



Routes to Market Report
12 - Satellite Technologies for
Fixed Satellite Broadband

Innovate UK


Lomax
Consulting

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Satellite Applications

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1. Introduction and Scope

The purpose of the report is to identify opportunities for UK space companies within the Fixed Satellite Services Broadband sector, as well as the key market trends and drivers. It aims to cover opportunities for new business growth in the global Fixed Satellite Services Broadband sector on a global basis through demonstrating applications for FSS that could be exploited by UK based Space companies.

Broadband can be defined as a “high-capacity transmission technique using a wide range of frequencies, which enables a large number of messages to be communicated simultaneously”. This briefing looks at the applications enabled using fixed *satellite* services transponder services as a platform for that application provision. It highlights a selection of applications that should, (subject to the right level of investment), offer considerable growth opportunities for the UK space sector in the coming decade.

Fixed Satellite Service (FSS) Broadband systems can both broadcast and receive communication signals across large distances in a way that terrestrial, wireless and sub-sea systems cannot always operate. They differ from Mobile Satellite Service (MSS) systems in that they are predominantly placed in a fixed, specific area, while MSS systems can be moved from one location to another or mounted on a mobile vehicle, for example. This briefing will concentrate on those fixed satellite services that are not used as part of any mobility solution.

The report will cover the near-term period from 2016 to 2020 and the long-term period to 2030.

2. Market Overview and Opportunities

The worldwide market for Fixed Satellite Services (FSS) is now over \$10 billion annually and is significantly larger than the worldwide market for mobile satellite services (MSS). Demand for both FSS and MSS is growing rapidly and the distinction between the two is becoming blurred as each is now serving the other's traditional markets. However, whilst many of the satellite operators (e.g. Inmarsat, Intelsat, SES), are pushing their Mobility agenda's hard, there remains strong application growth for Fixed Satellite Services based solutions.

Whilst there are many existing opportunities for Fixed Satellite Services Broadband connectivity, future new broadband applications are difficult to anticipate. However, UK Internet traffic has been predicted to grow five-fold between 2018 and 2023, driven by: machine-to-machine communication, (also known as the 'internet of things', where everything from fridges to farm animals could be connected to the internet); cloud computing (shared access to remote computing resources); online gaming; and the streaming of high-definition TV. These technologies often require higher data download speeds, faster data uploads, lower latency and greater accessibility on the move. Estimates of future demand for mobile data vary with one Ofcom forecast suggesting a 45-80-fold rise by 2030. Increased mobile broadband usage is expected to be met through the closer integration of fixed and mobile networks, with Wi-Fi and satellite provided services expected to play an increasingly important role.

The following highlights two opportunistic applications for growth over the next 10-15 years, namely; Fixed Satellite Broadband for Rural Areas (cellular extension and Internet provision), and Enterprise sector Machine to Machine and Internet of Things (M2M, IoT) services.

2.1. Fixed Satellite Services Broadband for Rural Areas

Broadband infrastructure in rural areas is often more challenging to deliver, but is vital to driving economic and social development in rural communities.

There remains a largely untapped market within the Fixed Satellite Service sector, for the provision of broadband services to consumers in rural areas. This can be split into those areas that are unserved as well as those that are underserved. There remains a large global demographic that have hitherto been passed over by broadband service providers due to a lack of appetite to invest in infrastructure to create cost-effective and commercially viable solutions. However, recently developed solutions integrating satellite and cellular technology provide an opportunity for UK space companies to expand cellular and internet coverage to rural areas and reach a vast proportion of the consumer population that has previously been underserved. Whilst these services can also be provided in urban areas, where satellite provides a realistic alternative to more traditional services, the focus here is on rural areas where return on investment are potentially greater.

There are two application aspects to providing services in rural and underserved area; Mobile Cellular Backhaul and Internet access.

2.2. Mobile Cellular Backhaul

The mobile market has experienced a huge surge in growth across the globe. However, mobile networks operators (MNOs) are still struggling to extend coverage to rural areas due to lack of infrastructure and the business case for investment making commercial sense. While it is often impractical and inefficient to extend mobile networks terrestrially, the use of small cells and satellite technology offers a quick and cost-effective solution that makes rural connectivity worthwhile.

The mobile market has grown so rapidly that subscriptions in developed areas are tapering off as Mobile penetration in cities is often over 100%, meaning that there are more subscriptions than people. But there is one demographic which remains untapped in the global market; the nearly two billion potential customers who currently live beyond the reach of mobile networks in remote regions. Until recently, operators would not even attempt to reach rural subscribers for two reasons:

1. They could not justify the time and expense involved in rolling out conventional infrastructure
2. The projected average revenue per user (ARPU) was extremely low

However, as urban markets reach saturation and as regulations often require mobile operators to provide a universal level of service everywhere, rural markets now represent a new frontier for continued growth.

