

Building our Industrial Strategy:

UKspace and Space Growth Partnership Response to Consultation Questions

The UK space sector

1. The space sector welcomes the Government's Industrial Strategy Green Paper and its emphasis on boosting UK productivity and growth through trade and investment. Supporting domestic skills and competencies, increasing exports and attracting high value export-focused Foreign Direct Investment will all be essential to meeting the sector's ambitious target of securing 10% of the estimated £400bn global space market by 2030.
2. Space is important to the daily life of UK citizens. It underpins our food distribution, finance, telecommunications and energy supply networks. **The UK has a critical dependency on the space sector for defence, the emergency services, weather forecasting, environmental monitoring, flood response and other essential functions of the state.** Consumer applications such as SatNavs and Smart Phones depend on space networks.
3. Space is a major industrial sector in its own right. **The UK space sector has trebled in size in real terms since 2000.** Total employment in the UK space industry reached more than 38,500 in 2014/15 following strong growth at a rate of **6.0%**¹ per annum since 2012/13 – more than three times greater than the employment growth rate in the overall UK economy. **The global market for space is expected to increase from £155bn per annum to £400bn per annum by 2030. The opportunity for the UK is to secure 10% of this global space economy, £40bn per annum (by 2030), creating a demand for at more than 50,000 new jobs.**
4. **It is a high-tech, export-intensive sector; and the average UK space sector productivity at £140,000 value-added per job is well over twice the UK's average.** It is also R&D intensive with over 8% of its direct GVA invested in research – over 6.5 times higher than the UK average. Space data and services are embedded in the infrastructure, products and services of other sectors, boosting their productivity and enabling them to develop products themselves that would otherwise not be possible. **We estimate that space's overall contribution to GDP is around £250 billion per annum.**
5. **Space inspires students to look at careers in science and technology sectors** – The Rosetta satellite which, travelled 64million km and dropped a lander on a 4km wide comet, and Tim

¹ The Size and Health of the UK Space Industry. London Economics Dec 2016

Peake's mission to the International Space Station were hugely successful in catching the attention of schoolchildren and the general public across the country. The UK's Mars Rover, a robotic Mars vehicle due for launch in the 2020 ExoMars mission, will continue to focus schoolchildren on science and technology.

6. The sector has a strong track record in engaging successfully with government since 2010 when the Space Innovation and Growth Strategy was published. This relationship has paved the way for government to set up the UK Space Agency, and Satellite Applications Catapult Centre. The European Space Agency has built their European Centre for Satellite Applications and Telecommunications at Harwell. **Since 2009 Industry has delivered a doubling of the space sector and the economic and social benefits that accompany this.**
7. **Industry is now proposing to re-invigorate its relationship with government and academia to accelerate growth in the sector still further. We have therefore set up a Space Growth Partnership to propose and deliver a sector deal, responding to the need to build on and accelerate that growth to meet the ambitious 2030 targets.**

About the Space Growth Partnership

8. **The Space Growth Partnership ('SGP') brings together the space industry, academia, UK Space Agency, Satellite Applications Catapult, Innovate UK and the Department for International Trade to deliver the shared ambition to increase the UK's share of the expanding global markets for satellites, space services and applications from around 7%² in 2015 to 10% by 2030. Around 100 people from the sector are contributing to SGP-led work streams, with the majority of this effort being provided by industry.**
9. The sector is transforming from an institutionally-led sector to one that is commercial in culture and can access private finance to fund infrastructure, applications and potentially high-risk R&D. This will create huge new global opportunities in the future. But space remains a strategic sector for the UK and other nations so this journey needs to be encouraged in a way that nurtures UK interests and benefits.
10. A partnership can nurture this culture and growth. **The SGP will focus on:**
 - a. **evaluating opportunities for using space infrastructure to create space-enabled services and applications that will benefit non-space businesses and citizens globally and bringing together the relevant community (supply chain, intermediaries, users, industry) to exploit those opportunities,**

² The Case for Space. London Economics July 2015, "UK captures 6.3% to 7.7% of the global space economy turnover"

- b. establishing five new major space clusters across the UK. These are likely to include universities and a skills training element that reflects local needs and specialisations to meet national sector requirements,**
 - c. making the UK a 'go to' place for space investors, where people will set up export businesses and entrepreneurs are confident that this is the location to anchor and sustain start-ups and SMEs,**
 - d. the establishment of a robust and agile regulatory framework for space that is fair and promotes growth,**
 - e. exploring in the Sector Deal opportunities where the Government could act as an anchor customer especially in relation to export sales,**
 - f. exploitation of the most inspiring space projects to support UK wide STEM initiatives,**
 - g. working with the government to ensure access to key skills from overseas.**
11. Our expectation is that following the submission of this response to the Industrial Strategy consultation, the Partnership will produce a 'Sector Deal' proposal for the space sector that is based on robust and deliverable actions. The answers to the questions below and any proposal from the sector will be consistent.
12. This response to the Industrial Strategy consultation is being submitted by UK space on behalf of the Space Growth Partnership.

1. Does this document identify the right areas of focus: extending our strengths; closing the gaps; and making the UK one of the most competitive places to start or grow a business?

13. The space sector agrees that the proposed Industrial Strategy focuses in the right areas to drive competitiveness and growth. The overall approach and the 10 pillars 'model' align closely with the space sector's ambition to identify specific actions for industry and Government that will accelerate the growth of the sector in the UK. From the sector's viewpoint, there are several additional areas that could helpfully be considered in future work.
14. Space is a rapidly commercialising sector. This is bringing in new entrants to the sector, different customers, private investors and novel business models. Space infrastructure and services are becoming increasingly affordable. However, this transformation is not yet complete anywhere in the world and, if the UK chooses to nurture this change, it will accelerate the sector's growth in the UK and produce significant economic and social benefits. **We would therefore welcome measures to help accelerate technical and business innovation in transforming sectors, with fast-paced and well focused R&D decisions, government procurements that incentivise private investors to increase capital investment, and targeted support for entrepreneurs.**
15. The sector welcomes Government's commitment to attempt to negotiate continued access to European Space Programmes, such as Galileo and Copernicus, as part of securing an exit deal with the European Union. This is a significant market for UK space companies, where we have a proven track record of having won work competitively that is far in excess of our programme contributions. **We would welcome working with Government to develop options to accessing European and global marketplaces that gives industry alternative approaches to sustain growth in these markets that can be adapted in the light of any final deal with the EU.**
16. Much of the space sector's benefit to the UK (and overseas nations) stems from the use of space data to increase the productivity of other sectors, for example, agriculture and transport. **It is important, therefore, that prospective trade deals permit the free flow of data in addition to products and services.** This will avoid restricting growth in applications that use space data in overseas markets, potentially the fastest growing segment of the sector's commercial marketplace.

2. Are the ten pillars suggested the right ones to tackle low productivity and unbalanced growth? If not, which areas are missing?

