

# Science and Technology Committee

## Oral evidence: UK Space Strategy and UK Satellite Infrastructure, HC 98

Wednesday 8 December 2021

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Members present: Greg Clark (Chair); Aaron Bell; Dawn Butler; Katherine Fletcher; Mark Logan; Rebecca Long Bailey; Carol Monaghan; Graham Stringer.

Questions 149 - 281

### Witnesses

[I](#): Yasrine Ibnyahya, Director of Advanced Concepts, Inmarsat; and Professor Sir Martin Sweeting, Founder and Executive Chairman, Surrey Satellite Technologies Ltd.

[II](#): Hina Khan, Senior Project Manager and UK Stakeholder Engagement, Spire Global Limited; and Jon Styles, Director, Assimila.

[III](#): Chris McLaughlin, Chief of Government, Regulatory Affairs, and Engagement, OneWeb.



## Examination of witnesses

Witnesses: Yasrine Ibnyahya and Professor Sweeting.

Q149 **Chair:** The Science and Technology Committee continues our inquiry into the UK space strategy and UK satellite infrastructure. I am very pleased to welcome our first panel of witnesses: Yasrine Ibnyahya, the director of advanced concepts at Inmarsat, and Professor Sir Martin Sweeting, the founder and executive chairman of Surrey Satellite Technologies Ltd—the world’s first small satellite company—who has been a professor at the University of Surrey. Thank you very much indeed for coming.

Perhaps I could start with Sir Martin and ask you to summarise, given your long and extensive experience in the sector, the particular strengths of the UK satellite industry.

**Professor Sweeting:** The UK space industry and academia have developed quite dramatically over a long history for the last 40 to 45 years. In the last decade, we have seen a resurgence of space interest and capability. We have a very strong academic network, with universities providing world-class instruments to international programmes, and we have a very strong space industry that is providing communications, Earth observation and navigation capabilities, not least of all the navigation payloads into the European Galileo programme. This is a major contribution of the UK, and it illustrates part of the strength of UK industry in providing key infrastructure components.

We also have a very strong communications capability, which my colleague will no doubt talk more about, and the UK Skynet programme, where UK companies have provided the military communications capacity over the last several decades. The UK has a very strong industry.

As you alluded to, Chair, the UK could be classified as stimulating the so-called new space movement, which has now dramatically changed the whole economics of space, not just in the UK but worldwide; we see that dramatically in the United States, where we see a number of small satellite systems allowing constellations for communications, for remote sensing and for other services to be done on a totally different economic model. SpaceX is one example. Kuiper is another.

Very many small start-up companies are providing innovative services. The UK has stimulated that whole movement. We need to capitalise on that and play a major role in that new space scene.

Q150 **Chair:** Thank you. You say that the UK stimulated it. What was it about the UK that resulted in that position of strength in those areas? Is it coincidence, or were there particular attributes that we had?

**Professor Sweeting:** Curiously, it was probably due to a lack of funding. If you go back to the early 1980s, the UK did not have a national space programme as such. For the UK and for the university that I represented at Surrey to participate in space, we had to find a new way to design,



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build and launch satellites on a much smaller budget because there weren't any funds. Curiously, the lack of funds stimulated an innovation and an approach to use the then emerging consumer micro-electronics, which were much cheaper than the conventional space-rated devices, in order to build spacecraft at a fraction of the cost and timescale. That was driven by necessity. That is what stimulated the innovation, and that innovation then took root.

Q151 **Chair:** Thank you. That is fascinating. I am sure we will want to follow that up. Having got to this position now, presumably you would see other countries looking to catch up and join this market. Looking forward, what do you see as the threats to the position that we have established?

**Professor Sweeting:** The growth of this so-called new space approach has been underpinned by substantial investment opportunities, particularly in the US. The amount of venture capital that has been put into new start-up companies and new ideas—putting SpaceX and the other smaller companies aside for a moment—is substantial. What is interesting to see is that Europe has been slowly catching up. It has not reached the same level as the US, but we are about three or four years behind in European investment. We see, for example, the Seraphim fund in the UK providing the opportunities now to try to stimulate some of these new start-up activities. To be honest, the UK initiated this, but other countries are picking it up and moving more rapidly with greater resource behind them.