Satellite communication has no topographic limitations, making it the only viable alternative when distance, terrain or line-of-sight issues negate other forms of backhaul. Although satellite might be more expensive than other solutions, it is scalable, highly reliable and can be deployed quickly, even under the most challenging geographical and climactic conditions. This makes satellite technology the best solution for rural market needs and offers a profitable opportunity for space companies in the UK and worldwide.

As many MNO's move towards defining their vision for 5G rollout, Fixed Satellite Services offer a unique way of extending this service to a wider user community as well as providing cost effective delivery in more urban areas. The fifth generation of mobile technology, expected to be implemented from around 2020, is a collection of technologies that aim to provide a perception of infinite and ubiquitous broadband capacity. Companies such as EchoStar and Inmarsat are already working together on producing hybrid Satellite and Cellular networks for the US market, but the opportunity for similar networks in most other countries is growing all the time.

5G aims to offer ubiquitous access to high data services and applications from any device, anywhere, at any time. Satellite must play a role in meeting these objectives. 5G is aiming to lower the net cost of broadband service access for consumers and will therefore need to be a multi-layered, heterogeneous network including terrestrial cellular (2G,3G, 4G), terrestrial RLAN, terrestrial broadcast and satellite based network offering seamless transitions between using Wi-Fi and mobile broadband.

5G terrestrial networks also need to interwork and integrate with other satellite based radio access technologies like Broadcast Satellite Services (BSS) and Mobile Satellite Service (MSS) systems to offer faster and more reliable connection at the edges of the network. Satellite based services clearly have a role to play in this hybrid network topology.

2.3. Internet Provision for Consumer Market

With the spread of the Internet across the globe, broadband connectivity has become a vital source of information for the population of the planet. However there remains huge numbers of underserved nations and individuals who reside in rural locations without access to even the most basic of Broadband connectivity. It is recognised that nearly two thirds of all Internet traffic is consumed for video applications, leading to a rising number of video broadcasting subscribers (YouTube, Amazon Video, Netflix etc.), that are driving the demand for broadband connectivity. Fixed satellite services have a role to play in providing increased bandwidth speeds to rural communities and areas underserved by terrestrial operators. This will see an increase in the demand for fixed satellite transponder capacity leasing, like that provided by Avanti and Inmarsat out of the UK, but also increase the demand for new satellites that could be built by companies such as Airbus and Surrey Satellite Technology who have satellite manufacturing facilities in the UK. Satellite terminal and modem manufacturers, such as Hughes, iDirect, Newtec at al, will also benefit from the increased demand for services.

The emergence of broadband access, DTH (direct-to-home), and DTT (digital terrestrial television) platforms also play a key role in the future growth satellite transponder market. Given that 4k television sets have become mainstream in Asia, United States and Europe, we are likely to see the launch of many 4k channels to the market in the next decade, initially driven by sports and movie consumption, as was the case with High Definition. Over the next two decades, incremental demand will be further augmented by the move to 8k. With higher resolution, the required transmission bandwidth will rise, (e.g. transmitting 4k in HEVC compression, it will be possible to host only two channels per transponder (36MHz) compared with the current 5-7 HDTV channels per transponder (using MPEG-4 encoding) or 10-20 SD channels per transponder).

2.4. Enterprise Applications

As well as Direct to Home (DTH) internet applications, the rising trend of advanced channel broadcasting has escalated the demand for enterprise use of satellite transponder based services across the globe. User groups include media and broadcasting, telecom companies, research and development institutions, defence and military departments and various government sectors. In addition, the finance, banking, retail and transportation industries all have potential for further use of satellite-based services to support their increasingly complex operations.

These industries are looking to procure more satellite enabled applications, (requiring the increased lease of transponder capacity); in order to provide broadband services to the more isolated places on Earth. Advancement in the channel quality and evolution of high definition channels and UHD TVs is anticipated to fuel the further growth of the satellite transponders market. Rising demands for Fixed Satellite Services, specifically over the new High Throughput Satellites, (HTS), are expected to generate new opportunities for the market in the coming years. In total, the satellite transponder leasing

market is anticipated to grow at a CAGR of 4.43% during the forecast period of 2015-2025 and will account for US\$ 19,225.3 Million by the year 2025.

Most of applications over satellites are attributed to commercial communications as organisations demand secure, high-speed IP-based connectivity that is always available, and supports its business applications, in any location on the globe. At the same time, enterprises must manage operating costs, fulfil the need for greater efficiencies, increase productivity, and maintain a consistent quality of service. Key applications critical to their success include multimedia distribution, access to email, VoIP and video applications, secure, financial transactions, and back up to business continuity.

So, whilst there remains great opportunity to provide cellular extension and internet services to a still underserved consumer market, commercial communication applications are projected to dominate the global Fixed Satellite Services satellite transponder market over the forecast period. Commercial communication includes video distribution, support of legacy telephone and carrier services, commercial mobility services, OUTV, enterprise data services and enterprise broadband satellite access services.