17. Yes. However, the **Government should continue to pursue its successful policy of reducing administrative burdens³ on business and other measures aimed at reducing bureaucracy and improving productivity.**
18. **There is also an opportunity in the Industrial Strategy to highlight the enabling role that efficient, proportionate, agile and robust regulation can play.** Good regulation provides clear frameworks and standards, against which performance can be monitored, managed, and compared. This can in turn help businesses to improve their own performance and manage risk (including national security risks), stimulating and supporting growth across sectors. An example of how a lack of regulatory policy can undermine the growth and competitiveness of a sector is the field of high-resolution Earth observation data. The latest space systems can produce very high resolution images from space for commercial customers. This can drive tension between commercial and national security priorities. **The current export control licensing framework does not distinguish between different customers and hence does not allow for a responsive regulatory framework to maximise industrial exploitation of key emerging markets.**
19. **Sector Deals are likely to provide an important contribution to Industrial Strategy because they offer a clear process to link the ten pillars into a cohesive approach to accelerate growth in key sectors of the economy. Space is one such sector and intends to submit a proposal for a Sector Deal.**

3. Are the right central government and local institutions in place to deliver an effective industrial strategy? If not, how should they be reformed? Are the types of measures to strengthen local institutions set out here and below the right ones?

20. **The sector believes that the existing national space institutions, the UK Space Agency, the Innovate UK Space Team and the Satellite Applications Catapult with its proposed Disruptive Innovation for Space Centre (DISC) are the correct organisations to deliver an effective strategy. There will be a requirement for these organisations to be appropriately skilled and sized to support a dynamic and growing industry.** The link between potential applications and the space segment is not as strong as it should be. Application stakeholders are often unaware of what the space industry can do for them, and the space industry needs to work more coherently to add and develop application opportunities. **The space sector has identified the need for local space clusters across the UK, as part of a national network of clusters, to deliver all the potential benefits from an industrial strategy.**
21. The Harwell Space Gateway has been an exemplar of clustering in the space sector, attracting some 70 businesses and institutions on to the campus. Harwell will continue to act as the UK Space Gateway but cannot deliver the desired and necessary growth in regional activities on its

³ The Scale of the Cumulative Burden, CBI Budget Submission Feb 2016

own. New clusters are required that can offer a full portfolio of capability at critical mass incorporating at least the following:

- a. a pool of skilled and talented labour from which to recruit
- b. a knowledge centre on space and its applications
- c. industry supply/value chain partners
- d. research and university facilities
- e. an outreach and innovation support infrastructure

22. Good co-ordination is needed between BEIS, DCLG, Local Enterprise Partnerships / local authorities and Devolved Authorities to ensure that funding to local infrastructures (transport and communications for example) compliments sectorial initiatives to grow space in the regions.

4. Are there important lessons we can learn from the industrial policies of other countries which are not reflected in these ten pillars?

1. The space industry is export intensive (36% of revenues are from exports) and faces strong competition with other nations in international markets, particularly from the US, France, Germany and Israel. Each of these countries has a specific policy that defines space as a key strategic capability and view it as important for sustaining sovereign freedom of action, export earnings, economic growth, and building partnerships with other countries. They invest more than the UK does to secure these benefits. **If the UK intends to become “the best place to export from”, and improve considerably on that 36% and undoubtedly great opportunities exist to do this globally, the UK must identify ways to compete with less money by targeting opportunities in innovative ways and attracting private investment.** Government can play a role by incentivising private investors to enter the sector as well as streamlining regulatory and export procedures by improving coordination and applying more innovative thinking, for example around emerging mega-constellations.
2. **The US, for example, forms partnerships with other countries to build secure satellite communication systems and export services, and France has formed similar strategic alliances in Europe (through the Helios programme).** France also has successfully used its defence ministry to promote significant export sales of earth observation satellites with allies. Both countries have secured huge knock-on benefits from subsequent commercial manufacturing and services orders from partners. The UK must consider how it too can enter into bi-lateral programmes in a way that is affordable to open up new global markets. **The importance of such international partnerships is not directly captured in the 10 pillars.**
3. Another aspect which is important is the fact that the creation of national competences in France and Germany (in this case around optical and radar satellites) has provided a focus for

developing an extensive national supply chain (including with SMEs) and stimulated investment in a broad supplier capability that can subsequently spill over into other areas. **This international leadership was made possible with government providing an overall strategic and technological direction.**

4. However, setting a strategic direction does not necessarily involve investing huge funding in public procurements. **In the US, the government changed public launcher procurement policy resulting in entrepreneurs investing billions of dollars in a new generation of launch vehicles to meet government and commercial requirements. Setting a clear direction of travel and underpinning the rationale for private investment has stimulated the creation of a huge commercial capability in the US.**

5. What should be the priority areas for science, research and innovation investment?

5. It's important for the space sector that each of the 3 areas of science, research and innovation are addressed; each in its own way but in a joined-up manner and led by the most appropriate bodies. The formation of UKRI offers an opportunity to join up the 3 areas but care needs to be taken to ensure the 3 do not become blended together. The role of the Catapult centres in helping to commercialise research should be reinforced, ensuring that business is able to access and exploit the outputs of research. For the same reason, **the Knowledge Transfer Partnership scheme should be strengthened, as the numbers of businesses using it could be greatly increased**
6. **For the space sector, most space research doesn't of itself drive significant economic growth, particularly in science missions. Priority areas should include those that build on our existing leadership positions or establish leadership in new sectors. Priority should go towards investment in innovation and developing solutions to business led research and innovation challenges.** Science and research investment, as well as scientists and academic entrepreneurs are needed to help drive down costs and obtain a better understanding of the scientific underpinning for new developments, as well as applications of technology and data utilisation. **A gap in research funding currently exists in the management, curation and dissemination of data sets from research missions and this hampers access and is a barrier to their uptake in downstream service development.**
7. **The SGP believes the UK's top priority should be to support its existing core business activities to, as a minimum, maintain its market share as the worldwide space business grows to an expected £400bn by 2030.** In December 2016, the UK subscribed to the latest round of ESA programmes, an essential investment in support of that goal. **However, the SGP's aim is not just to maintain market share but to take immediate steps to grow the UK's share of the world**

space market to 10% by 2030, an ambitious challenge requiring additional focused support.

Most space nations run national space programmes alongside their support for ESA to provide agile support for their sectors and take forward national priorities. This agility and ability to support national programmes (including international bi-lateral projects) will be important to secure new global opportunities to grow the space sector. **The SGP is therefore looking at the case for a national programme supported by both industry and government.**

8. A number of subjects have been identified as the innovation priorities to be addressed by the Industrial Strategy Challenge Fund (see Question 6). Most importantly, innovation across sectors is to be enabled in order to have maximum impact of the commercialisation of space. Encouraging investment from private sources will help bring about this change.

6. Which challenge areas should the Industrial Challenge Strategy Fund focus on to drive maximum economic impact?

9. The Industrial Strategy Challenge Fund has identified Satellites and Space Technologies as a potential candidate for specific focus under the Industrial Strategy Challenge Fund. The workshops carried out early in 2017 with industry suggested 7 key programmes under the heading of Satellites and Space Technology, broadly:
 - a. **How do we get more business, organisations and citizens using data originated from space in their daily activities?** The emphasis is on the use of data from space on the ground.
 - b. **How can businesses prove their products and services for use in space?** This addresses the challenge of gaining flight heritage needed to sell space products.
 - c. **How can public sector organisations improve their services and save costs by making more effective use of satellite applications and services?** This is about getting Government organisations to procure more effectively.
 - d. **How can businesses improve access to the increasing amount of remote sensing imagery generated from space every day?** Satellites are producing a tremendous amount of data, but it can still be difficult to access.
 - e. **What is the best way of achieving lower cost access to space, and reduce the dependency on non-UK providers?** Launch costs present a disproportionately large part of the total costs of a space mission – cracking this problem lowers the price point of many space missions and thus the services they provide.
 - f. **What is the best way to deliver satellite-based broadband communication capability to UK citizens and business?** Satellites can fill in the not-spots of broadband coverage across the UK (and beyond). In future, satellites will need to mesh seamlessly with 5G, a collaboration which is under way.

