Size & Health of the UK Space Industry 2018

A Report to the UK Space Agency

SUMMARY REPORT

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About London Economics

London Economics (LE) is a leading independent economic consultancy, with a dedicated team of professional economists specialised in the space sector.

As a firm, our reputation for independent analysis and client-driven, world-class and academically robust economic research has been built up over 30 years. From our headquarters in London, and associate offices in five other European capitals, we advise an international client base.

As a team, we have been pioneering innovative analytical techniques to provide trusted economic advice to decision-makers across the space industry, space agencies and international governments since 2008. Drawing on our solid understanding of the economics of space, expertise in economic analysis and industry knowledge, we use our expertise to reduce uncertainty and guide decision-makers in this most challenging operating environment.

Our consultants are highly-qualified economists with extensive experience in applying a wide variety of best practice analytical techniques to the space sector, including:

- Market sizing, analysis and demand forecasting;
- Business case support (economic and financial feasibility);
- Value-for-Money (Cost-Benefit Analysis, Cost Effectiveness Analysis);
- Impact assessment and policy evaluation (especially public utility and spillover benefits);
- Sophisticated statistical analysis (econometrics, regression);
- Analysis of industry structure and competitive dynamics;
- Commercial due diligence.

Head Office: London Economics, Somerset House (New Wing), Strand, London WC2R 1LA, United Kingdom.
w: londoneconomics.co.uk/space e: space@londoneconomics.co.uk
t: +44 (0)20 3701 7707 : @LE_Aerospace

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Authors

Divisional Director, Space
Associate Director, Space
Economic Consultant, Space
Economic Analyst, Space

Key findings

This 2018 edition of the ***Size and Health of the UK Space Industry*** is the most comprehensive measurement of the UK space industry yet, including new insights. The analysis is based on **948 UK-based space-related organisations**, comprising 276 survey responses and desk-based research of more than 600 organisations.

- Total UK space industry income grew to **£14.8 billion** in 2016/17, a growth rate of **3.3% per annum**. At current exchange rates following the depreciation of Sterling, this is equivalent to **5.1% of the global space economy** (2016/17). *Income is forecasted to grow 4.8% to £15.5 billion in 2017/18.*
- The **upstream** grew strongly to **£2.4 billion**, though the **downstream** still dominates at **£12.4 billion**. **Space Applications** is the largest segment with **69%** of income, of which 48% is Direct-to-Home (DTH) broadcasting. This is followed by Space Operations (**15%**), Space Manufacturing (**13%**) and Ancillary Services (**3%**).
- Across all activities, **Broadcasting** dominates (**51%** of total income) followed by **Communications** (**19%**), **Position, Navigation and Timing** (**12%**), **Defence** (which has grown to **8%**), and **Earth Observation** (**3%**).
- **Space Manufacturing was the engine for growth** (**27%** growth per annum), contributing three quarters of the overall change in total income. This was followed by **Ancillary Services** (**7%** p.a.) and **Space Operations** (**2%** p.a.). The **Space Applications** segment saw no growth (**0%** p.a.) in aggregate, with a **decrease in DTH broadcasting income** concealing growth of **Other (non-DTH) space applications** (**3%** p.a.): **satellite data (e.g. EO) processors** (**35%** p.a.), **satellite applications** (**32%** p.a.), **mobile satellite communications** (**27%** p.a.) and **location-based signal services** (**20%** p.a.).
- **The industry is diversifying**: The income share of **DTH is steadily decreasing** (from **69%** in 2010/11 to **48%** in 2016/17). This is partly due to **falling DTH income** (**-1.6%** in 2016/17), but mainly due to **strong growth** in income from **non-DTH activities** (**7.5%** p.a. since 2014/15) to **£7.7 billion** in 2016/17.
- The **UK space industry** now comprises **948 organisations**, with **39 new entrants per year** since 2012. Income growth from 2014/15 to 2016/17 (**+£924 million**) can be decomposed into: **organic growth** (**+£794 million**), **new entrants** (**+£357 million**), less **attrition** (**-£226 million**).
- Growth is concentrated amongst **very large enterprises** (**56%** of overall growth) and **larger SMEs** (**28%**), with the latter **growing particularly fast** (**31%** p.a., compared to very large enterprises at 2% p.a.).
- The industry is **commercially-focused**, with **82%** of income from sales to consumers and businesses. However, the **public sector share of income has increased** from 14% (2014/15) to **18%** (Space Agencies **4%**, Government **14%**), but remains marginally lower than the global average (20%).
- The industry is **concentrated**: **4** organisations account for **67%** of total income, and **7** for **76%**.
- **Exports** grew to **£5.5 billion** in 2016/17, or **37.4%** of total income. This is up from 36.4% in 2014/15 and this export intensity is **one third higher** than the UK economy. The share increases to **65.4%** for non-DTH activities.
- **Trade with Europe is very important – Europe** is the destination for **54%** of exports (49% in 2014/15) and the source of **69%** of imports (inputs). Plus, EU-funded programmes account for **4.8%** of **total non-DTH industry income**.
- The industry directly contributed **£5.7 billion** of **Gross Value-Added** to UK economic output (**0.29%** of UK GDP, up from 0.27% in 2014/15), and a total of **£13.0 billion** (including supply chain effects) in 2016/17.
- **Employment** in the UK space industry increased at a rate of **4.3%** per annum to **41,900 jobs** in 2016/17. This is equivalent to **0.13%** of the UK workforce (up from 0.12%), and a total employment supported of **117,000 jobs**.
- All 13 **UK regions** are home to headquarters of space organisations, though industrial sites (and employment) are **concentrated in London, South East and East of England, and Scotland**.
- The UK space industry's **labour productivity** (calculated as average GVA per employee) grew marginally to **£135,056** (up from £134,832 in 2014/15). This is equivalent to **2.6 times the UK's average labour productivity.**
- The space industry workforce is **exceptionally highly-skilled**, with **3 in 4** employees holding at least a primary degree. This is **higher than any sector covered by ONS Census data for England and Wales.**
- With **£566m** (**3.8%** of income, up from 3.0% in 2014/15) or **10%** of GVA invested in **R&D**, the space industry is **6 times more R&D intensive than the UK average**. This is led by Space Manufacturing (14% of income on R&D).
- **Economic uncertainty** is the **most prevalent barrier** for industry (**44%** of survey respondents). This is reflected in an '**UK-EU partnership deal for the UK's exit from the EU (Brexit)**' being cited as a '**key enabler**' for growth by **61%** of survey respondents. Even so, there is optimism with respect to near-term **income growth** (7 in 10 respondents) and **job growth** (7 in 10 respondents), especially from smaller space organisations.
- It is estimated that wider UK industrial activities representing **over £300 billion of UK non-financial business economy GDP (15.3%)** are **supported by satellite services** as follows (not mutually exclusive):
  - **GNSS (positioning, navigation and timing)** satellite services support **£264 billion** of GDP (13.4%).
  - **Meteorological** satellite services support **£159 billion** of GDP (8.1%).
  - **Telecommunication** satellite services support **£117 billion** of GDP (5.9%).
  - **Earth Observation** satellite services support **£92 billion** of GDP (4.7%).

Summary of findings

Introduction

The UK Space Agency ('the Agency') is responsible for all strategic decisions on the UK civil space programme and provides a clear, single voice for UK space ambitions. Every two years,[1] the Agency surveys all organisations in the UK who supply and/or make use of space or satellite services – from upstream manufacturing right through to downstream satellite-enabled applications, including both commercial and non-commercial activities (e.g. fundamental research, space science).

This edition is the latest in the series of the ***Size and Health of the UK Space Industry*** study, which represents **the definitive source of information on the UK space sector**. As such, it is used by the Agency to track growth and developments in the industry – including emerging trends and any limiting constraints on performance. These insights play an important role in shaping UK space policy and targeting support to industry to reach the 10% global share ambition by 2030.

The Agency again commissioned London Economics to conduct the study, covering 2015/16 and 2016/17 (*plus an estimated forecast for 2017/18*). By supplementing survey inputs with significant secondary research, and adopting thought-leading frameworks and best practice techniques to measure the space economy, the study aims to give a **comprehensive, progressive and accurate overview** of the size, performance and characteristics of organisations engaged in space-related activities in the UK. This report summarises the findings of the 2018 edition.

Approach

This edition maintains the methodology of the 2016 edition to preserve the consistency of the time series and to support the Agency's objectives of identifying patterns of growth and emerging trends.

As in previous years, the study collected industry data in the form of an online questionnaire, but it is important to note that the study is not solely reliant on the survey. Instead, the approach employs a **combination of primary and secondary research** to deliver comprehensive coverage of the UK space industry.

This edition makes several **improvements** on previous editions, ensuring **greater coverage** and **more accurate measurement** of the sector than ever before:

- Maintaining the evolved industry **segmentation** and its consistency with the historic upstream/downstream dichotomy;
- Expanded identification of space-related organisations in the UK, with a special effort to ensure better representation of universities, research institutions, and organisations in Scotland, Wales, Northern Ireland and other regional clusters. The 2018 findings are based on **948 UK-based space organisations;**
- An increase in survey responses to a total of **276 organisations**.
- Substantially expanded programme of **secondary research** to cover all space-related organisations in the UK – survey responses have been cross-checked and supplemented by desk-based research (statutory annual reports on Companies House, Bureau van Dijk's

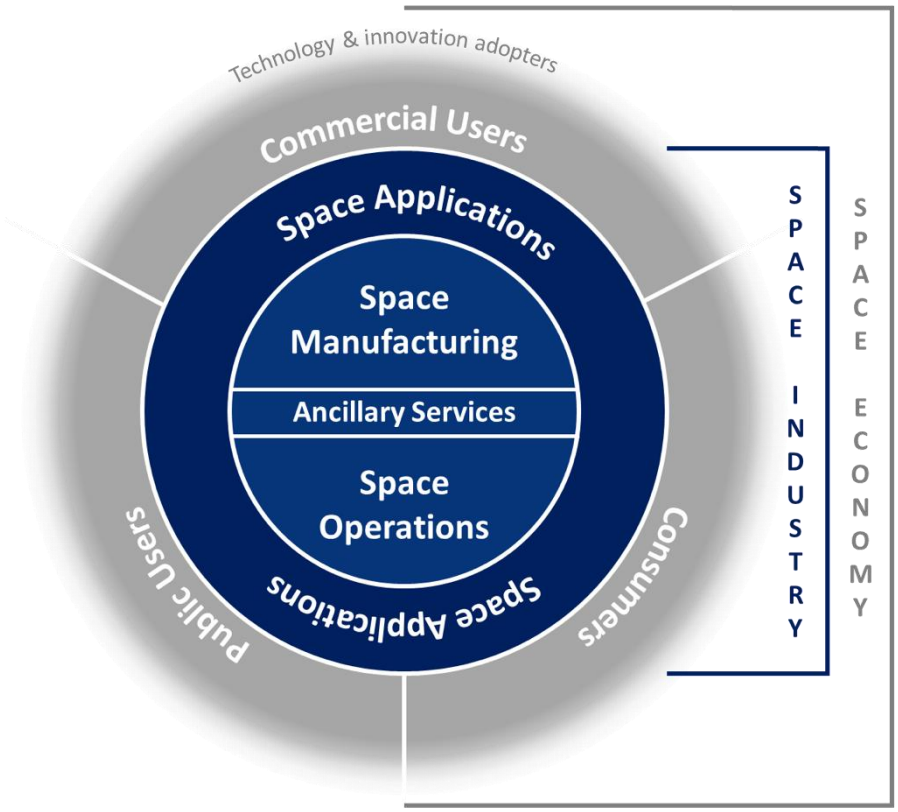
[1] The 2016 *Size and Health of the UK Space Industry* report is available at: https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2016.