Perhaps the most prevalent enterprise application relevant to space based provision is that of Machine to Machine (M2M) or Internet of Things connectivity. M2M Satellite communication is an emerging technique for communication and involves collecting, sharing and transferring of data across many regions to include those underserved by terrestrial means. The data gleaned is used by the organisation for decision making at various operational and strategic levels.

Whilst the majority of the estimated 50 Billion connected devices in operation by 2020, can be served by terrestrial means, there is still a role to play for satellite provided services. The M2M Satellite Communication market has a great potential because of its capability to connect with smart devices and inactive objects with the UK M2M Satellite Communication market alone expected to grow from \$178.17 million in 2014 to \$327.93 million in 2019, a CAGR of 12.98%. This growth is driven, for example, by the UK Government making an announcement that by 2020 every consumer and business in the UK will have a smart meter installed. This requires a strong M2M satellite communications network across the UK, whereby the Government will need to guarantee a robust and reliable connection with nationwide coverage that will require satellite based M2M services. Narrowband satellite services such as those provided by Inmarsat and Iridium will have a huge role to play in meeting the increased demand for this low data connectivity, either as a stand-alone solution or part of a hybrid network, (see later).

In terms of geographic spread and opportunity, the North American region still holds the maximum market share in the Fixed Satellite Services satellite transponder market due to extensive necessity for secure and reliable satellite-based communications that are being used in video distribution, DTH, and broadband access, albeit closely followed by the Asia-Pacific region. However, major growth is expected in the Middle East & Africa and Latin American markets due to rise in demand for direct-to-home (DTH) satellite TV, high definition (HD) to replace standard definition (SD) offerings, need for secure communications for military and defence, and the vibrant broadcast industry in the region.

3. Customer and End-User

The end users of the Fixed Satellite Broadband Services would be consumers, enterprise organisations, Governments and public-sector organisations. Target users are residents living in rural areas, consumers of Internet, mobile and television services, and employees of corporations or government agencies. For M2M and IoT applications, the end users are both Business to Consumer (B2C) and Business to Business, (B2B).

The target customers for UK space companies within the Fixed Satellite Services sector include:

- Retail consumers of mobile and internet Services
- Enterprise consumers of mobile and Internet services
- Mobile Network Operators
- Satellite service providers and resellers
- Terrestrial Telecommunication companies
- Broadcasting companies
- Financial institutions
- Government agencies
- Teleport operators

4. Value Proposition to the Customer and End-User

The use of Fixed Satellite Services offers many generic advantages when it comes to the provision of the identified applications for rural connectivity coverage extension and enterprise applications. These can be enjoyed by the customer (i.e. the service provider) and the end user, and include -

- **Cost Effectiveness** - Cost of satellite capacity does not increase with the number of users/receive sites, or with the distance between communication points. Whether crossing continents or staying local, satellite connection cost is distance insensitive.
- **Global Availability** - Communications satellites cover all land masses and there is growing capacity to serve maritime and aeronautical markets. Customers in rural and remote regions around the world who cannot obtain high speed Internet access from a terrestrial provider are increasingly relying on satellite communications.
- **Superior Reliability** - Satellite communications can operate independently from terrestrial infrastructure. When terrestrial outages occur from man-made and natural events, satellite connections remain operational.
- **Superior Performance** - Satellite is unmatched for broadcast applications like television. For two-way IP networks, the speed, uniformity and end-to-end control of today's advanced satellite solutions are resulting in greater use of satellite by corporations, governments and consumers.
- **Immediacy and Scalability** - Additional receive sites, or nodes on a network can readily be added, sometimes within hours; all it takes is the necessary ground-based equipment. Satellite has proven its value as a provider of "instant infrastructure" for commercial, government and emergency relief communications.
- **Versatility** - Satellites effectively support all forms of communications ranging from simple point-of-sale validation to bandwidth intensive multimedia applications on a global basis. Satellite solutions are highly flexible and can operate independently or as part of a larger network.

The implementation of a Fixed Satellite Broadband service can be cheaper than laying fibre in very rural areas. However, data transfer is costlier for consumers than fixed connections, and high latency can be challenging for applications such as on-line gaming, video conferencing and cloud computing.

4.1. Proposition for Satellite Backhaul

Small cell implementations are winning over customers (e.g. MNO's) through revenue sharing models that leverage existing infrastructure to increase profits. When small cells are connected to a cellular network, satellite providers that already have a presence in rural areas can provide cellular voice and

data backhaul coverage to previously unserved areas. In return, they receive a share of the revenue from the resulting traffic.

From the satellite provider's perspective, they can take advantage of unused bandwidth on existing infrastructure to provide additional services and earn additional revenue. From the MNO's perspective, they can avoid the costs of network deployment and maintenance while attracting traffic in areas where their local presence may otherwise have been economically unfeasible. This increasingly popular business model has been successfully implemented in places such as Indonesia and several African countries, but there remain strong opportunities in other geographies.

