

strategy&

In association with
 **UK SPACE
AGENCY**

Expanding frontiers

The down to earth guide to
investing in space

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pwc





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About this report

‘Expanding frontiers: The down to earth guide to investing in space’ seeks to help private capital investors better understand the space investment landscape, and the key dynamics and trends underpinning it.

It also highlights the diversity of investment opportunities across the sector and the UK’s prominent position as a destination of global space capital.

This report has been developed by Strategy&, the strategy consulting team of PwC, in association with the UK Space Agency. The insights have been developed through our shared experience in the sector, extensive stakeholder engagement and desktop research, with evidence sources presented where possible.

We are pleased to present this report for the benefit of the investment community and the space sector.



Foreword



Craig Brown
Investment Director,
UK Space Agency

I'm delighted to present this report from the UK Space Agency and PwC, which shines a light on the breadth and depth of space investment opportunities. From today's satellite communications to the future of orbital assembly, space has taken on an increased significance as a deeply embedded part of the global economy that is poised to grow at up to 11% per annum to 2030.

We are now at an inflection point, where ideas previously confined to the pages of science fiction represent attractive investment ventures – from solar power farms in geostationary orbit to robotic factories making exotic materials in microgravity. As the number of satellites above us increases dramatically, there are even greater opportunities to capitalise on the wealth of data they collect and on the international efforts – spearheaded by the UK – to keep the space environment safe and sustainable for generations to come. This report will, I hope, shift perceptions about space, the opportunities it generates, and how investors can benefit society while generating attractive returns. There has never been a better time to invest in this incredible sector, and we can all reap the benefits.



Matthew Alabaster
Partner,
PwC Strategy& UK

At PwC, we are proud of our relationship with the UK Space Agency and are excited by the opportunities facing the UK's space industry. This report shines a light on the substantial contribution that the space industry can make to solving some of our biggest global challenges, from decarbonising our economies to increasing food security and improving access to healthcare.

But the UK space industry will only maximise its potential if it receives the investment it deserves, particularly from the UK's world-leading venture capital, private equity and infrastructure fund sectors. Our analysis shows that there are opportunities for investors of all stripes; the industry contains asset-light and technology-driven businesses, as well as infrastructure assets and supporting services businesses, all of which stand to benefit from the significant growth of the global space industry.

We hope you find this report useful and encourage further engagement from those interested in investing into this dynamic sector.



Executive summary

Space already has a critical role in our global economy

Think 'space industry', and you might be forgiven for thinking of astronauts, rocket launches and the tourism ventures of billionaires. It is less recognised for its significant role as the 'hidden utility' underpinning our daily lives and economy, supporting an estimated £370bn (18%) of UK GDP every year.¹

The economic contribution of space internationally is predominately driven by around 5,000 active satellites² helping to tackle some of our greatest global challenges - including the transition to a low carbon economy, digitisation of industries, tackling food insecurity and alleviating pressure for future mobility solutions. Services such as satellite communications and connectivity, a renowned UK strength, are key to addressing these.

Disruption and innovation continues to unlock vibrant commercial space enterprise

Technology advances in satellite manufacturing and rocket launch have dramatically lowered the barriers to accessing space, enabling companies to exploit an increasingly diverse range of economic sectors with space-derived data, applications and services. By 2030, an estimated 100,000 satellites could be operational, increasing the impact of the sector.³

Longer term, innovation is also unlocking completely novel 'in-orbit' commercial markets, including debris removal, satellite servicing or solar power generation.

The sector's growth trajectory is expected to accelerate

The global space sector is worth over \$469bn, with 77% accounted for by the commercial market.⁴

Analysts project future growth of up to 11% per annum, with some segments such as earth observation, satellite communications and connectivity forecasted to grow even faster.^{5,6}

Significant capital has been attracted across a diverse range of investable segments

In total, over \$47bn of private capital has been invested across the global space sector since 2015, growing on average 21% per year. The UK has been a key hotspot, receiving 17% of this inflow, making it the second most attractive destination - only behind the US.⁶

This capital was deployed into more than 600 companies operating across three stages of the space value chain, which helps to highlight the diverse ecosystem of companies and business models of the sector:⁶

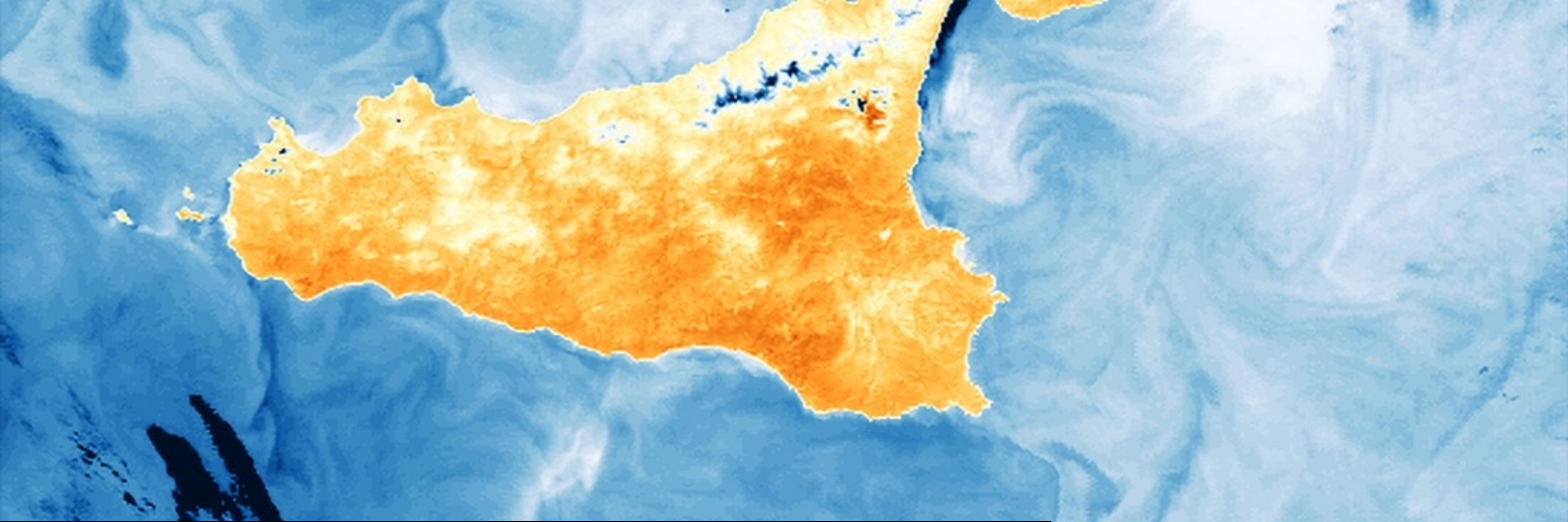
- Upstream: Spacecraft manufacturing and launch vehicles. \$22.6bn deployed across 210 companies⁶
- Midstream: Spacecraft operations and in-orbit management. \$5.6bn deployed across 152 companies⁶



The space sector is undergoing a rapid, transformative change. The cost and complexity of acting in space has fallen dramatically. Miniaturisation, digitisation, reusability, regulatory reform, and increased private capital have reduced the barriers to space, allowing more countries and commercial players to enter a field once available only to a select few.

UK National Space Strategy, 2021

Sources: 1) 'Size & Health of the UK Space Industry 2022', UK Space Agency (2023); 2) 'How Many Satellites are Orbiting Around Earth in 2022?', Geospatial World (2023); 3) 'The impact of satellite trails on Hubble Space Telescope observations', Nature Astronomy (2023); 4) 'The Space Report 2022 Q2', Space Foundation (2022); 5) PwC analysis using figures from 'Future of Space Tourism: Lifting off?', UBS (2021); 'Space The Dawn of a New Age', Citi (2022); 'The New Space Era: Expansion of the Space Economy', BoA (2023); 6) PwC analysis using Pitchbook data



Executive summary

- Downstream: Spacecraft-derived data, applications and services. \$19.6bn deployed across 267 companies in three primary areas: earth observation (EO), satellite communications and connectivity (SatCom), and satellite position, navigation & timing (PNT)¹

Despite only 56% of space investments in 2015 being made in revenue-generative companies, it reached 95% in 2022, demonstrating the growing maturity of the sector.¹

The investor base is rapidly expanding and diversifying

Whilst from our experience some perceive space as a market just for specialist investors, capital from across the investor spectrum has targeted the sector:

- The number of unique investors into space companies grew from 274 to 558 between 2020 and 2022¹
- At the peak of space investing in 2021, 63% of all space investors were new to the sector²
- 13 of the largest 15 venture capital firms and 8 of the largest 15 private equity firms in the world have invested in space sector companies¹
- 64% of corporate investment into the space sector came from non-aerospace and defence companies in 2022 – with

increasing interest across technology, telecommunications, media, financial and automotive sectors among others¹

The growing investor base is also contributing to the prevalence of exit opportunities, with 163 space sector exit events since 2015 through private and public markets.¹ This includes several megadeals being announced in 2022 including OneWeb, Inmarsat and Maxar.

The UK space sector offers an attractive ecosystem for space companies and investors

The UK has a rich heritage of commercial space innovation and hosts a dynamic industrial base of over 1,500 space companies, taking advantage of the UK's talent pool, world leading infrastructure and access to export markets.³

The UK Government recognises both the economic potential of the space sector and its strategic importance to society, and as such is investing in key space technologies and applications to reduce technical and business risk.

The UK space sector continues to be open for business and welcomes continued engagement with investors across the UK and overseas who are exploring opportunities to deploy capital across this dynamic and fast-growing market.



We will build one of the most innovative and attractive space economies in the world, and the UK will grow as a space nation ... [and] take action to unlock growth in the UK space sector, using government to unleash the potential of our industry, entrepreneurs, and innovators."