- g. **How can the UK be the first to refuel or service an existing in-orbit satellite?** This is another industry-challenging proposition, and links to robotics.

Also submitted by the SGP and under review by Innovate UK are subsequent suggestions for:

- h. **How can we make the UK the first mover in developing and exploiting the next big space based infrastructure?** How can we strengthen the links between the upstream and downstream space sectors and leverage private finance to stimulate and enable 'new space' applications and services such as IoT/M2M and 5G
- i. **How can satellites be used to build resilience and protect national infrastructure?**

- 10. All these programmes would bring economic impacts in the UK but also global export opportunities. For example, lowering the cost of access to space could bring multiple new service opportunities into the envelope of cost/price viability needed to unleash demand driven growth. However, the first programme – increasing the uptake of satellite applications for terrestrial use – has the broadest and largest economic impact as its benefits would be felt in all sectors across the UK; this is the use of satellite applications as an enabling technology.
- 11. Additionally, there are overlaps with almost all of the other proposed challenge areas, most significantly Transformative Digital Technologies, Robotics and Artificial Intelligence. Some of these engage the satellite technology sector per se, but the broadest economic impact is brought by the use of satellite data in other vertical markets, estimated by the Space Innovation and Growth Strategy to be around 90% of the total economic impact for space.

7. What else can the UK do to create an environment that supports the commercialisation of ideas?

- 12. The sector recognises the valuable role undertaken by the Innovate UK family, including Catapult centres and the Knowledge Transfer Network, in driving the commercialisation effort for UK businesses. Innovate UK is known best as a funding body for innovation, enabling ideas to progress to commercialisation. The Catapult centres and KTN are understood to provide the essential connecting functions that businesses need to commercialise their ideas. However, **there is a gap in terms of the assistance available to companies in raising the finance needed to grow their businesses**; talk of loans for innovation is longstanding but without result, and the link to private investment is mostly down to individual companies. **More could be done to help companies grow and scale by improving access to finance.**
- 13. **A particular problem is faced by new companies who do not have the retained profits or other means to match-fund the grants offered by Innovate UK.** In many cases a start-up or other young enterprise may have a great business idea but not the funds on hand needed to match

the 70% (maximum) of R&D project finance available from Innovate UK. Having an innovative solution to this problem would help incubate many new companies to successful growth.

14. Where the potential customer for a novel product or service is found in public bodies such as Government departments, a company of any size (but especially one who is not an established supplier for that customer) can encounter great difficulties in selling their offering. This can be caused by the company not understanding the, sometimes complex, nature of selling into Government, but also by complexities of Government organisation. **Finding a way of allowing Government bodies to buy new ideas more effectively would enable them to make productivity savings while helping supplier companies grow.**
15. The selling-into-Government challenge outlined above is one example of the bureaucratic difficulties faced by businesses, but there are other “red-tape” barriers to productivity and growth. A systematic approach to identifying blockers and addressing or removing them, where appropriate, would enable UK businesses to grow their domestic market and provide a sound basis to export.
16. The Catapult centres, and in particular the Satellite Applications Catapult for this sector, provide the connect function described above between businesses as well as their headline role to help commercialise the output of the research base. The Satellite Applications Catapult works closely both with businesses in the space sector and those outside our sector to facilitate new connections. To consolidate the success of the Catapult centres in supporting UK businesses at large, it is important that the performance metrics for Catapults enable them to partner businesses in developing innovative pre-competitive solutions for domestic and export markets without imposing conflicting commercial pressures that could compromise their independence.
17. Regulatory activity in the Space Sector is key, and increasingly complex, as satellite services become more prevalent for consumers and critical to the nation. Areas such as the sharing of spectrum between satellite service providers and the terrestrial based mobile industry are key debates which will affect the ability for the communications industry to enable a connected society with 100% capable coverage. Equally, enabling satellite service providers to access spectrum to deliver services globally for both national and commercial needs encourages private investment and gives options to the Government for future service provision. **Regulatory reform can help to support and stimulate the new market** for CubeSats, which, due to their relatively low cost and ease to build, are helping researchers and companies to be more experimental and innovative in how they test and use satellite technology and data. **Government can support this change by, for example, providing a flexible regulatory policy** that identifies low-risk CubeSat operations and applies proportionate licensing and regulatory standards in response.
18. **Most importantly, the significant level of funding brought by the ISCF must be used to commercialise ideas, rather than supply earlier stage science and research, in order to increase productivity across the UK, growing businesses and the wider economy.** In doing so

we must also take care not to simply fund “more of the same”, and look to be innovative in our approach to innovation.

19. Where UK public sector funds help to develop IP, protections are needed to ensure the IP stays in the UK and is exploited in the UK?

8. How can we best support the next generation of research leaders and entrepreneurs?

20. A key question to ask here is how to develop the next generation of research leaders and entrepreneurs as one group or as two distinct elements. In recent years, US universities have led a trend to delivering entrepreneurial modules to undergraduates during their science and engineering courses, in the hope that this will engender them with business skills to be deployed later in their research careers. However, the effectiveness of this approach is unproven.

21. There is a widely-held view that entrepreneurial training should be available to researchers and existing/potential business founders alike, but less consensus on how to best achieve this. The Growth Accelerator scheme run by BIS was phased out. Other schemes run on an ad hoc basis, but often require payment by the business, which they are unlikely to have available. **Re-establishing locally based schemes akin to the Growth Accelerator but on a somewhat improved basis would offer great support to entrepreneurs.**

22. People in the middle of their careers are a large and mostly untapped source of potential entrepreneurs. Entrepreneurs are often seen as recent university graduates or in late career/retirement, while the body of workers in mid-career may have great business ideas and relevant experience but are often supporting families and mortgages and thus unlikely to risk those to start a new business. **Introducing schemes to lure the mid-careerists into entrepreneurialism could unlock a major source of growth.**

9. How can we best support research and innovation strengths in local areas?

23. The Science and Innovation Audits carried out in 2016 by BEIS were useful and should continue to be used to assess local strengths. **Based on such findings each locality can then develop a plan to leverage these strengths. However, it is unlikely in the space sector that there will be many entirely self-contained communities able to exploit strengths without reference to more widely dispersed specialist expertise, including innovation and commercialisation support and support from experienced financiers and experts in relevant regulation and markets. Links and networks to such resources to other local communities will therefore be crucial.**

24. **In addition to better transport links, superfast broadband and high-capacity data links to connect local clusters and companies across the country will be a major factor contributing to success.** Part of this linking process should facilitate dialogues with wider sector-specific communities, as such contacts and discussion are frequently of themselves significant stimuli for innovation. Local groups should also be encouraged to be outward looking and may need assistance with the facilities and the overheads involved. Where local clusters are to be developed, it is important that business incubators and accelerators are fully engaged with local strengths and national capabilities.

