltd is now owned by Airbus a multinational company registered in the Netherlands. Their accounts for 2018 show a loss of £4,510,000 and a larger loss of £24,656,000 in 2017. Airbus is covering these losses and provides cash for continued operation. SSTL design and build SSTL-cube, SSTL-micro and SSTL-mini satellites. In addition, they design and operate ground stations for their satellites as well as the critical navigation payloads for ESA's Galileo programme. They also offer a commercial lunar mission support service. In all over the 30 plus years of operation they have launched 60 plus satellites with 7 constellations deployed and under contract. They believe they are over 40 per cent share of the global small satellite export market.

AAC Clyde Space Ltd

AAC Clyde Space Ltd is now owned by a Swedish company AAC Microtec AB. Their accounts show a loss of £1,321,228 on a turnover of £2,625,126 over the 8 months to 31st December 2018. They specialise in advanced nanosatellite spacecraft, mission services, and reliable subsystems. They design, build and launch a range of CubeSats , Epic and Epic Plus in 12u, 6u, 3u and 1u form factors. In addition, they provide satellite subsystems which can be put together to produce working satellites.

Alba Orbital Ltd

Alba Orbital Ltd based in Glasgow produce and launch PocketQube satellites in two series Unicorn-1 and Unicorn-2. The PocketQube standard is open and designed to be launched from their Albapod deployers. They broker the launch of these very small satellites and provide launch for as little as €25k. Their latest accounts covering 2018 indicated a profit of only £453. The low launch costs of these very small satellites allow the building of large constellations which provide greater coverage at lower costs.