UK National Space Strategy, 2021

Sources: 1) PwC analysis using Pitchbook data; 2) 'Start-Up Space', Bryce Tech (2022); 3) 'Size & Health of the UK Space Industry 2022', UK Space Agency (2023)

Global space sector



\$469bn market size of the global space sector¹

Up to **11%** annual growth forecasted by analysts for the space sector to 2030^{2,4}

77% commercial share of the space sector vs. Government programmes¹

60,000 - 100,000 satellites estimated by 2030 vs. 11,000 launched in the past 60 years³

\$47.8bn private investment since 2015 across over 600 companies⁴

95% of space sector companies were revenue generative that received investment in 2022 vs. 56% in 2015⁴

63% of investors were 'first-timers' in the sector during the investment peak in 2021⁵

80% of space investment driven by VC firms in 2022, who have made over 1,000 deals since 2015⁴

163 disclosed exits from private space investments since 2015⁴

UK space sector



1st UK National Space Strategy published in 2021, to "build one of the most innovative and attractive space economies in the world"⁶

2nd leading investment destination of private space capital since 2015 with a 17% share, behind only the US⁴

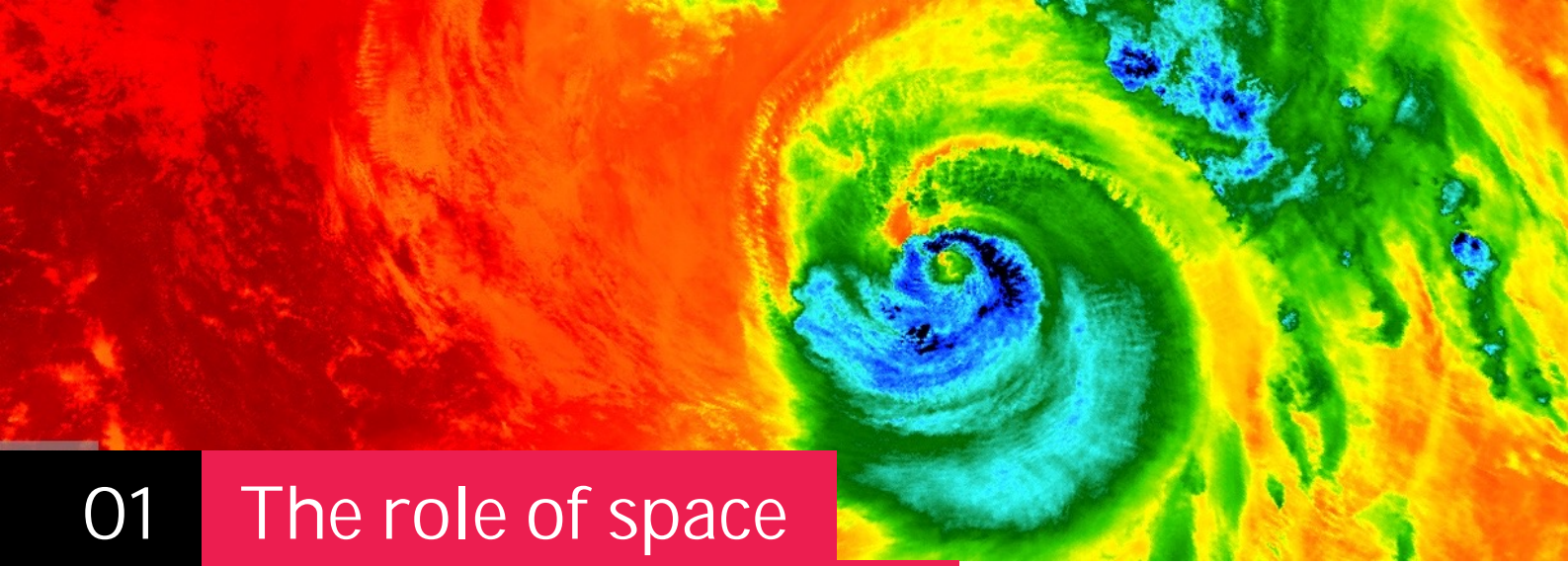
£17.5bn domestic revenue accounting for a ~5% share of the global space sector⁷

18% UK GDP underpinned by space, driven by space-derived data, applications and services⁷

#1 global producer of top cited space research, with over 50 UK universities having active space science functions⁸

1,590 UK space companies operating in the UK space sector across the end-to-end value chain⁷

Sources: 1) 'The Space Report 2022 Q2', Space Foundation (2022); 2) PwC analysis using figures from 'Future of Space Tourism: Lifting off?', UBS (2021); 'Space The Dawn of a New Age', Citi (2022); 'The New Space Era: Expansion of the Space Economy', BoA (2023); 3) 'The impact of satellite trails on Hubble Space Telescope observations', Nature Astronomy (2023); 4) PwC analysis using Pitchbook data. 5) 'Start-Up Space', Bryce Tech (2022); 6) 'UK National Space Strategy', UK Government (2021); 7) 'Size & Health of the UK Space Industry 2022', UK Space Agency (2023); 8) 'UK Space Science: a summary of the research community and its benefits', Space Academic Network (2021)




01 The role of space in our economy

The space industry is considered by many as ‘the hidden utility’ underpinning our daily lives.

In the 60+ years since the first satellite reached orbit, around 11,000 satellites have been launched.¹ In this time, our economy and many of our daily activities have become increasingly dependent on space assets. This influence is expected to further accelerate, with the National Science Foundation estimating that up to 100,000 satellites could be orbiting the earth by 2030.²

Satellites are estimated to underpin over **£370bn** (18%) of the UK’s GDP per year.³



The space industry’s value to citizens is primarily delivered through **three key domains**, and enabled by a wide range of value chain activities, from the production and operations of launchers and satellites, through to the exploitation of spacecraft-derived data, applications and services.

1 Satellite communications and connectivity (Satcom)

Internet and communication services from space that meet global connectivity demands, reaching every corner of the world, including in the air, at sea, on the move, and in remote locations, as well as augmenting existing ground-based terrestrial networks.



The global satellite internet market is expected to double between 2023 and 2030. It can play a role supporting the UK Government’s commitment to make ‘gigabit’ broadband available to 85% of premises nationwide by 2025, with similarly ambitious global targets set by the UN.^{3,4,5}

2 Earth observation (EO)

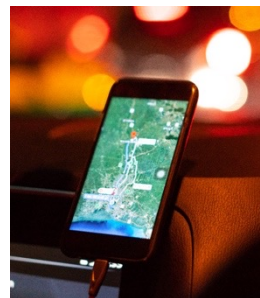
Satellite imagery and geospatial analytics that enables the monitoring of physical, chemical and environmental changes on earth, unlocking transparency and decision-making across a diverse range of sectors including agriculture, energy, insurance and national security.



The UK is home to over 100 EO companies, more than any other country in Europe, whose services support £106bn of the UK economy.^{7,8}

3 Space based position, navigation and timing (PNT)

Space-derived navigation and timing signals (e.g. GPS) that are built into most smartphones and connected devices, and critical to everyday activities and the continued evolution of moving people, vehicles and goods around the world.



It’s estimated that a loss of PNT services from space would cost the UK as much as £5.2bn over a five day disruption.⁴

Sources: 1) ‘As private satellites increase in number, what are the risks of the commercialization of space?’, World Economic Forum (2022); 2) ‘The impact of satellite trails on Hubble Space Telescope observations’, Nature Astronomy (2023); 3) ‘Satellite Internet Market Size’, Grand View Research (2022); 4) ‘UK space strategy and UK satellite infrastructure’, UK Parliament (2022); 5) ‘Levelling up the UK’, HM Government (2022); 6) ‘Achieving universal and meaningful digital connectivity Setting a baseline and targets for 2030’, United Nations (2022); 7) ‘Size & Health of the UK Space Industry 2022’, UK Space Agency (2023); 8) ‘Results EO Industry Survey’, September 2017, EARSC (2017)

Space is forming part of a wide range of investment strategies that link top-down global economic and social trends to investments in specific firms.

Across the world, entrepreneurs and capital are being attracted to commercial approaches that help solve some of our most important global challenges. The space sector is playing an increasingly critical role contributing to these efforts, particularly through the provision of satellite-derived data, applications and services.



Transitioning to a low carbon economy

Reaching Net Zero by 2050 to prevent or mitigate the impacts of climate change

Role of space: It is estimated that >50% of the world's climate variables are only measurable from space.¹ Earth observation satellites therefore support the monitoring of human-related emissions and environmental damage, unlocking unprecedented supply chain transparency.

Example: GHGSat uses earth observation satellites to detect industrial methane leaks and helped remove 2.3 megatons of methane (equal to 500k cars) in one year.² They have raised \$65m of funding and \$15m in grant funding, including from Innovate UK.



Unlocking future mobility services

Meet the mobility needs of an urban population expected to double by 2050⁵

Role of space: The ubiquity of space-based navigation systems (e.g. GPS) have transformed transport over the past 30 years, with continued innovation needed for new mobility services including shared, micro, autonomous and aerial transport.

Example: Xona Space Systems is developing a novel navigation satellite constellation, Pulsar, to deliver 10x greater positioning accuracy, enabling more reliable autonomous operations. They have raised \$26m from investors including Lockheed Martin, Toyota and Seraphim.



Digitisation of industries

Connecting activities to drive economic development and productivity growth

Role of space: The digital revolution is accelerating the connectivity of people, places and 'things', however ~40% of the world remains unconnected.³ Satellites are playing a key role in addressing the unequal access to digital technology across land, sea and sky, particularly in remote locations.

Example: OneWeb is deploying a novel satcom network for enterprise customers (e.g. Maritime, Aviation and Transport). Following financial challenges, in 2021 the UK Government and Bharti Global invested in OneWeb, and the company is now pending a major merger with the satellite operator Eutelsat.



Democratising healthcare

Supporting half of the world's population that lacks access to essential health services⁶

Role of space: Connected healthcare solutions are being unlocked in remote regions by satellite communications, enabling time-critical virtual doctor care and diagnostics inside and outside the home, and supporting a more data-driven healthcare system through access to global information.

Example: Viasat is deploying its satellite connectivity, through a partnership with telehealth company 19Labs, to underpin a telemedicine platform in rural communities that have been unserved or underserved. Viasat in the process of merging with London-based Inmarsat and is seeking to grow its UK presence over the next 5 years.



Tackling food insecurity

Increasing agriculture production 70% by 2050 to meet global demand⁴

Role of space: Rapidly changing land use patterns, crop health, irrigation needs and other agriculture variables are closely monitored from earth observation satellites, enabling better decision-support for farmers.

Example: Hummingbird is a satellite imagery analytics company enabling harvest optimisation, and the verification of regenerative agriculture practices. They raised over \$14m, before being acquired by Danish agritech company Agreena in 2022.

