



HM Government

National Space Policy



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Foreword

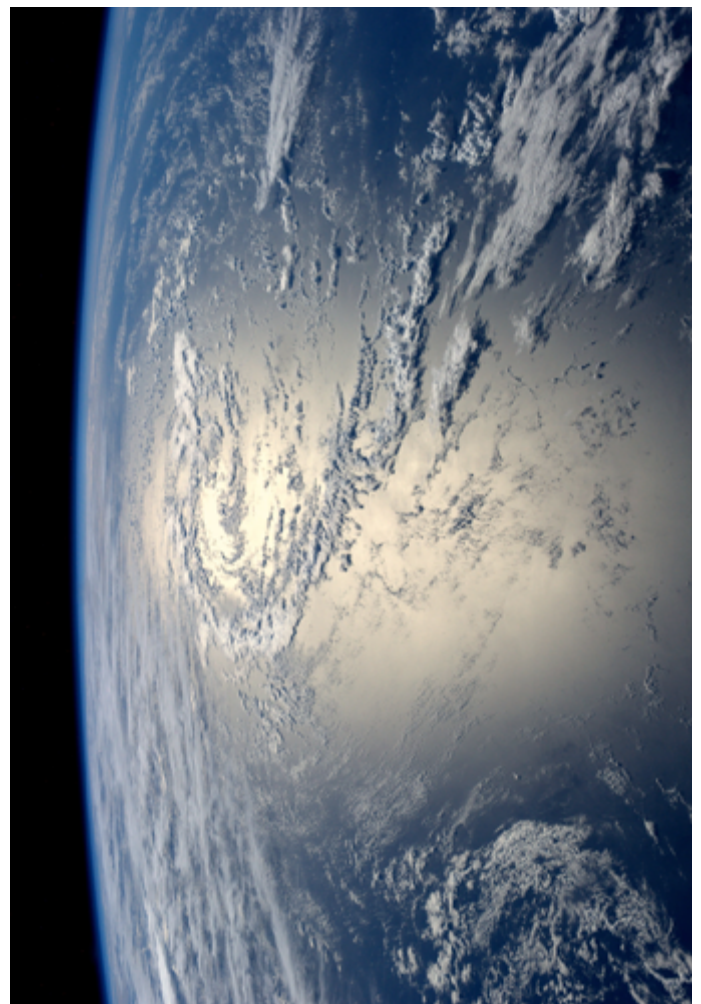
Space matters. Every time we go to work, turn on the television, make a mobile phone call, or engage the satnav system in our car or smart phone, space technology enables our modern life. Space also connects our armed forces and our humanitarian agencies around the world and delivers essential intelligence.

Here in the UK we have a powerful, innovative space sector, inspiring and improving lives, and bringing in billions to our economy every year. We are rightly proud and need to preserve and build upon our success. There will be many transformations ahead in our use of satellite technology and space programmes which will lead to discovery, jobs and growth, radically improving transport, agriculture, education, entertainment and much more besides.

Our universities are among the world's best, and our businesses among the world's most innovative. Both have been quick to grasp the opportunities that a growing space sector represents. This Government applauds the individuals and organisations that are responsible for our success today and we will continue doing all we can to encourage them towards new successes both at home and abroad.

Space belongs to all of us and it should matter to all of us in our modern world, delivering economic growth and productivity benefits right across society. That is why we need a national space policy, to ensure that all the benefits of space technology flow back to all our people. I hope that reading this document will help you to realise the potential of the UK in space.

The Rt Hon Oliver Letwin MP
Chancellor of the Duchy of Lancaster



Secretary of State's Introduction

In the 21st century, the new space race is a challenge to see who can best capitalise on the social and economic advantages that can flow from space science and technology. The UK's role in exploration – such as Tim Peake's Principia mission to the International Space Station and those beyond our orbit as we explore our Solar System – delivers cutting edge science and inspires the next generation of scientists and engineers. But the reality is that space technologies touch all our lives every day, in ways that were unimaginable only a few years ago. These technologies and applications can deliver even greater rewards to all of us today, tomorrow and far into the future.