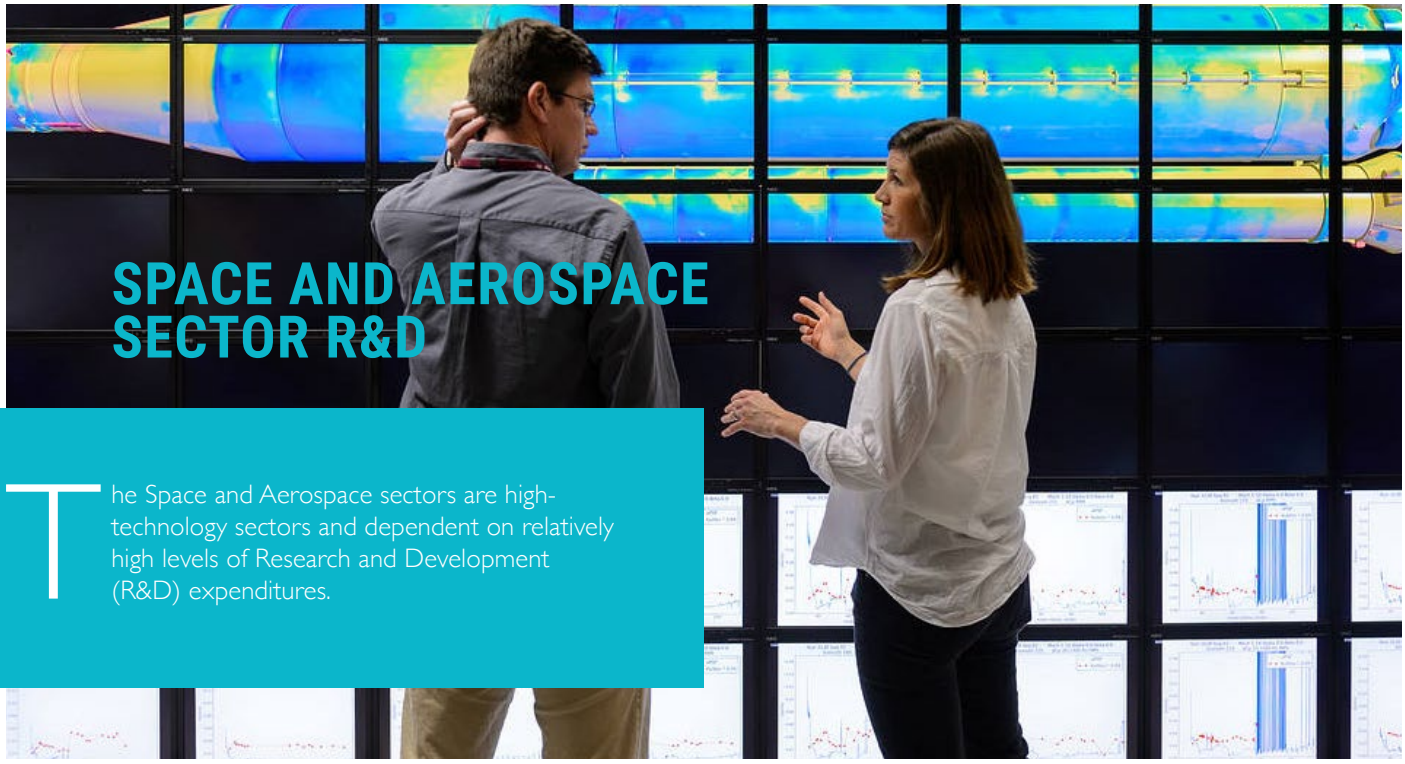
Oxford Space Systems

Oxford Space Systems specialise in antennae for satellites. They are known for a range of deployable antennas these include unfurlable reflector antennae with an outer ring, unfurlable reflector antennae with wrapped ribs, deployable helical antennae, Astrotube telescopic boom antennae and a steerable panel arrays for microsats, as well as large panel array antennae. This means that wider range of frequencies and data transmission speeds are available to small satellites equipped by Oxford Space Systems.

Reaction Engines Ltd

Reaction Engines Ltd was set up by three engineers in 1989 to take forward some research by Rolls Royce. They are developing an innovative combined hypersonic jet engine and rocket called the Synergetic Air-Breathing Rocket Engine (SABRE). The engine is dependent on a lightweight heat-exchanger that can precool the air entering the jet at hypersonic speeds allowing lighter materials to be used for the jet engine. It is this critical precooler that has been built and tested at temperatures representing operating at five times the speed of sound . This technology and the resulting engines will enable cheaper one stage flights to space and returns to a runway as well as fly from Brussels to Sydney in just over four hours cruising at Mach 5.

1 CubeSat (2015) CubeSat Design Specification (CDS) revision 13
2 Radu S, Uludag MS, Speretta S et al. (2018) The PocketQube Standard Issue 1, Alba Orbital, TU Delft Group of Astrodynamics for the Use of Space Science
3 Reaction Engines (2019) Press Release – Reaction Engines Test Programme Fully Validates Precooler at Hypersonic Heat Conditions, 22 October 2019



SPACE AND AEROSPACE SECTOR R&D

The Space and Aerospace sectors are high-technology sectors and dependent on relatively high levels of Research and Development (R&D) expenditures.

NASA

OECD Aerospace Sector R&D

The standard measure of business R&D spend uses the OECD's Frascati Manual (OECD, 2015) definitions of R&D and the International Standard Industrial Classification (ISIC) definition of the Aerospace sector as aerospace manufacturers. The data has been converted from national currencies into US dollars using a Purchasing Power Parity (PPP) methodology that examines the price of a wide basket of goods and services rather than relying on market exchange rates.

This shows that corporate spending on space R&D at 26,645 million US$ vastly exceeds the business spend elsewhere with UK businesses spending the equivalent of 2,359 million US$ less than a tenth of the US spend. In part this reflects NASA commitment to private sector launch vehicles and tech-industry funders using extensive R&D tax credits to fund their development.

Table 6

Aerospace Sector Business R&D Spend in 2016

	PPP US$ millions
United States	26,645.0
France	3,589.6
United Kingdom	2,368.5
Germany *	2,194.3
Italy	1,695.0
Canada	1,203.6
Japan	753.9
Spain	619.2

** note German data covers 2015 rather than 2016*
Source: OECD (2019) Main Science and Technology Indicators, Volume 2019 Issue 1

Table 7 contains data on the UK's space sector's R&D spending by segment, this data is based on surveys and a slightly ad-hoc definition of the sector.

Table 7

UK Space Sector R&D Spend and R&D intensity

	R&D Expenditure	% of Total Income
Space Manufacturing	£255m	14%
Space Applications	£252m	3%
Space Operations	--	1%
Ancillary Services	--	7%
Overall	£566m	3.8%

Source: London Economics (2019) Size and Health of the UK Space Industry 2018

This means that the data is necessarily partial. However, it is clear the space manufacturing, which in the UK is largely satellite manufacturing, has the highest levels of R&D expenditure and the highest intensity compared to income.

