Introduction

At the end of 2015, the UK Government made a pledge to deliver broadband services to everyone in the country by the end of the parliament. This commitment places broadband services on a par with utilities, such as water or electricity; it signifies that the technology of modern communication has become of the utmost significance for Government. However, the approach used to date, bolstering and investing in existing broadband infrastructure (exchanges, street cabinets and copper wire), is unlikely to work for “the last 5%”, the remaining proportion of UK citizens with no access to fibre broadband. As a result, Government must now prioritise alternative approaches - wireless and satellite - that have been largely unsupported until now.

Satellite broadband is not well understood as a service. This is due, in part, to the current market dominance of fibre, but is also because of early issues associated with the technology. Many of these have been addressed, but this often goes unrecognised. Modern High Capacity Satellites (HCS) can now deliver reliable, superfast broadband to thousands of customers simultaneously; speeds are now in access of 24/30 Megabits per second (Mbps) and service providers are aiming at 50-100 Mbps by 2016/17. The UK can learn much from the example of the USA provider, ViaSat, which serves almost 800,000 users.

Satellite broadband is well suited to those unable to, cost effectively, access fibre, and as an overlay technology for mobile users. Increased use would encourage competition amongst broadband providers and give consumers more choice. Satellite has utility, beyond that of fibre, for both consumers and the national interest (it can be used for critical national infrastructure, emergency and security services), but it would be better enabled by additional capacity and resilient, hybrid networks. This would ensure that services could meet demand and become part of the national digital infrastructure, encouraging and supporting downstream innovation and addressing ever wider markets.

1 EutelSat’s Tooway service in Europe and ViaSat’s Exede service in the US are generally used at 12 Mbps but are capable of 30 Mbps. Australian services aim beyond this. Capacity and speed are both improving.
The market opportunity

“The last 5%” equates to some 1.4 million households and £0.5bn in potential revenue. In Europe, this figure is likely to be even higher and this market holds further opportunities for the UK to capitalise. Additional broadband capacity would generate benefit for UK services and products such as antennas, software, applications and satellite components.

The Policy Exchange estimates that, in 2016, 12% of UK GDP will be directly linked to the Internet; the UK is home to the world’s most prolific online shoppers and social media users, with demand for data growing at about 35% per year. Modern HCS can service this demand.

In total, the opportunities amount to £1-4bn per annum. In addition, investment in satellite broadband would directly support the growth of the UK space sector and enable satellite to become instrumental in solving the “digital divide”.

In order to support Government agendas, national resilience and security, consumer demand and initiatives such as smart cities, the UK needs a coherent digital infrastructure that is a blend of terrestrial and satellite enabled, fixed, mobile and nomadic services.

With coordinated effort, the UK space industry, telecommunications and media companies could deliver these services to both the Government and the population. However, their potential must be harnessed, and the future national demand for broadband services assessed, so that industry can plan ahead. With appropriate governmental support and the requisite business environment, ground networks and space based capacity are there to meet emerging demand.
1. Introduction and Context

1.1 Introduction

“We will deliver faster internet, to help you work and communicate more easily. We will secure the delivery of superfast broadband in urban and rural areas to provide coverage to 95 per cent of the UK by the end of 2017, and we will ensure no one is left behind by subsidising the cost of installing superfast capable satellite services in the very hardest to reach areas. We will also release more spectrum from public sector use to allow greater private sector access. And we have set an ambition that ultrafast broadband should be available to nearly all UK premises as soon as practicable.”

CONSERVATIVE MANIFESTO MAY 2015

The aim of this report is to elucidate how satellite can contribute to the delivery of superfast consumer broadband services, as part of the UK’s digital infrastructure: the focus for Broadband Delivery UK (BDUK), under the aegis of the Department for Culture, Media and Sport (DCMS). It also suggests that satellite broadband can support the growth of the country’s space sector, by generating business from systems and services used at home and abroad. It examines wider opportunities in Europe and further afield.

Satellite broadband encompasses both basic broadband (2 Mbps +) and superfast broadband (24/30 Mbps +), delivered by satellite, rather than terrestrial means.

This report is produced in consultation with satellite broadband service providers and operators Avanti and ViaSat. It looks ahead to 2030, with the major focus within a timeline to 2020.
1.2 Background

As of May 2015, 278% of UK homes enjoyed access to superfast broadband and these numbers were increasing. The Government target is to make superfast available to 95% of UK premises by 2017 and for all by 2020.