The value of the space sector in the UK has grown from £6.5 billion in 2007 to £11.8 billion in 2014. Our ambition is that the sector should grow to £40 billion by 2030. This is the first time that we have set out the wider UK government's approach to space, creating a stable policy environment for industry and business. This enables industry and businesses to grasp the global opportunities that space offers.

Satellite technology and space exploration are transforming our understanding of the universe and our place within it. However, people may be far less aware of the contribution space technologies are making to the delivery of high-quality public services, such as broadband for all. Space technologies are supporting our national security and contributing to our economy directly and through data and technology that enable businesses in other sectors.

The UK space sector has been able to deliver year-on-year economic growth and job creation over the last decade at a level that many sectors would envy. However, we cannot rest on

our laurels. The sector must remain ambitious and look for new opportunities to build on the talent and expertise we already have in this country, such as the ambition to create a spaceport in the UK. With more than 200 small satellites launched in 2014, the opportunity for the UK to capture a percentage of this market requires real leadership from government. We must create the conditions in which businesses and others have the confidence to invest in an infrastructure that will support their future success.

Continued economic growth and job creation are a vital part of our vision for space and we have backed this up by publishing the Space Growth Action Plan. As space becomes more ubiquitous in our everyday lives we also need to ensure that the space environment and infrastructure are safe and protected. We are committed to working with industry and academia in Britain and around the world to ensure that our positive reputation for space security is recognised and replicated. Working in partnership with agencies worldwide we will promote British excellence in both manufacturing and other services to support the continued success of the UK space sector.

Any space policy needs to keep up with the pace of change and reinvention in technology and in society. This document describes how we will do that and support the UK space industries in achieving their ambitions and realising their potential.

I hope that you will share my pride in all we are achieving and my optimism for the future.

Sajid Javid MP
Secretary of State for Business, Innovation and Skills.

Roles and responsibilities for space in the UK



The UK Space Agency is responsible for the government's civil space programmes, covering policy, regulation and delivery. It is also responsible for the transposition of international UN treaties to UK legislation. In doing its work, the Agency coordinates closely with other government departments.

The Department for Business Innovation and Skills (BIS) is the parent department of UK Space Agency. In addition, BIS uses satellite data for more accurate mapping through the Ordnance Survey; monitors land use through the work of the Land Registry; delivers space weather and weather forecasting through the Met Office; coordinates resilience to space weather; and provides export control.

UK Trade and Investment leads on export and inward investment activities within a strategic framework developed by the Agency.

The Department for Environment, Food and Rural Affairs and its agencies use satellite data for environmental management programmes.

The Department for Energy and Climate Change supports its climate change research and modelling with data from space.

The Department for Transport is leading the selection of a preferred location for a UK spaceport that can operate spaceplanes, including the regulatory environment for a spaceport and its operations.

The Cabinet Office is a key partner on the National Space Security Policy, and coordinates satellite data for emergency response and management. It also leads UK Critical National Infrastructure and the National Risk Assessment including space and space weather.

The Ministry of Defence uses space-enabled services in support of military operations, and works to support international security policy interests. It also supports disaster response and management using satellite infrastructure.

The Defence Science and Technology Laboratory supports science and technology development for defence and security applications using space.

The Foreign and Commonwealth Office assists the space sector capture new export opportunities and provides representation of UK policy in international civil and security partnerships, such as through the United Nations.

The Home Office uses space-enabled services for emergency services and law enforcement.

The Ministry of Justice supports offender management using space-enabled services.

The Department of Health uses medium-range weather forecasting for advanced warning of public health threats.

The Department for International Development facilitates use of space technology for development and humanitarian activities.

The Department for Education draws on the inspirational effect of space to encourage children and young people up to the age of 19 to engage with science, technology, engineering and maths.

The Department for Culture Media and Sport facilitates the sharing of spectrum both for space missions and space-enabled services, and uses satellites to deliver broadband for all.

The Natural Environment Research Council uses Earth Observation (EO) data, often in combination with other datasets and models, to understand how the environment works. NERC also provides national capability in EO (such as the National Centre for Earth Observation) which enables scientists to participate and develop missions and applications from the data.