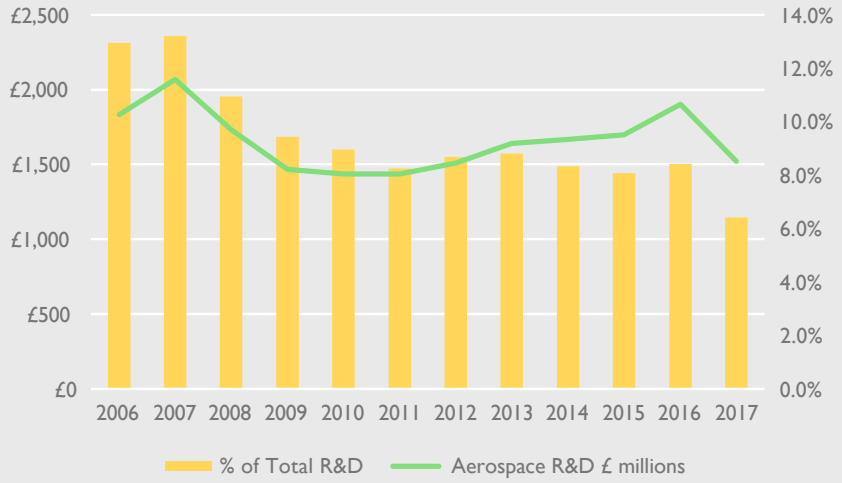
UK Aerospace Sector R&D

Figure 9 shows the level of R&D spend by the UK Aerospace sector. This is based on a Government statistics agency survey which has legal powers to encourage responses. It is also based on the Standard Industrial Classification definition of the aerospace sector. This means that it is more easily compared internationally and is less prone to non-response bias.

This shows that UK aerospace R&D spending peaked in 2007 before the banking crisis. After 2007 R&D spending slumped until 2011 when a slow growth occurred until 2016. The 2017 figures show a relatively sharp downturn and at this stage it is difficult to determine if this is the beginning of a new downward trend or a one-off annual aberration. However, throughout this period aerospace R&D spending has represented a declining proportion of overall R&D spending by UK businesses. This indicates that the aerospace sector which is traditionally R&D intensive is in the UK not attracting as much R&D funding as other sectors. This may be linked to the relatively low levels of Government support for the sector over the period.

Figure 9

UK Aerospace R&D Spend and as % total BERD, 2006 to 2017



Source: Nomisweb/ Office for National Statistics 2019

The aerospace sector which is traditionally R&D intensive is in the UK not attracting as much R&D funding as other sectors

UK Aerospace Case Studies

As with the UK space case studies the following UK aerospace case studies are intended to put some flesh on the bare statistical bones. They are not intended to be representative of the whole sector but are intended to allow some issues to be explored in more detail.

Team Tempest

The project to develop a British sixth generation fighter jet by 'Team Tempest' already has an Italian partner and a possible Swedish partner. The development of such complex platforms needs the economies of scale offered by a Europe wide partnership. Currently the UK team led by BAE Systems involves Rolls Royce, Leonardo and MBDA Missile Systems. The Tempest is planned to be a sixth-generation stealth fighter. It will be larger than the F35 and have significantly greater range. It is intended to have a virtual cockpit projected on the pilot's helmet and the ability to be flown unmanned.

The European Aviation Safety Agency (EASA)

The European Aviation Safety Agency (EASA) has been identified by the House of Commons Business, Energy and Industrial Strategy Committee as having potentially critical impacts on the UK Aerospace sector in the event of a hard Brexit.
The safety agency has negotiated bilateral links with all the significant aerospace safety agencies in the world. This means acceptance by EASA means acceptance worldwide. Without access to EASA, which is an EU body, the UK would have to establish a new body and negotiate bilateral deals across the world. Perhaps more importantly currently the UK has a significant voice in one of the world's major aerospace safety bodies, so UK manufacturers are able to influence the direction in which regulations evolve. Outside of EASA the influence of UK manufacturers would be greatly reduced.