Q152 **Chair:** Thank you very much indeed. Ms Ibnyahya, you represent a company that is involved in applications and making use of the satellite infrastructure. What do you see as the UK's strengths in that part of the sector that you are engaged in?

**Yasrine Ibnyahya:** You are absolutely right: we buy satellites, we procure the launcher, and then we sell those services around communications and telecommunications in general.

As for the strengths in the UK, when it comes to large spacecraft manufacturing, Inmarsat is a procurer of very large spacecraft, the size of double-decker buses. There is a strong capability in payloads, which are the communication modules, particularly in Stevenage and Portsmouth. We see good strength there. Historically, of the 14 assets we have in space at the moment, nine of them were born and manufactured in the UK. Of the seven ongoing developments, five of them are being made in the UK. The challenge when it comes to large satellite manufacturing is that we can make the payloads, but we do not know how to make the full system—the full satellite—and that is for a few reasons.

One is that we do not have those large manufacturers present in the UK and the infrastructure to integrate those systems. I am hearing that with the Skynet 6 programme there will be more facilities that will enable this capability eventually, so that is quite positive.



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As a satellite operator, we also sometimes procure low-Earth orbit satellites for technology demonstration. It is a very nice way to launch satellites in orbit to validate our technology concepts. I have been around the whole UK on a road trip figuring out who the best partners are and we have very strong capability in the UK in the small satellite sector.

When it comes to constellation, though, Inmarsat has recently announced a programme called Orchestra with the ambition eventually to have a small constellation of low-Earth orbit satellites. The capability of mass manufacturing is not here yet, so there will be challenges. Unless that infrastructure is available in the UK, there will be challenges over time to address those needs.

Q153 **Chair:** You say those manufacturing capabilities are not here yet. Does that imply that they are in the pipeline, or are you signalling that it would be desirable that they should be?

**Yasrine Ibnyahya:** I am implying that it would be desirable to have that. I am implying as well that, today, we have only one large prime that could address our needs as an operator.

Q154 **Chair:** Which is?

**Yasrine Ibnyahya:** Which is Airbus. Therefore, it would be encouraged to have more diversity of suppliers in the UK because as an operator we like innovation, and innovation is often driven by competition. It is important to have that diversity of suppliers in the UK.

**Chair:** Thank you very much indeed. I will turn to my colleagues. Before I do, I should have asked whether any members had any declarations they wanted to make. Carol Monaghan has one.

**Carol Monaghan:** Thank you, Chair. I would like to refer Members to my register of interests, specifically, that in February 2020, as part of the all-party parliamentary group on space, I visited the OneWeb manufacturing facility in Florida.

**Chair:** Thank you very much, Carol. I do not think any other Member has anything to add, in which case I will go to Graham Stringer.

Q155 **Graham Stringer:** Thank you. Professor, you mentioned the work you were doing with Galileo. Has that been affected by the United Kingdom's decision to leave the EU?

**Professor Sweeting:** Yes, quite dramatically. SSTL manufactured all 34 of the current Galileo payloads, two of which were recently launched. That completed the first operational Galileo constellation configuration. However, due to our withdrawal from the EU, we are not able to bid for the follow-on systems, and, consequently, we are now unable to participate in offering manufacturing of those payloads into the next generation of Galileo.

Q156 **Graham Stringer:** You will have suffered because of that. Do you think



the Galileo project will suffer because of it?

**Professor Sweeting:** I would like to think so because we built up a lot of expertise in the UK in providing those payloads over a 10 or 12-year programme. However, expertise exists in Europe. The impact will be more on timescale and cost. It would have, I am sure, been quicker and more cost-effective if we had been able to continue in the programme. It will introduce that additional cost and time delay within Europe, although they will still manage to do it.