The Science and Technologies Facilities Council uses space data for fundamental research into understanding of the Universe, and supports development of new space technology.

The Medical Research Council uses human spaceflight studies for medical research.

The Engineering and Physical Science Research Council funds underpinning engineering research that can have application in a number of areas, including space.

The Bio-technology and Biological Science Research Council supports life sciences research from space infrastructure.

The Economic and Social Research Council uses space data for development studies.

InnovateUK supports the development of innovation from research to practical application and commercialisation.

Context

Space has become increasingly important to modern Britain. This trend is set to continue as societies in the developed and developing worlds rely increasingly on space based assets as one of the critical infrastructures to meet the needs of an estimated population of 9 billion in 2050. Satellites will assist with better management of scarce resources, offer improved communications and support more efficient use of energy. Our global space assets are rightly recognised as part of our critical national infrastructure, and space weather is included in our national risk assessment, acknowledging the risk it represents to both space and ground-based facilities. Once the domain of only those who understood rocket science, space is now a leveller of society in developed and developing countries.

Space is also the most exciting laboratory imaginable for the pursuit of basic scientific questions about the universe and our own planet. Satellite technology and space exploration create, transmit and exploit the Big Data – the ability to combine vast sets of data in new ways to create new linkages, patterns and ultimately new knowledge – that is required to address the major challenges facing society including food security, climate change, pollution and biodiversity loss in our increasingly digitised world. We stand on the cusp of successive technology revolutions in which space will play a key role.

The UK space sector has delivered year on year economic growth rates of around 8% over the last decade, and it enables twice as many jobs as it directly employs¹. Government recognises that space is both a strategic asset and an enormous opportunity, welcoming the industry's ambitious target to grow its share of the global market from 6.5% to 10% by 2030². Government has supported an impressive growth in the sector to date, and will continue to do so.

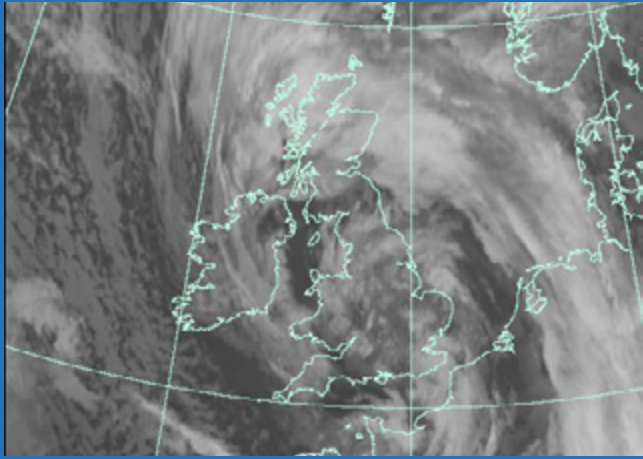
Inherently, space activities are dual use in nature given that it is the same environment, largely the same technology and sometimes the same infrastructure which is used to meet both our civil and defence goals. Space programmes can sometimes span decades, requiring a long-term framework for decisions about how we use space technology. Therefore, the overarching National Space Policy links the UK Civil Space Strategy and the National Space Security Policy, and aligns with Government's Science and Innovation Strategy³ and the National Security Strategy. This National Space Policy has drawn on independent economic analysis⁴, and has been developed in partnership with industry and academic stakeholders to provide that long term view.

¹ <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2014>

² <https://www.gov.uk/government/publications/government-response-space-growth-action-plan>

³ <https://www.gov.uk/government/publications/our-plan-for-growth-science-and-innovation>

⁴ <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2014>;
<http://webarchive.nationalarchives.gov.uk/20121205150610/http://www.bis.gov.uk/assets/biscore/economics-and-statistics/docs/10-624-bis-economics-paper-03.pdf>;



Case study

Rapidly-changing weather is an everyday fact of life in the UK. The Met Office uses satellite infrastructure to deliver critical public services, such as weather forecasting where satellite data provides the largest contribution of all observation sources (including surface weather stations, balloons, aeroplanes, etc.) to forecast accurately. We also use satellite data in our response to extreme weather events, to manage flood risk and support emergency relief.