To date, a complex combination has been used to accelerate the delivery of terrestrial superfast broadband. This comprises of: commercial deployment of fibre broadband (by BT), fibre/cable broadband (by Virgin Media), public subsidy by the UK Government (some £500m, focused on BT) and local authorities (a similar sum in total).

Up to now, a 2Mbps minimum standard has been implemented into the Government’s broadband initiatives. There are indications that this is set to increase, but little investment has been demonstrated to date.

Crucially, “speed” is just one factor of performance. Capacity (volume) also plays a large part. The typical competitive satellite broadband offered is currently capped at 10-40GB, but 50-100GB is viable in the near to medium-term (2016/17) and “unlimited” is realistic in the future. It is already offered with some US packages. However, in Europe, unlimited services have not yet proved successful.

It’s also now becoming apparent that a focus on “speed” is what has led to the pre-eminence of fibre optic technology, and a strategy that targets improving an already reasonable service, for most, into a superfast one for the same group of users. This has disadvantaged rural areas and even some parts of towns and commuter belts. It is clear that, without action, the digital divide will soon become a chasm.

The Government has now acknowledged this and, together with the Parliamentary Space Committees (PSC) and the Digital Policy Alliance (DPA), has implemented pilot programmes to examine technical and business options to accommodate “the last 5%”. These projects include satellite based trials to see how technology advancements and business approaches can be used to provide superfast access for situations where fibre is simply not cost effective or not the full answer.
Those affected may also include the emergency and security services, newsgathering, critical national infrastructure organisations and mobile users (extending to transport, such as trains and aircraft). The inclusion of these wider applications ensures that satellite services potentially benefit the Innovation and Growth Strategy (IGS)\(^4\) and the National Space Security Policy (NSSP)\(^5\) as the provision of vital services for our economy and national security is at stake, and satellite has distinct advantages over fibre.

### 1.3 Market Definition

The UK Government’s target is to have the best broadband in Europe, with ‘superfast’ defined as providing download speeds in excess of 24 Mbps\(^6\). There is, however, some discrepancy, as the EU defines superfast as 30 Mbps. Hence any service seeking European funding must be capable of delivering up to that speed.

In addition, satellite is not viewed by the EU as a Next Generation Access (NGA) technology. For NGA purposes, the term ‘superfast broadband, only applies to networks using optical fibre. Neither has satellite been viewed as part of a coherent digital solution in Europe, although it already delivers speeds of at least 6-20 at a price point of £30-40 per month.

There is thus a danger that the EU definition of ‘superfast’ does not address the needs of many Europeans for a reliable and effective, high throughput, broadband service. The market is further constrained by the fact that, currently, satellite is regarded as only suitable for areas where basic broadband services (at a minimum download speed of 2 Mbps) are not available at affordable prices, which further restricts improvement to services.

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4 Innovation and Growth Strategy (IGS), Reference A.
5 National Space Security Policy (NSSP), Reference B.
6 By DCMS. OFCOM consumer report 2014 views superfast as 30 Mbps, Reference C.
1.4 Market Opportunities

The Policy Exchange estimates that 12% of UK GDP (in 2016) will be directly linked to the internet. Demand is growing at around 35% per year and the most popular uses in the consumer domain are for films and TV. UK nationals are also the world’s most prolific online shoppers and social media users.

Thus, provision of a robust and resilient satellite broadband ecosystem would benefit a variety of streams of activity and generate an estimated additional £1-4bn in revenue per annum. Areas that could potentially benefit include:

- **UK consumer broadband**: a market of 280,000 households paying £30 per month would generate a £0.1bn annual revenue; a market of 1.4 million households would generate £0.5bn in direct annual revenue from the service.

- **UK fixed broadband**: connecting educational establishments (schools and home learners), healthcare and SMEs (including rural businesses), would generate a similar income to households.

- **Global consumer broadband**: in addition to satellite broadband services, UK-made products that exploit HCS technology include antennas, software, applications, satellites and their components. Combined, these would generate several billion pounds in revenue.

- **Increased use of internet**: bundling broadband with, for example, voice calls and TV broadcasting would create a significant market both at home and abroad. This would also benefit streaming services like Netflix, Amazon Prime, etc.