In general, Fixed Satellite Service systems are advantageous because they provide guaranteed reception in the area that they are placed. Since Fixed Satellite Services systems are permanently installed, they collectively provide users with reliable cell phone reception across most of a country through their backhaul capabilities.

4.2. Proposition for Enterprise Satellite Services

Fixed Satellite Broadband services for enterprises offer the ability to deliver information at a faster rate while containing costs as well as deliver IP access instantly, regardless of the local infrastructure or location. For example, enterprise organisations can communicate with offices/employees in remote areas, streamlining the productivity of the company and enabling stronger connectivity.

With enterprise satellite service, communication links can be set up in any location, making it an ideal choice compared to Wi-Fi, microwave and terrestrial services. These services also provide the power and flexibility to support a large enterprise network.

These services allow enterprises to:

- Extend the reach of enterprise services
- Improve M2M communications across the enterprise
- Increase productivity across the enterprise
- Improve emergency response times and effectiveness
- Better manage critical infrastructure

With M2M applications, managed satellite service improves access and visibility to field assets with real-time position tracking, managing remote assets and operations, and visibility into critical areas of the supply chain. High-performance M2M terminals can be used for a broad range of applications including emergency responders, oil and gas pipeline monitoring, mobile fleet management, and high-value asset tracking.

These services provide benefits for enterprise applications, as these organisations can depend on fast, reliable access for remote teams even under the most difficult scenarios and for as long as is needed, (e.g.) a day or months, and easily move to the next location. They can also monitor remote assets and command-and-control messages through a secure network infrastructure.

For more effective emergency responses, satellite services enable critical communication to national or regional distributed relief organizations when existing terrestrial communication systems are unavailable or current connection options are insufficient.

Satellite-enabled critical infrastructure keeps remote workers connected to the enterprise through internet, email, VPN and standard office applications, enable off-site video surveillance monitoring or

storage, and act as the primary connectivity for terrestrial and mobile services during disaster recovery.

Satellite services also allow streaming of live news and events from the field in high-definition plus provide Wi-Fi for thousands of spectators and vendors with affordable, high-speed IP access.

5. Market Competitiveness

5.1. Alternatives to Fixed Satellite Broadband Services

The fast evolution of terrestrial telecommunication networks will always bring into question the viability of satellite based services, where the cost of entry and ongoing connectivity is often significantly higher. Competition from fibre-optic cable networks, GSM networks, Wi-Fi, LPWAN and future 5G services should be assessed as suitable alternatives against the requirement for greater capital investment in procuring satellite based communications systems. Broadband could also be provided by current 4G or wide-area Wi-Fi networks, which have been shown to deliver superfast connections to rural areas under test conditions. Limitations of such systems include speeds that depend on the number of users, restricted availability of fast links between the local wireless network and the rest of the internet, as well as the cost and difficulty of installing wireless networks in hilly area, for example.

Wi-Fi hotspots are the standard way to connect to the internet at home. Around one third of broadband use outside of the home is also via public Wi-Fi hotspots. Speeds of up to 1 GBPS are now possible with new Wi-Fi technologies. However, speeds are limited by the connection supplying the Wi-Fi hub (provided using either fixed or mobile technology), the number of users and the number of hotspots at a location.

5.2. Alternatives to Satellite Backhaul

The current alternative backhaul delivery methods being used today are fibre and microwave technologies. Fibre lines are ideal for urban areas, where a single deployment facilitates backhaul for a large quantity of data. As data traffic spreads to more geographically remote areas, fibre becomes less and less cost-effective due to increasingly expensive deployment costs and a drastic reduction in usage. In rural areas, the sheer distance between locations, difficult terrain, trench construction and slow deployment makes fibre a highly unlikely backhaul option unless the fibre lines are already in place.

Managed Wi-Fi services extend the reach of broadband internet connections with professionally installed or plug-n-play hotspots for both single and multi-site networks. Designed to be the most flexible and comprehensive Wi-Fi for carriers, enterprises and government partners, these services enable delivery of unique branded Wi-Fi hotspot experience to customers anywhere on any device.

Microwave supports large quantities of data transmission, but also has its limitations. When the gap between coverage areas is large and unpopulated, it is not economically feasible to add towers to bridge the distance. And for many rural areas, such as rain forests or mountainous regions, microwave is simply not an option because it requires line-of-sight.

6. Role of UK Companies

Today, the UK's space industry is worth billions of pounds and while the UK may only have a 1.8% share of the global industry's 'upstream' business, the manufacture of space vehicles, it has a

disproportionate share of the ‘downstream’ sector, which includes applications, terminals, modems, software services and data provided by satellites.

UK Space companies cover a wide range of disciplines, and could benefit from the current application opportunities -

The demand for greater transponder capacity will assist the UK based Space companies who manufacture large satellites, (Airbus), medium sized satellites, (SSTL) and very small CubeSat’s, (Clyde Space). These companies can provide transponder capacity to meet increased demand, but also provide opportunities within their supply chain in areas such as on-board software, thrusters, atomic clocks etc. Terminal and modem manufacturers will also benefit from the increased demand for DTH equipment as well as the need for satellite antennas for M2M and IoT applications.