Sources: 1) 'Global Future Council on Space', World Economic Forum (2021); 2) 'Satellites serving a greener planet', Canadian Government (2022); 3) 'Facts and Figures 2021: 2.9 billion people still offline', International Telecommunication Union (2021); 4) 'Global agriculture towards 2050', Food and Agriculture Organization (2019); 5) 'Urban Development', World Bank (2023); 6) 'World Bank and WHO: Half the world lacks access to essential health services, 100 million still pushed into extreme poverty because of health expenses', World Health Organisation (2017)

Beyond today's satellite services, novel space domains are also emerging to unlock future commercial services.

These new opportunities have opened-up due to the dramatically decreasing cost of accessing space and seek to take advantage of the unique characteristics of the space environment. Innovative companies working in these domains are striving to set the foundations of major industries to come in the next decade and beyond.



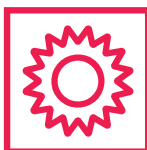
Space transportation and tourism

Example: Commercial opportunities enabling passengers to experience micro-gravity weightlessness (the floating effect), the inspirational view earth from space, or the ability to travel with rocket technology from point A to point B on earth in record speeds. UBS forecasts the potential value of the space tourism industry to reach \$4bn by 2030.¹



In-space manufacturing and mining

Example: Companies producing materials in space through 3D printing leveraging unique microgravity conditions, or offshoring pollutive industries away from earth, as well as companies seeking to extract precious metals from orbiting asteroids. Citibank forecasts microgravity R&D to generate \$14bn in annual sales by 2040.²



Space-based solar power

Example: The operating of commercial solar power stations in orbit, with constant sun-exposure and no cloud or night cover. This would enable spacecraft to collect solar power from space, convert it to energy and beam it securely to power grids on earth. Citibank forecasts space-based solar power will generate revenues of \$23bn by 2040.²

Sources: 1) 'Future of Space Tourism: Lifting off?', UBS (2021); 2) 'Space The Dawn of a New Age', Citi (2022)

02

Dynamics across the global space sector

The 'New Space' period has been defined by accelerated commercial space activity.

Between 2005 to 2021, the global space economy grew over 2.5x representing an annual growth rate of 6%.¹ This included rapid growth in 2021 of 9%, continuing to put space sector growth on the higher end of many other large sectors such as broader aerospace and defence, pharma, and automotive.²

During this period, the term 'New Space' has gained momentum, referring to the acceleration of the private commercial space industry. This has been supported by governments increasingly championing a more entrepreneurial sector, and supporting organisations that are seek to reduce the cost of accessing space and capitalise on new business models and services.

Size of global space sector in 2021, in contrast to the 2005 size of \$180bn:¹

\$469bn

Proportion of the 2021 sector accounted for by the commercial space market (the remainder is Government space programmes):¹

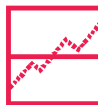
77%



The space sector is forecasted to reach up to a \$1 trillion market size by 2030.

Financial analysts have forecasted a range of global space sector growth projections between 6-11% annually to 2030, for example:

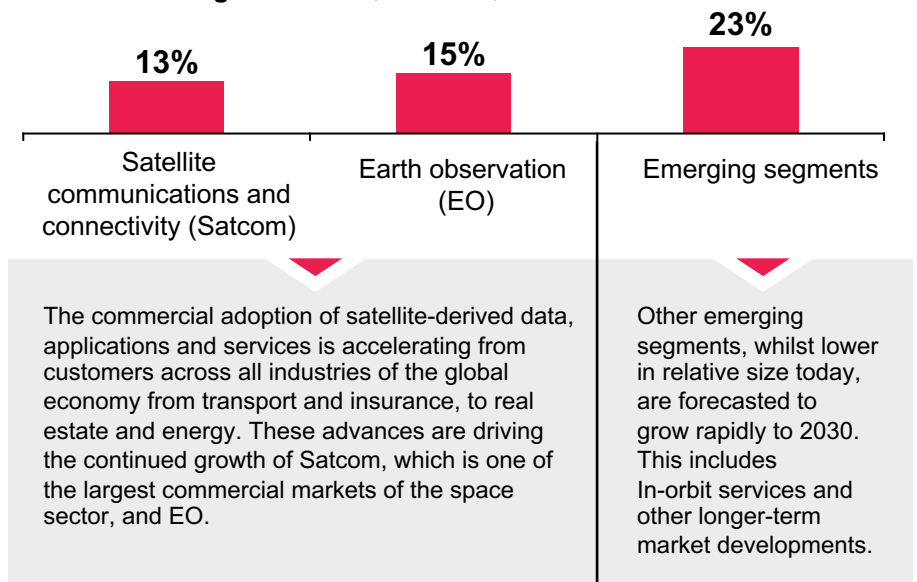
- **UBS** forecasts the sector to reach \$900bn by 2030, revised upwards from \$800bn forecast made in 2019 that implied ~7% annual growth.³
- **Bank of America** forecasts the sector to surpass \$1 trillion by 2030, growing 11% per annum.⁴
- **Pitchbook** forecasts the sector to grow by 10% per annum.⁵



Segments delivering value to x-sector users are expected to have particularly high growth rates.

Example space segments with rapid forecasted annual revenue growth^{6,7,8} %, to 2030F, and market size

NON-EXHAUSTIVE



These are just some examples of the fastest segments of the space sector, whose growth rates compare to estimates of other rapidly growing investable segments such as electric vehicles (~18%) or fintech (~20%).^{9,10}

Sources: 1) 'The Space Report 2022 Q2', Space Foundation (2022); 2) 'Global Pharmaceuticals & Medicine Mfg', IBIS World (2022), 'Global Automobile Engine & Parts Mfg', IBIS World (2022), 'Aerospace and Defence Global Market Report', The Business Research Company (2022); 3) 'Future of Space Tourism: Lifting off?', UBS (2021); 4) 'The New Space Era: Expansion of the Space Economy', BoA (2023); 5) PwC analysis using Pitchbook data; 6) 'NSR'S GLOBAL SPACE ECONOMY REPORT', NSR (2022); 7) 'Growing Number of Earth Observation Projects', Acumen Research and Consulting (2022); 8) 'Space The Dawn of a New Age', Citi (2022); 9) 'Insights on Fintech Market | Vantage Market Research'; 10) Globe News Wire (2022), 'EV Market 2022-2030', Allied Market Research (2022)



Key characteristics of the space sector are being disrupted, which is unlocking new business models and expanding the commercial opportunity.

Driving the growth of the space sector, and helping to understand the investment rationale of 'why now', are critical trends opening up greater access to rapidly improving and affordable space capabilities. This is enabling the sector to deliver greater value to an increasingly diverse range of commercial customers.



Disrupted economics of rocket launch

Innovations in rocket production, microelectronics, reusability and ride-sharing services have driven down the cost of launching satellites into space by a factor of x30 since 1981, creating greater access for entrepreneurs to pursue new business models.¹



Manufacturing and assembly cost decline

Automation, 3D printing and the move from bespoke assembly towards more standardised commercial off-the-shelf components have cut satellite production costs, with the cost per Gbps of capacity (i.e. data capacity) declining 90% from 2013 to 2021.²



Satellite miniaturisation and technology advances

Satellite development has advanced significantly since the 'SmallSat' revolution, driven by UK-based Surrey Satellite Technology. Sensors and software have dramatically improved, similar to the iPhone, whilst shrinking satellites into new size categories such as 'CubeSats' and 'NanoSats.'



The revolution in big data capabilities

The ability to collect, store and analyse vast data sets from satellites has accelerated, including the use of cloud computing and machine learning. This continues to unlock new data-driven use cases and insights for the benefit of citizens and businesses on Earth.



Novel in-orbit sustainability approaches

The number of satellites forecasted to grow to potentially ~100,000 by 2030.³ There is increasing pressure for a more sustainable space sector. This is driving innovation and demand for managing satellite traffic and debris, and extending satellite lifespans through reusability, in-orbit repair and refuelling.



Shifting Government policy

Governments are increasingly shifting policy away from channelling capital through public development programmes, instead stimulating private sector innovation and procurement. For example, a core element of the UK Space Agency's ambition is to 'Catalyse Investment' and enable companies to exploit the unique characteristics of space.

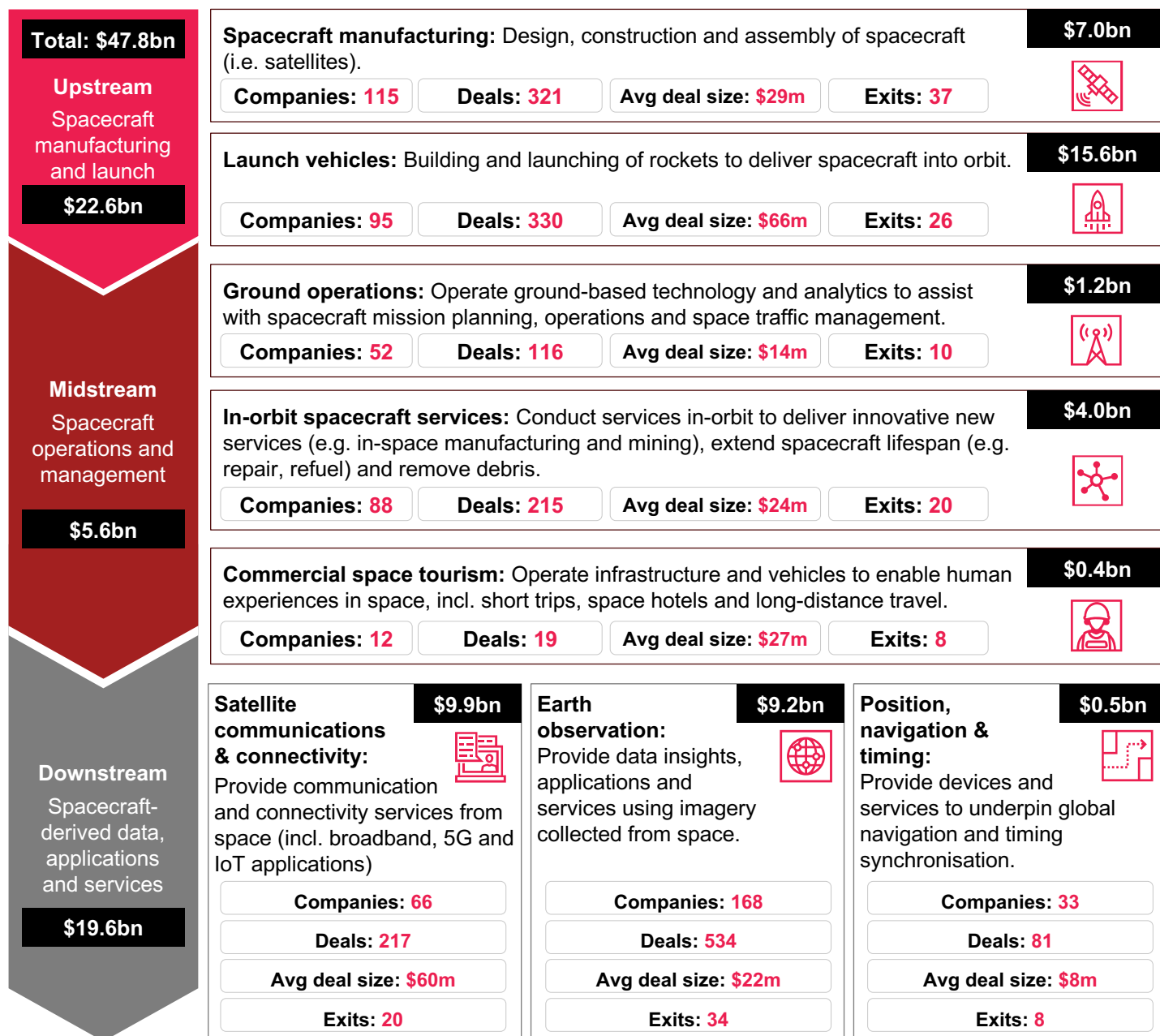
Sources: 1) 'Space The Dawn of a New Age', Citi (2022); 2) 'Affordability Is Transforming the Satellite Industry: How Each Segment Is Keeping Up with the Pace of Change', Kratos Defense (2022); 3) 'The impact of satellite trails on Hubble Space Telescope observations', Nature Astronomy (2023)