Government's National Space Policy has four interrelated policy headings which are expanded on below.

Government:

1. Recognises that space is of strategic importance to the UK because of the value that space programmes deliver back to public services, national security, science and innovation and the economy.
2. Commits to preserving and promoting the safety and security of the unique space operating environment, free from interference.
3. Supports the growth of a robust and competitive commercial space sector, underpinned by excellent academic research.
4. Commits to cooperating internationally to create the legal frameworks for the responsible use of space and to collaborating with other nations to deliver maximum benefit from UK investment in space.

1. **Government recognises that space is of strategic importance to the UK because of the value space programmes deliver back to public services, national security, science and innovation, and the economy.**

Government believes that space holds the key to vast additional societal, security and economic benefits for the UK as we move towards an ever more digitised society.

Public services

Today our everyday lives depend on space technology: it is woven into society. We rely on satellites to connect our global society, forecast the weather, manage our finances, access the internet, expand broadband coverage, trade, deliver television signals, underpin national security and assist aid efforts.

Government will drive the use of innovative services from space where they are the most cost effective solution to improve public services, through coordination across departments and in partnership with the wider UK space sector. For instance, Government will use space to bridge the digital divide where satellite technology is the only effective means to deliver broadband to meet the needs of the last 5 – 10% of the UK population. Government will seek to pool its needs across civil and defence policy areas, as a single customer, where appropriate, to enable industry to capture new business opportunities.

Case study

Selected in 2008, Tim Peake, is the first British astronaut in the European Space Agency's astronaut corps. From his scientific research conducted while on the International Space Station to his work as a careers ambassador with education projects across the UK, Tim is already a major source of inspiration for students and children interested in science, technology, engineering and maths.



Government will continue its efforts to increase the supply of a skilled workforce on which the space sector depends by investing in education and outreach programmes, drawing on the inspirational value of space to attract students to wider studies on science, engineering, technology and mathematics.

National Security

Defence operations and our international security policy interests are heavily underpinned by access to space systems, and we will continue to use space capabilities to enhance the United Kingdom's national security.

The growing economic and military significance of space means a growing vulnerability to the associated risks, either from non-malicious hazards e.g. space debris and space weather, or threats from malicious counter-space technologies. Government is committed to assuring this critical strategic capability.

Security, defence and intelligence co-operation with our international partners, including the United States, is exceptionally close, and our work together in and through space is an essential part of this. We will sustain this relationship by maintaining capabilities and assets which bring mutual benefit.

As space becomes more congested, so does the risk to the space capabilities on which we rely for our national security. There is a growing need in the United Kingdom and other countries for a more holistic space situational awareness picture and more predictive capabilities. This involves the surveillance of space, and the

analysis and assessment of potential threats and hazards to space activities.

Government will ensure space assets and services are used to strengthen the nation's security and to protect civilian infrastructure, and that those space systems themselves are protected accordingly.

Science and innovation

The UK has an exceptional scientific landscape. With 3% of the global funding for research, the UK produces 16% of the world's most highly-cited articles, and is ranked second in the 2014 Global Innovation index. Space provides a unique vantage point from which to deliver the scientific research and innovation upon which new products, processes and services often depend. Space is the ultimate laboratory from which we can understand the complexity of the environment at almost all scales. Scientific research and technology development go hand in hand, advancing the development of areas crucial to today's society, from communications to environmental management.

Government will support space programmes to research the fundamental scientific questions around our planet and universe, often in collaboration with partners through our membership of the European Space Agency (ESA).

Case study

ESA's Gaia mission, launched in 2014, has set out to create a 3D map of our Galaxy, the Milky Way. Generating a petabyte of data from its UK-built, state of the art sensors, using Big Data to build a 3D picture of a billion stars, planets asteroids and comets in the Universe.



Government will also ensure that new space technology (e.g. robotics, advanced materials) and knowledge (e.g. of our changing climate) is successfully transferred to other sectors and into industry.

Government recognises that it plays an essential part in the innovation process, sharing risk and spear-heading new technologies and will support joint industrial-academic activities that act as a springboard to market success.