Orbis financial database, London Economics' proprietary databases and knowledge of the space industry, etc.) of **more than 600 organisations**;

- **Additional analysis** of UK income and inputs (e.g. by country and customer types) to provide new insights; and
- An **update** of the assessment of the **use of space and satellite services** across the UK economy.

These improvements together ensure **greater coverage, more accurate measurement** and **deeper insight** of the sector than ever before in a way that is consistent with international best practice[2].

Segmentation of the UK space economy



Source: London Economics

The **'space industry'** is defined to include all organisations that are engaged in any space-related activity to some degree. It comprises both:

- **Commercial organisations** (i.e. businesses, companies, firms) that earn revenue from the manufacture, launch and operation of satellites/spacecraft, and from utilisation of the signals and data supplied by satellites/spacecraft to develop value-added applications; and
- **Non-commercial organisations** (e.g. universities, research institutes) that secure funding to contribute space-specific research and expertise throughout the industry supply chain, often in partnership with commercial organisations.

[2] For example: OECD's *The Space Economy at a Glance* series, and The Space Foundation's *The Space Report* series – both of which were used as reference estimates in the setting of the Space IGS ambitions.

Reflecting this diversity, this edition maintains the reference to '**Income**' rather than 'Turnover'. Non-commercial income includes grant funding, core funding, research funding, tuition fees, departmental expenditures, and operating budgets.

A **'space-related activity'** is defined to be any one (or more) of the following activities:

- **Space Manufacturing: Design and/or manufacture of space equipment and subsystems**

  Including: launch vehicles and subsystems, satellites/payloads/spacecraft and subsystems, scientific instruments, ground segment systems and equipment (control centres and telemetry), suppliers of materials and components, scientific and engineering support, fundamental and applied research.
- **Space Operations: Launch and/or operation of satellites and/or spacecraft**

  Including: launch services, launch brokerage services, proprietary satellite operation (incl. sale/lease of capacity), third-party ground segment operation, ground station networks.
- **Space Applications: Applications of satellite signals and data**

  Including: Direct-To-Home (DTH) broadcasting, fixed and mobile satellite communications services (incl. VSAT), location-based signal and connectivity service providers, supply of user devices and equipment, processors of satellite data, applications relying on embedded satellite signals (e.g. GPS devices and location-based services) and/or data (e.g. meteorology, commercial GIS software and geospatial products).
- **Ancillary Services: Specialised support services**

  Including: launch and satellite insurance (incl. brokerage) services, financial and legal services, construction, software and IT services, market research and consultancy services, business incubation and development, policymaking, regulation and oversight.

The importance of space and satellite services in the UK does not end with the activities of the space industry. Rather, a wide range of **non-space activities** (including consumer, industrial, and public sector) are **supported by satellite services** – termed **'users'**. 'Space' is therefore designated as a critical element of the UK's national infrastructure. For the purposes of this study,[3] (commercial) users are defined as 'organisations in **UK industries supported by satellite services** for whom, if satellites were to be de-activated, their business would be severely disrupted even after an appropriate adjustment time has passed'.

Caveats and limitations

Though the research has been conducted by a team of independent economists with specialist knowledge of the space sector, using best practice and best judgement to calculate robust and fair estimates, the following caveats apply:

- **Measurement error uncertainty:** The analysis employs estimation and approximation techniques – the true coverage of the analysis and the measurement error associated with survey respondent data cannot be estimated.
- **Unidentified omissions:** Despite best efforts, some organisations with space-related activities based in the UK are likely to have been missed, but any omissions should be on the smaller end of the size spectrum and would not have a meaningful impact on estimates.

[3] The focus of this study is on the space industry and commercial users of space and satellite services, though users of space extend to non-commercial domains: public users (e.g. HM Government) and consumers (i.e. general public).

- **Exchange rate fluctuations:** The monetary values quoted in this report are expressed in GBP. During the period of analysis (2015/16 – 2016/17), there has been an overall depreciation in the GBP against the USD and other major currencies, particularly against the EUR and JPY. Since the UK space industry supply chain sources inputs from overseas (foreign currency prices converted to GBP) and exports goods/services for sale abroad (GBP prices converted to foreign currency), the pattern of income over time (and the global share) therefore reflects both an actual change in sale volumes and fluctuations in currency values over that time. The impact of these exchange rate movements on UK space industry performance may be delayed owing to a lag effect of forward contracts for imported inputs.
- **Financial years:** All companies (with formal requirements to report figures) estimate income and employment across financial years. The start and end dates of these reporting years vary between companies. Estimates of space-related income and employment recorded for this study therefore reflect the specific financial years of companies. Reference to years in this report similarly reflect financial years and not calendar years.

Note: All figures presented are in constant 2016/17 (financial year) prices. All growth rates are in real terms (inflation-adjusted), all average growth rates are compound annual growth rates (CAGR).

Size of the UK space industry

Income

Total UK space industry income grew to **£14.8 billion** in 2016/17.

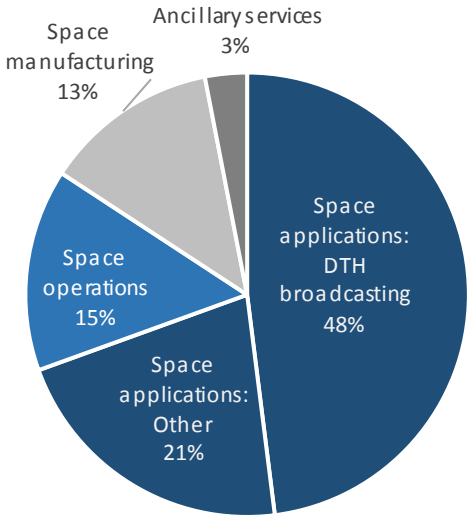
The **upstream** is notably larger than previous years at **£2.4 billion**. However, the **downstream** remains dominant – at **£12.4 billion** in 2016/17, or 84% of total industry income. Without Direct-To-Home broadcasting (DTH), overall the space industry income reduces to **£7.7bn**, with downstream accounting for 69% of total industry income.

Analysing the space industry income by segment reveals substantial differences in size. **At £10.3 billion**, **Space Applications is by far the largest segment**, accounting for **69%** of income – dominated by DTH broadcasting, which makes up the majority of income in this segment and **48%** of total space income (down from 52% in 2014/15). **Space Operations** is the second largest segment (**15%**), with **Space Manufacturing** (**13%**) in third and **Ancillary Services** accounting for **3%.**

UK space industry income by segment, 2016/17

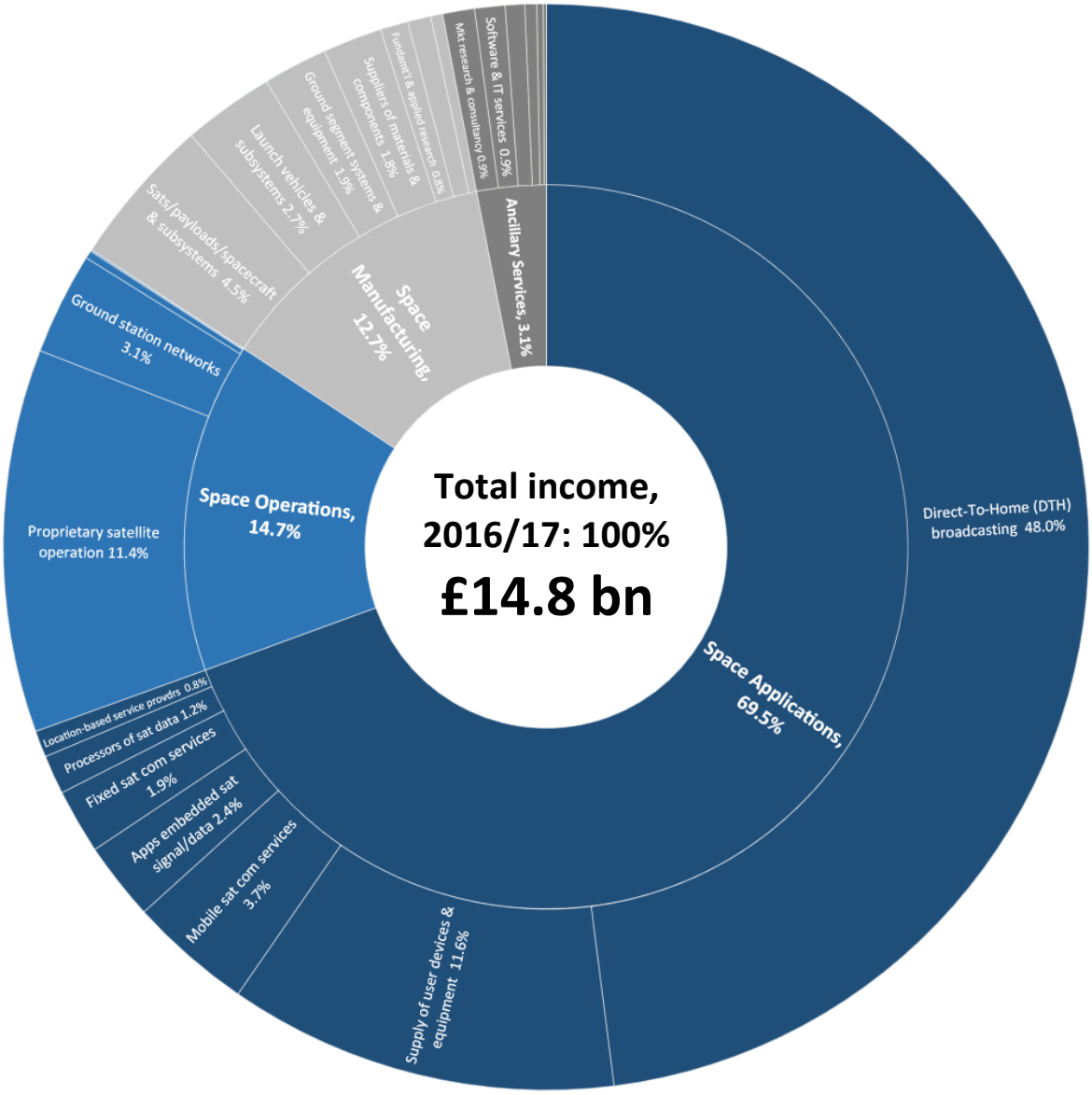
Segment	2016/17 £m
Space Applications	10,278
- DTH broadcasting	*7,101*
- Other applications	*3,177*
Space Operations	2,179
Space Manufacturing	1,882
Ancillary Services	453
Total	**14,792**

Source: London Economics analysis



After DTH, the next largest Space Applications activity is **Supply of user devices and equipment**, with **12%** of total income. Together, **satellite communication services** account for **6%** of total income (**4% Mobile**, **2% Fixed**). Space Operations is dominated by **Proprietary satellite operations**, accounting for **11%** of total space income. The **Manufacture of satellites, payloads, spacecraft and subsystems** is the largest Space Manufacturing activity, with a **4%** of total industry income.