Team Artimis

'Team Artimis' aims to fast track the launch of a small satellite constellation to provide the Royal Air Force and other services with a resilient system for providing sensor data, including live video, to the battlefield. The team consists of the Ministry of Defence, the Defence Equipment and Support, the RAF, Defence Science and Technology Laboratory, Surrey Satellite Technology Ltd, Airbus, Raytheon and Virgin Orbit. The relative low cost of small satellites as well as the range of launch options their low weight offers provides an interesting feature. The intention is to have a reserve of satellites available for quick launch by Virgin Orbit to provide a response to attempts to disrupt conventional satellite systems or to cover new areas during a crisis. This also translates the UK's competitive advantage in small satellites into a potential military advantage.

UK AEROSPACE SECTOR BREAKDOWNS

Using the broader concept of the aerospace sector, which includes the aircraft manufacturing sector as well as the space sector allows a more detailed analysis of secondary data sources. This provides the only available breakdowns by region and size of employer.

In the East Midlands aerospace employment represents

6.8%

of manufacturing employment and

0.9%

of all employment

Regional Breakdown of Aerospace Employment

Table 8 shows that aerospace employment is concentrated in some regions more than others.

In the East Midlands aerospace employment represents 6.8 per cent of manufacturing employment and 0.9% of all employment. This reflects the long history of light engineering, most notably the automobile sector, in this region and its links to the aerospace sector. In 2018 the South West region's aerospace employment represented 8.5 per cent of the regions manufacturing employment and 0.7 per cent of total employment. This reflects the tradition of aerospace activity in the region especially in Bristol. Another region with a large proportion of aerospace employment is Wales where 5.6 per cent of manufacturing employment is in the sector and 0.6 per cent of total employment. In part this reflects the Airbus plant in North Wales that produces all the wings for their civil aircraft and another Airbus facility in Newport.

Another region with a large proportion of aerospace employment is Wales where 5.6 per cent of manufacturing employment is in the sector

Table 8

Regional Breakdown of UK Aerospace Sector Employment, 2018

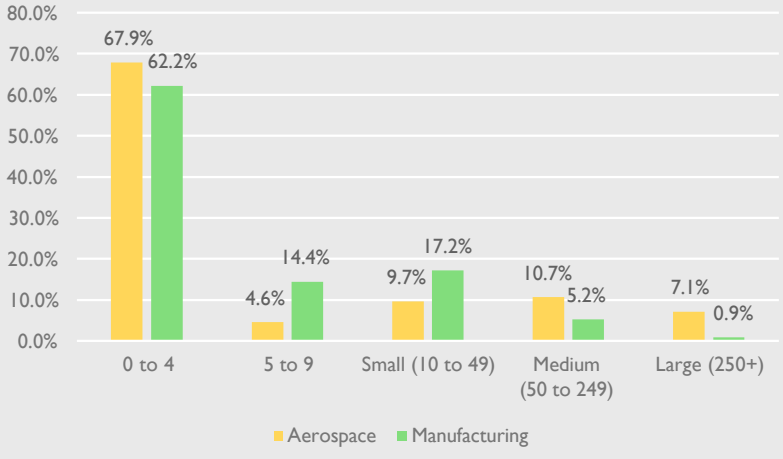
	Aerospace employment	Aerospace as % Manufacturing	Aerospace as % Employment
North East	1,500	1.3%	0.1%
North West	14,000	4.4%	0.4%
Yorkshire and Humber	900	0.3%	0.0%
East Midlands	18,000	6.8%	0.9%
West Midlands	4,500	1.5%	0.2%
East	6,000	2.8%	0.2%
London	300	0.3%	0.0%
South East	9,000	3.4%	0.2%
South West	18,000	8.5%	0.7%
Wales	8,000	5.6%	0.6%
Scotland	3,000	1.7%	0.1%
Great Britain	82,000	3.4%	0.3%

Source: Nomisweb analysis of Business Register and Employment Survey

Figure 10 shows the size break down of local units within the aerospace sector and the wider manufacturing sector. This shows that the aerospace sector has a larger proportion of its employment located in micro size band of zero to five employees, the medium size band of 50 to 249 employees and large establishments with more than 250 employees. This might reflect the complexity of the final products of the sector, which require larger facilities to produce, squeezing out smaller establishments.