Many UK companies make equipment and instruments to be integrated on the satellite platform, such as specialist power sources and ground based control and data reception services and facilities.

Some of the major global satellite service providers and their value-added resellers will also benefit from the applications identified. These include Avanti Communications, Inmarsat and companies such as Galaxy 1 who provide satellite enabled M2M and IOT managed services.

Others have a UK presence and will benefit from global growth opportunities and investment in the UK market.

7. Revenue Projections

	2016	2017	2020	2030
Fixed Satellite Services	US\$1.670 billion	US\$ 1.763 billion	US\$2.076 billion	U\$2.581 billion
Satellite Backhaul	US\$219.81 million	US\$246.29 million	\$US346.41 million	US\$1.080 billion
Satellite Transponders	US\$1.686 billion	US\$1.775 billion	US\$2.07 billion	US\$3.48 billion

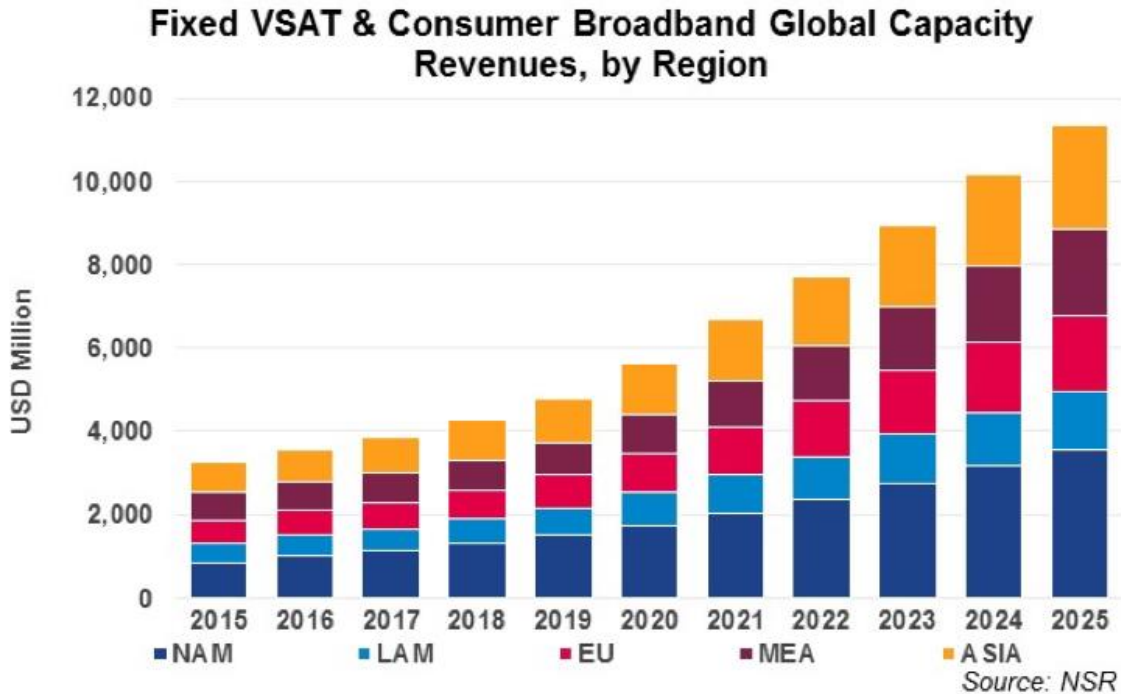
The estimated revenue for UK space companies has been estimated for each market sector by taking 10.3% of the global market sizes for each market.

The figure 10.3% was derived from a report by London Economics on the economic impact of Britain’s space industry, which found that Britain’s space companies have 11.2% of the international operations market for space vehicles, and 10.3% of the applications market for the services and data provided by satellites. Overall this means the UK has 6.3% and 7.7% of the global space industry’s annual turnover, which is estimated at about £160bn a year.

The following market size estimates were used:

- The global fixed satellite services (FSS) market has been valued at USD 15.35 billion in 2015 and is projected to reach USD 20.16 billion by the end of 2020 growing at a CAGR of 5.60% during the forecast period.