UK space income by segment and activity, 2016/17



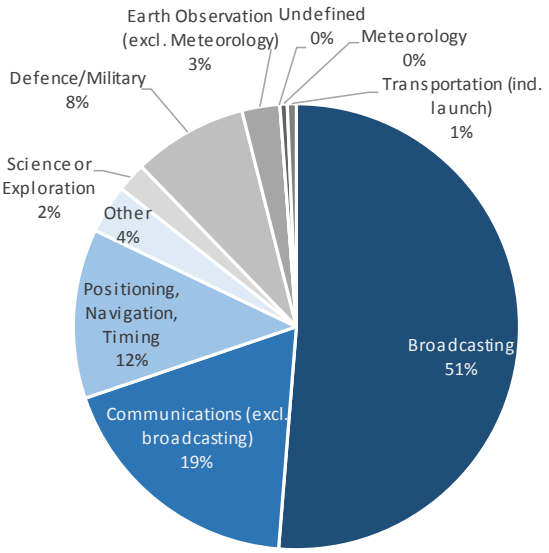
Source: London Economics analysis

Looking across all segments, **Broadcasting** dominates with a total income of **£7.6bn**, or **51%** of total income in 2014/15. However, this has decreased from 56% in 2014/15, suggesting continued diversification in the industry. Together with **Communications** (**19%**) and **Position, Navigation and Timing** (**12%**), they account for **82%** of total space industry income. Some changes since 2014/15 are notable: **Defence/Military** has seen strong growth that increases its share from 2% to **8%** in 2016/17, and though small, space **Transportation** has increased from 0.2% to **0.7%** in 2016/17.

UK space industry income by capability, 2016/17

Capability	2016/17 £m
Broadcasting	7,584
Communications (excl. broadcasting)	2,741
Positioning, Navigation, Timing	1,819
Defence/Military	1,228
Other	523
Earth Observation (excl. Meteorology)	407
Science or Exploration	315
Transportation (incl. launch)	97
Meteorology	78
Total	**14,792**

Source: London Economics analysis



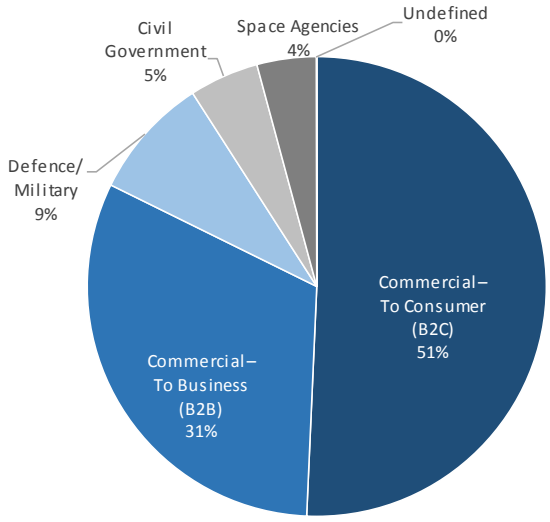
The industry is **commercially-focused**, though the share of income generated from the **public sector** has **increased** from 14% (2014/15) to **18%**, comprising **4%** from space agencies (of which: **3%** ESA) and **14%** from government bodies (of which: **5%** civil; **9%** military). This is still marginally lower than the global average of 20%[4]. In the 2016/17 financial year, sales to consumers (B2C) and businesses (B2B) represented **82%** of total sales, and total income generated from B2C and B2B customers has increased from **£11.8 billion** to **£12.2 billion** in 2016/17 (growth rate of **1.7%** per annum).

In total, **European Union-funded** programmes (Galileo, EGNOS, Copernicus, Horizon 2020, other) account for **£372 million**, equivalent to **2.5%** of total industry income or **4.8%** of non-DTH income.

UK space industry income by customer type, 2016/17

Customer		2016/17 £m
Commercial	Consumer (B2C)	7,500
	Business (B2B)	4,670
Defence/Military		1,276
Other Civil Government		402
European Space Agency (ESA)	Galileo	190
	EGNOS	0.12
	Copernicus	34
	Other	264
Research/Science Funding Bodies		174
European Commission (EC)	H2020	15
	Other	133
UK Space Agency		70
Other Space Agency		60
Undefined		3
Total		**14,792**

Source: London Economics analysis



The industry is **concentrated**: in 2016/17, just 4 organisations accounted for two thirds (67%) of total income; and with the next three, the top 7 accounted for more than three quarters (76%).

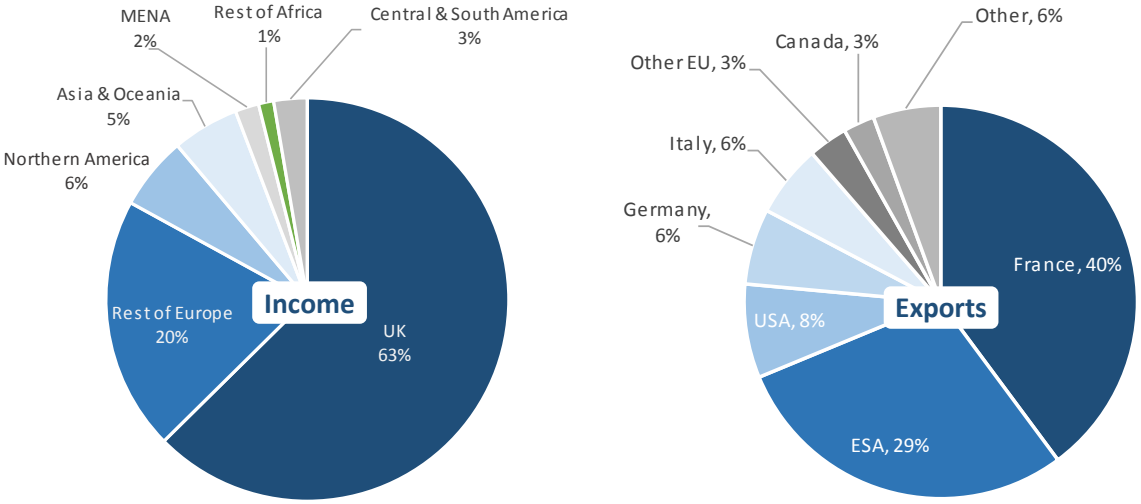
[4] The Space Foundation (2018). *The Space Report 2018*.

Exports

The UK space industry has enjoyed **success in exports and now generates more than 37%** (**£5.5 billion**) of income from abroad (up from 36% in 2014/15).[5] At **37%**, the UK space industry's export share is **one third higher** than the export share of the UK economy as a whole (**28%**[6]). The picture improves further if DTH broadcasting – which has a strong domestic market focus – is filtered out. Indeed, **the export share of UK space industry excluding DTH stands at 65% in 2016/17** (compared with 69% in 2014/15).

As shown in the left-hand pie chart below (Income by region), the most important export market for the UK space industry is the **Rest of Europe,**[7] representing **20% of total income** (up from 18% in 2014/15) and **54% of total exports** (up from 49% in 2014/15). **The Americas**, comprising Northern America and Central & South America (incl. Caribbean), continue to represent the third largest market with **total share of 9%** of income.

UK space industry income and exports by geographical source, 2016/17



Notes: Regional-level analysis of income on the left-hand side is based on the full industry sample (948 organisations). Country-level analysis of income (exports) on the right-hand side is based on the limited survey sample (157 respondents to this question).

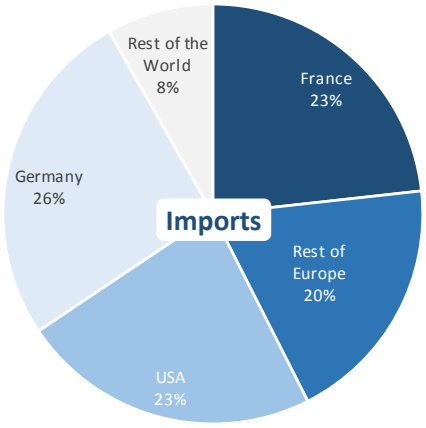
Source: London Economics analysis

The right-hand pie chart above (Exports) is based on a limited sample of respondents[8], but allows a view of exports by country. The regional picture of **Europe as the UK's most significant foreign market** appears to be driven by significant UK exports to **France** and **ESA**, with a combined share of **69%** of all UK exports. Beyond Europe, the **USA** and **Canada** are the UK's leading export markets, with shares of **8%** and **3%**, respectively.

[5] By definition, goods and services sold to ESA are an export as the ownership of goods or intellectual property changes hands from a UK entity to an entity that is based in a foreign country and which is not majority-controlled by UK interests.
[6] Trade in goods and services – UK export % of GDP, 2016. Source: OECD (2018). 'Trade in goods and services (indicator)' from *OECD National Accounts at a Glance*. Available at: https://data.oecd.org/trade/trade-in-goods-and-services.htm
[7] Includes European Space Agency, European Commission, and European governments, businesses and consumers
[8] The discrepancy between regional and country-level analysis of income is the result of differences in the sample size (948 organisations vs 157 survey respondents, respectively).

Imports

Based on a limited sample (85 respondents), more than half (**58%**) of the industry's inputs are imported from overseas. As with exports, imports are concentrated in the same regions – Europe dominates with **69%** of all imports, followed by Northern America with **27%**. Imports are heavily concentrated – just three countries account for **72%** of imports. These countries are Germany (**26%**), France (**23%**) and the USA (**23%**).



Source: London Economics analysis

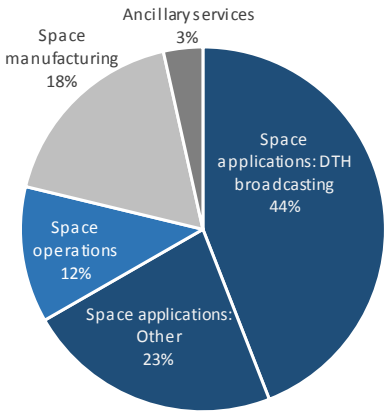
Contribution to GDP

A key impact of any sector, region, or firm on the economy is its contribution to the output, or Gross Domestic Product (GDP) of the country as approximated by Gross Value-Added (GVA). In 2016/17, the UK space industry is estimated to have directly contributed **£5.7 billion** of GVA (in current prices) to UK economic output – equivalent to **38%** of space industry income and **0.29%** of total UK GDP. Since 2009/10, space has increased its share of UK GDP by **0.05 percentage points**, suggesting stronger performance relative to the rest of the UK economy.