10. What more can we do to improve basic skills? How can we make a success of the new transition year? Should we change the way that those resitting basic qualifications study, to focus more on basic skills excellence?

25. The space sector relies primarily on a high skilled workforce where 3 out of 4 employees hold a first degree or equivalent. However, we fully support the ambition to secure the broader economic and social benefits of equipping the majority of citizens in the UK with good basic skills. There are potentially improvements that space services can offer to improve basic skills, for example, the delivery of web-based training to rural areas using satellite broadband services.

11. Do you agree with the different elements of the vision for the new technical education system set out here? Are there further lessons from other countries' systems?

26. **The Space sector is interested in working with Government to help develop the new technical education system set out in the Industrial Strategy document.** Anecdotal evidence suggests this sector can make extensive use of the proposed technical education system in both manufacturing and applications areas.

27. Space services are often embedded in products used by other sectors where they can enable productivity and growth in those sectors. Key examples are agriculture, maritime transport and disaster management. It is in the interests of both the user sector and the space sector to maximise the take up of new tools being developed, this take up itself may require users to develop new technical skills. **Thus, there is the potential at least for new space services and applications to drive a significant technical training requirement in user sectors across the economy.**

28. From the 6 April 2017, UK space companies with a salary bill of over £3m will contribute to an apprenticeship levy. This provides an opportunity for the sector to scale up its apprenticeship training schemes. As part of this scaling activity, **the space sector is assessing whether there is a case for space technology institutes and will consider carefully whether there would be an**

advantage for the sector and for the UK if these were developed in collaboration with other sectors.

29. The step to simplify the large number of technical qualifications to a smaller set focussed on the needs of industry is a hugely useful step in the right direction. The Government should carefully consider the branding of these qualifications and their global portability. Many space companies are international in their operations and we need to produce world class people who will work locally, nationally and across the globe on space projects – only by doing so will the UK operate at the leading edge. For example, they may wish to consider replacing “Level 3” which has no portability and limited equity with employers with “Technical A-Level” or similar.

12. How can we make the application process for further education colleges and apprenticeships clearer and simpler, drawing lessons from the higher education sector?

30. Not a question that we can comment on authoritatively.

13. What skills shortages do we have or expect to have, in particular sectors or local areas, and how can we link the skills needs of industry to skills provision by educational institutions in local areas?

31. The UK space sector directly employs 38,500 people with some three-quarters of all employees holding a first degree or equivalent. A significant number of these require space-specific skills, particularly those in manufacturing, mission planning and operations, and some aspects of data analysis. We are competing with other high technology sectors in the UK for staff broader high-tech skills, notably those with digital, IT connectivity, complex project management, image analysis and science skills.
32. Anecdotal evidence we have collected to date suggests that the sector collectively is running with several hundred unfilled vacancies. **The sector is also dependent on overseas workers with around one-third of those employed in the sector originating from European countries outside of the UK. Companies in the UK often find that overseas applicants for jobs have better skills than those that apply from the UK – there is a quality as well as a quantity dimension in overseas recruitment.** With a sector looking to recruit more than 50,000 new staff over the next 13 years to account for growth in manufacturing, services and applications, there is the potential at least for a shortage of skilled employees to stifle growth.
33. We are undertaking work to better determine estimates of the likely number and specialist make-up of skilled people needed in the sector. There is the prospect to link skills with growth of the sector in specific regional space clusters. **We are already planning how to establish five new major space clusters across the UK that are likely to include universities and a skills**

training element that reflects local needs and specialisations to meet national sector requirements.

- 34.** An important aspect of space its ability to set out exploration, science and technical achievements in one of the most exciting environments known to us to inspire young people and their parents to consider STEM subjects at school and university. The sector therefore can help deliver a long-term flow of UK students with the right qualifications for a broad range of high tech sectors in the UK. **As part of a sector deal, the UK is considering an industrial commitment to present space achievements to an additional 25,000 students over 4 years to help maximise STEM take-up.**

14. How can we enable and encourage people to retrain and upskill throughout their working lives, particularly in places where industries are changing or declining? Are there particular sectors where this could be appropriate?

- 35.** We estimate that the space sector will need to recruit some 50,000 engineers and scientists by 2030 if it is to deliver its growth ambitions. In addition to recruiting graduates and overseas specialists, this will require an extensive training programme to re-skill those joining from other technology and service sectors. There will also be a growing need for courses to provide continued professional development and vocational training for existing employees in the space sector.
36. We assess that modular MSc courses will be the most important mechanism for those entering the sector with first degrees or through alternative technical training routes. These courses best meet both the needs of companies and individual staff. The most important consideration from a sector perspective is to match industry demand for training to the future supply of courses being created, both in terms of the quantity of students and course content. A specific concern raised with us by universities is the dedicated resource needed to put together relevant courses. Although they recognise these courses are likely to be a priority for the sector it has become increasingly hard to justify such discretionary effort in advance of a proven need. The Space Growth Partnership is working to assess these issues.
37. There will also be a need to upskill workers in (or entering) other sectors in the economy to use the space services and applications being developed to increase productivity and competitiveness in that sector, for example, space geo-spatial and communications services likely used on future farms. It is important that such sectors change to increase the uptake for, and make best use of, new services.
38. There seems to be a wider opportunity for UK MSc courses to train overseas users in the use of space products either to directly stimulate overseas demand for training (the service and training can be sold as a package) or, just as importantly, for workers employed by UK

businesses and overseas partners to develop and demonstrate products and services in host nations globally.

15. Are there further actions we could take to support private investment in infrastructure?

- 39. The space sector already provides infrastructure in the areas of digital, transport, water and flood defence across the World. Large scale satellite communications infrastructure has been provided by the satellite industry on a commercial basis for over 20 years. The sector can therefore make a contribution to UK infrastructure by using existing space assets, launching new, bespoke, assets or by engaging with other sectors to embed space data in their infrastructure developments.**
40. Private finance for major public sector driven infrastructure frequently presents significant challenges for a number of reasons. Long planning and implementation cycles, the significant scale of overall funding required, political risk factors associated with high impact and frequently controversial projects and the complexity of charging users and beneficiaries to recover cost and create uncertainty about the financial returns on investment.
- 41. However, the reducing costs of space assets, particularly using smaller satellites and cheaper launches, is making space infrastructure more affordable and attractive to private investors for public sector infrastructure. Investors need to see a case for investment. Government can stimulate such investment by agreeing to procure a proportion of a service capacity in advance. It can also aggregate consumer or business demand, again reducing market risk. The assurance of a 'market' for the product or service and a revenue inflow over time reduces risk to a level manageable for private investors. This mechanism could be deployed to create sovereign surveillance infrastructure in the security domain, with spare capacity being sold directly to overseas governments in export deals.**
- 42. At smaller scale, the sector is developing a track record in increasing the availability of private finance for SMEs and start-up ventures. Seraphim have recently launched their £80m Space and Special Applications Fund with £50m in British Business Bank funding. The Satellite Finance Network has supported the formation of the £25m Space Net Ventures (S)EIS Fund. The Satellite Finance Network also acts as a coordinating body to put entrepreneurs in touch with investors, mentoring the efforts of entrepreneurs to give them the best chance of securing private and any necessary public investments to take forward space proposals.**
43. **The UK Space Agency's Space for Smarter Government Programme is aimed at coordinating government procurement of space services and applications to generate efficiency savings for Departments and, potentially, new products, companies can sell in export markets. This is a valuable activity that is producing usable outcomes but one that is not being taken forward at a**

sufficient scale to create visible impact in terms of a contribution to infrastructure or procurement.