Figure 10

Size Breakdown of UK Aerospace and Manufacturing Local Units, 2019



Source: Nomisweb analysis of UK Business Counts - local units by industry and employment size band

Regional Breakdown of Aerospace Local Units

Table 9 shows numbers employed by size of employer across the English regions, Scotland Wales and Northern Ireland. This shows a roughly similar distribution by size in each region and no clear pattern by those regions with a large proportion of employment in the aerospace sector. The North East and Scotland have a slight preponderance for small (10-49 employees) establishments but the differences are not striking.

Table 9

Regional Breakdown of Aerospace Employment by Size of Employer, 2019

	Micro (0 to 9)	**Small** (10 to 49)	**Medium** (50 to 249)	**Large** (250+)	**Total**
East	266,530	36,720	7,595	1,005	311,855
	85.5%	11.8%	2.4%	0.3%	100.0%
East Midlands	176,350	27,405	5,895	835	210,490
	83.8%	13.0%	2.8%	0.4%	100.0%
London	509,415	59,570	12,885	2,315	584,185
	87.2%	10.2%	2.2%	0.4%	100.0%
North East	71,710	13,895	2,965	455	89,020
	80.6%	15.6%	3.3%	0.5%	100.0%
North West	262,955	42,140	9,055	1,375	315,525
	83.3%	13.4%	2.9%	0.4%	100.0%
Northern Ireland	75,885	11,765	2,250	290	90,190
	84.1%	13.0%	2.5%	0.3%	100.0%
Scotland	181,340	34,000	6,730	1,050	223,125
	81.3%	15.2%	3.0%	0.5%	100.0%
South East	408,920	55,705	11,370	1,650	477,645
	85.6%	11.7%	2.4%	0.3%	100.0%
South West	232,205	36,220	6,845	900	276,170
	84.1%	13.1%	2.5%	0.3%	100.0%
Wales	107,115	17,820	3,310	505	128,745
	83.2%	13.8%	2.6%	0.4%	100.0%
West Midlands	210,325	32,530	7,125	1,110	251,085
	83.8%	13.0%	2.8%	0.4%	100.0%
Yorkshire and Humber	183,405	31,380	6,825	965	222,575
	82.4%	14.1%	3.1%	0.4%	100.0%
UK Total	2,686,155	399,145	82,845	12,455	3,180,605
	84.5%	12.5%	2.6%	0.4%	100.0%

Source: Nomisweb analysis of UK Business Counts - local units by industry and employment size band

IMPACT OF BREXIT ON UK SPACE AND AEROSPACE SECTORS


Tim Peake / Flickr

The impact of Brexit on the sector depends on the type of Brexit and the degree of regulatory and standards divergence from Europe that is desired. A hard Brexit will make it difficult to engage with the standards and safety bodies within Europe even those that are structurally independent of the European Union.

If the UK is unable to retain membership of these bodies then the UK will not be able to influence the development of future standards and regulations

Given that our main aerospace markets are likely to continue to be European, products will have to be aligned with European safety and regulatory standards. However, if the UK is unable to retain membership of these bodies then the UK will not be able to influence the development of future standards and regulations.

ESA Galileo project

The European Space Agency (ESA) is an entity separate from the EU so the UK will continue to contribute and benefit from its activities . However, there is some controversy other the ESA Galileo project. Galileo provides a European satellite navigation system as an alternative to the American GPS system and the Russian GLOSNASS both of which could switch off the positioning signal. Galileo also offers a distress beacon system and very accurate positioning for European militaries. As this system has been funded by the EU it is possible that the UK will be excluded from the military signals. As a result, there has been a suggestion that the UK will produce a UK alternative to Galileo for the UK military. Similar problems may emerge with the EU funded Copernicus Earth Observation programme and the Space Surveillance and Tracking (EUSST) programme.


ESA

A Brexit risk assessment produced by Airbus

The UK was one of the four founding countries behind Airbus, the European consortium that designs and builds civil and military aircraft. Airbus employs 14,000 people nearly one in five of aerospace employment in the UK. Airbus has produced a Brexit risk assessment. Without EASA certification, parts made in the UK cannot be included in Airbus planes. This means that UK suppliers of the more than 10,000 unique parts for Airbus will need to transfer the Design Organisation Approval (DOA), Production Organisation Approval (POA) and Maintenance Organisation Approval (MOA) to the EU. This will be a major undertaking for the 4,000 UK companies supplying Airbus. The risk assessment says: "this is why Brexit imposes additional major risks to the aerospace sector compared to other industries." Additionally, they estimate that "production is likely to be severely disrupted" as result of customs and tariff barriers.