UK space industry Gross Value-Added by segment, 2016/17

Segment	2016/17
	£m
Space Applications	3,777
- DTH broadcasting	*2,482*
- Other applications	*1,295*
Space Operations	684
Space Manufacturing	1,005
Ancillary Services	197
Total	**5,663**

Source: London Economics analysis



As with income, the **downstream segment** generated the majority (**£4.5 billion** or **80%**) of space industry **Gross Value Added** in 2016/17, down on the 86% share in 2015/16. **The majority of UK space GVA is generated in the Space Applications segment with 67%**, slightly less than the **69%** of income accounted for by the segment. As for income, this segment is led by Direct-To-Home broadcasting (contributing **44%**). At **18%** (up from 10% in 2014/15), Space Manufacturing accounts for a higher share of GVA than income (**13%**). At **12%** Space Operations accounts for a smaller share of GVA than income (**15%**). Ancillary Services contributes **3%** to both space industry GVA and income.

Employment

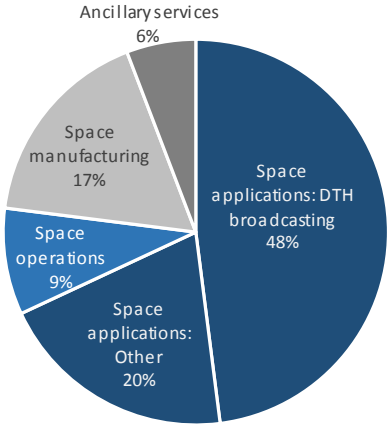
Employment is another key measure of impact on an economy. Total employment (headcount) in the UK space industry increased from 38,500 jobs supported in 2014/15 to **41,900** jobs in 2016/17 – equivalent to **0.13%** of the total UK workforce. The total breaks down to **8,900** jobs supported in the **upstream** segment and **33,000** jobs in the **downstream**.

Unsurprisingly, Space Applications also dominated employment, accounting for **68%** of the industry's total, of which DTH broadcasting is **48%** of the total. Space Manufacturing employs a greater number of staff than Space Operations (**17%** and **9%**, respectively), with Ancillary Services making up a small but important workforce (**6%**).

UK space industry employment by segment, 2016/17

Segment	2016/17 # of employees
Space Applications	28,538
- DTH broadcasting	*20,117*
- Other applications	*8,421*
Space Manufacturing	3,748
Space Operations	7,203
Ancillary Services	2,440
Total	**41,929**

Source: London Economics analysis



Labour productivity and skills

The labour productivity (GVA per employee) for the UK space industry in 2016/17 was **£135,056** (up marginally from £134,832 in 2014/15). This is equivalent to **2.6 times the UK's average labour productivity** (**£52,626**).[9]

However, whilst a useful and informative metric, labour productivity does not tell the whole story. Activities that rely on a large capital stock to deliver goods and services may present large labour productivity estimates as fewer employees are required. Similarly, some activities support value creation elsewhere in the value chain, such as fundamental and applied research and policymaking, regulation and oversight.

This high level of labour productivity reflects the **exceptionally skilled workforce** of the UK space industry, based on the limited sample of responses received. Survey respondents indicate that most employees have undertaken university education, with **75%** of employees possessing at least a bachelor's degree. **13%** of employees hold vocational qualifications (i.e. a Higher National Certificate (HNC) or Higher National Diploma (HND)), and the remaining **11%** possess other qualifications, including space-specific diplomas from ESA or other settings. In terms of the 'share of employees holding a higher degree, first degree or HNC/HND and equivalent qualifications', the **average qualification level of space industry employees is higher than any sector covered by ONS Census data for England and Wales**. This applies for the whole space industry and all four of the value chain segments.

[9]ONS (2018) Subregional Productivity: Labour Productivity (GVA per hours worked and GVA per filled job) indices by UK NUTS2 and NUTS3 regions. Available here: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivitylabourproductivitygvaperhourworkedandgvaperfilledjobindicesbyuknuts2andnuts3subregions

Research and Development (R&D)

Investments in research and development generates new knowledge, products and processes, allowing organisations to use the inputs available to them more efficiently and to supply improved products or services to the economy.

R&D expenditure in 2016/17 stood at **£566m**, or **3.8%** of total industry income. This is higher in absolute terms than in recent years the 2016/17 total amounts to 135% of the 2014/15 total in real terms (growth of **16% per annum**). In monetary terms, the Space Manufacturing segment has the largest R&D activity at **£255m** (45% of industry total), followed by Space Applications at **£252m**. However, R&D intensity varies widely by segment. The Space Manufacturing segment is the most R&D-intensive, reinvesting **14%** of income on R&D. Space Operations and Space Applications are lower on R&D intensity at **1%** and **3%** of income invested in R&D, respectively. The modest space-related R&D expenditure in DTH broadcasting is the main reason for the low R&D intensity of Space Applications – **non-DTH application organisations** spend a much higher **17**% of GVA and **7%** of income on R&D. Ancillary Services invests a higher amount on R&D at **7%** of income, although this is still below the industry average of 10%.

This pattern highlights a key feature of the space industry: **capabilities developed in the R&D-intensive upstream are commercialised by downstream organisations**. **Space Manufacturing** and **Ancillary Service** organisations maintain their R&D intensity through **external funding**, with **53%** of and **63%** R&D funding sourced externally (e.g. research grants), respectively. Organisations in the Space Operations and Space Applications segments are more reliant on internal R&D funding (where the organisation self-funds the R&D activity), raising a lower **38%** and **39%** of R&D through external funding. Without the R&D intense space manufacturing segment, there would be no space applications, so public schemes are designed to transfer income from the lucrative downstream activities to the enabling upstream activities.

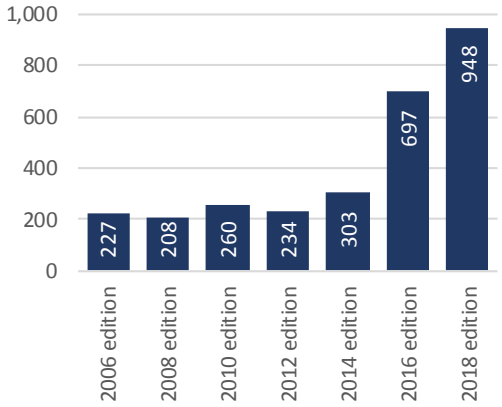
With the equivalent of **10%** of direct GVA in the industry invested in R&D – **6 times higher than the UK average** of 1.7%[10] – the UK space industry compares favourably with key economic sectors such as Machinery and equipment and Electrical components (7.7% and 3.6%, respectively). However, the motor vehicles sector invests greater proportions of GVA than the space sector with 20%.

[10] ONS. (2018). Gross domestic expenditure on research and development. Total R&D expenditure in the UK in 2016 represented 1.67% of Gross Domestic Product (GDP).

Health of the UK space industry

Growth: Population

Since the 2012 edition, the population of organisations confirmed to have space-related activities in the UK has **grown from 234 to 948 organisations**. Whilst identification is boosted over time as knowledge of the sector grows, growth in the sector's population continues – with new entrants, such as start-ups and spin-outs, plus a growing list of inward investments offsetting attrition from the industry.



Before 2012, the number of new incorporations – an indicator of entry into the industry – averaged a rate of 22 companies per year. This trend has increased in more recent years to an **average of 39 new companies per year between 2012 and 2016**.

Growth: Income

Total income of the UK space industry continued to grow over the two-year period, although the rate of growth slowed to **3.3%** per annum between 2014/15 and 2016/17 – from an average of **8.5%**[11] per annum between 1999/2000 and 2012/13, and more recently **6.5%** between 2012/13 and 2014/15. While this represents slower growth than the historical trend, it still **outpaces growth in the general UK economy** which also exhibited a slowdown over the same period (2.0%)[12]

UK space industry income growth, 2009/10 – 2017/18*

Year	Current prices, £m	2016/17 prices, £m	Real growth
2009/10	8,334	9,663	8.0%
2010/11	9,188	10,292	6.5%
2011/12	11,087	11,907	15.7%
2012/13	11,848	12,398	4.1%
2013/14	13,347	13,651	10.1%
2014/15	13,702	13,868	1.6%
2015/16	**13,998**	**14,152**	**2.1%**
2016/17	**14,792**	**14,792**	**4.5%**
*2017/18**	*15,938*	*15,500*	*4.8%*

Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis

Highlights:

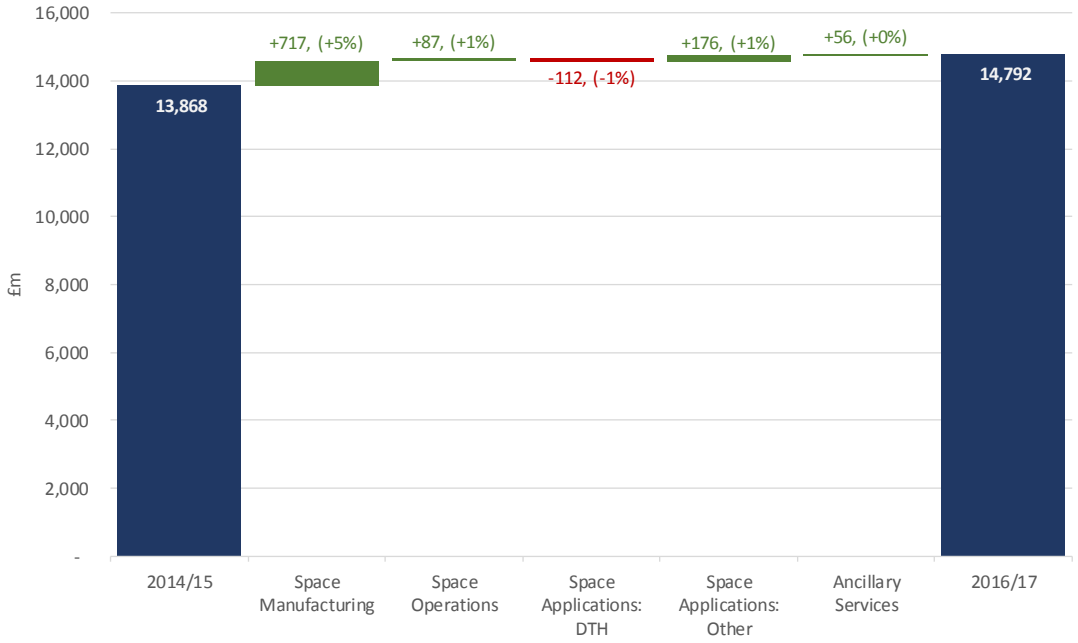
- The industry is **diversifying**: the share of income accounted for by **Direct-to-Home (DTH) Broadcasting has continued its decreasing trend**, falling from **69%** in **2010/11** to **48%** in **2016/17** (*and 45% in 2017/18f*). This partly due to a **fall in DTH income** of **-1.6%** in 2016/17 *(and -1.1% in 2017/18f*), but mainly due to **strong growth from non-DTH activities** of **7.5% per annum** since 2014/15. This saw Non-DTH income total **£7.7 billion** in 2016/17.

[11] London Economics (2015). *The Case for Space 2015*.
[12] ONS (2018). GDP first quarterly estimate, UK: July to September 2018. Financial year estimate based on quarterly GDP figures.