Q157 **Graham Stringer:** Thank you. Where do you think this country is world leading, and are there any areas that we should, or could, become world leading in the satellite industry?

**Professor Sweeting:** There are probably a number of areas where we play very strongly on the world stage. If I had to pick out one or two, the UK launched the first active space debris removal demonstration mission a couple of years ago, which is now addressing a growing problem, and we have seen it in the last couple of weeks with the Russian ASAT test. This is an area where we have developed clear world leadership.

Building on that, the general field of space robotics and autonomous systems is an area where the UK has strengths, and this is going to be a major role and influence on the development of space in the next 10 years.

Q158 **Graham Stringer:** Thank you. Yasmine?

**Yasmine Ibnayahya:** There is a very strong capability in the UK when it comes to payload design. The payloads of the future are smarter. There is a lot of intelligence on board. There is a strong capability in the UK both for the very large spacecraft and the smaller spacecraft. This is something the UK can continue doing really well. The UK, in general, is very good at designing one-off missions, and the engineering capability is very strong. I would encourage continuing that leadership and supporting that.

Q159 **Graham Stringer:** Thank you. Will you briefly explain to me how in-orbit manufacturing works and what the benefits of it are?

**Professor Sweeting:** There will be a stepwise approach, I believe, to this. The first stage will be in-orbit assembly of spacecraft. The advantages of being able to assemble and, later, manufacture spacecraft in orbit means that for the first time we will be free of the constraints of launch. Rather than trying to fold up your satellite, origami-wise, into the small nose cone of the rocket and then shaking it and having to design to survive those first 20 minutes, if in principle we can initially launch payload modules and assemble them into much larger structures that you could fold into the nose cone, that clearly allows us to do a great deal more in space. Subsequently, we can do in-orbit manufacturing—in the simplest terms, launching a 3D printer with the materials and manufacturing your satellite in orbit, which means you are unconstrained



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on the size of the satellite that you could use for a wide range of applications.

Q160 **Graham Stringer:** Are we ahead of the field in this area?

**Professor Sweeting:** I would say we are among the front-runners on developing that and hopefully demonstrating that technology.

Q161 **Graham Stringer:** Yasrine, do you have anything to add?

**Yasrine Ibnyahya:** No, I concur with Martin.

Q162 **Graham Stringer:** How will the UK developing launch sites help the satellite industry in this country?

**Professor Sweeting:** As a satellite manufacturer, I have spent a lot of time procuring launches from all different countries. Having the UK launch will considerably simplify the logistics and hopefully simplify the export processes that go with procuring foreign launches. I hope it would also be more cost-effective.

In reality, the size of the rocket and the economics of the launcher will influence the overall business viability of UK launch. Having a UK launch will certainly make life a great deal easier from the point of view of the manufacturers. Having a sovereign launch for sovereign missions is going to be one of the most important elements.

Q163 **Graham Stringer:** Thank you. Yasrine, is the association between Viasat and Inmarsat a takeover or a merger?

**Yasrine Ibnyahya:** It is an acquisition.

Q164 **Graham Stringer:** It is an acquisition.

**Yasrine Ibnyahya:** Yes.

Q165 **Graham Stringer:** Right. Do you expect it to be called in under the National Security and Investment Act?

**Yasrine Ibnyahya:** It is an acquisition. It is not a hostile acquisition. There are a lot of synergies between the two companies. The intent of the acquisition of Viasat is to leverage our UK presence.

The honest answer to your question is: "I don't know." I have seen that in the public Viasat's ambition is very much to leverage the UK presence in the UK. The deal is ongoing at the moment. All the negotiations are continuing with the Government as we speak.

Q166 **Graham Stringer:** Inmarsat has contracts with the Ministry of Defence, does it not? It might be affected by security. How would you expect it to affect the totality of the satellite industry in this country?