16. How can local infrastructure needs be incorporated within national UK infrastructure policy most effectively?

44. **The space sector believes that local infrastructure can make a significant contribution to the development of national space infrastructure.** The Space Growth Partnership is assessing 5 sector clusters across the UK with each of these clusters bringing capability in specific areas needed for national programmes, for example, in manufacturing technology and processes, geospatial analysis, Earth observation and satellite launch. This obviously also links closely with the development of specific skills in each local cluster.
45. A priority for local infrastructure is likely to be good access to superfast broadband communications infrastructure, both at hubs of activity and across the local community. **Access to broadband is an issue for many local communities and there is the potential to use satellite connections to bridge this gap quickly.** This approach can be complimentary to the roll out of the fibre and mobile network, with the benefit of satellite in remote areas resulting from low infrastructure costs, speed it can be deployed and the fact that satellite capacity is quite agile and can move as the terrestrial networks develop.
46. **Joint working between sectors is also likely to stimulate new local economic activities.** For example, the space sector is looking to identify new satellite-enabled demonstration projects with other sectors, which requires a range of innovations, including local machine-to-machine communication networks, remote access to the Cloud and satellite positioning and observation data to showcase to local businesses how this all works together. This has a strong potential to drive local business growth and productivity improvements.
47. **The Government can therefore stimulate the skills and the space supply chain by using its power to bring customers, commercial suppliers and infrastructure providers together and ensure that superfast broadband is removed as a barrier to growth.** Aggregating consumer, business and government demand can stimulate the delivery of broadband to areas currently underserved and new investment in satellite broadband technology.
48. **Launch services will, as an all-new UK capability, stimulate the development of related services near the location of a UK spaceport(s).** For safety reasons, this will need to be located away from current industrial and economic hubs and can be used to deliver local economic and social benefits.

17. What further actions can we take to improve the performance of infrastructure towards international benchmarks? How can government work with industry to ensure we have the skills and supply chain needed to deliver strategic infrastructure in the UK?

49. Given the economic stimulus provided by good quality broadband connections, the European Union is proposing that one-half of all EU citizens have access to 100 mbps broadband, with the remainder having access to 30 mbps broadband, by 2020. The space sector is in a position to connect 'not spots' in rural communities in the UK and EU with superfast broadband, using satellites already in orbit or due to be launched in the next 2 years. This can be achieved at a competitive price if Government and local champions can resolve the significant cost of initial connections to consumers. Satellites are likely to deliver these connections to remote communities much faster and at lower cost than fibre or mobile networks.

50. The UK has set out an ambition to launch small commercial satellites from the UK by 2020. This establishes new infrastructure in the UK with a supply chain that will be able to offer an end-to-end capability for a new generation of small satellites from concept through to in-orbit network. An ability to launch is the norm for the most advanced space nations. Although the UK approach being adopted is to stimulate commercial services, the launch infrastructure being created will also be important for the UK's broader institutional and security uses.

18. What are the most important causes of lower rates of fixed capital investment in the UK compared to other countries, and how can they be addressed?

51. The UK space industry is highly capital intensive, from Inmarsat investing many hundreds of millions in satellite infrastructure (\$413m in 2016) or Airbus investing in new clean-rooms for manufacture. The industry has shown that given the right conditions it is ready to make significant capital investments, many directly in the UK. Charting a growth strategy with strong business cases is the best way to increase capital investment.

52. Another key feature particular to the space sector is the undeniably large influence of UK government investment as a customer and technology development partner (mirroring most other developed nations). The consistency of this support is vital to allow investments to be planned and amortized over many years. **It is difficult to overstate the importance of long term, visible, political support for a sector in trying to secure discretionary investment, inward investment and the confidence of overseas customers.**

53. The UK has a different management culture to other countries which tends to focus on relatively short term returns and KPIs. The same can be said to be true of the US but their investment culture also embodies a long-term approach to capital & equity investments, which strives for

market hegemony probably driven by the heritage of a huge domestic market. Recent examples include Amazon, Google and Tesla which have been supported by very patient investors.

54. This is supported by a strong cadre of experienced leaders and managers, for example in Silicon Valley, who are able to work in this environment. This approach is highly relevant to space where start-ups, such as OneWeb and Planet Inc., have to take on huge capital investment burdens (at least several \$100m) without expecting profits for many years. **The UK should complete its Patient Capital review and ensure that the results allow the creation of transformative capex-intensive start-ups in the UK.**

19. What are the most important factors which constrain quoted companies and fund managers from making longer term investment decisions, and how can we best address these factors?

55. A number of factors can constrain investment decisions, both for home-grown and foreign direct investment. **Such companies as those looking to make long term investments in particular value consistency of policy, beyond simply the electoral cycle, to give greater certainty to the policy environment or major investment decisions by government.** Continuity of funding for such initiatives where relevant is also essential and adds additional confidence for companies and fund managers about government's commitment to such initiatives.
56. In addition, a good support network from government for exports of products that investors may choose to produce in the UK is important as it then enables the country that has seen the investment to serve as the export base for the product or service in question. **Where possible, government should be prepared to act as a customer in order to show confidence in the product or service they are helping to promote.** The Industrial Strategy Challenge Fund should provide a seed investment from government to demonstrate new technologies which are relevant to government.
57. Uncertainty over long timescales regarding realisation and refinancing options in large projects is also often a concern. Sources of 'patient capital' on a sufficiently large scale could potentially avoid some of the hazards of refinancing. Other **measures that could encourage long term investing include cross-party agreed governmental lock-ins to financial, political and regulatory environments, government anchor tenancy for infrastructure projects and focused encouragement for corporate investors.**
58. **Access to talent and a skilled workforce is also a key factor in investment decisions, particularly for highly-skilled sectors such as space, as is access to a strong academic base where research-and development is a priority.** In the context of the UK's exit from the EU, avoiding as much as possible any additional customs regulations or procedures will also be vital for the ease of movement for UK-manufactured parts to other sites a company may have if inside the EU.

59. **In the space sector in particular, continued access to collaborative programmes and organisations such as the EU funded and the European Space Programmes and the European Space Agency respectively, also serve to provide additional opportunities for companies choosing to invest in the UK that in turn support the UK sector and market.**

20. Given public sector investment already accounts for a large share of equity deals in some regions, how can we best catalyse uptake of equity capital outside the South East?

60. Uptake of equity capital in the regions beyond the South East depends on the development of local communities/ecosystems of financiers and entrepreneurs with access to a critical mass of investment opportunities. These communities need to be connected by efficient communications and transport infrastructures (face-to-face meetings with management teams remain by far the most important engagement for investors).