- The global satellite transponder market is estimated to be USD 15.55 Billion in 2015, and is projected to reach USD 20.10 Billion by 2020 at a CAGR 5.3% from 2015 to 2020.
- Northern Sky Research (NSR) projects revenues from wireless backhaul over satellite will climb from \$1.7 billion in 2014 to \$5.3 billion by 2024. (CAGR 12.04%)



8. SWOT Analysis

8.1. Opportunity 1: Satellite Cellular Backhaul

Strengths	<ul style="list-style-type: none"> – The general advantages of fixed satellite services (coverage, resilience, availability) – The advantages of satellite over terrestrial services in terms of performance – The cost-effectiveness and flexibility of small cells over macro cells
Weaknesses	<ul style="list-style-type: none"> – Lack of time and funding for implementing new infrastructure in rural communities – Lack of expertise and experience with the method and technologies
Opportunities	<ul style="list-style-type: none"> – The vast and untapped population of consumers in rural areas such as Africa, the Middle and Far East and BRIC Countries. – Introduction of new business models (revenue sharing models) – The rapid growth of the satellite backhaul market – The continued growth of Video usage – The rising number of mobile and Internet users
Threats	<ul style="list-style-type: none"> – Competition among UK space companies – Increased government regulations

8.2. Opportunity 2. DTH, DTT and Broadband to Rural Areas

Strengths	<ul style="list-style-type: none"> – Increase in transponder incremental capacity – Rising trend in satellite provided television services – Strong UK and global broadcasting market – Increasing revenues for satellite commercial communications
Weaknesses	<ul style="list-style-type: none"> – Lack of user maturity regarding emerging technologies
Opportunities	<ul style="list-style-type: none"> – Increased consumer usage and demand of these services – Increased Broadband service provision and coverage legislation – Launch of many 4k channels in the market over the next decade – Move to 8k in the next two decades – Growth in Middle and Far East, BRIC and African markets
Threats	<ul style="list-style-type: none"> – Growth of GSM infrastructure; use of cellular rather than satellite – Declining global incremental supply – Increased government regulations

8.3. Opportunity 3: Enterprise Satellite Services M2M/IOT

Strengths	<ul style="list-style-type: none"> – Provide broadband services to businesses in even remote locations – allows enterprises to expand their reach – Instant high-speed access – More secure and reliable than alternatives – Enables critical communications during emergency response
Weaknesses	<ul style="list-style-type: none"> – Higher cost relative to terrestrial networks for very low data requirements
Opportunities	<ul style="list-style-type: none"> – Increase in demand for connectivity of sensors and assets to enable Big Data analytics – Increase transponder incremental capacity – Improved service provision demand
Threats	<ul style="list-style-type: none"> – Growth of GSM infrastructure – Declining global incremental supply – Increased government regulations

9. Opportunity Barriers and Enablers

Organisations such as Avanti Communications and SES have been providing lower cost HTS Ka-band capacity solutions for a few years now. Multiple models for commercialising satellite Internet have been tried and what these experiences have shown is that it is critical to develop a strong retail presence for the market to flourish. The “build it and they will come” approach does not work, and the market requires significant effort for demand stimulation. The comparison of the European and the North American markets provides good insights in this direction. With comparable levels of available income, rural population, penetration of Internet, the North American market has grown spectacularly while Europe has somewhat lagged. It hasn’t been until very recently, after the emergence of stronger retail players, that the European market has started to meet higher growth expectations.

Affordability has been the other major barrier for satellite Internet. While it is now possible to offer packages priced at similar levels as DSL (of course with much more stringent data caps), the focus on

rural areas that feature lower available income compared to their urban counterparts as well as the high cost of the terminal, limits service take-up. Financing the terminal often requires long-term contract commitments that are not attractive for end users and presents high risks for the service provider. This is a serious barrier even in middle-income countries and has deterred growth in areas such as Latin America and Eastern Europe.

While there is still plenty of room for growth in developed economies, satellite Internet is still just scratching the surface of the total addressable market. The majority of the 3.9 billion people who are still offline are in the lower-income economies, and replicating the model from developed markets will not always succeed. Subsidies and other forms of financial support will be needed to see ubiquitous take-up of service.

9.1. Mobility Solutions as the Primary Means for Accessing the Internet

With prices of smartphones plummeting, mobility solutions are becoming the primary, (if not the only), way for accessing the internet in emerging markets. At the same time, expansion of ground networks is slowing down and satcom can now offer a very valid solution for extending cellular mobility coverage through backhaul services. The combination of these elements is creating a tremendous opportunity for satcom to play a bigger role in the cellular infrastructure.

However, entering this market presents its own challenges. Mobile Network Operators (MNOs) have their own internal dynamics, and it is usually very hard to remove the old beliefs of satellite being an expensive, inconvenient and low-speed solution. Fighting invalid and old stereotypical beliefs as well as influencing MNO investment priorities, (network densification vs. network expansion), are some of the stronger barriers for satcom in this promising vertical.

To keep higher degrees of control over the service, some satellite actors have developed demand aggregation offers independent of Mobile Operators. These solutions usually involve Wi-Fi hotspots in unconnected and underserved locations like the proposed Avanti-ESA-Newtec or SES-Facebook-Gilat partnerships. NSR forecasts a big portion of the consumer broadband demand for satellite services will actually come from these demand aggregation points, especially in developing markets. These services have the potential to stimulate demand at a faster pace and reach areas ignored by mobile operators. However, the challenge will be back to developing strong retail arms and offering affordable solutions.

The new wave of competitively priced capacity is opening a vast opportunity for satcom to serve mass consumer markets. However, to reach these mass markets, the right business models need to be developed. Adapting the product to each market segment is essential, and this means putting a great emphasis on sales channels, partners and product architecture.