- **Critical National Infrastructure**: robust and resilient communication to re-establish connectivity following a major power outage would be a major benefit. Developing systems and approaches specifically for satellite broadband could be a significant global market.

- **Transport**: Government support for satellite broadband would enable service on trains, connected cars and aircraft. In-flight Wi-Fi is growing significantly, with companies such as Inmarsat, GoGo and ViaSat all delivering services for an expanding market, with a potential multi-billion-pound global revenue.

7 1.4M households = 5% of the population, 280,000 = 1%.
Media and live events: a growing sector. With people accessing more and more video, often live and not just at home, there is growth in highly localised, market-tailored content, together with the expectation that this should be delivered via the internet. Broadcasters, large and small, are exploring this area. Demonstrable expertise in technology and service delivery for this sector is forming a significant market and already producing revenue for ViaSat in the US and, to some extent, Avanti in Europe. Local news and sport are the cornerstones of this type of content and their market size is on the rise internationally.

The MOD Future Beyond Line of Sight (FBLOS) project. Expected to generate revenue in the billions throughout its lifespan, FBLOS is expected to succeed Skynet 5 from 2022 and is particularly relevant for governmental use, both at home and abroad. It is likely to use satellite broadband to some degree. This will provide UK industry with an opportunity to play a major role in the programme, using existing design, test and build facilities. It could also provide service management, wider connectivity, infrastructure and services.

The Emergency Services Mobile Communications Programme (ESMCP). With its current focus on 4G/LTE, the ESMCP needs to look to complementary services such as satellite, primarily for coverage and resilience but also to accommodate high demand users. As the information needs of emergency services grow (to include video, on the spot assessment and digital information links), being connected will become even more critical. Satellite broadband can provide this connectivity in the form of 4G deployable “bubbles”, independent of the terrestrial network. Significant revenue is expected through the lifetime of the programme.

The healthcare and telemedicine market. In-home and in-transit services will benefit most from satellite, particularly those in rural and underserved areas. Strong growth is expected.
2. Current market overview

2.1 Market Size and Value

The Government has, to date, invested some £1bn in Fibre to the Cabinet (FTTC), the use of existing infrastructure to deliver broadband. However, this approach will be ineffective in reaching “the last 5%” of the population, those with no access to superfast broadband. The UK has 28 million households and “the last 5%” equates to 1.4 million of these. The most conservative assumption, that 20% of these homes will go on to use satellite broadband, amounts to 280,000 households, a significant market. With each of these households paying an average of £30 per month, a revenue of £0.1bn per annum can be expected.

In respect of the larger European market, the situation is more oblique as, currently, any failure to meet certain rules about how public money should be spent (State Aid conditions), is a potential breach of European legislation. Removing these constraints would result in a larger market of approximately one million users. In many countries where terrestrial connectivity is poor, or non-existent, the market size could be as large as 50% of households.

Satellite broadband is already seen as a growth sector in many parts of the world - North and South America, Asia, Africa and Europe. It supports social inclusion, education, health and, in some regions, provides critical connectivity through the delivery of Wi-Fi and 4G/LTE backhaul.

2.2 Technology enabling the customer experience

High Capacity Satellites and the Ka-band

High Capacity Satellites (HCS), also known as high throughput satellites (HTS), can provide unparalleled degrees of bandwidth and throughput as a result of high levels of frequency re-use across multiple narrowly focused spot beams.

Satellites operating in Ka-band offer significant advantages over conventional satellite networks (operating in Ku-band and lower frequencies), including more bandwidth and higher data capacity, and thus enabling new services and a superior user experience. Europe’s first Ka-band satellite was launched by Avanti in 2010 and was manufactured in the UK. This was swiftly followed by the Eutelsat KaSat satellite.

In the US, currently, only satellite broadband providers are experiencing market growth, with cable operators and telcos losing subscribers. ViaSat already has around 650,000 subscribers using the Ka-band and has ordered new satellite capacity.
“Affordable satellite broadband for the general public is therefore a new and developing market,” according to the UK Space Leadership Council. “The success or otherwise of satellite broadband in the UK will be determined by the acceptance of this new technology in the market and the take up of satellite broadband capacity.”

Services and speeds and capacity

Under the Phase 3 pilots for BDUK, Avanti are demonstrating 30Mbps and 24Mbps services to 1000 households. This will serve to inform future government funding decisions and establish price points for services.