03

Segmenting the investable space value chain

Over 600 companies across the space sector have received in total ~\$48bn of private capital since 2015, with 163 exit events helping to unlock investor returns. It can, however, be challenging to generalise the space investment opportunity, given the broad spectrum of investable segments across the value chain. This ranges from capital intensive hardware businesses to software data-focused companies. The attractiveness of opportunities for investors across the value chain will therefore depend on many factors, including target deal size, returns profile and risk appetite.

There are investment opportunities for all investor types, with global space capital flows distributed across a diverse range of investable segments*:



*See methodology note for sector space segmentation definition

Key:		Total global disclosed private investment since 2015, including only the subset of total deals that disclose the amount of capital invested
Deals		Number of global deals across all deal types
Avg. deal size		Average capital invested across disclosed deals
Companies		Companies that have disclosed receiving private investment since 2015
Exits		An event when an investor sells its equity stake in a portfolio company

Sources: PwC analysis using Pitchbook data

The sector is made up of a diverse and globally increasingly competitive industrial base:



Note: Logos are included for illustrative purposes and are not indicative of private investment levels, nor are exhaustive. Many companies may operate in more than one segment.

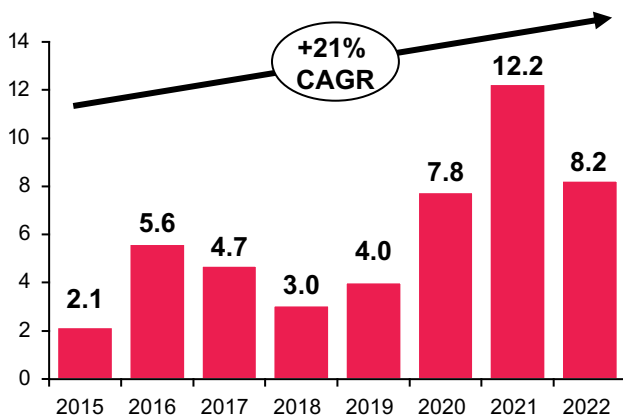


04 Investment deep dive analysis

Global investment landscape overview

Space capital remained relatively resilient in 2022, despite the challenging investment context for innovative sectors.

Total private investment in space¹
2015-2022, \$bn



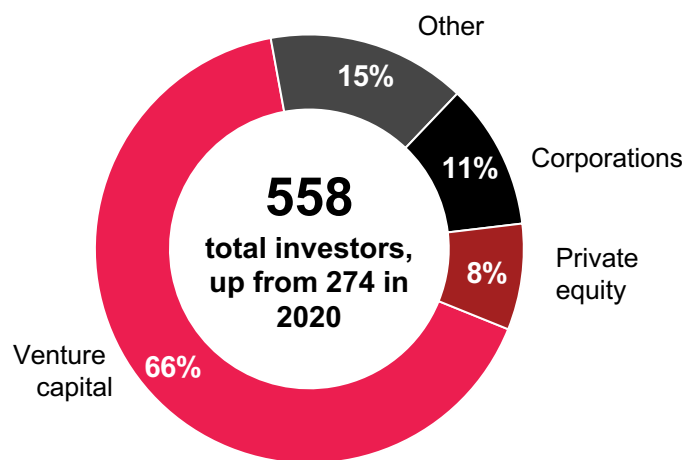
Private space investment dipped in 2022, consistent with declines in the broader investment market, which included a 35% decrease in global VC funding.²

Despite this there were a number of major deals announced in 2022 that are pending completion and therefore not included in the figures. This includes the acquisitions of Inmarsat (\$7.3bn), Maxar (\$6.4bn), Aerojet Rocketdyne (\$4.7bn) and OneWeb (\$3.4bn).³

The UK has been the leading destination of space investment in Europe, and 2nd globally behind the US, receiving 17% of global investment since 2015.¹

VC funds continue to be the leading investor type, whilst new investors continue to be drawn to the sector.

Investors by primary investor type¹
2022, % of investors

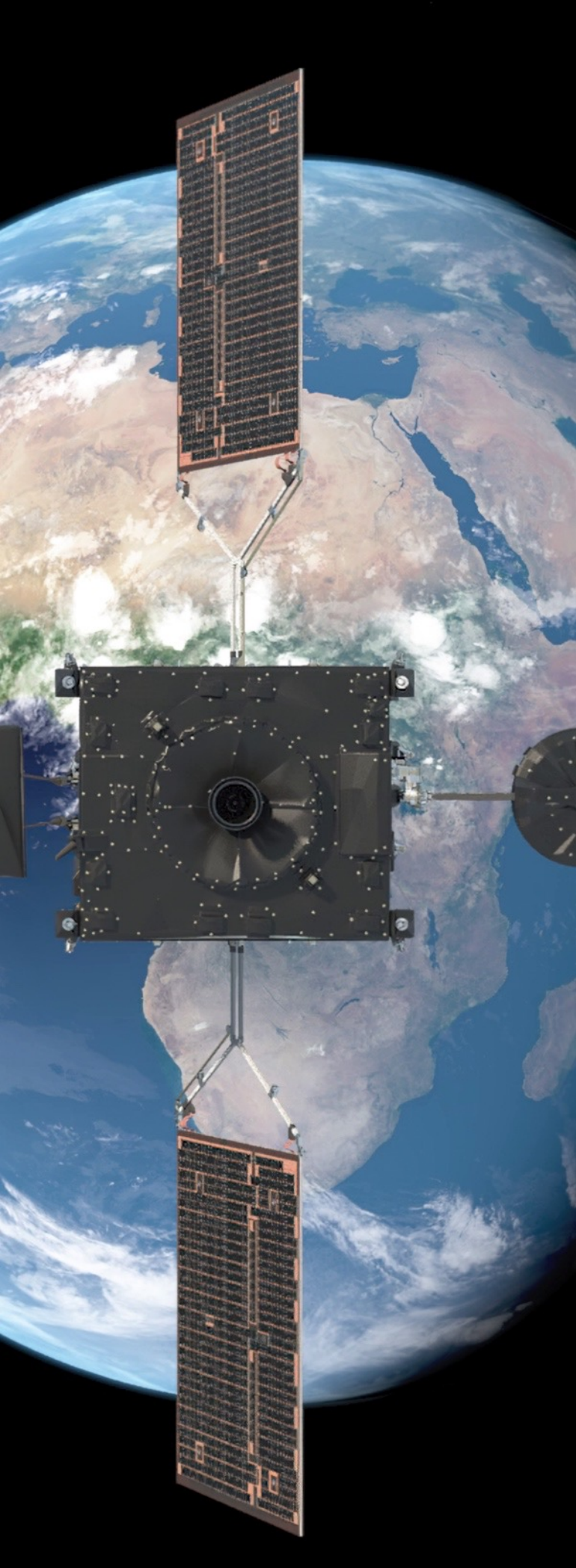


The investor base is also diversifying significantly, with 63% of investors new to the space sector during the investment peak of 2021.⁴

These new investors have included software-focused VC technology funds, deep tech funds, large scale private equity buyout funds, and corporate investors from sectors including transport, media, insurance and many others.

Further details are broken down in the following deep dive sections.

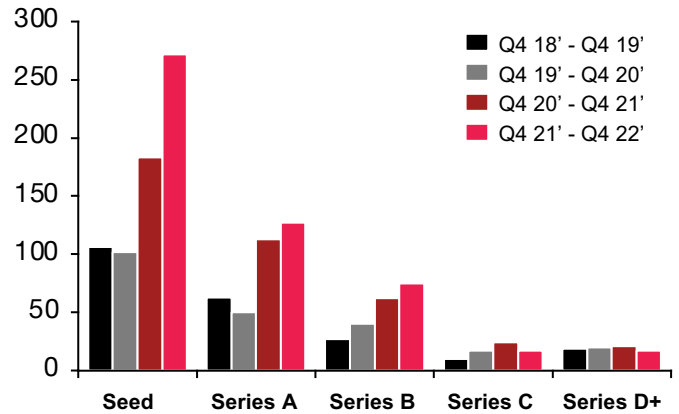
Sources: 1) All figures in section 4 have been extracted from Pitchbook using the methodology explained in the methodology note included at the end of this report. Other investors primarily include accelerators, incubators and angel investors. PwC analysis using Pitchbook data; 2) 'Early-Round Unicorn Numbers Still Strong Despite 2022 VC Pullback', Crunchbase (2023); 3) Pitchbook; 4) 'Start-Up Space', Bryce Tech (2022)



Deal volume growth has been driven by the growth in early-stage funding rounds.