UK Space companies also need to forge closer working relationships with cellular companies. By adopting a network architecture that incorporates a variety of methods, rather than adopting the one-size-fits-all approach of macro cells, UK space companies can ensure a more flexible system for providing satellite communications that will allow them to expand to previously untapped markets in rural areas. Working groups and joint R&D will enable the creation of smaller, more easily deployed micro cell/satcom enable solutions.

Awareness and educational challenges also exist when trying to extend GSM and satellite based broadband to Consumers in rural area. They often have a lower level of usage maturity, as they have previously not had access to these services and thus would need some education and training on how to use the devices and services.

The satellite service providers will also require additional training and experience with the implementation of the satellite backhaul and small-cell deployment-integration, as this is a recently developed method that is likely unfamiliar to them.

In addition, providing broadband infrastructure does not guarantee that Rurally based consumers will make use of it. Despite 97% of UK premises having the potential to connect, 18% of households do not subscribe to either fixed or mobile broadband. Research suggests that this is due to factors such as cost, a lack of online skills and unfamiliarity with the benefits.

9.2. Satellite Transponders

Major restraints hampering the growth of the satellite transponder market include competition from fibre-optic transmission cable networks and requirement of huge capital investment in building satellite networks.

Declining global incremental supply is another restraint on the satellite transponders market. According to intelligence from Lyngsat, European transponder incremental capacity is expected to surge from just over 200 Transponders in 2013 to around 500 Transponders in 2014 (36MHz equivalent), before coming back down to under 300 Transponders during 2015-2017. At the same time, incremental demand is expected to hold steady until at least 2016. Global incremental supply is expected to reach 700 Transponders (C- and Ku-band 36Mz transponders), up from around 330 Transponders in 2013. Global incremental supply is expected to come back to 500 Transponders in 2015 and gradually decline to 400-level by 2018-19.

Large barriers to the market also include increasing regulations, which prohibit the growth of many UK space organisations. Economic factors also have an impact. For example, commercial satellite service providers (including Intelsat, SES and Eutelsat) have been engaging with the US Department of Defence to improve service provision for some time. The budget cuts of 2013 and since have added a sense of urgency to these efforts, but the global economic situation mean that many infrastructure investment programmes are on hold or have been cancelled.

Likewise, UK space companies and commercial satellite service providers should engage with the UK government agencies to increase government investment in technological advancements and work toward decreasing regulatory pressure on organisations launching and operating satellites.

A further trend which is influencing market growth for satellite services over terrestrial alternatives is the trade-off between performance and coverage. As the satellite industry is maturing and the operators are targeting a more dynamic and flexible market, the design complexities and resultant capabilities of the satellites are increasing. For instance, the growth of Ka-band transponders might be affected by the performance versus coverage trade-off, (whereby the Ka-links are more susceptible to propagation impairments caused by rain and other atmospheric disturbances), the ability to offer smaller, cheaper terminals and lower cost services into areas not previously covered, can far outweigh this perceived issue. So, whilst performance can be constrained by propagation, and even latency issues), being able to provide communications services into areas previously without service means that consumers and enterprises alike will look to the advantages of a satellite enabled application, rather than the negatives.

Another key growth enabler is the rising availability of HTS. As the HTS uses many small spot beams distributed across a particular service area, these beams help the satellite to link to small aperture earth stations at high data rates. Whilst attenuation from rain has been a major challenge for many satellite links including the HTS, such satellites have developed sufficient rain fade margins to provide

a good quality link. The transponders used in HTS can be at Ku and Ka Band and offer the ability for smaller, lighter antennas that cost less to produce and require less power to operate.

The way the satellite communications industry has evolved, along with increased satellite applications, has provided of the opportunity for satellite operators to grow at a substantial rate. In the past 10 years, all areas in satellite communications have seen increased revenues and the market has witnessed some major changes on the economic and technological fronts. Moreover, the rise in demand for various applications such as video conferencing, OTT (over-the-top) content, IPTV (internet protocol television), DTT (digital terrestrial television) platforms, broadband access, DTH (direct-to-home), meteorology, military surveillance, and others, has resulted in significant demand for advanced satellite transponders, in turn, stimulating the satellite transponder service market.

10. Market Dynamics

The satellite market is mature and ripe for disruption by emerging technology. The upstream sector is becoming ever more accessible to and affordable for start-ups who want to fly their own missions. Small Satellites and Low Earth Orbit (LEO) constellations make the possibility of creating new ways of providing satellite based broadband a reality. Networks from OneWeb, O3B, SpaceX and other such networks are all funded or in production and offer great partnership opportunities for UK Space companies. The UK also has a track record of challenging the traditional big business paradigms of space through low-cost, small alternatives, with UK universities leading the way in developing new applications. Surrey Satellite Technology Ltd (SSTL) is a prime example of this, beginning as a spin-out of the University of Surrey. The founders of SSTL built on the success of UoSAT-1 and UoSAT-2 in the late 1970s to deliver low-cost, low-mass (50–60kg) satellites to an international customer base. These satellites could be launched ‘piggy-backed’ with larger satellites at a fraction of the cost. This has opened access to space to a multitude of new users, including educational institutions and other nations interested in establishing their own space capabilities.