- **Space Manufacturing was the industry's engine for growth**, exhibiting a growth rate of 27% per annum and contributing almost three quarters of the industry's entire growth (£717m) over the 2014/15 – 2016/17 period. This performance was followed by **Ancillary Services** and **Space Operations** with growth rates of 7% and 2% per annum, respectively.
- In contrast, the **Space Applications segment saw no growth overall** (**0%**), with a **decrease in DTH income** (**-1%** per annum) **concealing growth of Other (non-DTH) space applications** of **3% per annum**: **satellite data processors** (**35%** per annum), **applications using satellite signals/data** (**32%** per annum), **mobile satellite communications** (**27%** per annum), and **location-based signal services** (**20%** per annum).
- The size of the DTH broadcasting segment meant that this decline **dampened overall industry growth by over 10%.**

The contribution of these segment-level changes to overall growth is presented graphically below.

Decomposition of UK space industry income growth by segment, 2014/15 – 2016/17



Source: London Economics analysis

- Delving deeper to activities reveals **substantial variability in growth performance**. Income from **Launch vehicles and subsystems increased significantly** (+242%) from a low baseline – contributing 40% of overall industry growth. This performance reflects the **UK Spaceflight** programme and **Defence** activities.
- Other notable performers include **Suppliers of materials and components** and **Scientific engineering support**, with annual growth rates of **45%** and **42%**, respectively.
- Considering income by capability (activities across all segments), **strong growth** in **Defence** and **Transport** stands out (**105%** and **102%** growth per annum, respectively). With real growth of over £930 million in monetary terms since 2014/15, **Defence** is the **main contributor to overall space industry growth over the study period.** The increase in defence income alone is equivalent to the industry's entire growth over the study period.
- This growth is dampened by contraction in income from other capabilities – e.g. **Scientific instruments** (**-37%**, driven by survey responses), **Legal and financial services** (**-58%**, driven by attrition of space-related business away from the UK), but particularly a **reduction** of **-£181m** in **Broadcasting** (**-1%**).
- A number of organisations have **ceased trading or have exited** the UK industry, accounting for a loss of -**£226m** since 2014/15 (**-24%** of overall change in industry income).

Earth Observation also achieved **remarkable growth** since 2014/15 (+£150m, growing at a rate of **25% per annum**), to account for **3%** of total UK space income.

UK space industry income growth by activity, 2014/15 – 2016/17

Segment	Activity	Space income 2014/15 2016/17 prices, £m	Space income 2016/17 2016/17 prices, £m	CAGR (%)
Space Manufacturing	Launch vehicles and subsystems	35	404	242%
	Satellites/payloads/spacecraft and subsystems	573	658	7%
	Scientific instruments	132	52	-37%
	Ground segment systems and equipment	172	281	28%
	Suppliers of materials and components	124	262	45%
	Scientific and engineering support	51	104	43%
	Fundamental and applied research	79	120	23%
	Space Manufacturing segment total	**1,165**	**1,882**	**27%**
Space Operations	Launch services	2	2	9%
	Launch brokerage services	1	4	75%
	Proprietary satellite operation (incl. sale/lease of capacity)	1,528	1,686	5%
	Third-party ground segment operation	47	35	-14%
	Ground station networks	513	452	-6%
	Space Operations segment total	**2,091**	**2,179**	**2%**
Space Applications	Direct-To-Home (DTH) broadcasting	7,213	7,101	-1%
	Fixed satellite communication services (incl. VSAT)	380	283	-14%
	Mobile satellite communication services	335	540	27%
	Location-based signal service providers	82	119	20%
	Supply of user devices and equipment	1,909	1,714	-5%
	Processors of satellite data (e.g. EO)	96	173	35%
	Applications relying on embedded satellite signals/data (e.g. GPS, meteorology)	200	348	32%
	Non-DTH Space Applications segment subtotal	*3,002*	*3,177*	*3%*
	Space Applications segment total	**10,214**	**10,278**	**0%**
Ancillary Services	Launch and satellite insurance (incl. brokerage) services	58	88	23%
	Legal and financial services	66	12	-58%
	Software and IT services	82	134	28%
	Market research and consultancy services	178	140	-11%
	Business incubation and development	9	49	133%
	Policymaking, regulation and oversight	6	31	136%
	Ancillary Services segment total	**397**	**453**	**7%**
Total UK space industry income		**13,868**	**14,792**	**3%**

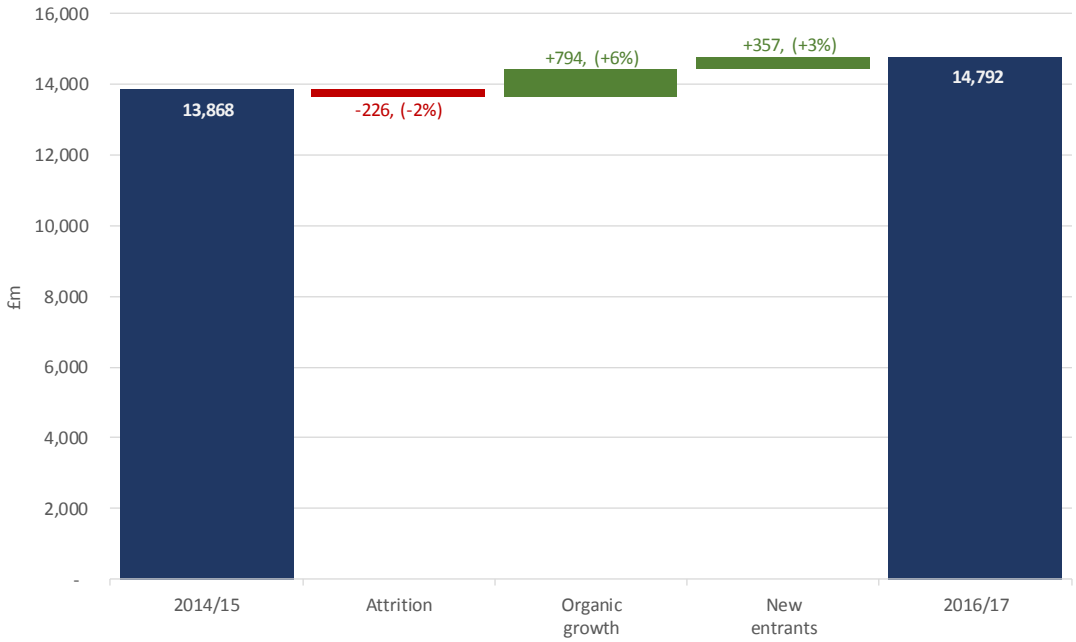
Source: London Economics analysis

Note: For disclosure control purposes, all figures have been confirmed to be based on a minimum of 6 organisations.

To further deepen our understanding of income growth, contribution analysis of **various factors** to the **overall change in space industry income between 2014/15 and 2016/17**, is instructive.

Since the last edition in 2016, a number of organisations have **ceased trading or have exited** the industry, accounting for a loss of **£226m.** This is equivalent to **-24%** of overall change in industry income and -**2%** of 2014/15 industry income. However, organisations that remain account for **organic growth** of **£794m** – equivalent to **86%** of overall change and **6%** of 2014/15 income. **New entrants** further boosted aggregate income by **£357m**, or **39%** of overall change and **3%** of 2014/15 income. This decomposition is presented graphically below.

Decomposition of UK space industry income growth, 2014/15 – 2016/17

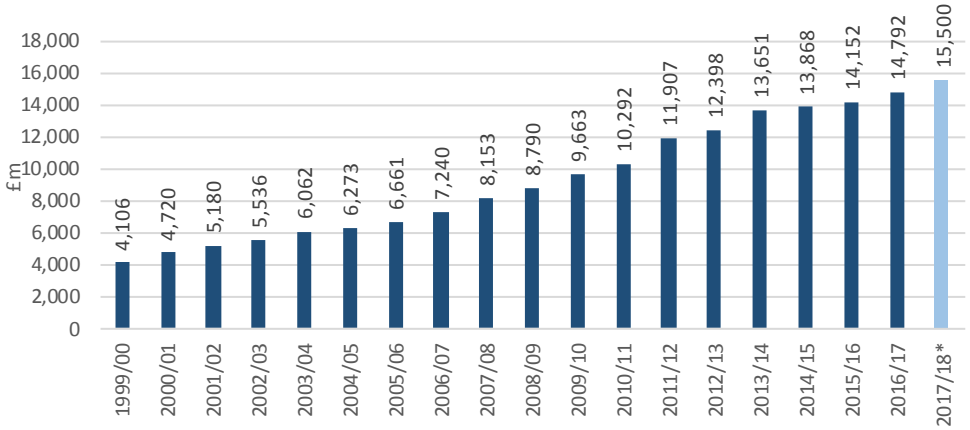


Source: London Economics analysis

In terms of organisation size, growth is driven primarily by **very large enterprises** (space income >£100m) with **56%** of the overall change, but also by a tranche of **larger SMEs** (space income of £1m-5m) accounting for another **28%** of the overall change. Furthermore, these **larger SMEs are growing faster** (**31%** growth per annum) than the very large enterprises (2% growth per annum).

Over the longer term the UK space industry has more than trebled in real terms since the turn of the millennium, growing at an average rate of **7.8% per annum since 1999/00**.

UK space industry income, 1999/00 – 2017/18*

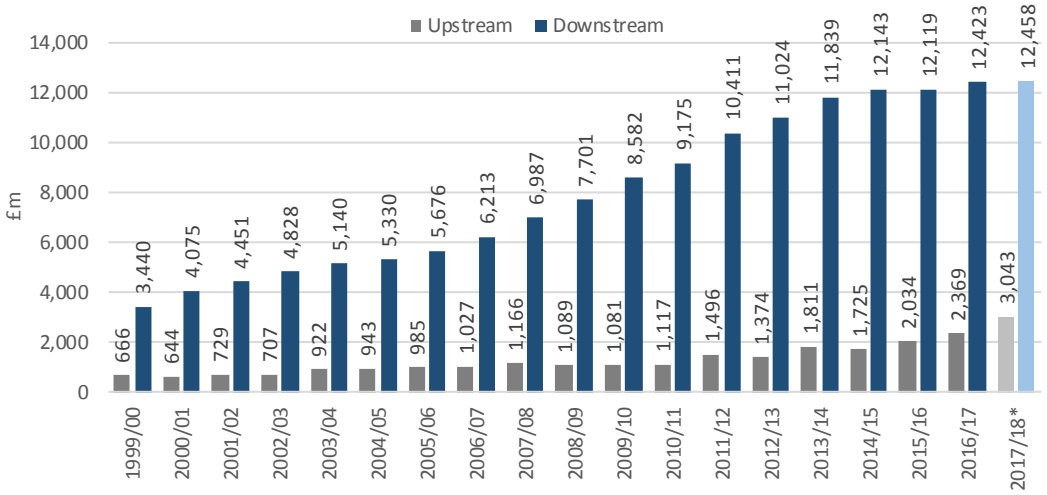


Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis

This development was largely driven by strong and continuous growth in the downstream segment (with a real compound annual growth rate of **7.8%** since 1999/2000), resulting in total income in the downstream segment of **£12.4 billion** in 2016/17. While developments in the upstream segment have historically been more varied, this segment has nevertheless experienced compound annual growth of **7.8%** since the 1999/2000 financial year – bringing total upstream income to **£2.4 billion** in 2016/17. Though the **upstream segment** contains almost 475 organisations in the 2016/17 financial year, it is **dominated by large players** whose specific business environments and developments can mask faster growth among other firms in the segment.