Government will target its intervention across the science and innovation cycle from cutting-edge research and development through to near-market initiatives, ensuring that the UK is at the forefront of this critical modern technology.

Economy

Government shares the ambitious target set by industry to grow the UK's global share of the space market from 6.5% to 10% by 2030. In 2014 the UK space sector directly contributed £11.8 billion to the UK economy and employed nearly 35,000 skilled workers. Impressively, the sector has consistently achieved growth of over 8.8 per cent per year even during a period of recession. The true economic value of space is significantly larger when you look at the services enabled by space infrastructure in sectors such as agri-tech, meteorology, energy, telecommunications, insurance, transport, maritime, aviation and urban development. The space sector is not only a growth sector itself, but is the vital future enabler of growth in other sectors.

Government recognises that significant returns on investment in space technology will be achieved through long-term targeted government intervention, establishing the environment where industry can thrive and manage risk. Government will continue to invest in skills and technology development, especially on disruptive space techniques, data and technologies with market applications.

It will champion UK capability within foreign markets, ensuring that our export sales remain strong and highlighting the many benefits for those who choose to invest in the UK. Government will also continue to play an important role in connecting UK scientists, innovators and businesses with their space counterparts around the globe.

Case study

The UK government deals with the issue of orbital debris for space missions from the cradle to grave (or graveyard orbit in the case of geostationary communications satellites). This work is then reflected through UK involvement in the United Nations Committee for the Peaceful Uses of Outer Space (UN COPUOS) where the UK is a strong advocate for the adoption of best practices by all States and the maintenance of a level playing field for our national industry, ensuring a sustainable environment in which the space markets can continue to grow. The UK Space Agency is responsible for issuing licences under the UK Outer Space Act, ensuring compliance with proven debris mitigation practices, and departments, such as the Ministry of Defence, help monitor activities.



2. **Government commits to preserving and promoting the safety and security of the unique space operating environment, free from interference.**

It follows from the strategic importance and value of space that we should take steps to safeguard our national interest. Without access to space services, our ability to manage transport, freight and resources, communicate, synchronise networks, predict the weather, and coordinate emergency services would be severely diminished. In an age where we are growing increasingly dependent on space technology, and at a time when we are moving towards increasingly autonomous systems like driverless vehicles, we need to be confident that we can rely on space. With such confidence will come huge opportunity as we will be able to use space to deliver ever more safety-critical services and applications.

Responsibility will rest largely with owners and operators of space services or with infrastructure owners and operators. Government will treat space threats in the same way as we would approach any other threat to our strategic national interests. Furthermore, the UK is uniquely placed to develop and promote an international governance framework to secure our continued access to space infrastructure and services.

As space becomes more congested and contested, Government will increase its role in programmes which monitor threats and hazards that could disrupt, degrade or damage our space infrastructure. It will ensure the resilience of our space infrastructure matches our increasing dependence on it.

The UK will continue to play a leading role in promoting a sustainable, safe, secure and peaceful space environment, especially working through the United Nations Committee on the Peaceful Use of Outer Space. Government believes that generating a reliable picture of the space environment is best achieved collectively and welcomes initiatives such as those in the United States to catalyse broader space security cooperation in this area.

The UK is one of the leading countries in orbital debris research. The UK Space Agency is working in partnership with industry and academia to address the problems and create solutions for the growing issue of space debris. This work is then reflected through UK involvement in the United Nations Committee for the Peaceful Uses of Outer Space (UN COPUOS) where the UK is a strong advocate for the adoption of best practices by all States and the maintenance of a level playing field for our national industry. This ensures a sustainable environment in which the space markets can continue to grow.

Government will develop its national space situational awareness capability, as a basis for a stronger UK contribution to international and commercial cooperation. Government is committed to maintaining the accurate space weather forecast capability established in the UK in 2014, including the provision of future space infrastructure to underpin this critical forecasting ability. The UK will continue to work closely with key European partners on issues relating to the security of European space programmes.