4 BEIS guidance satellites and space programmes after Brexit https://www.gov.uk/guidance/satellites-and-space-programmes-after-brexit

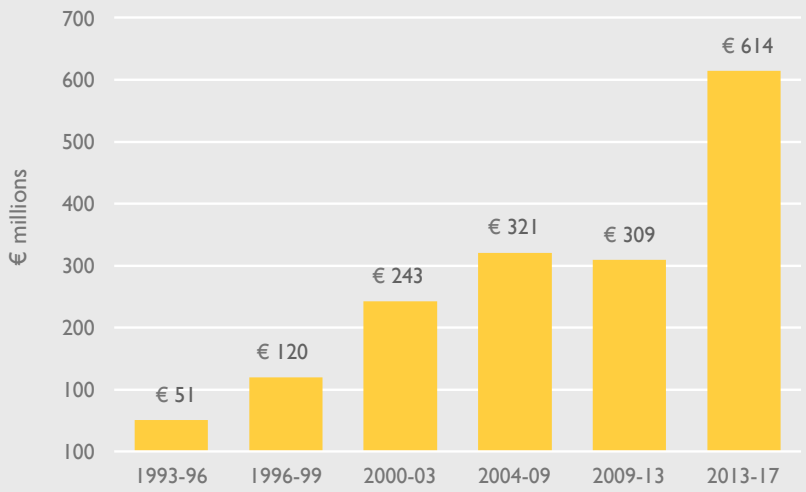
5 Airbus (2018) BREXIT – Risk Assessment, 21 June 2018

R&D Funding

The European Space Agency is separate from the EU and this means that regardless of Brexit the UK will maintain membership. The only problem is with some EU funded projects such as Galileo where the EU might exclude UK companies from participation. Retaining membership of the ESA is increasingly important as the body is a significant source of R&D funding for the sector. Figure 11 shows that since the 1993-95 funding round when the ESA spent €51 million on R&D the spending has increased more than tenfold so that in the 2013-17 funding round, they spent €614 million. Other EU funded R&D funds such as Horizon 2020 will be dependent on negotiating associate membership and the UK Government providing funding to the EU equivalent to the funds obtained by UK from Horizon 2020.

Figure 11

ESA's funding €millions



Source: OECD (2019)

The Impact of Leaving EASA

If as a result of a hard Brexit, or otherwise, the UK manages to be excluded from the European Aviation Safety Agency (EASA) with its bilateral deals with other aviation safety bodies throughout the world and the UN's International Civil Aviation Organisation would have major impacts on the UK's aerospace sector. UK manufacturers would have to get certification from a new national safety body and then also seek certification through EASA while having no influence over the development of EASA's standards. This would also mean that there was no scope for regulatory divergence following Brexit as the any UK standards would have to be compliant with EASA standards. Even if the UK is allowed to retain membership of EASA the current EASA rules do not allow non-EU members voting rights.