North America is expected to be the prominent region for the Fixed Satellite Services market in the short term. Increasing usage of Ka-band to serve the rising need for network-users, media and government is projected to drive the market in this region. The presence of a large customer base along with ever changing competitive and regulatory landscape is also expected to drive the market in the Asia Pacific region.

Other key dynamics of the global space industry, specifically in the satellite manufacturing industry, include consolidation and vertical integration in the supply chain and a limited number of experienced satellite integrators.

Trends in the financial performance of the satellite industry include

- Revenue of the satellite industry increasing, but margins dropping
- Different strategies to boost profitability of satellite manufacturing
- 22% revenue growth in the satellite manufacturing industry in the past decade

Market dynamics in the GEO communication satellite industry include:

- Incumbent manufacturers of GEO communication satellites are innovating to adapt their products
- New manufacturers of GEO communication satellites are evolving to serve government markets
- Incumbent manufacturers hold 90% of the commercial GEO communication satellite market
- American and European manufacturers compete for high-end GEO satellite systems

Strategic trends impacting the satellite manufacturing industry:

- Opportunistic partnerships between manufacturers for market access
- Competition between manufacturers not just on the product, also technology transfer & financing
- PPP and hosted payloads put more risks on the manufacturers
- Two external factors are acting on the competitiveness: Currency exchange rates & ECA support

11. Market Trends

11.1. Fixed Satellite Services Market Trends and Drivers

The market dynamics and trends of FSS systems are particularly addressed in terms of four main factors: (1) the competitive impact of high-efficiency fibre-optic terrestrial and submarine cable communications networks; (2) the conversion of FSS systems from analogue to digital services that allowed FSS systems to be more cost-efficient and use spectrum more efficiently as well as migrate to spectrum in higher bands more effectively; (3) the move of FSS systems toward deployment of smaller and lower cost ground systems (variously called VSATs, VSAAs, USATs, and micro terminals) that allowed services to migrate closer to the “edge” of telecommunication user networks (i.e., satellite services directly to end user facilities); and (4) a shift in regulatory policy that allows FSS systems to compete directly for services that has generally served to reduce cost and spur innovations in services and applications.

The satellites required for FSS require low power output which is expected to fuel market demand over the forecast period. FSS offers high speed of initiating service and avoid transit charges which are projected to proliferate market growth. Further, it provides cost effectiveness, high reliability and performance which are further anticipated to positively impact market growth.

FSS solutions efficiently serve customers with allocated spectrum and creates effective backup for fibre optics cable, making satellite communication the optimum choice for multi-point communication. These solutions offer reliable and secured connectivity, meeting the requirements of the users which are further anticipated to augment market growth over the forecast period.

Increased spending on telecom/voice backhaul, enterprise and broadband connectivity, content and broadcast delivery, business and emergency continuity solutions along with military satellite communication is expected to drive global demand over the forecast period. A further, rise in the number of broadband subscribers and HDTV channels along with acceleration of DTH TV platforms is expected to proliferate the Fixed Satellite Services market growth.

Rising demand for corporate enterprise networks and consumer broadband coupled with need for high-throughput connectivity in high data growth sectors are projected to be the key driving forces for the FSS market. Increasing use of high throughput satellite (HTS) for broadband communication which offers frequency reuse and on-board processing along with double throughput capability than traditional FSS is estimated to offer prominent opportunities for market growth.

However, high capital investment for launching the satellite along with increasing competition from fibre-optic transmission cable networks is anticipated to serve as major restraints to the FSS market growth. Additionally, limited orbital locations and challenges related to deployment of applications requiring the critical role of ground station equipment vendors are foreseen to hamper the FSS market. However, governmental regulations pertaining to deregulation and reductions in regulation constraints are expected to positively impact the FSS market.

11.2. Satellite Transponders Leasing Market Trends and Drivers

The key drivers for this market include growing demand for Fixed Satellite Services and the evolution in Ka-band and Ku-band services. Innovation and growth in HDTV and video broadcasting are also expected to largely contribute towards the growth of market in the coming years.

Research by Credit Suisse indicates that transponder demand is likely to grow from 296 Transponders (in 2012) to 370 (2013), 451 (2014), 542 (2015), 650 (2016) and 780 (2017). The demand for Ultra HD, virtually non-existent in 2012 and 2013, is expected to reach from 12 Transponders in 2015, 40 in 2016 and 63 in 2017. Transponder demand for 3D and SD channels, which currently account for 0.5% and 85.2% of the total TV market respectively, are expected to grow at a more modest rate, though their respective market share of TV channels is expected to either decrease or hold steady.

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