More recently, the **downstream segment has grown at a much slower rate of 1.1%** per annum since 2014/15. The dominant size of the downstream segment means this below trend growth masks the **impressive growth of 17.2% per annum in the upstream** over the same period**.**

UK space industry income (upstream and downstream), 1999/00 – 2017/18*



Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis

Growth: Employment

Total employment in the UK space industry reached more than **41,900 jobs** in 2016/17 following strong growth of **4.3%** per annum since 2014/15 – more than **three times** the employment growth rate of the **overall UK economy** (**1.4%** per annum)[13].

Employment in the **downstream** has enjoyed steady growth of **5.0%** per year since 2014/15, increasing to **33,000** jobs in 2016/17. On average, **upstream** employment has increased by a rate of **2.1%** per year since 2014/15 to reach a total of **8,900**.

DTH broadcasting remains the largest employer with **48%** of total space industry employment. Nevertheless, this represents a decline on previous years, reflecting the **-0.1% per annum** decline in DTH employment since 2014/15 and stronger employment growth across other activities.

[13] Office for National Statistics (2018). UK labour market statistics: March 2018. https://www.ons.gov.uk/releases/uklabourmarketstatisticsmar2018

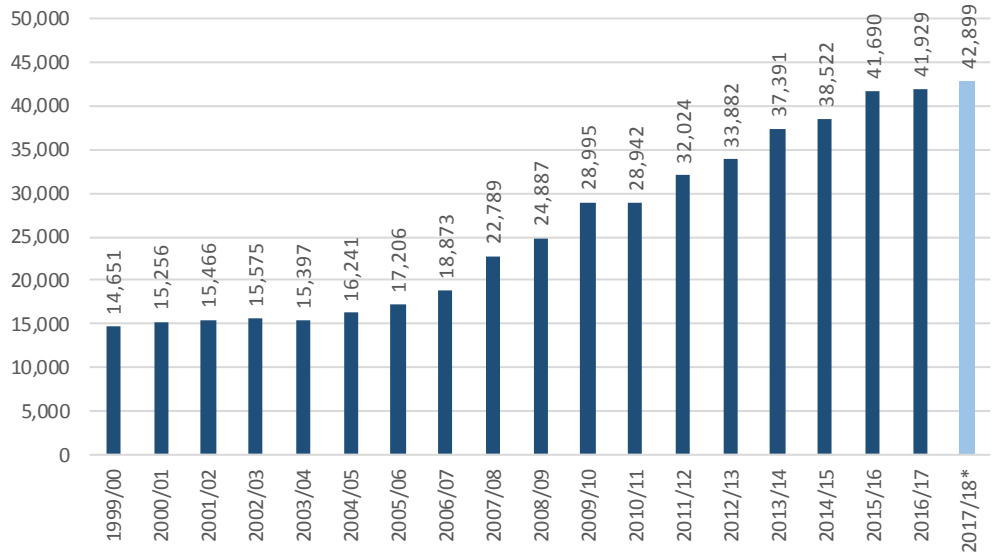
UK space industry employment, 2009/10 – 2017/18*

	Upstream		Downstream		Total	
	Employees	Growth (% year)	Employees	Growth (% year)	Employees	Growth (% year)
2009/10	7,106	-2.7%	21,889	24.5%	28,995	16.5%
2010/11	7,117	0.2%	21,825	-0.3%	28,942	-0.2%
2011/12	7,406	4.1%	24,618	12.8%	32,024	10.6%
2012/13	7,391	-0.2%	26,491	7.6%	33,882	5.8%
2013/14	8,907	20.5%	28,484	7.5%	37,391	10.4%
2014/15	8,575	-3.7%	29,947	5.1%	38,522	3.0%
2015/16	**9,032**	**5.3%**	**32,658**	**9.1%**	**41,690**	**8.2%**
2016/17	**8,940**	**-1.0%**	**32,988**	**1.0%**	**41,929**	**0.6%**
*2017/18**	*9,276*	*3.8%*	*33,623*	*1.9%*	*42,899*	*2.3%*

Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis

The chart below presents space employment since 1999/2000. Employment has grown strongly throughout the period at a compound annual growth rate of **6.4%.** In the last five years, employment growth has been below this long-term average at 5.5%.

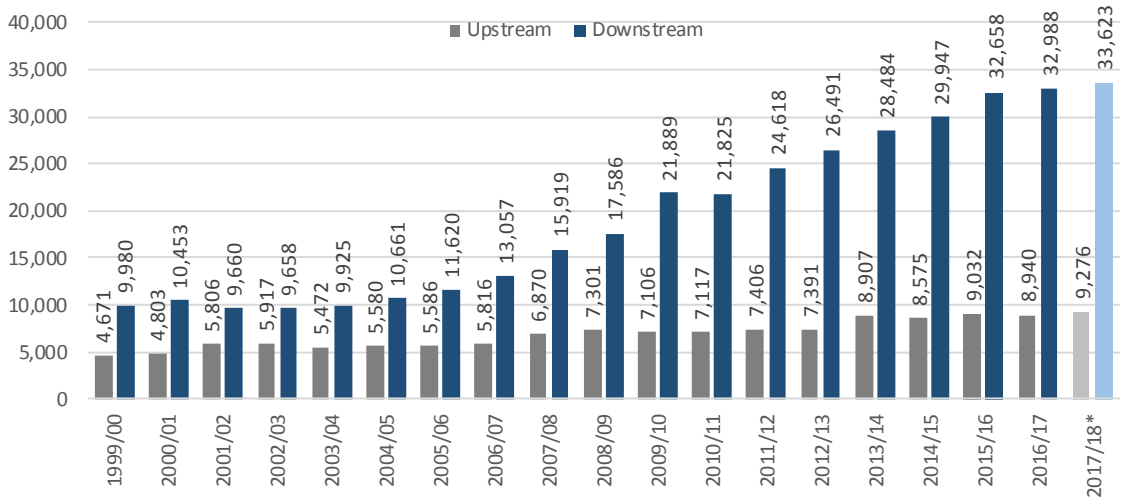
UK space industry employment, 1999/00 – 2017/18*



Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports.
Source: London Economics analysis

Apart from a small drop in 2010/11, the downstream employment has grown continuously since 2003/04. Upstream employment exhibits more variance – as with income, the concentration of income in the heavy upstream segment means that changes within a small number of large companies determine the general development within the segment.

UK space industry employment (upstream and downstream), 1999/00 – 2017/18*



Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis

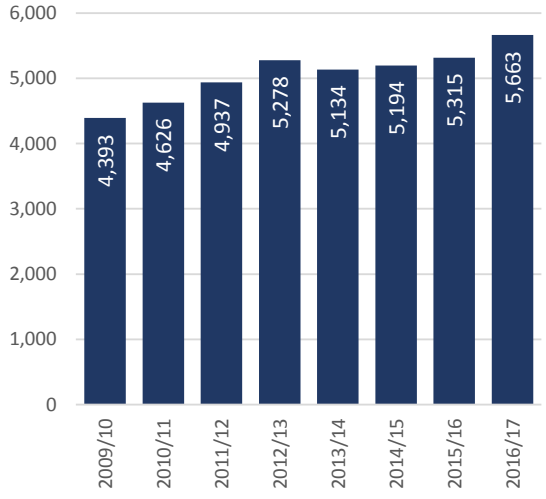
Growth: Gross Value Added (GVA)

Gross Value Added increased in real terms by **9.1%** between 2014/15 and 2016/17 to **£5.7 billion** – a real annual change of **4.4%**. The **upstream** has been a major contributor to this growth, with a real compound annual growth of **26.0%** over the same period. Despite this, the dominant size of the **downstream** segment means that this growth is offset by the slower compound annual growth rate of **0.7%** in the downstream segment. This has meant that the **upstream** share of total space industry GVA has **grown** from 14% in 2014/15 to **20%** in 2016/17.

UK space industry Gross Value-Added, 2009/10 – 2017/18*

Year	£m, current prices	£m, 2016/17 prices	Real growth
2009/10	3,789	4,393	0.50%
2010/11	4,130	4,626	5.3%
2011/12	4,597	4,937	6.7%
2012/13	5,044	5,278	6.9%
2013/14	5,020	5,134	-2.7%
2014/15	5,132	5,194	1.2%
2015/16	**5,257**	**5,315**	**2.3%**
2016/17	**5,663**	**5,663**	**6.5%**
*2017/18**	*6,438*	*6,261*	*10.6%*

Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis



The UK space industry accounts for an increasingly larger share of UK GDP, estimated to be **0.29%** in 2016/17.

Industry composition

The UK space industry covers the **full spectrum of organisation size** (in terms of space-related income and not total organisation income), from start-ups with low space-related income to

multinational conglomerates turning over tens of millions in space-related income. However, the space industry is **dominated by large organisations**, with just **13** organisations accounting for **83%** of total space-related income in the industry and **935** organisations accounting for just **17%**. **Only 108 organisations generate space income in excess of £5m.**

Barriers to growth

Although the period of analysis covers the EU membership referendum (June 2016) and negotiations for exit (ongoing at the time of writing), the **overall tone of respondents was positive for the next 3 years**. Even so, a number of survey respondents cited **uncertainty resulting from Brexit and the UK's future role in EU-managed space programmes.**

Economic uncertainty is the most prevalent barrier for the largest number of respondents, with **44%** of respondents. Around four in ten (39%) respondents indicate **staff recruitment** as the next largest barrier, followed by **cash flow** (33%), and **obtaining finance** (31%).

The responses indicate that companies with significant space income have very limited problems **obtaining finance** (only **2%** of respondents weighted by income) or **receiving late payments** (**2%**), but **large organisations** tend to be particularly worried about **economic uncertainty** (**87%**), **competition** in the market (**75%**), and **access to skills** (**52%**). For both large and small firms alike, **exchange rates**, **overseas licensing and regulations**, **cash flow** and **staff recruitment** appear to be barriers.

Enablers to growth

The industry's concern for economic uncertainty corresponds to a general desire for a **'UK-EU partnership deal for the UK's exit from the EU (Brexit)'**, with **61%** of all respondents citing it as a **'key enabler'** for growth. This is followed by a desire for increased spend on the UK **National Space Programme** (**58%** of respondents) and **encouraging STEM uptake** through education and outreach activities such as Tim Peake's *Principia* mission (**43%**).

When weighted by income, the results suggest that a **'UK sector deal'** (Prosperity from Space) would be a **key enabler** for growth in the industry – with **95%** (compared to 45% of all respondents) citing it as a key enabler to growth. This is followed by a need for **business-friendly legislation** and regulation (**74%**) and a **'UK-EU partnership deal for the UK's exit from the EU'** (**64%**). **Encouraging STEM**, **enhanced export support** and the **regulation of spaceflight** were also cited as key enablers by almost half of all respondents to the question.