Global deal volume by investment round¹

Q4 '18 - Q4 '22, count of deals

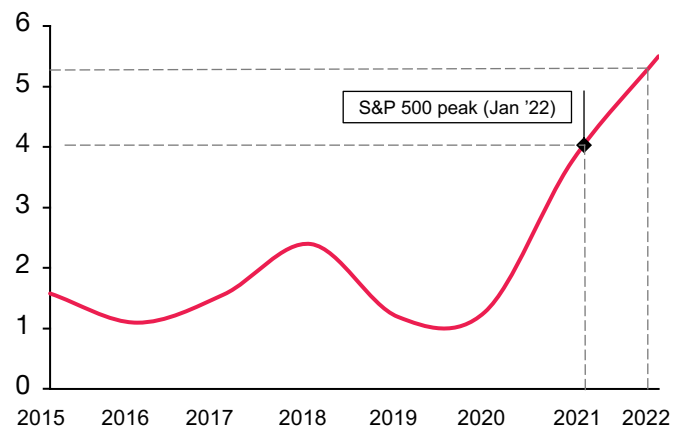


Whilst Series C and D+ volume has been flat, many of the more mature space companies in 2021 and 2022 opted to raise capital publicly rather than through late-stage deals. This was amidst a boom in public markets, and included for example, Spire Global, Astra Space, BlackSky, Satellogic, SatixFy and Rocket Lab.²

The median investment in the space sector has tripled in 3 years.

Global median deal size³

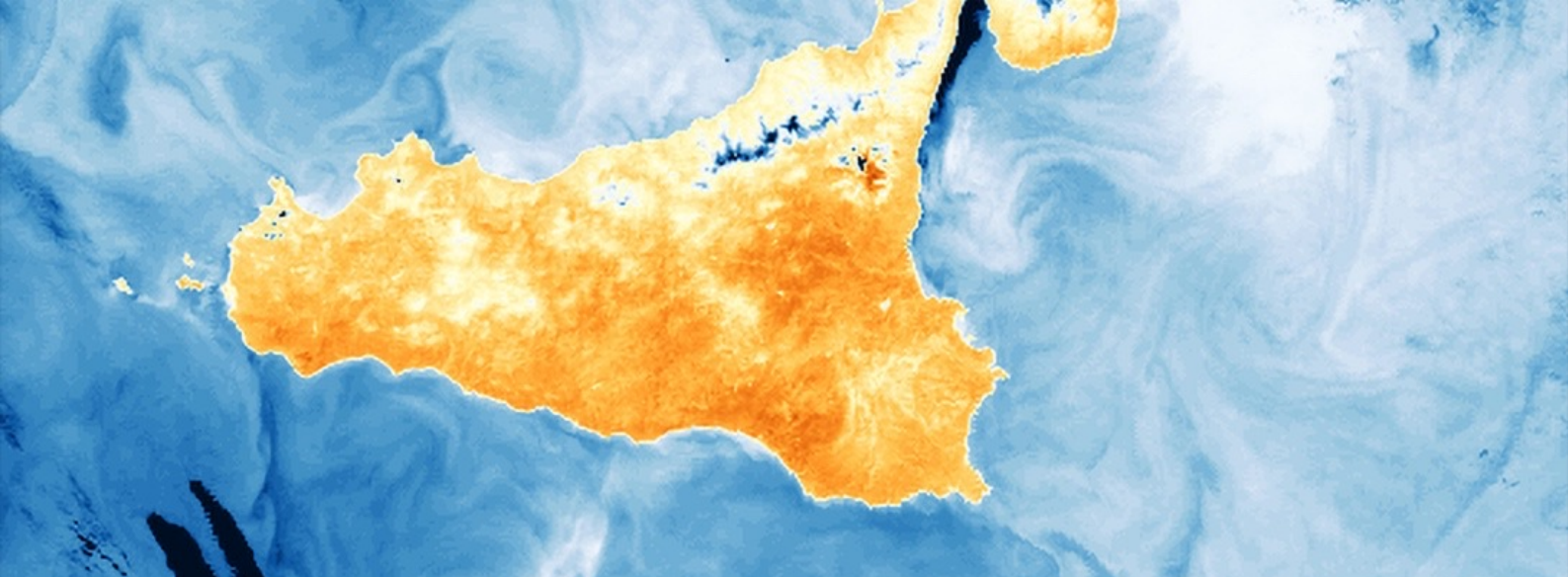
2015-2022, \$m



The growth in median deal size continued into 2022, even beyond the peak of the S&P 500 market cap in January 2022, showing maturity levels of the sector is growing.

Median deal size for early-stage investments, especially from seed to series B, has increased 400% since 2020.

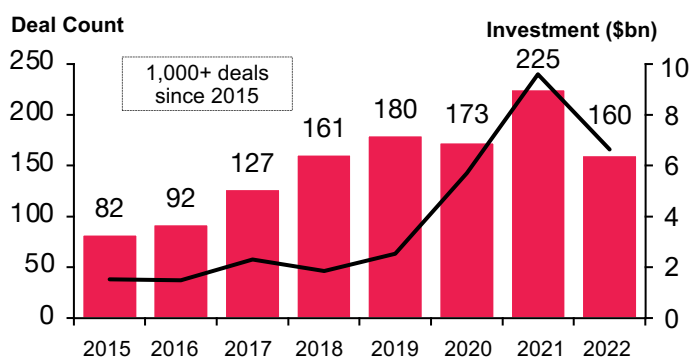
Sources: 1) 'Q4 2022 Seraphim Space Index', Seraphim Capital (2022); 2) Pitchbook; 3) PwC analysis using Pitchbook data; 4) 'Cardiff start-up Space Forge boosted after closing the biggest seed funding round in Europe's space tech sector', BusinessLive (2021)



Venture capital (VC) investors

VC is the primary source of private space capital inflows, accounting for 80%, or \$6.6bn in 2022.¹

Global VC space deals & investment¹
2015-2022

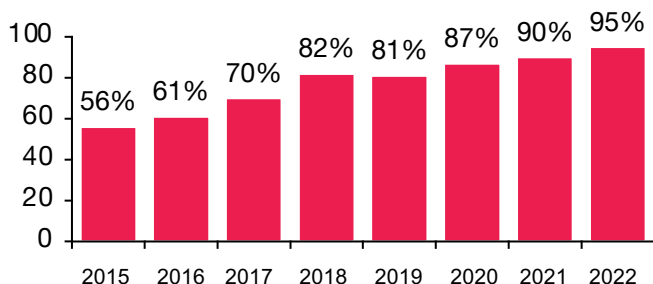


2021 saw record levels of VC funding in the space sector, with 2022 seeing a drop-off in line with the broader VC global landscape.

SpaceX remains a key recipient of VC funding, representing 37% of disclosed VC capital invested into the space sector since 2015.¹

VC capital has been targeting increasingly mature and revenue-generative space companies across the ecosystem.

Share of VC space deals in revenue generating companies¹
2015 – 2022, % of deal volume



Sources: 1) PwC analysis using Pitchbook data. To note that Sequoia appears twice as Sequoia Capital China is reported separately; 2) 'Space The Dawn of a New Age', Citi (2022)

The most active 10 space investors have a specific space or aerospace focus, and have participated in 150 space deals since 2015.²

The 10 most active global space investors since 2015²



The UK has been an active market for specialist space investors, with seven of the most active global investors (above) deploying capital into UK space companies.

The UK is also home to the HQ of leading space fund Seraphim Capital, as well as the choice destination for international offices of others such as the US space and deep tech fund TypeOne VC.

Active space investors also include some of the world's largest VC funds that hold a broader technology focus.

13 of the largest 15 global VCs have invested in space companies since 2015¹



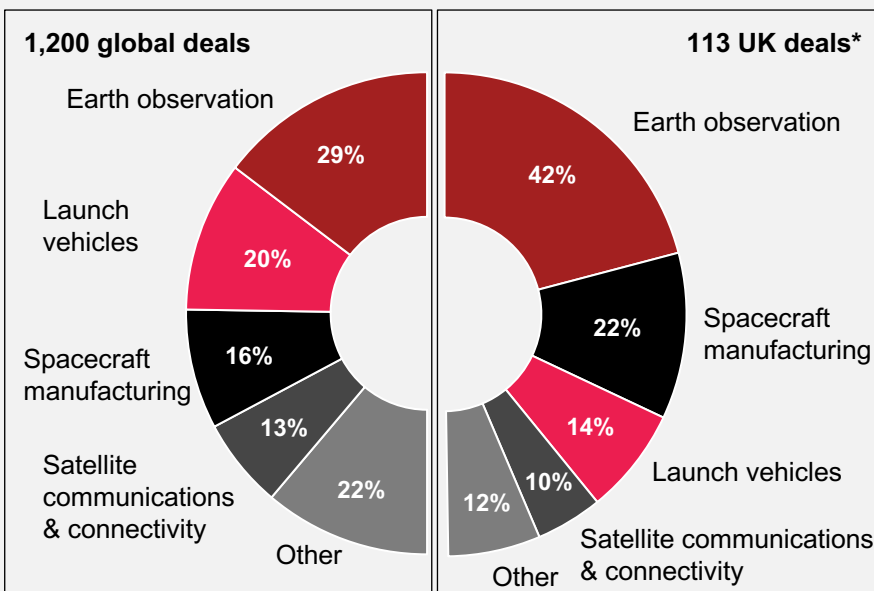
9 of the 15 largest UK-based VCs have invested in space companies since 2015¹





VC firms have targeted the full value chain, with all space segments seeing deal count at least double, and capital investment growth of over 5x since 2015.¹

VC investment segmentation, global vs. UK¹
2015-2022, % of deal volume



Earth observation has represented the largest share of global deal volume every year since 2015 and is a prominent segment of the UK space sector. This segment includes both satellite operators selling imagery and insight services, as well companies focused on the exploitation of third party satellite data for the benefit of x-sector customers.

*Differences in these figures compared to the results presented in in 'Size and Health of the UK Space Industry 2022' are driven by the use of different sources of data.

Sources: 1) PwC analysis using Pitchbook data



The UK is a world leader in EO technology and data analysis, with over 100 EO companies operating in the UK, the largest number in any one country in Europe. EO is estimated to support £100bn of annual GDP in the UK.