61. **Local ecosystems should offer businesses and aspiring entrepreneur's access to advice on the appropriateness of different types of finance according to purpose and risk (covering grants and equity to different types of debt and export guarantees for example). This financial landscape is frequently a poorly understood issue. Local facilities should also include acceleration and incubation facilities with the capacity to help develop management teams and business models.** This kind of assistance is badly needed in order to raise the volume and quality of investable propositions from many sectors; too many investment proposals still do not reach the quality threshold that justifies commitment of investors' resources to further scrutiny and due diligence. Development of local space clusters (Question 16) will assist the space sector in this drive for expansion and quality.

62. Also of benefit to the sector is the availability of recently launched private-sector investment funds focused on space applications. They can invest anywhere in the UK. Large funds offer a breadth of remit and portfolios that can mitigate individual risks and provide long term viability for funds by pooling private sector investors' interests. Further capacity of this kind will need to expand in the coming years.

21. How can we drive the adoption of new funding opportunities like crowdfunding across the country?

63. **Space often requires large investments so crowdfunding is likely to be suitable for smaller applications companies with lower capex.** In these cases crowdfunding could be quite suitable as space tends to capture the public's attention but the sector has limited examples of raising such funding. These offerings are becoming increasingly commoditised and many organisations seeking such finance in the space industry would benefit from familiarisation advice. This too

could be provided on-line. However, awareness of such options is low and a review of uptake and user experience could be used to assess whether there is a need to drive widespread adoption.

64. Some factors that put investors off include the high legal/court costs of recovering relatively small amounts of defaulted debt. For equity investors, the crowdfunding risks can be very high and massive dilution a strong probability for those who cannot follow their investment with larger injections of finance for those propositions eventually requiring substantial investment over long (e.g. 10 years+) timescales.

22. What are the barriers faced by those businesses that have the potential to scale-up and achieve greater growth, and how can we address these barriers? Where are the outstanding examples of business networks for fast growing firms which we could learn from or spread?

65. Barriers faced by space businesses vary depending on the nature of the product, service and target market. Primary barriers include:

- a. barriers to trade (e.g. compliance with regulations imposed in overseas markets)
 - b. harnessing the specialised and scarce skills needed
 - c. regulatory barriers
 - d. finding new supply/value chain partners (particularly where technologies and markets are immature and where the appropriate networks and relationships have yet to develop)
 - e. accessing sufficient finance
 - f. convincing new customers that innovative products and services will work for them.
66. A particular challenge for space applications companies (often SMEs) is the frequent absence of established relationships between the space community and value/supply chain partners who can adopt the capabilities on offer and subsequently channel these into new commercial markets. **Providing small companies and start-ups with an understanding of how target markets work and the barriers to uptake along the value chains and channels needed to penetrate them is crucial. To this end the SGP plans to establish Communities of Interest with the aim of surfacing and developing new domestic and global cross-sector growth opportunities for the sector by bringing together end-users, space companies, investors, intermediaries and regulators in a pre-competitive forum to tackle common barriers.**
67. To facilitate access to finance The Space Growth Partnership has initiated a number of moves to encourage inflows of private finance of all forms. The SGP's Satellite Finance Network works to engage all forms of private and public finance with entrepreneurs and others seeking finance for space based propositions. The Satellite Finance Network has also supported the formation of the £80m Seraphim Space and Special Applications Fund and the £25m Space Net Ventures

(S)EIS Fund. Furthermore, UKSA and the Catapult have acted as part of their regional development strategies both at Harwell and elsewhere to bring about a significant increase in new start-up and early stage SME incubation capacity to feed these funds.

68. **In the space sector, industry, academia and government agencies are working with the Satellite Applications Catapult and KTN networks to explore new value chain relationships and to gain the required insight into the requirements of potential new clients quite outside the space sector itself.** We are assessing how to systematically increase the scale of this activity within application focused Communities of Interest in key growth areas of the economy where we see a major opportunity for them to use space data to improve productivity.
69. **Time to market ahead of competition is also critically important for companies aiming to enter new markets and scale up quickly. Whilst the UK should continue to work through ESA to develop and demonstrate new technologies and applications, reaping the benefits of cost sharing and collaboration a National Space Programme should complement ESA activities (a point already discussed in Q5) and enable the UK to focus on new commercial opportunities .**

23. Are there further steps that the Government can take to support innovation through public procurement?

70. The UK Government already procures space enabled capability through programmes such as the Skynet secure communications system and GPS tags for offenders. **There is widespread agreement that greater use of space enabled services would achieve better and more cost effective public services.** Government procurement can also lead directly to overseas sales of systems.
71. A recent exemplar was the 2012 London Olympics, which spurred the development and adoption of new Geospatial Information Services (GIS). This led to innovative use of space data across government. **Government and industry should therefore look to fully deploy and where possible ramp up programmes aimed at fostering government procurement of space systems that will lead to new services for government, cost savings, and innovative products that can be exported by UK companies.**
72. **Programmes such as SBRI and SSGP can be a very effective tool for stimulating innovation and early development of solutions. Pull through into procurement contracts should follow, ideally without the discontinuities of re-competition, which deters industry involvement and threatens previous company investment in IPR and know-how.** The UK Space Agency's Space for Smarter Government programme and SBRI could be scaled-up with government departments incentivised to take advantage of the innovative solutions which are developed. , assisted by the formation of a Community of Interest to explore development of government procurement opportunities and processes.

24. What further steps can be taken to use public procurement to drive the industrial strategy in areas where government is the main client, such as healthcare and defence? Do we have the right institutions and policies in place in these sectors to exploit government’s purchasing power to drive economic growth?

73. **Government procurement can make the UK an early adopter of new services that can produce export-ready products for overseas customers.** There is the potential to create a virtuous circle: from government as a customer spurring the development of innovative products and services; government customer commitments reducing the market risk to the point that private companies will invest; to companies being able to meet UK national needs and subsequently supply services to overseas government and commercial customers.
74. The UK could usefully adopt this approach to compete successfully with countries that are already dominant in space export markets. This question relates closely to the consultation questions on national infrastructure and more detail is available in Q15 and 16.
75. When evaluating international tenders for goods and services, government should not simply select the lowest price but assess the costs across the entire lifecycle of the project (e.g. long-term product support) and assess the wider economic impacts of the decision

25. What can the Government do to improve our support for firms wanting to start exporting? What can the Government do to improve support for firms in increasing their exports?

76. The work that Government does at home and overseas through its international network of embassies, International Trade Advisors and UK operations to support and promote UK export activity is recognised and appreciated. Also, the recent establishment of the Department for International Trade, bringing together trade and investment, export control and export finance under a single body is a welcome move.
77. Increasing exports and attracting high value export-focused FDI will be key to meeting the sector’s target of securing 10% of the estimated £400bn global space market by 2030. The space sector is already highly export-focused, with exports accounting for £5bn of the sector’s £13.7bn revenues^[1]. The Green Paper’s commitment to a Team UK approach to winning large overseas contracts is welcomed, and should be explored for the space sector. The extremely competitive nature of the global space industry means that this coordinated approach is essential. Analysis

^[1] London Economics (2016) *Size and Health of the UK Space Industry*

shows that space industry exports could grow to around £15bn² p.a. by 2030, but this will only be possible by extending and accelerating all current efforts.