**Yasrine Ibnyahya:** The acquisition of Viasat?

**Graham Stringer:** Yes, the acquisition.



**Yasrine Ibnyahya:** It is a very positive indication that the UK is attracting foreign capital. We are in an era of consolidation now. There are about 55 telecommunications operators around the world, and this first move is an indication that there will be more and more consolidation in a macroeconomic environment, where competition is very strong, particularly with the US. It will strengthen the UK in its R&D activities and in its positioning on the global scale. Inmarsat is the largest operator in the UK and has a global presence. I believe Viasat is very keen on leveraging the engineering and R&D capabilities. It will strengthen the UK's relationship with the Five Eyes countries as well. A lot of positive things can come out of this.

Q167 **Graham Stringer:** In the nature of the space industry and satellites, there is a lot of international collaboration. Would it be better for the UK if there was more concentration on co-operation and collaboration with medium-sized companies in this country?

**Yasrine Ibnyahya:** Having all sizes of companies is very important in a country. When you work with a large operator or a prime satellite manufacturer, you are the catalyst for bringing SMEs' capability to a global market. The combination of the two is very important: supporting the SMEs and the start-ups to come up with agile innovation and high risk taking while the large established primes will give market access, global reach and distribution channels. It is very complementary between the two.

Q168 **Graham Stringer:** Thank you. Professor Sweeting, do you have anything to add?

**Professor Sweeting:** All the big primes are totally dependent on the SME supply chain, so it is critical to ensure that we encourage that supply chain. If we are going to develop, as the space strategy indicates, a national and sovereign space capability, that becomes even more important, and it also send a signal internationally that the UK is an active and capable space nation.

Q169 **Chair:** I want to follow up on one of Graham's questions on in-orbit manufacturing. Sir Martin, what you have said about what is possible to get over the constraint of what can fit in the nose is very interesting. Does that mean that, if we develop this technology and it is successful, the proliferation of small satellites might be left behind and we will be going into a world of very large satellites?

**Professor Sweeting:** It is an interesting question. What we will see is that there are certain applications—for example, space power generation: solar power from orbit—that would require very large structures in orbit.

Some science instruments require very large apertures to look more deeply into the universe and will require large space systems. At the same time however, we will need constellations of multiple satellites to give temporal revisit for Earth-like applications, whether it be communications or Earth observation. Those are probably still best



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carried out by the smaller-scale spacecraft or routine operations. What we will see is moving to the manufacture of both large and small satellites in orbit, and that hopefully will allow us to develop more novel approaches and services.

Q170 **Chair:** I see. On the future of in-orbit manufacturing, do you see that as a set of capabilities that is new and that there might be a race as to who can best supply that, or do you think it is most likely to come from an extension of the activities of existing manufacturers?

**Professor Sweeting:** At the moment, it is just over the horizon for most companies' viewpoints. My view is that this will develop over the next decade, and as it develops it will have a fundamental impact on the way the terrestrial space industry develops, so there will be growing momentum for countries to develop this capability. The UK perhaps has a thought leadership position on this at the moment. If we can build behind that, we stand a very good chance of being up in the frontline as well.

Q171 **Chair:** Specifically, is your own company, Surrey Satellites, investing in this as an expanding area of activity?

**Professor Sweeting:** I should declare I have three jobs, although I only get paid for one. I am the executive chairman of Surrey Satellites, but I am also chairman of the Surrey Space Centre, which is the academic research arm associated with this. I also lead the UK national hub on space robotics and autonomous systems, which is a group of five universities exploring exactly these types of new capabilities through the initial development of robotics for active space debris removal, where the UK is currently in the lead, and then moving on to in-orbit servicing and in-orbit manufacturing and assembly. These are activities that we are collectively—both industry and academia—very strongly joined together in and developing.

**Chair:** Thank you very much indeed.

Q172 **Aaron Bell:** In growing the industry, what support does the UK satellite industry need from the Government, if any, to increase its success?

**Professor Sweeting:** There are probably two key areas. The lowest-cost area is that of regulatory support. The regulatory environment is critical in enabling new ideas to be brought forward quickly and effectively, whether it be for launch, Earth observation or communications services. Having a really responsive regulatory environment that encourages that is one of the most effective.