Services in the US tend to use “at least” speeds, whereas in the UK and Europe they are advertised as “up to” speeds. In the US, ViaSat’s Exede service and, in Europe, EutelSats’ Tooway service are generally used at 12 Mbps but are capable of 30 Mbps. In Australia, ViaSat technology enables 100 Mbps broadband services.

Satellite broadband operators recognise the need to constantly increase user speeds whilst maintaining an acceptable price and quality for consumers, and this drives capacity. Speed, therefore, is but one indicator of performance; also relevant are page load times, quality of service and bundling, exemplified by “all you can eat” type data packages. These all contribute to the user experience.

At under four seconds, satellite broadband page load times now also compare favourably with fibre, which averages 2.5-3.5 seconds.

Service is also improving rapidly. ViaSat 1, launched in late 2011, is currently the highest capacity satellite in the world. ViaSat 2 is to be launched in 2016 and will have more than twice the capacity and seven times the coverage of its predecessor.

The success of the UK trials, together with ViaSat’s technology, strongly suggest that satellite can now meet “superfast” definitions and, more importantly, a satellite station can offer almost immediate access for customers, which fibre clearly does not.

The future

By 2020, it’s likely that a large number of satellite broadband vendors will be using HCS and will thus provide a mix of dedicated and shared beams. This will enable increased cohesion between networks and terrestrial fibre-optic backhaul for resilience.

Cloud services are likely to be offered by several vendors together with media bundling, “voice over IP” and other customer value add-ons. The growth in the use of the internet, the internet of things, 3D

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8 Satellite Broadband Services Report to the UK Space Leadership Council, Jun 2011
printing and the data-hungry\textsuperscript{9}, touch-enabled “tactile internet” will require significant telecommunications infrastructure and further drive demand.

HCS will ultimately become the norm for 4G/LTE backhaul and for home, business, vehicle and even individual connectivity. With innovation driving down the cost of space capital, capacity will become economically available to all and scale of use will enable further reductions in cost to users.

With the technology to support this growth either already available or coming soon, it is essential that the business and political environment continues to encourage industry to deliver the capacity to enable UK growth. Given suitable capacity, today’s satellite broadband appears suited to solving connectivity issues for “the last 5%”.

2.3 Customer Base

Current and potential customers include end users, local resellers, media, content, healthcare and mobile service providers, utilities and government entities.

End users can be households, businesses, home and mobile workers (an increasing market). The business market includes the energy sector, natural resources (such as mining, forestry and water), agriculture (and its supply chain), healthcare, education and SMEs.

The satellite broadband value chain includes the upstream manufacture of satellites, ground stations, launchers and equipment for use on consumer premises. The satellite operator typically wholesales these products to national or local resellers, who provide the end-user service and customer support.

According to OFCOM’s 2014 consumer experience report: “Take-up of the internet remains stable, with four in five (83%) households able to access the internet at home. 78% of households use either fixed and/or mobile broadband. Of note, about half (46%) of mobile broadband users use the service mainly, or always, at home.” This demonstrates that residential broadband, which includes Wi-Fi and pico cells to enable mobile technology to be used in the home, is a growing market and likely to remain so. In addition, “many consumers have a fixed-line mainly, or only, for broadband. Some 14% of consumers with a fixed-line said they never used it to make phone calls.”

Dispensing with landline charges altogether may thus be attractive to customers and is something satellite broadband can offer. Often, Skype or voice over IP (VoIP) phone services are used as a substitute. “Use of VoIP services continues to grow,” says OFCOM, “and a third now use this method of communication.” Many companies now provide this with satellite broadband.

\textsuperscript{9} IEET Engineering and Technology May 2015
Fixed broadband is a key enabler for education, health enterprises, rural businesses, homeworkers and other private and public sector activities. However, broadband customers are not always fixed in position (a fact not adequately addressed by BDUK). Mobile use does not present an issue for satellite; small, transportable user terminals (60-90cm) are available, delivering upwards of 12 Mbps. Some are even auto-point and can be set up within minutes, delivering significant throughput for a variety of purposes. They are suitable for caravan or holiday lets, but also for professional use and especially effective (when combined with Wi-Fi or pico cells to extend mobile phone access), for places where terrestrial services are non-existent or have failed. In the air, current satellite broadband technology can deliver a very respectable 100 Mbps on a commercial airliner.