Expected performance over the next 3 years

Survey respondents indicated an **encouraging optimism** with respect to **near-term income growth** – especially from larger space organisations. Over the **coming three years**, the UK space industry is expected to **outperform the economy** as a whole – with **73%** of respondents expecting **income growth**, of which **48% expect it to be more than 10% higher** than the previous three years.

The **UK space workforce** is expected to **grow faster than total UK workforce employment**, with **68%** of respondents predicting **job growth** and a further **25%** expecting their workforce to remain largely unchanged. **Smaller organisations** expect to see **more job growth** on average.

The survey respondents indicate a strongly positive story on **export growth** over the coming three years. Whilst **25%** expect a continuation of the current export sales level, **57%** of respondents

predict slight (**20%**) or **much higher** (**37%**) **growth in export sales**, with **smaller organisations** particularly **optimistic** on export sales growth.

As with exports, while 30% of surveyed organisations see a continuation of current R&D expenditure levels, more than half of respondents (**55%**) forecast an **uplift in R&D investment**, split between **slightly higher** (**24%**) and **much higher** (**31%**). Again, **smaller organisations** are more **optimistic** about future R&D expenditure, than larger space organisations.

Strong optimism is also apparent for total investment over the next three years, with **60%** of respondents expecting **total investment to be either slightly** (23%) **or much higher** (37%) than the previous three years. **Larger companies** appear to be somewhat more **optimistic** on foreseen investment.

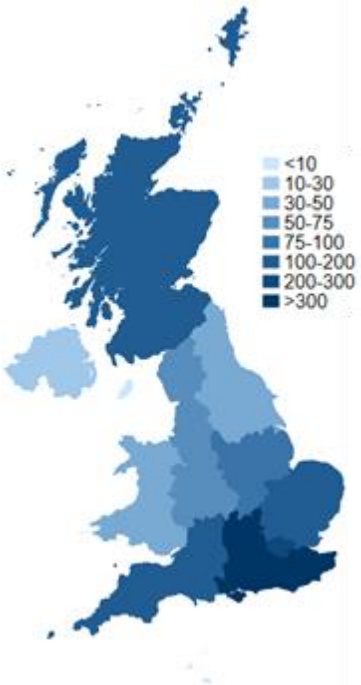
Regional distribution of the UK space industry

The 2018 survey asked respondents to identify the **regional composition** of their UK workforce by location and postcode. However, the breakdown of income continues to be based on Head Office (or headquarters) location due to the inherent complementarity of activities at different sites. This makes a more granular approach infeasible.

The regional distribution is presented across the **twelve 'NUTS1'[14] regions of the UK** – the nine regions of England and the three country-level regions of Scotland, Wales and Northern Ireland – and the British Crown Dependencies.

UK space organisation population by region, 2016/17

Region	Count of organisations engaged in space-related activities
South East	368
London	218
South West	173
East of England	146
Scotland	132
East Midlands	83
North West	75
West Midlands	74
Wales	47
Yorkshire and the Humber	44
North East	34
Northern Ireland	26
Crown Dependencies	4
Total	**1,424**



Note: For organisations with more than one site, each site is counted in the relevant region.
Source: London Economics analysis

[14] Eurostat's Nomenclature of Territorial Units for Statistics (NUTS).

Population

Space-related activity **sites** are **concentrated in the South and East of England** – comprised of **South-East** (368 sites), **London** (218 sites), **South-West** (173 sites) and **East of England** (146 sites) regions – followed by **Scotland** (132 sites). **Wales** is home to 47 space-related organisation sites, and **Northern Ireland** has 26 sites. All NUTS1 regions have a count of space-related organisation sites in the double-digits, whilst there were 4 such sites in the British Crown Dependencies.

The total sums to more than the total number of organisations (948) as many organisations have more than one site, and some organisations have sites in more than one region.

Income

All thirteen countries and regions are home to headquarters of space industry organisations. However, the distribution of total income of headquartered organisations varies greatly across regions.

London's attraction as a domicile for space organisation headquarters is clear. The majority (**£9.5 billion, 64%**) of total UK space industry income in 2016/17 continues to be generated in the capital. Reflecting the site distribution, income is also **strong in the South and East of England**. In total, the three South-Easterly English regions register **94%** of total UK space income. Despite being a distant second in terms of income, the South East (**£2.4 billion, 16%**) is by far the largest region in terms of number of organisations (269 organisations), with London second on 172 organisations. The combination of Headquarter income and number of organisations show that larger organisations tend to be headquartered in the capital.

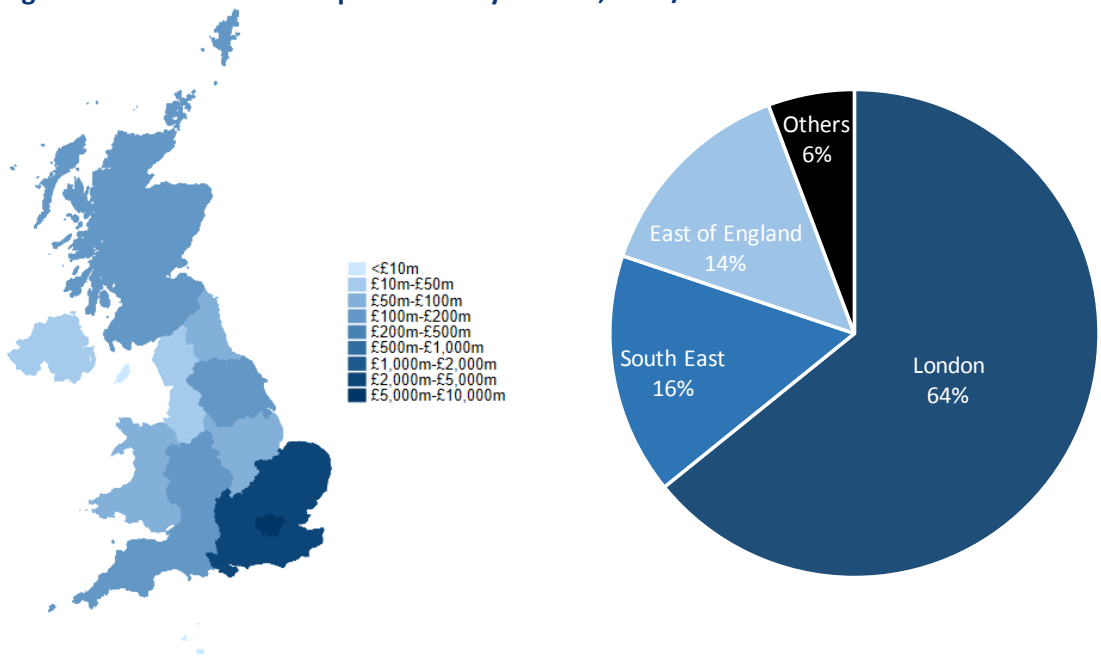
In terms of the segment-level income, **East of England leads Space Manufacturing,** while **London dominates all other segments**.

UK space industry income by region, 2016/17

Region	Number of organisations headquartered in region	Income (2016/17) £m
London	172	9,484
South East	269	2,364
East of England	102	2,088
South West	99	184
Scotland	83	140
West Midlands	40	127
Yorkshire and the Humber	24	102
East Midlands	54	77
North East	22	75
Wales	27	67
Northern Ireland	15	40
North West	35	33
Crown Dependencies	*Redacted*	*Redacted*
Other	*Redacted*	*Redacted*
Total	**948**	**14,792**

Note: Income is wholly attributed to the headquarters of the organisations. To protect confidentiality of survey responses, income data for the Crown Dependencies and Other have been redacted.
Source: London Economics analysis

Regional distribution of UK space industry income, 2016/17



Source: London Economics analysis

Employment

Space employment is much more evenly **distributed across regions** than income, revealing that **large UK space organisations** (especially those headquartered in London and the South-East/East regions) **have locations in multiple regions**.

London and the **South East** employ the most staff and account for **51%** of all employees combined. **Scotland** and the **East of England** follow, with shares of **18%** and **10%**, respectively.

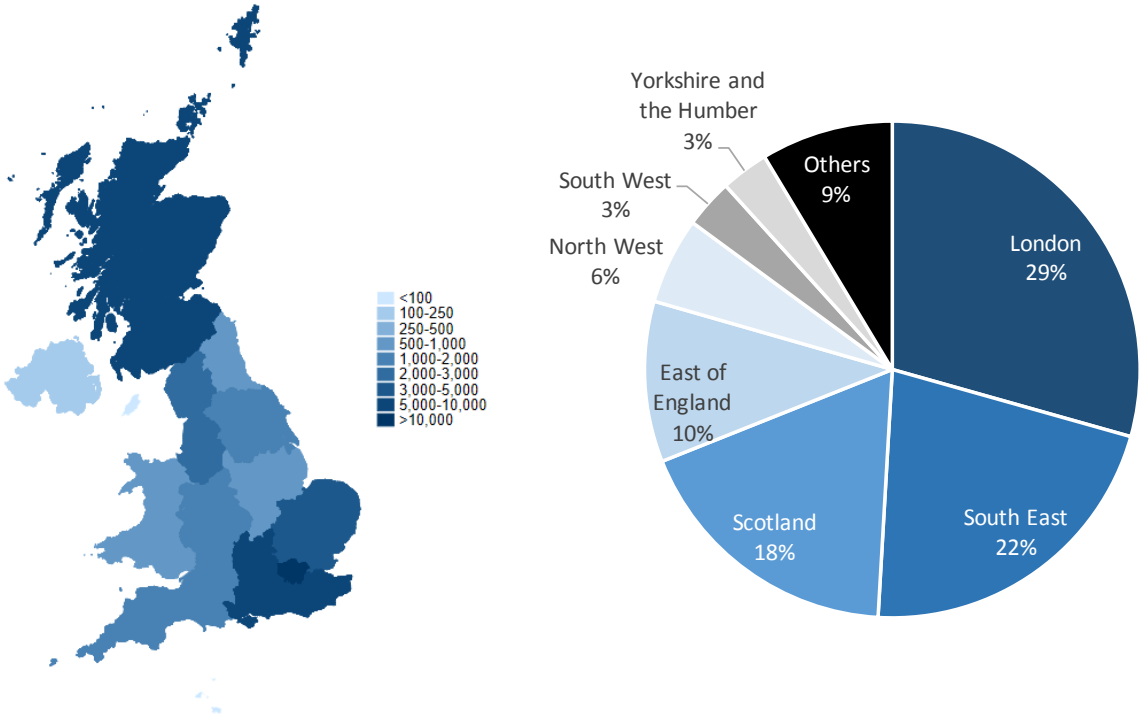
UK space industry employment by region, 2016/17

Region	Count of organisations engaged in space-related activities	Employment (2016/17)
London	218	12,286
South East	368	9,023
Scotland	132	7,555
East of England	146	4,379
North West	75	2,360
South West	173	1,333
Yorkshire and the Humber	44	1,302
West Midlands	74	1,170
North East	34	907
East Midlands	83	868
Wales	47	517
Northern Ireland	26	145
Crown Dependencies	*Redacted*	*Redacted*
Other	*Redacted*	*Redacted*
Total	**1,424**	**41,929**

Note: To protect confidentiality of survey responses, employment data for Crown Dependencies and Other have been redacted. As some employees do not have a designated workplace, some employees are unassigned to a site in a region.
Source: London Economics analysis

Scotland stands out – its share of employment (**18%**) is considerably larger than its share of income (**0.9%**), showing that many UK organisations that are headquartered elsewhere have strong presence in Scotland and other regions. A DTH broadcasting call centre in Scotland is a contributing factor to Scotland's strong concentration of regional employment in Space Applications.