The second—

Q173 **Aaron Bell:** On that first, are there any particular barriers at the moment that you would want to see removed?

**Professor Sweeting:** It is a rather wide-ranging question. I am not sure there is anything very specific. From my experience, one of the areas that restricts our export is that of a rather lengthy and sometimes



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extremely conservative export policy. Other countries are moving very quickly. Sometimes, we are so worried about export position that we hesitate and other countries move ahead. That is the area that I see personally.

**Aaron Bell:** I interrupted you, so back to you.

**Professor Sweeting:** Money is always helpful. The key point is Government investments in very well-focused and chosen points where there is a potential for market development but the market is not yet ready and industry can take a certain amount of risk but perhaps not the whole risk. Then Government coming in with some key investments at the right point really makes a change. There is a very good example of the previous Science Minister, Lord Sainsbury, who invested a relatively small amount of money that really stimulated the whole of the UK's small satellite Earth observation international collaboration. It was 10% of the total, but it was just that key point that got business up and running and demonstrated to international partners that the UK Government were behind this activity, and then others would join.

Q174 **Aaron Bell:** Thank you. Ms Ibnyahya?

**Yasrine Ibnyahya:** In terms of Government support, there is an element of financing that is very helpful at national level and the European Space Agency. The challenge we are facing as industry is that it would be useful to have multi-year financing programmes. Right now, we are very much limited by yearly support. In the scale of satellite programmes, those programmes are relatively long-term programmes.

The second element is that it would be very helpful to have Governments as the first anchor customer. As an industry, we are happy to take a lot of risks, but if the Government could share those risks with us when it comes to demonstration of capability or bringing new capability in the UK and sharing those risks together, that would be extremely helpful.

Clarity on the national space strategy programme would be very important. It is very good to have a strategy. Now, we need to have more of an implementation plan identifying the budget allocation to deliver this vision and identifying what programmes or initiatives we are going to say "no" to, which is always very hard but is extremely important to identify what not to do to focus on what we want to be the leaders on.

Q175 **Aaron Bell:** We have had some evidence suggesting that there are too many different sources of funding for space-related missions and so on—UKRI, the space agency, the ESA. Is that your companies' experience? Would it be better if there was a single point of contact from where you get public investment for these missions?

**Yasrine Ibnyahya:** There is a European Space Agency. The UK injects a lot of capital through it. ESA is playing a very strong role in co-ordinating those global programmes with the rest of the European industry. That is



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extremely helpful because we do not have all the capabilities to do all the programmes in the UK.

It is important now to focus on the national programmes as well and co-ordinate that. As you said, there is the National Space Council. The Civil Aviation Authority are now in charge of launchers and space debris management. There are the UKRI, UKSA and MOD defence initiatives as well. It needs to be centralised to a certain extent. We see that working really well in other countries. The National Centre for Space Studies in France and DLR in Germany are much more centralised, and it is proving to work really well.

**Professor Sweeting:** I agree. There is a plethora of avenues, and sometimes that is rather confusing. Any one of those is perhaps not big enough to help industry move in a certain direction.

I agree with Yasrine, but with one other observation. The other side of that coin is that by having different pockets of funding you do not get group-think in a certain direction. If EPSRC, NERC or ARIA come up with an idea and they want to follow it, that might stimulate something.

We have to be streamlining it so that it is not quite so confusing and time-consuming for industry and academia to find the funding, but I would be very careful to make sure we do not end up with something that ends up with a group-think approach and we miss some of the more exciting innovations.

Q176 **Aaron Bell:** I was struck by your answer earlier that the lack of funding has stimulated innovation in the past. Our total public investment into space is less than a half of Germany's and less than a third of France's. You said earlier that it was all about investing the right amount at the right time. Do you think we need to be investing more in total across the sector, or are we leveraging private investment more effectively in the UK?