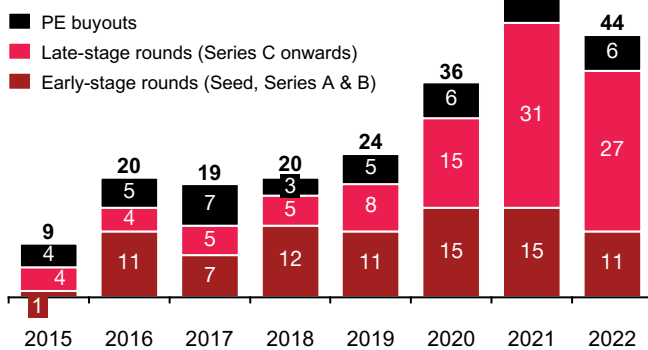
UK Space Strategy and UK Satellite Infrastructure Report, House of Commons Committee 2022

Private equity (PE) investors

PE firms have been increasingly active in the space sector, participating in 48 buyouts and 182 investment rounds since 2015.¹

Global PE space deals¹

2015-2022, count of deals by type



Over \$19bn of capital has been deployed through PE funds since 2015, and 2022 was another significant year with six completed space buyouts.

Additionally, the largest ever PE investment in the space sector was announced in December 2022 as the buyout firm Advent International looked to acquire US-based earth observation operator Maxar Technologies for \$6.4bn. The deal was completed in 2023, but is not included in these figures.

The average space company targeted by PE investment had already raised \$325m.¹

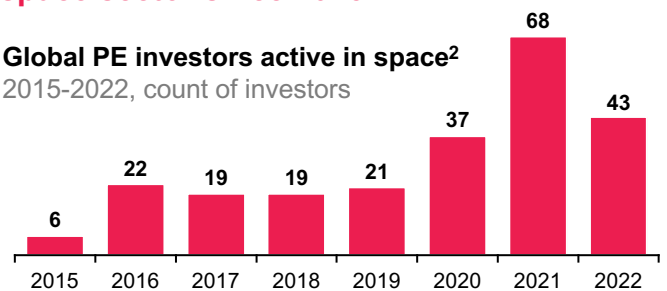
PE deal volume has primarily been in earth observation, launch and manufacturing. However, whilst satellite communications and connectivity represents only 13% of deals since 2015, it has accounted for 37% of invested capital, driven by several major deals and a larger addressable commercial market relative to other segments.

The UK has a rich heritage in satellite communications and connectivity and has been the destination for some of the largest investments, for example the acquisition of UK-based Inmarsat by Apax Partners in 2019 for \$3.4bn, which is now subject to the recently announced \$7.3bn acquisition by US-based Viasat (awaiting deal completion).⁴

There have been an increasing number and diversity of global PE firms active in the space sector since 2015.

Global PE investors active in space²

2015-2022, count of investors



At the investment peak in 2021, 71% of the PE investor base were 'new' to the sector³

8 of the largest 15 global PEs have invested in space since 2015¹

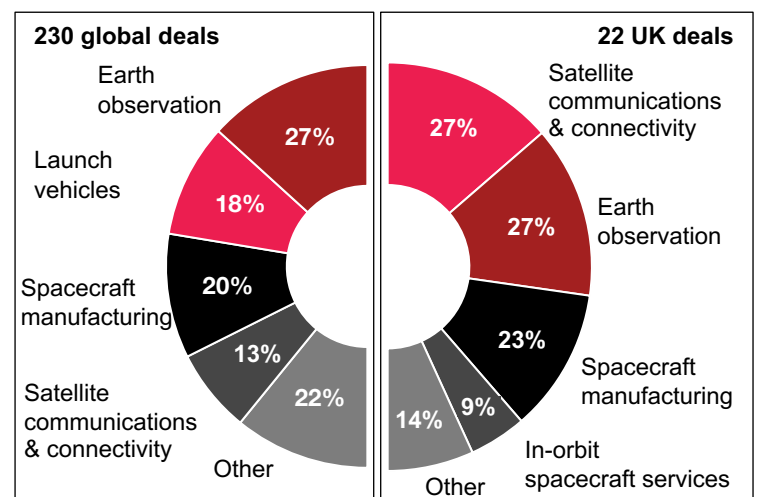


3 of the largest 15 UK PEs have invested in space since 2015¹



PE investment segmentation, global vs. UK¹

2015-2022, % of deal volume



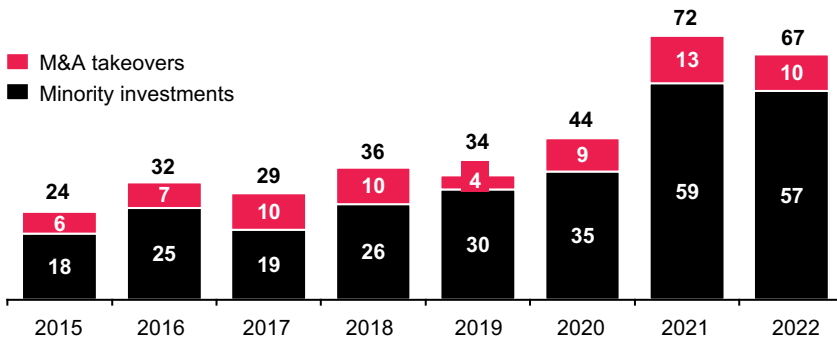
Sources: 1) PwC analysis using Pitchbook data (private equity investors are funds whose primary investor type falls within the Private Equity Pitchbook classification); 2) Pitchbook; 3) 'Start-Up Space', Bryce Tech (2022); 4) 'Viasat lands Britain's Inmarsat in \$7.3bn deal', Financial Times (2021)

Note: For this analysis, PE firms are considered those who primarily invest in PE deals (late-stage and buyouts), though they may have a small share of early-stage VC activity. Additionally, the base number of PE investors is different in the Pitchbook analysis (source 1) vs. Bryce Tech analysis (source 3).

Corporate investors

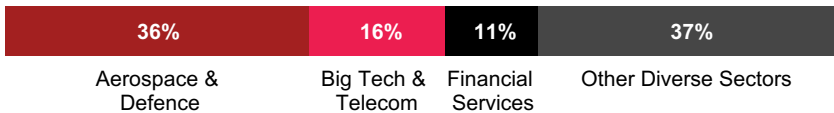
Corporates are increasingly pursuing investment opportunities and have accounted for 17% of space investors since 2015.¹

Corporate global space deals¹
2015-2022, count of deals by type



Corporate across a diverse range of sectors are targeting strategic space investments, beyond just traditional Aerospace & Defence primes.

Global corporate investors in space¹
2022, % of investors by sector



Corporates are investing in the space companies to capitalise on opportunities ranging from revenue generation and customer experience, through to operational efficiency and ESG (environmental, social and governance) progress.

Emerging in-orbit space domains are also seeing greater traction from corporates taking longer-term strategic bets, for example across in-space refuelling and manufacturing.



Near term, space as an investment theme is also likely to impact a number of industries beyond Aerospace & Defence, such as IT Hardware and Telecom sectors.

Morgan Stanley³

Sources: 1) PwC analysis using Pitchbook data, 2) Pitchbook, 3) 'Space: Investing in the Final Frontier', Morgan Stanley (2020)

Example recent equity investments²

Aerospace and Defence

- Airbus:** HawkEye 360 – EO
- BAE Systems:** In-Space Missions – Spacecraft manufacturing
- Boeing:** Virgin Orbit – Launch
- Lockheed Martin:** Satellite Vu – EO
- Northrup Grumman:** Orbit Fab – In-orbit services
- Raytheon:** Northern Space & Security – Space traffic management
- Rolls-Royce:** Reaction Engines – Launch

Big Tech & Telecommunications

- Alphabet:** Planet Labs – EO
- Amazon:** Facebook Satellite Internet – Satcom
- Apple:** Coherent Navigation – PNT
- Microsoft:** Regrow – EO
- Bharti Airtel:** OneWeb – Satcom
- Cellnex:** Sateliot – SatCom
- Deutsche Telekom:** Devas – SatCom
- Swisscom:** ClearSpace – In-orbit services
- Vodafone:** AST SpaceMobile – Satcom

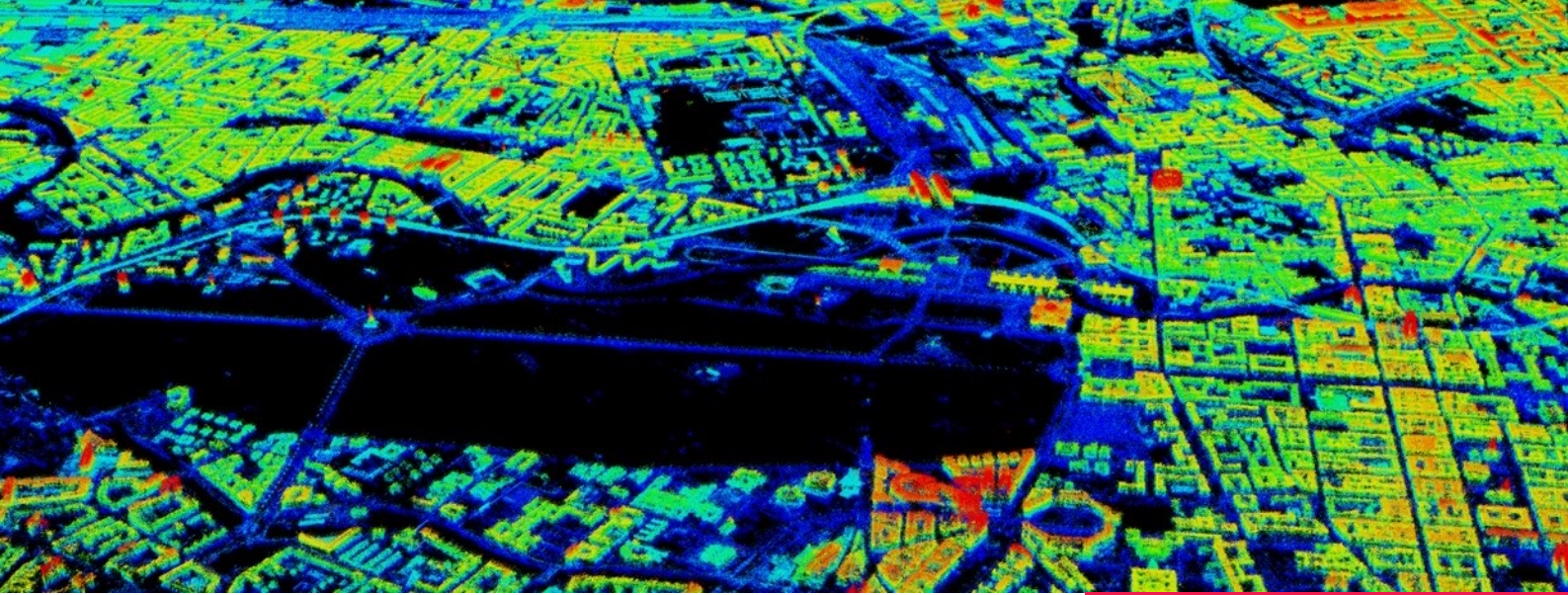
Financial Services

- AmTrust:** Assure Space – In-orbit spacecraft
- AXA XL Insurance:** SpaceAble – Space traffic management
- FM Global:** Airworks – EO
- Liberty Mutual:** Jupiter Intelligence – EO
- MS&AD Insurance Group:** Jupiter Intelligence – EO
- Munich Re:** OrbitFab – In-orbit services
- OKAPI:** Orbits – Space traffic management
- RenaissanceRe:** Synaptech – Space traffic management