A further advantage satellite holds over fibre is the ease of reaching the end customer. This can prove a physical challenge, as well as being cost prohibitive (£2500 is not unusual) for fibre providers. However, presenting customers with a service offering is not easy and is still a significant challenge for satellite broadband providers. With dominant players such as BT and Virgin outpacing and out marketing smaller resellers, the advantages of satellite broadband are not well known to the average consumer. This means that those most in need often have little idea how to go about solving their problems.

In order to boost the roll out of satellite broadband, subsidies have been offered to encourage people to take up the service. However, the approach taken - with schemes and amount of subsidy offered differing and dependent on area – has been criticised as overcomplicated. As a result, take up in many areas has been disappointing. A more coherent and simplified campaign is clearly necessary, together with better advertising - nationally, regionally and locally. Voucher scheme processes need to be slick, emphasising rapid turnaround, while addressing the fact that, although equipment costs are relatively high compared to terrestrial options, total system costs are significantly less.

As the customer base is fluid and not a guarantee of business, companies wishing to provide coverage or capacity also need to understand the business risks where fibre broadband access is limited but user demand remains unclear.

Widely regarded as a success, Avanti’s campaign, in collaboration with the Scottish Government, used a preliminary survey to identify and gather together users with poor broadband. This was then presented as a viable commercial proposition for Avanti and a six-month roll-out was performed to alleviate the problem. This approach also gives Government the opportunity to examine additional local or regional needs, such as emergency services, fall-back communications or community projects.

2.4 Competitive Landscape

Terrestrial forms of communication, whether superfast fibre or 4G/LTE, are considered to be the main competition for satellite broadband. These two technologies have some major disadvantages. The former is cost prohibitive for many areas of the country and the later has coverage issues (but also throughput). However, from another perspective, these technologies could be viewed as complementary services.

There is also competition within the satellite broadband market itself, which is of benefit of consumers. Lower pricing, the removal of upfront equipment costs, higher speeds and unlimited data volumes all mean that satellite is becoming an attractive option for those seeking a higher speed broadband connection.¹¹

The UK now has a choice of three satellite based technology platforms designed for consumers: Avanti (Ka), Eutelsat (Ka Tooway - which largely uses ViaSat technology) and SES Astra (Ka and Ku). These providers all offer satellite broadband services in the UK as well as parts of Africa and Europe. The US market is covered by ViaSat and Hughes.

There has been little change in the overall market structure in the UK since 2011, with a number of intermediary satellite internet service providers purchasing services wholesale, packaging them (either under the operator’s brand, or adding their own) and wrapping different features around them, as well as offering additional incentives.

With the current Ka capacity over the UK becoming fairly loaded, companies are looking for future alternatives.

¹¹ http://point-topic.com/free-analysis/satellite-broadband-in-the-uk/
2.5 Export / International Landscape

The 2011 Satellite Broadband Services Report to the UK Space Leadership Council judges the overseas market to be far greater than that in the UK. For UK operators, the chance “to supply services in these markets provides the opportunity for economic growth” says the report. “Further, as demand for higher data rate services and capacity increases, this is likely to drive operator investment in new satellites that can meet next generation needs.”

In order to deliver fast broadband (defined here as having a speed exceeding 20 Mbps), the report estimates that Europe will need investment of between £1-1.5bn in new satellites and associated technology. Satellite based services, it argues, can potentially be rolled out more quickly and more economically than fibre in large parts of the continent that cannot access broadband. There are also markets for satellite operators (wholesalers) and national or local resellers (retailers) outside Europe.

However, government intervention across the EU and elsewhere in the world has had the effect of skewing the marketplace and reducing the number of addressable opportunities for satellite broadband. This is a result of national or European structural funds to subsidise the capital cost of deploying terrestrial fibre to areas where this would not otherwise be economically viable. However, in many other parts of Europe, Africa, the Middle East, North and South America, the market remains strong.

12 Britain’s Superfast Broadband Future sets out that less than 60% of EU or OECD homes currently access broadband
3. Market drivers current & future

3.1 Market Drivers: PESTLE analysis

Political: The UK Government is pursuing a “digital by default” approach: meeting the needs and demands of the population, whilst enabling reduced costs (in staff, infrastructure and processes), with decentralisation where appropriate. However, this requires investment to deliver the network backbone, primarily through the BDUK programme, which is fibre-based. Almost £1bn has been invested by central and local Government in the rollout of superfast broadband as FTTC. Government has also funded studies to resolve the issue of broadband access for “the last 5%.”