Satellite services rely on access to radio spectrum to communicate with the ground and frequently also need spectrum for payloads and instruments. The UK will continue to work internationally through the International Telecommunications Union to secure and protect the assignments to satellite services that serve UK interests. Government will ensure that the sharing of spectrum between services, both domestically and internationally, does not result in harmful interference to space services.

3. Government supports the growth of a robust and competitive commercial space sector, underpinned by excellent academic research.

Government aims to make the UK the most attractive place for space businesses of all sizes to set up and thrive. For example, the UK's approach to Corporation Tax, currently the lowest in the G7, offers a significant incentive for companies to invest here rather than in one of our industrialised competitors. Government recognises the vital role that commercialisation of science and new technologies play in our future growth and will continue to provide businesses with the environment and infrastructure necessary to generate large scale innovation in areas where there are higher risks and wider benefits, as is characteristic of the space sector.

Government recognises fully that a dynamic and prosperous UK space sector is best led by the industry itself and thus we have welcomed the sector's ambitious Space Growth Action Plan which aims to develop and strengthen the UK space sector over the next 15 years. In the space sector the pace of discovery and application is noticeably quickening. Government has taken a strategic view to develop long-term partnerships between industry, academia and the whole of government due to the quality of links between business, the research community and Government which is itself a source of competitive advantage in the global marketplace. These links are already strong and Government will continue to support joined-up working between academic and industrial sectors as the catalyst for the discovery of

Case study

EPSRC, in partnership with research institutes, invested a total of £13.3M in the National Wind Tunnel Facility (NWTF) in January 2014. The NWTF is a network of experimental test facilities, consisting of 17 tunnels distributed across seven UK universities that complement each other in terms of the type of experiments and capabilities they support. This investment underpins fluid dynamics and aerodynamics research of relevance to the space sector.



new knowledge and for economic growth in the sector. Satellites have been recognised as one of the eight great emerging technology sectors⁵ that support UK science strengths and business capabilities and in which the UK is set to become a global leader.

Centred around the British Business Bank, Government will continue to make finance markets work better for innovative, smaller businesses. Government will support innovation and entrepreneurship which will aim to underpin private-sector investment in space, for instance through the Satellite Applications Catapult in Harwell. Government will also fund a range of technology support programmes, spanning blue skies research through to near-market applications, with differing financial models.

The clustering of resources and industries in specific locations can provide a conducive context for success - this is already evident through the coordinated investment in the UK Space Gateway at Harwell. The Government will, as part of our wider national infrastructure strategy, develop further clusters around existing and new space assets in industry and academia, replicating the “Harwell effect”.

Government will ensure that the growth benefits of the space industries are felt at local level as well as nationally, linking with Local Enterprise Partnerships and the Devolved Administrations. It will support “downstream” clusters of companies that can utilise space to deliver innovative products or services into space-enabled markets that align with local smart specialisations.

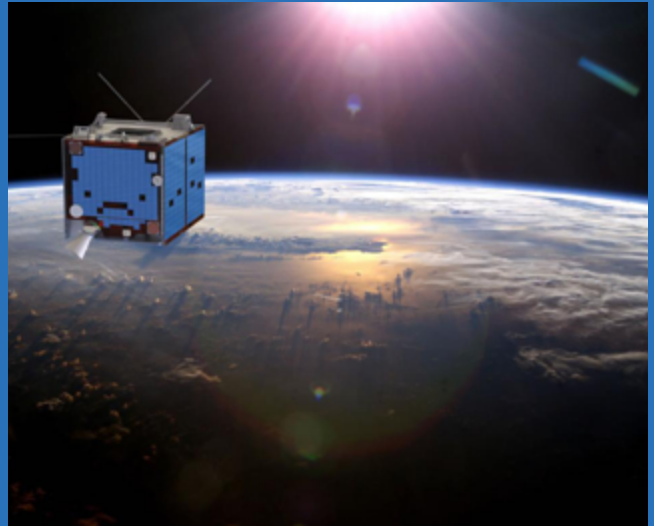
Government will also drive adoption of innovative space solutions for the delivery of public services, acting as a customer where space provides the optimum solution to effective delivery of public services.