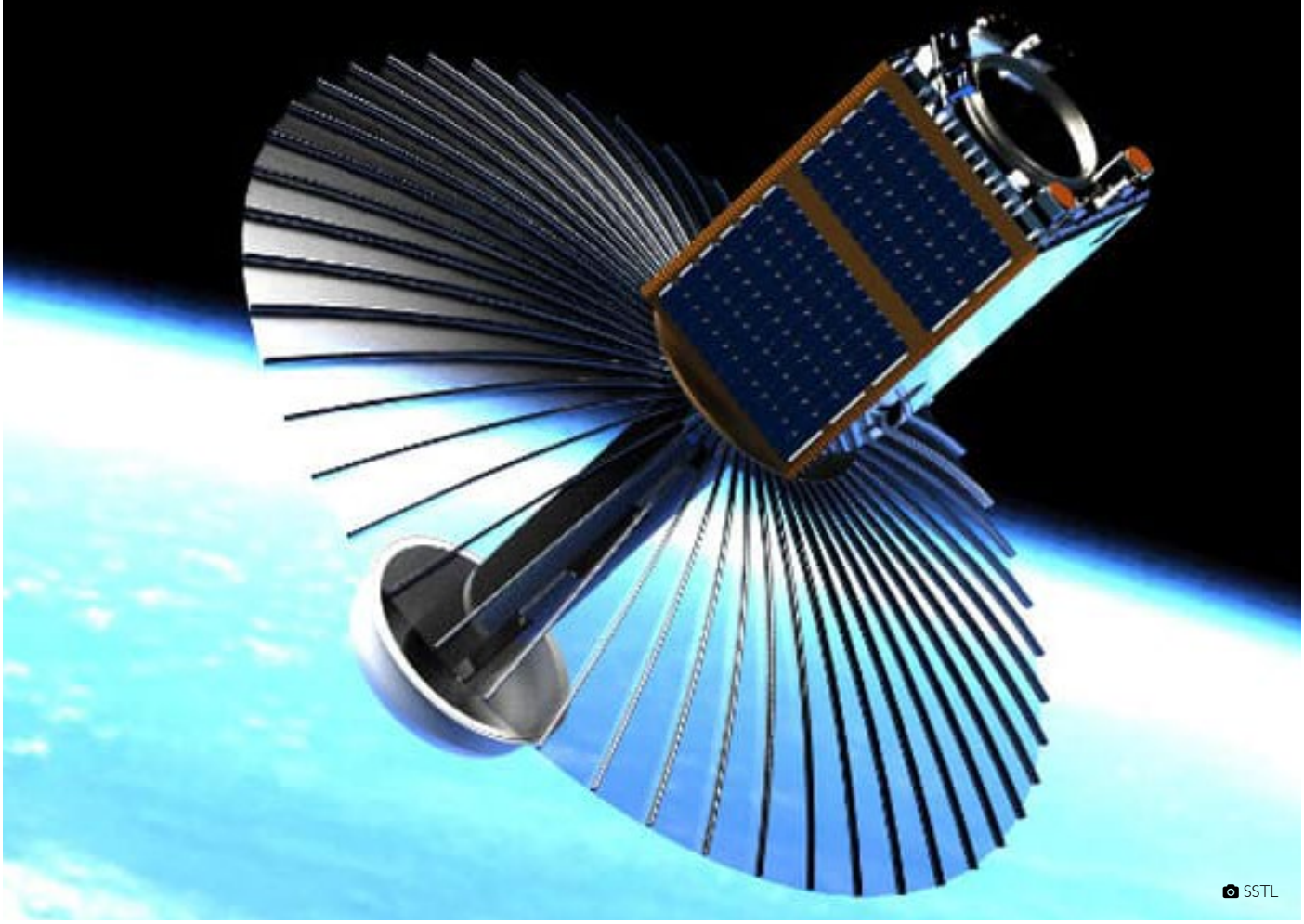
The Impact of Reduced Military Cooperation

Major defence platforms, such as the Tempest fighter, are so expensive to develop that they can only be produced as a result of international collaborations. The EU is increasingly driving these partnerships and could exclude non-EU members from participation in these projects as they are threatening to do over the Galileo satellite navigation system. Being outside of the EU means being outside of the EU's military and security collaboration and this could exclude UK military aerospace projects from potential partners and markets. This in turn would make the costs of developing domestic advanced military platforms prohibitive and seriously impact an important component of the UK's aerospace sector.

CONCLUSIONS AND SUMMARY

The UK has significant and globally competitive space and aerospace sectors. These might be smaller than would be expected based on the size of the UK economy, but there are specific areas of expertise such as small satellites and Rolls Royce's engines.

However, the scale of space and aerospace investments mean that international collaborations are vital. The levels of government support for aerospace R&D is lower in the UK than in comparable countries. The levels of UK aerospace business investment in R&D is slowly recovering from the impact of the banking crisis, but R&D spending is not growing as fast as in other UK sectors. Currently the UK is deeply embedded in the operations of the European Space Agency (ESA) and Airbus, both of which provide significant R&D funding. However, there are some EU funded programmes, including Galileo, that might exclude the UK after Brexit. Additionally, Brexit will change the relationship with the European Aviation Safety Agency which Airbus and the House of Commons Business Energy and Industrial Strategy Committee have identified as a 'critical' issue.



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