Economic: Government is keen on commercial investment. It may be less reluctant to commit large scale funding for long term programmes and an IGS objective is to encourage this investment. The UK’s space sector is thriving and contributes £9.1bn a year to the economy. It directly employs 28,900 people and has a growth rate of almost 7.5% per annum. The aim of the IGS is to increase the (expected) national share of £400bn in the global space-enabled market to 10% by 2030, with an interim goal of growing the UK space industry to £19bn in turnover by 2020.

Socio-Cultural: The average UK household now owns more than three types of internet enabled device. One household in five owns six devices or more. The UK is thus becoming increasingly connected. This growth in the use of technology within the home has driven the BDUK programme but demand for data is increasing and also extending beyond the home.

Technological: Advances in devices and network provision have increased expectations, particularly in urban areas. Investment in high specification engineering (to deliver, for example, a superfast backbone across the UK) is significant. The UK has also sold off spectrum to encourage technical innovation. In 2013, OFCOM auctioned 250MHz of spectrum in the 800MHz and 2.6GHz bands. The successful bidders were Telefonica O2, Three and Vodafone, with EE using some of its existing 1800MHz radio spectrum to launch 4G. Telefonica O2’s bid was for specific bands of spectrum that came with an obligation to provide indoor 4G coverage to at least 98% of the UK population by the end of 2017. O2 also contracted to provide 4G coverage for at least 95% of the population within England, Northern Ireland, Scotland and Wales. However, networks do not provide 100% coverage as 4G is not economically capable and does not have the capacity to bridge much of the digital divide. Satellite offers a technically and commercially more viable option for many users.

13 The Size and Health of the UK Space Sector 2010/11
Legal: From a legal and regulatory perspective, the UK is an attractive place for satellite communications and service providers. However, EU regulations, which disadvantage satellite provision in comparison with fibre, make broadband delivery complicated in terms of State Aid.

Environmental: From a physical perspective, the UK has a good communications infrastructure, including a number of significant satellite communication sites. These range from BT’s major hub at Madley in Herefordshire through to Goonhilly in Cornwall and major MOD/NATO sites such as at Colerne in Wiltshire, Oakhanger in Hampshire and Vodafone sites in Oxfordshire and Scotland. There are also a number of smaller commercial hubs across the country. The UK has significant terrestrial infrastructure, albeit disconnected in some cases and on different government programmes. Major fibre-related work can involve significant upheaval and environmental impact, necessitating the installation of tunnels, masts and powerlines. Satellite has a major advantage over terrestrial provision in this respect, as gateways or access nodes can be installed on existing sites. A reduction in the size of access nodes also means they can be placed in many commercial or government locations. Consumer premises equipment (CPE) is also reducing in size.
3.2 Space Industry SWOT

Strengths: Satellite broadband is a solution for the most inaccessible regions and a means to close the digital divide. It’s no longer a service of last resort. It’s currently available and can be deployed immediately. There is an opportunity to address a global marketplace.

Weaknesses: Satellite broadband has not, generally, been competitive with fibre in the non-rural marketplace, in part because it has not been subsidised sufficiently by Government. Typically, resellers are SMEs with low advertising budgets and visibility, unable to compete with the larger terrestrial broadband companies. A number of satellite products currently have download allowance limitations and these are disliked by consumers (most terrestrial packages are unlimited). This is not the case in the US and is also likely to change soon in the UK. Satellite broadband from geostationary orbit is subject to some latency but average page load times are comparable to industry norms. Legacy Ku band services have imbued satellite broadband with a negative image that is hard to shake off. As a result, it is often perceived as a last resort; its performance is deemed to be poor and costs high in comparison with terrestrial technologies.

Opportunities: Sizeable national, regional and global market opportunities exist. The provision of an offering competitive with terrestrial broadband would allow the satellite market share to, not only grow considerably, but service wider needs. There is a strong perception that fibre is the only future. However, it is, by definition, fixed; it cannot address mobile requirements, which include trains, cars or people on the move, as well as mobile homes, temporary (building) sites and security related deployments.