Regional distribution of UK space employment, 2016/17



Source: London Economics analysis

Across the UK, **0.13% of the total workforce** are employed by space organisations. However, this proportion is considerably higher in Scotland (**0.29%**), London (**0.24%**) and the South East (**0.21%**).

Supply chain effects of the UK space industry

In order to capture the total economic impact of the UK space industry, it is necessary to consider not only its direct impact, but also indirect and induced impacts throughout the economy. This is possible by estimating and applying a series of economic **multipliers**.

Gross Value-Added (GVA)

The *Type II* multiplier measures direct, indirect and induced effects. It is estimated at **2.30**, implying that **each £1 of space industry GVA generates £1.30 worth of GVA in the supply chain and supporting sectors**.

The **contribution of the UK space industry** including indirect and induced effects is therefore estimated at **£13.0 billion** in 2016/17. This implies that the sector's direct GVA of **£5.7 billion** generates an additional GDP contribution of **£3.1 billion** in the UK economy through indirect impacts and another **£4.3 billion** through induced impacts.

Employment

The *Type II* employment multiplier measures direct, indirect and induced effects. It is estimated at **2.79**, suggesting that **the activity of 100 employees in the space industry supports 179 additional employees among suppliers and in other economic sectors** (such as retail and services). Using this multiplier, we estimate that the **total UK-based employment supported** by the activities of the UK space industry in 2016/17 is **117,000 employees**. Direct employment in the space industry (**41,900**) thus supports **75,100** additional UK jobs through indirect and induced effects.

Wider UK GDP supported by satellite services

Beyond the direct effects of the space industry itself, an assessment was made of which **(non-space) UK industries employ satellite services** in their commercial operations in order to derive an estimate of the **proportion of UK GDP that is supported by satellite services**. To ensure robustness of the estimates, the assessments have been validated through a process of targeted interviews with experts.

The estimates do not purport to be a valuation of the economic value contributed by, nor attributed to, the space and satellite services industry. Instead, they indicate the total value of output of those industries that are supported by space and satellite services. For example, in Precision Agriculture, cereal farmers employ meteorological information for scheduling, Earth Observation data to monitor crop development, and GNSS to apply variable amounts of fertiliser to plants. UK agriculture GVA from cereal production is supported by space, as the current, modern business model for a farmer would be seriously disrupted if satellite signals were lost.

Caveat: The analysis does not cover the full UK economy. Instead, it reflects the coverage of the ONS's Annual Business Survey (ABS) and is limited to the **UK Non-Financial Business Economy** which accounts for approximately two thirds of the UK economy in terms of Gross Value Added**.** In other words, it excludes: financial and insurance, public administration and defence, public provision of education, public provision of health and all medical and dental practice activities.

In total, it has been estimated (based on 2016 data) that space and satellite services support industries with a combined turnover of at least £698 billion and that contribute **£302 billion to GDP (15.3%**[15]**)**.

Considering the value of supported economic output by satellite service yields:[16]

- **GNSS (positioning, navigation and timing)** satellite services are estimated to support industries with a total turnover of £625 billion and that contribute **£264 billion** to GDP (13.4%).
- **Meteorological** satellite services support industries with a total turnover of £374 billion and that contribute **£159 billion** to GDP (8.1%).
- **Telecommunication** satellite services are estimated to support industries with a total turnover of £250 billion and that contribute **£117 billion** to GDP (5.9%);

[15] UK GDP from http://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abmi/pgdp. Please note the non-financial business economy (numerator) excludes financial and insurance, public administration and defence, public provision of education, public provision of health and all medical and dental practice activities. The denominator includes all output of the UK economy.

[16] The figure for total value of GDP supported by satellite services does not equal the sum of the four individual satellite service categories as individual satellite services are not mutually exclusive – as outlined for precision agriculture applications in the text.

- **Earth Observation** satellite services are estimated to support industries with a total turnover of £229 billion and that contribute **£92 billion** to GDP (4.7%).

Deeper analysis of the total found that **£139 billion of UK GDP** is **enabled by satellite services.** This means that permanent unavailability of satellite service would require at least major adaptation to restore functionality. A further **£163 billion of UK GDP** is **supported by satellite services** in a minor support capacity (i.e. supporting redundancy or enhancement of offering). The importance of the continued operation and outputs of the space industry to the UK economy is clearly demonstrated.

Progress towards 2030 ambitions

As the definitive measure of UK space income, employment and exports, this report presents a **progress report** on the UK government's strategic **ambitions** for the industry **by 2030**.

Income

Ambitions: 8% by 2020, and 10% by 2030, of the world's space economy.

Status: 5.1% of the global space economy in 2016/17.

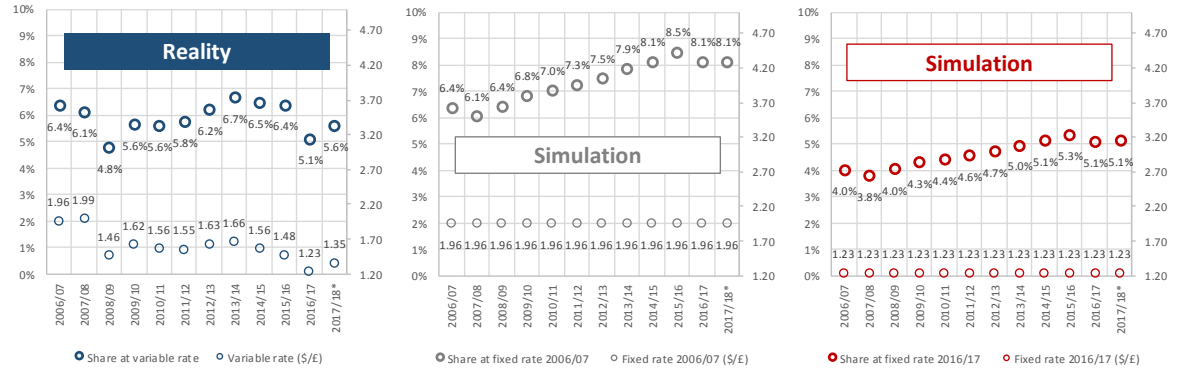
When comparing UK income (expressed in GBP £ Sterling) with global income (expressed in USD $ Dollars in *The Space Report*) across years, currency exchange rate fluctuations are an important factor; and the extent of currency fluctuations in recent years has been substantial. A strengthening US Dollar against Sterling means that UK income converts to a lower value in US Dollars, and though the depreciation of Sterling would have made UK exports more competitive to boost UK income, this boost was not sufficient to outweigh the currency effect. Consequently, the **UK's global share fell** from 6.5% in 2014/15 to **5.1% in 2016/17.**

Whilst currency fluctuations are an economic reality, it is illustrative to consider two hypothetical simulations of the UK's share of the global market with artificially fixed exchange rates:

> **N.B.** It should be noted the exchange rate has not been constant, and that a currency depreciation can serve to increase exports (as prices are lower in the foreign currency) and reduce imports (foreign inputs are more expensive in Sterling). Together, these effects contribute to the variable exchange chart, but are not captured in the discussion of constant exchange rates.

- **Reality: Variable exchange rates** (left): The significant depreciation of Sterling against the US Dollar in 2008/09, and again recently, had a strongly detrimental effect. In reality, at variable exchange rates, the UK's share of the global space economy has fallen below the 6.4% level when the ambition was formulated (2006/07) to the present 5.1% share.
- **Simulations: Fixed exchange rates** (middle: $/£ rate fixed at the 2006/07 level; right: $/£ rate fixed at the 2016/17 level): The UK space industry has grown significantly faster in Sterling than the global space economy in US Dollars – in current prices, UK space income has increased by 91% since 2007/08, whereas the global space economy has increased by 42%. The middle simulation shows that if the 2016/17 UK space income were to be valued at the (artificially) fixed 2006/07 $/£ rate (the base year for the Space IGS ambition), then the UK's share of the global space economy would be higher – at 8.1%.

UK's share of global space economy: reality and simulations, 2006/07 – 2017/18*



Note: 2017/18 forecasted based on survey respondents' forecasts and analysis of available annual reports
Source: London Economics analysis using mid-market exchange rate on 31st December from xe.com

Exports

Ambitions: Export share of 60% by 2030.

Status: Export share of 37.4%.

The Space IGS targets an export share of 60% by 2030 from a starting point of 22% in 2010. The 2016 report showed an export share of 36.4% in 2014/15, and the export share has grown since to **37.4%** in 2016/17.

Considering the non-DTH activities of the space industry (where export is more likely), export intensity is estimated at 65.4% in 2016/17 (down slightly from 69% in 2014/15). Successful cultivation of non-DTH activities may therefore serve to realise the Space IGS export ambition.

Employment

Ambitions: 100,000 jobs created by 2030, equivalent to a total space industry workforce of 119,100.

Status: 41,900 space industry jobs (direct) in 2016/17.

The Space IGS targets the creation of a further 100,000 space industry jobs from a starting point of 19,100 in 2007. Nine years later, in 2016/17, the space industry supported an estimated 41,929 direct jobs. To achieve the IGS ambition, a compound annual employment growth rate of **8.4%** would need to be realised.

Outlook for 2017/18

This study includes forecasts for a year beyond the period of the headline analysis – i.e. 2017/18.

Caveat: The headline findings relate to the 2016/17 financial year, as this is the latest estimate based on full data availability (e.g. annual accounts, which are often lagged). The figures relating to 2017/18 are forecasted based on a reduced set of data (survey respondents' forecasts and analysis of available annual reports), and so should be treated with caution.

These forecasts indicate accelerated growth in 2017/18, with notable highlights as follows:

- Income is forecasted to grow 4.8% over the year to £15.5 billion in 2017/18, resulting in an increased UK share of 5.6% of the global space economy.
- With a continued decline in income from DTH broadcasting (-1.1%), its share of total UK space income is forecasted to fall further to 45% in 2017/18, continuing the trend of UK space industry diversification.
- Employment is projected to reach 42,900 employees – a growth rate of 2.3%.
- Gross Value-Added is forecasted to grow strongly (10.6%) to £6.3 billion.
- Reflecting the fact that GVA is forecasted to grow faster than employment, labour productivity is expected to grow 8% to £145,950.

LE London Economics

Somerset House, New Wing, Strand,
London, WC2R 1LA, United Kingdom
londoneconomics.co.uk/space
space@londoneconomics.co.uk
+44 (0)20 3701 7707
@LE_Aerospace