Other Diverse Sectors (incl. Transport, Media, Consumer, Agriculture)

- Agreena:** Hummingbird Technologies – EO
- Alibaba:** Qianxun SI – PNT
- Cargill:** Regrow – EO
- Coca-Cola:** OneWeb – Satcom
- John Deere:** NavCom Technology – PNT
- Merck:** ALCAN Systems – SatCom
- S&P Global:** Ursa Space – EO
- Universal Music:** Descartes Labs – EO
- Zonda Home:** Bird.i – EO
- Porsche:** Isar Aerospace – Launch
- Suzuki Motors:** Ispace – In-orbit services
- Toyota:** Xona Space Systems – PNT

Note: Deals are included for illustrative purposes and are not exhaustive.



There have also been growing signs of industry consolidation, amidst the proliferation of new space companies. Analysts expect this trend to continue.

Example consolidation deals¹



Satellite communications

UK-based OneWeb and France-based Eutelsat are expected to complete their merger in 2023, creating over €1.5bn in synergies between their LEO and GEO satellite fleets.¹

The acquisition of UK-based Inmarsat is expected to be completed in 2023 by US-based Viasat, driving global expansion and improved connectivity performance.²

Nanosatellite IoT platform company Hiber was acquired by Astrocast in 2022, to create a vertically integrated satellite-enabled IoT provider.³



Earth observation

Maxar acquired Wovenware in 2022, an AI and software development company specialising in geospatial production.⁴

Spire acquired exactEarth in 2021 to enhance their maritime tracking capabilities, historical database, and increasing its overall customer base by over 75%.⁵

Planet Labs acquired VanderSat in 2021 to deliver advanced agriculture data products to customers in the agriculture, insurance, civil government and finance industries.⁶



Spacecraft manufacturing

BAE Systems strengthened its satellite manufacturing capabilities, acquiring UK-based In-Space Missions in 2021, and strategically investing into ICEYE in 2022.^{7,8}

Boeing acquired Millennium Space Systems in 2018 to add vertically-integrated small satellite manufacturing capabilities to its growing portfolio of satellite offerings.⁹

Space mission solution provider Redwire acquired Oakman Aerospace in 2021, to add capability in digital engineering, spacecraft design and development.¹⁰



Consolidation remains a key thematic given volumes of new capacity being launched.

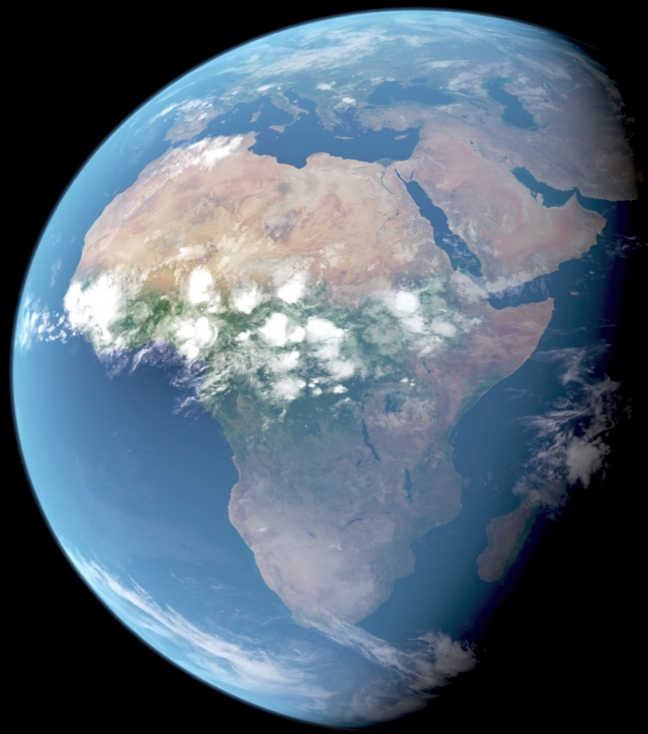
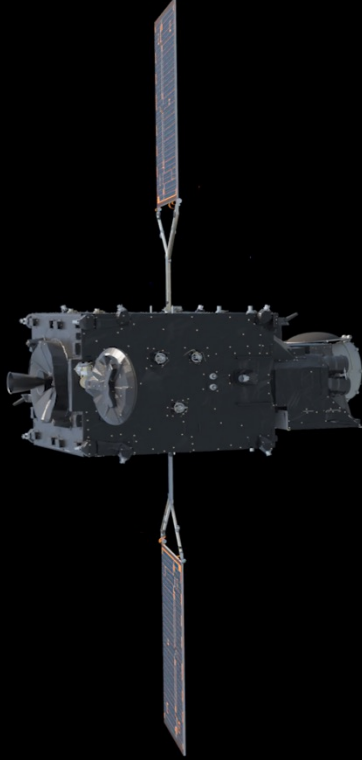
Deutsche Bank, 2022



Remote-sensing (earth observation) companies project robust growth; some executives anticipate consolidation in the sector.

Wall Street Journal, 2021

Sources: 1) [‘Eutelsat and OneWeb’](#), OneWeb (2022); 2) [‘Viasat and Inmarsat Combine’](#), Inmarsat (2021); 3) [‘Astrocast acquires Hiber, accelerates OEM strategy’](#), Astrocast (2022); 4) [‘Maxar Acquires AI And Software Engineering Company Wovenware’](#), Maxar (2022); 5) [‘Spire Global, Inc. Completes Acquisition of exactEarth Ltd’](#), Spire (2022); 6) [‘Planet To Acquire VanderSat’](#), Planet Labs (2022); 7) [‘In-Space missions limited announces acquisition by BAE Systems’](#), In-Space Missions (2021); 8) [‘ICEYE To Provide Radar Imaging Satellite for BAE Systems’](#), ICEYE (2022); 9) [‘Boeing Completes Acquisition of Millennium Space Systems’](#), Boeing (2018); 10) [‘Redwire Acquires Oakman Aerospace’](#), Redwire (2021)

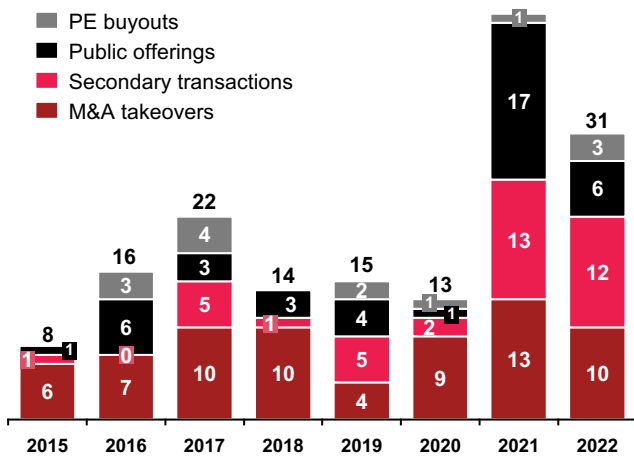


Capital exits

Investors have benefitted from over 160 space sector exit events since 2015, through a diverse range of routes.¹

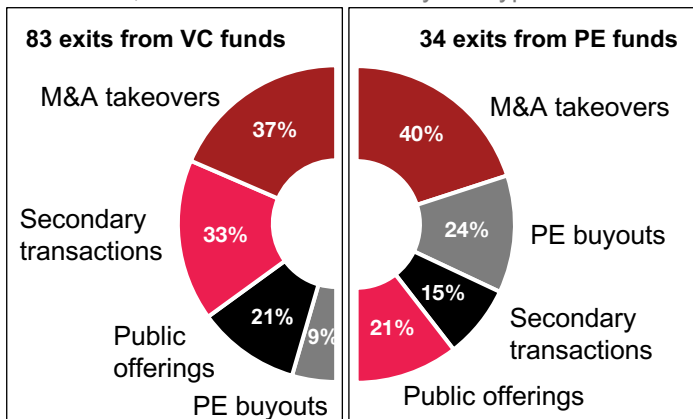
Space exits since 2015¹

2015-2022, count of deals by type



Space exit routes for VC-backed vs. PE-backed investors¹

2015-2022, % of exit deal volume by exit type



Note: For this analysis, only deals with disclosed investor exits are included.

Sources: 1) PwC analysis using Pitchbook data (disclosed exits only)

2022 saw a record-setting year for PE firm exits through four M&A takeovers, two PE buyouts and one IPO.¹


Most space sector exits have occurred through M&A takeovers or secondary transactions (investors sell equity to other investors in a new fundraising round).


Public offerings since 2021 in particular have also been a chosen path of exit for companies in the space sector. However, the shares of many publicly listed space companies have seen prices decline from their market peaks, similar to many innovative stocks across other sectors.

In a landscape of tighter capital markets, our work in the sector has highlighted greater attention being placed on robust business models and revenue generation.