Threats: The effects of subsidy schemes which favour terrestrial fibre deployment, as well as 3G, 4G or LTE mobile technologies presented as an alternative to fixed line broadband in low income economies.
4. Growth potential

4.1 Expanding Markets

Aside from the singular growth in the use of the internet, high-definition TV (HDTV) and ultra high-definition TV (UHDTV), satellite broadband benefits from wider utility within several new markets: emergency services, health, education and critical national infrastructure; new software applications; networking technologies; data centres, hubs and gateways; fibre connections; antennas; remotely piloted air systems (to deliver goods ordered by newly connected customers) and network and service operations centres.

Several of these markets are addressed in related IGS papers.

4.2 Market Blockers

As already noted, the dominance of terrestrial broadband providers has, up to now, comprised the major stumbling block for satellite solutions, and the reason “the last 5%”, together with local government, have lacked awareness or understanding of alternative delivery solutions.

Whilst satellite is ubiquitous and, once launched, can rapidly deliver broadband services, the decision to build, launch and operate a satellite is a major undertaking. So, unless a market is obvious and stable, there is a financial risk, although innovations bringing flexible coverage and capacity are in progress. However, Government also has a role in mitigating this risk through the encouragement and support of investment for the benefit of consumers and the national interest.

4.3 Opportunities for the UK

The UK is home to major international telecommunications and space companies. It is a hub of academic and industry research and development. The IGS, the UKSA and the UK’s relationship with the ESA all encourage and support development. The existence of the IGS and NSSP demonstrates the Government’s desire for an increasingly prominent role in the sector. Growing UK-based companies and encouraging inward investment, including IP and technology, will help to meet IGS targets.
4.4 ViaSat - a case study in success

A satellite broadband provider with its headquarters in California, ViaSat specialises in engineering connectivity where terrestrial networks are not practical, cost effective or able to provide a high-quality service. By designing increasingly higher capacity satellites and versions with smaller payload (the brain that will ensure the satellite does what it is meant to do), ViaSat has driven down the “capital cost of space”, making competitively priced superfast broadband a realistic goal for the UK and wider markets.

ViaSat’s success in both the US and Australia is demonstrable. For two years running, the company has been endorsed by the US Federal Communications Commission (FCC) as “number one internet service provider for delivery on promise.” The FCC made the award after studying the performance of four delivery technologies - DSL, cable, fibre and satellite - and evaluating services from 14 of the largest broadband providers to thousands of subscribers. They found that, on average, ViaSat’s Exede Internet service delivered 161% of its advertised upload speed, compared to 108% for fibre-to-the-home and cable-based services and 99% for DSL-based services. Exede also had the least amount of performance variation, consistently ranking at 130% (and above) of advertised speed. Even during peak periods, 90% of consumers received 140%, or better, than the advertised speed of 12 Mbps.

In Australia, ViaSat is working to provide satellite internet to locations where access to fibre is not possible. In 2012, ViaSat was selected by the Australian National Broadband Network (NBN) to design Australia’s entire ground infrastructure. NBN estimated that 200,000 homes and businesses would benefit from ViaSat satellite internet, under a programme to bring high speed broadband and telephone services within the reach of all Australian residents, a similar approach to that taken in the UK. Target deployment is 93% fibre and 7% other technologies, with 3% of the connectivity to be provided by satellite.

Last year, ViaSat introduced its next generation high capacity satellite, ViaSat-2, launching in 2016. The ViaSat-2 class will not only be able to provide capacity for a superfast service, but will also economically support the increasing bandwidth requirements of users.
Satellite broadband is particularly well suited to meet the needs of “the last 5%” of the UK population, those with no access to broadband. Satellite enabled systems have utility beyond that of fibre for consumers and the national interest, but would be better enabled by additional capacity and resilient, hybrid networks. Joined up action is needed to both bridge the digital divide and ensure sufficient capacity to meet rising demands.

Action is required: from industry to help identify market gaps in the requisite detail; from Government, to regulate, to provide policy and stimulation; from academia, to contribute technical research plugging identified gaps and from the Catapults, to support industry and academia. Detailed proposals consist of:

1. **A Government approach to determine how to meet needs** - national, regional and local - in a cost effective, resilient manner with a combination of technologies (fixed and satellite broadband as well as mobile) appropriate to the environment.
   - **Who:** DCMS/BDUK, UKSA, Catapult, industry
   - **Risk if no action:** the sector remains negatively competitive (skewed towards fibre) and a comprehensive national digital infrastructure is not realised.