Government will facilitate access to markets, promote the availability of investment capital, and put in place a predictable and proportionate regulation regime which supports growth whilst meeting national and international security obligations. Government will enable the sector to capitalise on new opportunities that come from our increasingly automated society, where safety and resilience are essential prerequisites to service delivery in areas like autonomous vehicles, resource management and communications. Government will assist UK employers to compete more successfully and respond more innovatively in the growing global markets for space-related products, notably in areas such as satellite manufacturing; space-based instrumentation; satellite-based services; launchers; and terrestrial applications of satellite technologies.

⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311900/informatics-satellites.pdf

Case study

UK industry and academia worked together with InnovateUK, the UK Space Agency and the Satellite Applications Catapult to design, build and launch an innovative satellite to trial UK technologies in space called TechDemoSat-1. Designed and built by UK industry, this functions as an 'in-orbit test facility' for innovative UK payloads and software. At roughly the size of a washing machine and a surprisingly low mass of around 150kg, the satellite uses UK expertise in small satellites to allow small and medium-sized enterprises to test eight payloads in space.



Access to safe and cost-effective launchers is clearly fundamental to any country's long-term capacity to participate in space-based activities. Government will enable access to new space markets where they offer significant advantages to UK space businesses. For example, we have already set out our ambition to establish a spaceport in the UK and are examining the case for commercial spaceflight and small satellite launch activities.

Such activities may start with sub-orbital space tourism and micro gravity science services. These can build crucial technical and operational know-how, and the credibility for further UK launch capabilities. In due course, Government intends to go further and launch small satellites from the UK. A future spaceport is likely to be located in a coastal location, offering the potential to stimulate high-tech growth in local communities in Cornwall, Scotland or Wales, providing new and long term manufacturing and service jobs.

4. **Government commits to cooperating internationally to create the legal frameworks for the responsible use of space and collaborate with other nations to deliver maximum benefit from UK investment in space.**

The Government will increase its international collaboration on development and participation in space missions and applications, as well as sharing with others the best practices that we have developed. Space is ungoverned by any single nation. Nations around the world have to share the space environment. The cost of space programmes also means it often makes sense to share the necessary infrastructure.

Without sovereign governance, international consensus is required to promote the right regulatory framework in Space and the cornerstone of international space law remains the 1967 Outer Space Treaty. The regulation of space activities is rooted in the importance of countries playing by the same rules and we will take a balanced approach to regulation, ensuring that it is proportionate and commensurate with the nature of the space programme it addresses, in terms both of scale and risk.

Case study

In August 2014, the Department for International Development (DFID) announced a ground-breaking strategic partnership with the private sector to deliver e-learning programmes in Kenya to thousands of marginalised girls. The programme is delivered around an internet learning platform, accessed via high-speed satellite broadband connectivity. The partners provide students with interactive, individualised learning tools, personalised maths tuition with a virtual online tutor, alongside digital learning content for maths, literacy and life skills, and tuition and support to teachers to use ICT in their teaching. This is enabled by UK industry, using technology developed as part of a public-private partnership with the UK Space Agency, delivered through the European Space Agency telecommunications R&D programme.



The Government is committed to further developing Transparency and Confidence Building Measures in Outer Space as outlined in the 2013 report of the United Nations Group of Governmental Experts and promoting norms of responsible behaviour that could contribute to the international legal framework of Space activities. Through its work in international fora such as the United Nations General Assembly, the Conference on Disarmament and the G7 the UK will continue to promote the rule of law and its application to the Space domain.

Among the most important vehicles for international civil space collaboration for the UK are the European Space Agency (ESA), the European Union (EU) space programmes, and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). International collaboration allows the UK to participate in more ambitious projects, benefit from economies of scale, and the possibility to create new opportunities for public services, science and innovation, security and the economy.

Government will work through established and emerging international space partnerships, including bilateral programmes. It will help secure the greatest possible return for the UK economy and science base from our

participation in European programmes. Government will increase UK representation within ESA, for example by increasing take-up of secondment opportunities at ESA and the EU by UK staff from both business and within government. This investment is supported and supplemented by the UK Government's own commitment to continue to invest domestically in science, innovation and technology.