Many investors that have placed capital into companies with an established UK presence have recently exited through a diverse range of channels.¹


NON-EXHAUSTIVE

Hummingbird Technologies
Earth observation 
Acquired by agritech start-up Agreena in 2022
of selling investors: 17
Time horizon since founding: 7yrs

In-Space Missions
Spacecraft manufacturing 
Acquired by defence prime BAE Systems in 2021
of selling investors: 2
Time horizon since founding: 6yrs


Bird.i
Earth observation 
Acquired by real estate analytics provider Zonda Home in 2020
of selling investors: 9
Time horizon since founding: 6yrs


OneWeb^{1,2}
Satellite communications & connectivity 
Acquired by the telco Bharti Airtel & the UK Government in 2020 (after financial difficulties)
of selling investors: 2
Time horizon since founding: 8yrs


Effective Space
Spacecraft manufacturing 
Acquired by space debris removal company Astroscale in 2020
of selling investors: 2
Time horizon since founding: 7yrs

Clyde Space
Spacecraft manufacturing 
Acquired by spacecraft manufacturer AAC Microtec in 2018
of selling investors: 3
Time horizon since founding: 13yrs

Northern Space and Security
Space traffic management 
Acquired by defence prime Raytheon in 2022
of selling investors: 0
Time horizon since founding: 4yrs

Inmarsat³
Satellite communications & connectivity 
Buyout by PE funds Apax Partners, Warburg Pincus and two others in 2019
of selling investors: 2
Time horizon since founding: 40yrs

SatixFy
Satellite communications & connectivity 
NYSE-listed SPAC in 2022
of selling investors: 7
Time horizon since founding: 10yrs

Spire
Earth observation 
NYSE-listed SPAC in 2021
of selling investors: 86
Time horizon since founding: 9yrs

Notes: 1) Investment was following OneWeb Chapter 11 Bankruptcy, 2) \$2.4bn OneWeb merger with Eutelsat announced in 2022 pending completion, 3) \$7.3bn Inmarsat merger with Viasat announced in 2022 pending completion.

Key:

- Corporate acquisition
- PE buyout
- Public listing

Sources: 1) Pitchbook (disclosed exits only)





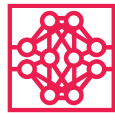
Investing in the UK space sector

The UK space sector has continued to be an attractive and high growth destination for private investment.

The UK published its first National Space Strategy in 2021, setting an ambitious vision to 'build one of the most innovative and attractive space economies in the world.'

This strategy demonstrates the UK Government's commitment to the long-term growth of the sector, with multiple Departments playing a critical role in its delivery.

With a strong heritage of space innovation, there are many characteristics that uniquely position the UK's space ecosystem.



A world leading standing in science and innovation.

Significant R&D investment: The UK in 2022 announced its largest ever R&D budget at ~£40bn for the 2022-2025 period¹, including:

- Committing £190 million to the Advanced Research in Telecommunications Systems Programme (ARTES) to support UK industry develop next generation products, services and applications for the space telecoms sector. Amongst other benefits, ARTES has already supported 75% of funding recipients to reduce their time-to-market.²

Global space influence: The UK is at the heart of global space innovation, contributing between €420-450m to the European Space Agency annually (around 10% of ESA's annual budget), supporting major NASA programmes such as the Artemis moon mission, collaborating with Australia through a bilateral 'Space Bridge', in addition to many other national and international programmes and partnerships.³

Established innovation infrastructure: The UK has a vast network of domestic space innovation infrastructure, including:

- 83 research centres, 64 space test facilities and 53 universities with active space research functions;⁴
- Leading space hubs such as the Harwell Space Cluster, which is a flagship gateway to the UK space sector and home to over 100 space organisations, Space Park Leicester, as well as Glasgow which builds more small satellites alone than anywhere outside California.^{5,6}

Skilled STEM workforce: 26% of graduates in the UK completed STEM degrees (science, technology, engineering, mathematics).⁷

Innovation leader: The UK is ranked 1st in the G7 for Research, Impact, and Reach, and its share of top 10% highly-cited publications in space literature is 2nd globally.⁸

Sources: 1) 'Government announces plans for largest ever R&D budget', HM Government (2022); 2) 'Evaluation of UKSA funding through the ARTES programme', Technopolis Group (2019); 3) 'Impact evaluation of UK investment in ESA', Technopolis Group (2022); 4) 'UK Space Science', Space Academic Network (2022); 5) 'Scotland's space industry has incredible potential', The Scotsman (2020); 6) 'Harwell Space Cluster plays pivotal roll in growth of UK Space Sector', Harwell Campus (2022); 7) 'Where Students Choose STEM Degrees', Statista (2022); 8) 'International comparison of the UK research base', BEIS (2022) d



A diverse ecosystem of leading companies across the value chain.

Rapidly growing industrial base: The number of space companies operating in the UK has grown on average 23% per annum to reach over 1,590.¹ This ranges from new start-ups founded in the UK such as Oxford Space Systems and SatelliteVu, to international companies choosing the UK for core operations such as Airbus, Spire, Thales Alenia Space, Viasat, MDA and Astroscale.

End-to-end value chain offering: The UK space sector is developing a network of domestic launch capabilities across the UK, complementing other activities such as ground systems, manufacturing, spacecraft operations and downstream satellite applications. This enables companies to undertake full end-to-end value chain activities in the UK.

Leading ancillary service network: The space sector benefits from the City of London and wider UK competitive advantage in professional services, including legal, insurance, banking and consulting services.



A healthy investment landscape underpinning the sector and fuelling growth.

Leading European destination of private capital: The UK is the highest recipient of private capital in Europe and second highest globally, receiving 17% of global space investment since 2015.² As an example, UK-based Space Forge raised Europe's largest ever seed round for a space tech company, whilst UK satellite communications and connectivity companies Inmarsat and OneWeb have been the target of major funding rounds.

Increasingly active space investor base: The number of UK space investors is growing fast, with 35 VCs active in the UK space sector in 2021, more than double the 2019 number. The UK investor base includes specialist funds such as Seraphim Capital and TypeOne VC, as well as other diverse funds such as Downing Ventures and Molten Ventures who have participated in multiple UK space deals.²

Range of investor exit routes: Investors have exited UK space investments through multiple routes including the acquisitions of UK-based Inmarsat, OneWeb, Hummingbird Technologies, In-Space Missions, Bird-I, Northern Space and Security, and many others.

Sources: 1) 'Size & Health of the UK Space Industry 2022', UK Space Agency (2023); 2) PwC analysis using Pitchbook data



Acknowledgements

This report was developed by Strategy&, part of the PwC Network, in association with the UK Space Agency.



The UK Space Agency plays a major role in delivering the government's National Space Strategy.

We support a thriving space sector in the UK, which generates an annual income of £17.5 bn and employs c.48,800 people across the country.

Our staff include scientists, engineers, commercial experts, project managers and policy officials who help to:

- Catalyse investment to support projects that drive investment and generate contracts for the UK space sector
- Deliver missions and capabilities that meet public needs and advance our understanding of the Universe
- Champion the power of space to inspire people, offer greener, smarter solutions, and support a sustainable future

[Read our Corporate Plan](#) to learn more about our priorities and plans for the next three years.



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- Satellite use case and commercial value proposition development



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Methodology

Dataset:

The investment and deals dataset is derived from the analyst-curated 'Space Technology' vertical from Pitchbook. The vertical tracks over 600 companies globally and includes over 2000 unique deals between 2015 and 2022. Any references to specific investments or companies are non-exhaustive and not intended to be investment advice. All data included reflects information available as of January 9, 2023, and any changes made retroactively after that date are not captured.

Exchange rate:

In select cases, values reported in pounds were converted to dollars based on the average exchange rate in the corresponding year:

GBP to USD Exchange Rate								
Year	2015	2016	2017	2018	2019	2020	2021	2022
Rate	1.53	1.35	1.29	1.33	1.28	1.28	1.38	1.24

Segmentation:

Pitchbook divides the 'Space Technology' vertical into three segments and further subsegments. These subsegments were mapped to our segmentation using the alignment shown below. Companies that were categorised into more than one segment were allocated to the segment that they primarily operate in. Similar reports vary in terms of terminology and what falls under the definition as a space company. Pitchbook defines a space company as "companies that provide services, engage in scientific research, and/or develop technology related to spaceflight, satellites, or space exploration".

PwC Segmentation	Pitchbook Segment		
Spacecraft manufacturing	Manufacturing	Components	Propulsion
Launch vehicles	Rocketry hardware, components & design	Launch providers	Commercial space launch
Ground operations	Mission control, design & logistics	Ground station networks	Space debris & tracking
In-orbit spacecraft services	Space infrastructure	In-space manufacturing	Space exploration
Commercial space tourism	Space tourism		
Satellite communications & connectivity	Satellite internet	Internet of things (IoT)	Miscellaneous telecoms
Earth observation	Satellite imagery	Earth monitoring	Geospatial analytics
Position, navigation & timing	Position, navigation & timing		

Investment deep dive analysis:

Global investment landscape overview:

Total private investment includes the sum of disclosed deals and excludes deals classified as capital markets activity (debt and public offerings). Total space investors are categorised by their primary investor type according to Pitchbook. Other investors primarily include accelerators/incubators & angel investors. UK investment was determined by a company's HQ location according to Pitchbook and does not include companies with significant operations in the UK but headquartered abroad. Median deal size figures exclude deals without a disclosed deal size.

Venture capital:

Venture capital include deals participated by investors classified as primarily venture capital investors in Pitchbook. The 10 most active global space investors are determined by the number of space investments since 2015. The largest 15 global and UK VCs are determined by the funds assets under management (AUM). The share of VC space deals in revenue generating companies was determined by Pitchbook research which independently

verifies a company's business status at the time of a deal. "Revenue generating" includes the classifications "Generating Revenue" and "Generating Revenue/ Not Profitable".

Private equity:

Private equity deals include deals participated by investors classified as primarily private equity investors in Pitchbook. This includes traditional private equity deal types, such as buyouts and growth equity rounds, as well as earlier stage investments. The largest 15 global and UK PEs are determined by the funds assets under management (AUM).

Corporate:

Corporate deals include deals participated by investors classified as corporations in Pitchbook. These investments include traditional corporate deal types, such as, as well as earlier stage investments including corporate investors.

Capital exits:

Capital exits include completed exit deals disclosed on Pitchbook's database. VC and PE exits only include exit transactions with disclosed sellers and is meant to be representative rather than exhaustive.

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