78. **Broadly, the sector's growth prospects would be enhanced significantly by scaled-up and better coordinated export and FDI promotion support from government, working in partnership with industry.** The Space Growth Partnership will be bringing forward specific recommendations in this area. One area which is already apparent is that the strategic nature of many space businesses means that international partnerships (i.e. in-country partners) are essential. **The current International Partnership Programme therefore needs to be continued and extended to include non-ODA countries. In addition, access to European markets (France, Germany and Italy in particular) needs to be preserved.**
79. For SMEs and first time exporters, access to finance, skills, and overseas buyers and partnerships are important priorities. **For manufacturing exporters, export controls remain a serious barrier to growth. The sector encourages government to review its approach to export licencing against those of its competitors, including the balance between risk and prosperity and the speed of decision-making. In the longer-term, free trade agreements with the US and high growth economies can help tackle the tariff and non-tariff barriers that impede UK exports, including restricted government procurement.** For example, we have identified that significant challenges exist for the huge Indian and Chinese markets which need to be addressed together.
80. **While non-EU markets offer enormous opportunities for space, the importance of trade between the UK and EU cannot be underestimated. The space manufacturing sector operates highly integrated EU supply chains, with the EU accounting for 90% of the sector's manufactured imports and 94% of its exports^[2]. EU procurement represents an important source of revenues and technology development. The sector is also highly reliant on the movement of skilled business people, with non-UK EU nationals making up an estimated 30% of the UK workforce. For these reasons, the space sector welcomes the Green Paper's confirmation that the Government will pursue, as a priority, a bold and ambitious free trade agreement with the EU as well as plans to negotiate continued access to EU programmes (such as Copernicus and Galileo).**
81. Finally, programmes to stimulate, coordinate and cross government programmes (via UKSA and SA Catapult) as well as provide innovation funding need to take exportability into account as services developed for the UK government are highly regarded abroad and can be sold in overseas markets.

^[2] ECORYS (2012) *Study of the specificities of the space sector and of the European space industry in international trade negotiations and relevant commercial agreements*

26. What can we learn from other countries to improve our support for inward investment and how we measure its success? Should we put more emphasis on measuring the impact of Foreign Direct Investment (FDI) on growth?

82. The UK has a very positive story to tell on Foreign Direct Investment; more companies locate their business in the UK than in any other country in Europe. The actions this Government has taken, such as reducing tax burdens and improving regulation, have helped make the UK the best place in Europe to do business.
83. It is important that new investment supports growth and prosperity, creating and securing jobs in high-skilled high-value roles.
84. The space sector has recognised the potential of FDI to support its own growth ambitions and would support a greater emphasis being placed on measuring FDI's impact. This could help inform an ongoing policy approach that ensures the right incentives and framework exist to ensure the UK continues to present itself as the location of choice for overseas investors.
85. **The space sector is a good example of where overseas investment can support and complement domestic growth. For example, the growing Harwell space cluster is successfully attracting investment from both UK based and overseas organisations. Almost a third of the c70 space organisations based at the growing Harwell campus have located from overseas.** In addition, companies which were already present in the UK have increased their UK staffing by locating at Harwell.
86. As mentioned in the response Q32 the opportunity exists for \$8bn p.a. global equity investment in the space industry by 2030. To capture a significant part of this investment it is essential to make the UK the best place to invest in and the Space Growth Partnership will be making some specific recommendations on how this can be achieved.

27. What are the most important steps the Government should take to limit energy costs over the long-term?

87. Not a question that we can comment on authoritatively.

28. How can we move towards a position in which energy is supplied by competitive markets without the requirement for on-going subsidy?

88. Not a question that we can comment on authoritatively.

29. How can the Government, business and researchers work together to develop the competitive opportunities from innovation in energy and our existing industrial strengths?

89. Space can have a significant role to play in energy generation from prediction of renewable energy (wind via weather forecasting) to monitoring fuel usage / extraction (e.g. by monitoring the volume of fuel stocks in refineries via SAR). These cross-sector opportunities need to be further encouraged and accelerated.

30. How can the Government support businesses in realising cost savings through greater resource and energy efficiency?

90. Satellite technology has a role to play in energy efficiency, primarily through improved traffic management. There is a significant opportunity in this area since transport accounts for 40% of final energy consumption steadily rising since 1970 to become the largest use of energy (Energy Consumption in the UK November 2016 update).

91. Satellites contribute to the energy efficiency of road users by improved navigation (SatNav) reducing wasted miles and avoiding traffic jams. There are significant opportunities for optimizing the road network particularly with the advent of autonomy which is highly reliant on satellite technology.

92. Satellites will also have a key role to play in aviation by smart air traffic control. By optimizing take-off and landing approaches fuel usage can be reduced, particularly in strong weather conditions (work carried out in SESAR programme).

31. How can the Government and industry help sectors come together to identify the opportunities for a 'sector deal' to address – especially where industries are fragmented or not well defined?

93. Space is already a successful high-tech sector in the UK. It has doubled in size since 2009 has a value added per employee productivity around 2.7 times that of the UK average and invests over 8% of its direct GVA in research. The use of space data and services is embedded into other sectors in the economy and it is estimated that it therefore contributes £250⁴ billion per annum to UK GDP.

94. The UK's Industrial Strategy and Sector Deals offer the space industry the opportunity to accelerate its growth and innovation above the current baseline.

⁴Size of Health of the UK Space Industry 2016

95. The space sector in the UK is a cohesive sector and has already taken forward action to identify the opportunities in a credible, robust, sector deal proposal. **We have already established a Space Growth Partnership to take forward the progress needed for a sector deal.** We intend to establish a Space Sector Council that represents the industrial, academic and government interests in the sector. We have a champion for the sector who will engage with Ministers as our proposals come together.

96. The sector deal itself will be market and global opportunity led. Space is a commercializing sector and there is an opportunity to significantly increase the private investment in the sector. Government has a role to encourage this change. **We therefore propose that a sector deal could include measures to lock in the existing competitiveness, productivity and growth of the sector; a cross-sector / cross-economy growth package, a National Space Programme and an agile regulatory framework to take forward the main elements in a deal.**

32. How can the Government ensure that 'sector deals' promote competition and incorporate the interests of new entrants?

97. The space sector is highly competitive and global. UK companies are often in direct competition with the best companies in the USA, France, Germany and other advanced nations. They have survived and prospered in part due to the close working relationship between the industry and the UK government which needs to continue and be enhanced.

98. The industry, however, is not complacent. **Huge private sums are being invested in new companies, primarily in the US, and the UK has the opportunity to attract similar investments if it can establish the right approach. This will stimulate new entrants to the UK, both from inward investment and entrepreneurial start-ups. By 2030 private equity investment in space could reach \$8B p.a. and if the UK seeks to become 10% of the overall industry then we need to find a route to capturing \$800M equity investment per annum.**

99. UK space programmes are generally competitive and any sector deal the Partnership's recommendations will ensure that competition is central in its proposals to ensuring fairness and to supporting new entrants thereby increasing the involvement of SMEs and the development of new supply chains. However, **there may need to be direct relationships with companies in situations where there is an opportunity to secure large scale private investments in commercial programmes. In some cases, competition might require funding parallel competing programmes to a relatively high level of maturity.**

100. A key element to ensuring that fairness is maintained (also between participants of all sizes) will be to create Communities of Interest in the Partnership which will seek to connect and stimulate new entrants around significant new opportunities and value-chains. These will

concentrate on pre-competitive actions. In particular, when these new entrants start to become successful it will be necessary to ensure that they have the ability to scale-up quickly.