2. **A broad view of demand** across the full range of user communities and governmental needs: home, enterprise, mobile use, transport and emergency services. By grouping demand, industry will be best able to deliver the necessary capacity and cost effective solutions.
   - **Who:** Cabinet Office / DCMS, Space Leadership Council, UKSA, industry
   - **Risk if no action:** the satellite industry is less likely to put in place the requisite capacity in time to meet national demand.

3. **A strategy to offset the influence of terrestrial providers**, a governmental campaign to ensure consumers and enterprises are aware of different connectivity options.
   - **Who:** DCMS/BDUK, UKSA
   - **Risk if no action:** the digital divide will grow wider and the satellite broadband market will not be energised.

4. Consideration of how media or content providers can do more to **highlight satellite utility**, particularly for “the last 5%.” Space industry engagement with Sky, BT, Virgin and others could yield results.
   - **Who:** DCMS/BDUK, UKSA, UK Space with for example Sky, Virgin, BT.
   - **Risk if no action:** lost market opportunity for UK companies to develop approaches with global relevance.
5. **Satellite as a component of broadband schemes.** UK and European rural broadband strategy should be rebalanced to prevent the crowding-out of satellite.
   **Who:** DCMS/BDUK, UKSA
   **Risk if not done:** many of those unconnected will remain so, the digital divide will grow wider and the satellite broadband market will not gain impetus.

6. **The development of terabit capacity satellites and improved cost effectiveness and performance of consumer premise equipment** to meet demand, in accordance with Nielsen’s Law which requires a 1.5X speed increase per annum. As a minimum, satellite broadband needs to achieve speeds exceeding European Digital Agenda targets of 100Mbit/s in advance of 2020.
   **Who:** UKSA, ESA, Catapult, UK space and wider industry
   **Risk if not done:** a delay in meeting IGS targets and the Government’s digital agenda.

7. **Support for indigenous UK companies** together with continued encouragement of inward investment in technology (from the EU and US, for example) through regulations and positive policy towards spectrum and access to space.
   **Who:** OFCOM, UKSA, UK Space / wider industry
   **Risk if not done:** not meeting IGS targets.

8. **Stimulation of UK export demand** in international markets, especially in areas of governmental interest.
   **Who:** DfID, UKSA
   **Risk if not done:** compromising IGS targets, together with reduced market opportunity and influence in key regions.

9. **Coordination between UK based telcos (e.g. BT and Vodafone) and the satellite industry to grow UK business abroad - 4G/LTE backhaul and satellite broadband services should be addressed.**
    **Who:** UK Space and industry
    **Risk if not done:** threat to IGS targets and lost market opportunities.

10. **State Aid constraints** on the deployment of satellite broadband services should be addressed.
    **Who:** BDUK, UKSA, BIS
    **Risk if not done:** fibre is artificially mandated as a needs solution.
# Annex A

## References and Background Articles

<table>
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<th>TITLE</th>
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<th>AUTHOR</th>
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<td>Space Innovation and Growth Strategy (IGS)</td>
<td>2014-2030</td>
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<td>B</td>
<td>National Space and Security Policy</td>
<td>Apr 2014</td>
<td>HMG</td>
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<td>Parliamentary Space Committee / Digital Policy Alliance Meetings on “Broadband for all; how do we get 100% coverage”</td>
<td>25 Nov 2013</td>
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<td>G</td>
<td>Parliamentary Space Committee / Digital Policy Alliance Meetings on “Broadband for all; can satellite and radio get us 100% cover today?”</td>
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<td>L</td>
<td>Space Mega Trends to 2030 and Beyond</td>
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<td>Frost and Sullivan</td>
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## Report Contributors

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<th>Company/Organisation</th>
<th>Name / Contact Details</th>
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<tr>
<td>Avanti</td>
<td>Glynn Jones and Simon Barrett</td>
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<td>ViaSat</td>
<td>Neil Fraser</td>
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### Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>BDUK</td>
<td>Broadband Delivery UK</td>
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<td>Bn</td>
<td>Billion</td>
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<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
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<tr>
<td>CPE</td>
<td>Consumer Premises Equipment</td>
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<td>DCMS</td>
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<td>DFID</td>
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<td>Mbps</td>
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