33. How can the Government and industry collaborate to enable growth in new sectors of the future that emerge around new technologies and new business models?

101. **This is a challenge being tackled by the Space Growth Partnership in its activities aimed at building new supply/value streams to ‘downstream’ users of space based communication, navigation and observation capabilities of satellite networks. It is based on ‘Routes to Market’ explorations and Communities of Interest formation (see response to Q22) to help develop new supply chains from amongst interested parties.**
102. Depending on a Community of Interest’s application focus, such groups can facilitate cross-sectoral links and explore shared challenges. Concepts such as the ‘satellite enabled digital farm’ and ‘satellite integrated 5G network’ are examples of what is being considered as potential cross-sectoral satellite enabled developments.
103. **These would be part of a proposed National Space Programme within a sector deal to develop and demonstrate new commercial space capabilities in the UK, including R&D, procurement competitions, multi-lateral opportunities and skills**
104. The role of neutral bodies such as [Research and Technology Organisations \(RTOs\)](#), Catapults and the KTN is clearly very important to the mediation of potential user/client and commercial interests while technologies, applications and markets are still immature; they also facilitate collaboration between competitors while activities remain at the pre-competitive stage.

34. Do you agree the principles set out above are the right ones? If not what is missing?

105. Yes, the principles set out are the right ones. The Space Growth Partnership intends to make some specific recommendations along these lines as part of a Sector Deal with Government to implement ambitious plans to grow the space sector over the next 15 years and beyond.

35. What are the most important new approaches to raising skill levels in areas where they are lower? Where could investments in connectivity or innovation do most to help encourage growth across the country?

106. The space sector agrees that improving connectivity between communities tends to spur innovation, the take-up of innovative services and the flow of ideas. As importantly, it promotes flexible working practices, encouraging those with family responsibilities and those that find it more difficult to travel to access new learning opportunities and work.
107. **As highlighted in the answers relating to infrastructure, space can contribute to these aims by providing broadband connections that support distance learning and connections to work that can improve the lives of citizens where skill levels are lower.**
108. **The introduction of satellite launch services in the UK is likely to stimulate skills and innovation in remote areas of the UK as a value chain and support activities develop around the new spaceport(s) to support this launch capability.**
109. **The space sector is explicitly considering skills needs and training provision in areas of the UK as part of its approach to creating regional space clusters. We expect that different clusters will concentrate on specific market areas for the sector, leading to specialisations within clusters.**

36. Recognising the need for local initiative and leadership, how should we best work with local areas to create and strengthen key local institutions?

110. The Space Growth Partnership is tackling regional challenges with an engagement plan aimed at capitalising on and reaching beyond its traditional hubs in the South East, including by creating fully functional space clusters further afield that co-locate business, research and pools of entrepreneurial and talented labour.
111. There is already a broad picture of regional involvement in the space sector but this requires significant upscale of regional growth programmes already being run by UKSA and the Catapult. There are 4 aspirational regional networks in NW England, Scotland, Wales and Northern Ireland. **The Satellite Applications Catapult has established five Centres of Excellence: on the South Coast (Portsmouth), North East (Durham), South West (Exeter), East Midlands (Leicester) and Scotland (Strathclyde). There is physical infrastructure in terms of 'space parks' or other buildings or R&D facilities at Harwell, Westcott (Aylesbury), Leicester, Goonhilly (Cornwall) and in Surrey. There are business incubation facilities that have been set up in most of these locations. In addition, industry already holds supplier days around the country and undertakes supplier improvement programmes with existing UK suppliers located across the country.**
112. **The SGP proposal is to work with all the potential regional entities and proto clusters to encourage growth across the country.** This would provide the basis for a competition seeking proposals to create the five new 'space focus' clusters in the UK by 2020, with each

proposal focusing on exactly what each cluster would offer to regional partners and the national sector. There would be minimum criteria for a new cluster in terms of numbers of companies in the cluster, jobs created and contribution to both local economy and the sector. But there would not be criteria that stifled innovative proposals.

113. As ever, quality and availability of the 'right people' with the appropriate skills, experience and willingness to take on the challenging, difficult and risky roles leading collaborations between multiple public sector and private sector bodies and institutions in large scale local initiatives is key. Most such lead roles require full time and properly remunerated executive and supporting administrative resource.

37. What are the most important institutions which we need to upgrade or support to back growth in particular areas?

114. **The most important institutions for the space sector are the UK Space Agency, Satellite Applications Catapult, Innovate UK and the European Space Agency. Government strategy has been effective in establishing these institutions in a way that drives industry growth and in providing high levels of coordination across the UK sector. Securing ESA's European Centre for Satellite Applications and Telecommunications at Harwell has provided a signal that this body sees the UK at their lead in these areas of activity.**
115. **We do see areas where the UK could strengthen these institutions. If the sector is to accelerate its growth it will need to identify and secure new market opportunities that are over and above those that can be secured by one company as normal business development activities. It will require a partnership between industry, academia and government to successfully pursue these.** In the case where these opportunities are cross-sector and cross-economy in nature (space data and services transforming other sectors to increase productivity or introduce all-new capabilities) we envisage a strengthened Satellite Applications Catapult potentially leading these by establishing communities of interest to bring together customers, investors, intermediaries, suppliers and wider experts to access these opportunities.
116. **There are also new opportunities for commercial services in the space sector itself, for example a disruptive innovation centre for space, increasing the number of UK suppliers and capabilities in the small satellite launch field and undertaking in-orbit assembly and servicing operations in space. These will need substantial effort to mature and may involve strengthening institutions such as UKSA and Innovate UK. The opportunity is for the UK to lead or co-lead globally in some of these new commercial markets.**

38. Are there institutions missing in certain areas which we could help create or strengthen to support local growth?

- 117. The area where the space sector sees growth opportunities but where coordination could be strengthened is in the security area.** The UK has a well-developed approach to secure communications but even here could potentially make more use of commercial telecommunications services apart for a central and highly secure core service. Space can offer important situational awareness and other intelligence data from space but there is no clear-cut mechanism in the UK to evaluate this offering and encourage private investment to develop the products that can be used in the UK and overseas markets. For example, **the UK is the only G7 economy that does not have Earth imagery assets of its own and relies entirely on data provided by other nations for its security needs.**
- 118. Space assets already provide important security related services, for example, precision positioning and communications for aircraft, ships and land assets. In the future, we might potentially add a satellite launch capability. Following the loss of Flight MH370, serious consideration could be given to having information normally sent to flight recorders to be streamed to a secure data centre rather than stored in an asset that might never be found (or be investigated by local authorities that do not have the competence to handle the information).**
- 119. The newly-formed Space Security and Prosperity Ministerial Committee would provide an excellent opportunity to collate cross-Government support for new infrastructure and services in this area.** The Defence Growth Partnership might provide an effective mechanism to lead this.
- 120.** We therefore suggest that the Space Growth Partnership and the Defence Growth Partnership co-ordinate activity to determine the growth potential from a strategic relationship between the sector and government on security services. This would inform any need for an institution in this area.

- End -