**Professor Sweeting:** I am always aware that my earlier comment is a dangerous one because politicians can leap on that and say, "Well, in that case, let us give you less." Industry needs to be hungry but not starving. That is also a relative to what is happening in the wider international space scene. The UK needs to make sure that we have in total a larger investment in space. That can be in the utilisation of space. Yasrine also mentioned that Government play an important role as a user of space from industry and an anchor tenant in some cases. I would vote for more expenditure on space, but it needs to be focused rather carefully to get innovation.

Q177 **Aaron Bell:** Do you want to add anything, Yasrine?

**Yasrine Ibnyahya:** The UK is very good at attracting private investment. I think it is second behind the US at attracting private investment in space, so that is a very positive message. As we all said, the ranking of the UK on the global scale in general when it comes to



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space investment is way behind the US and China. European countries and the European Commission in general are also injecting a lot of capital in space. There is a balance to be found between stimulating private investment, which usually comes once the technology is demonstrated, and that is where the UK, with its national support, will unlock those technology demonstrators for the industry and private financing to step in to bring that to a global scale.

Q178 **Aaron Bell:** Thank you. You both represent quite large companies. What support can be given either by your companies or by the Government to ensure that smaller companies and start-ups are given the chance to grow in this area and contribute to the growth of the industry?

**Yasrine Ibnyahya:** I work a lot with start-ups because of the nature of my job, which is bringing breakthrough innovation into the company. As an industry, we work through mentoring; we collaborate with accelerators—Seraphim being one of them; we provide a lot of mentoring and a lot of access to our facilities for them to do testing, etc. When it comes to financial support, there is a valley of death. Once they have had their seed money and they need to scale up, there is a bit of a challenge there. Perhaps the Government could be invited to welcome more investment firms to find ways of giving access to financing those start-ups so that they can grow, and we, as an industry, will take the responsibility to bring them that global market access and export capability that they by themselves cannot have.

**Professor Sweeting:** From SSTL, we have spun out five new, even smaller SMEs that have now picked up some of the ideas, and, where they see a new market and new opportunity there, they are responding to that. That is one area where, in a way, we can help try to stimulate that SME market.

The other one is in the supply chain where we are reliant on services, components and facilities; our activity, I hope, stimulates those SMEs to focus on that.

One of the real opportunities for SMEs is in the applications sector because that is a relatively quick and easy thing to start up with relatively low capital investment. New ideas for new services can stimulate an SME, and they can bring up working alongside the hardware that we produce.

Q179 **Carol Monaghan:** Yasrine, could you tell us more about the valley of death? What happens to small start-ups when they hit this barrier? Do they disappear, or are they getting funding from other countries?

**Yasrine Ibnyahya:** Both. Very often, what is amazing for a lot of the start-ups is that they get, at the beginning, a lot of support with Innovate UK grants, and that gets them started. Then they get to more angel investments and initial venture capital money. Then, sometimes they run out of cash and disappear, or they will try to get foreign investment, as



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you said. There is a wider venture capital ecosystem around the globe—a lot of it is based in the US—that is investing into UK companies today.

Q180 **Carol Monaghan:** There is US investment into the UK. Are any other countries significant?

**Yasrine Ibnyahya:** Europe has some large investors. Israel has a lot of capabilities as well. We see hubs of innovation.

Q181 **Carol Monaghan:** I am wondering more about countries like China and Russia.

**Yasrine Ibnyahya:** NASA's budget in the US is \$22 billion. China's budget is \$11 billion. Russia is just behind. Those countries are heavily injecting capital.

Q182 **Carol Monaghan:** Is that into UK companies as well?

**Yasrine Ibnyahya:** US, yes. I do not know about Russia and China.

**Carol Monaghan:** You do not know. Thank you.

Q183 **Chair:** Thank you, Carol. Can I follow up on the early answer that Sir Martin gave to Aaron about export policy? You said that a conservative export policy was a barrier. Could you illustrate how that is holding back exports?

**Professor Sweeting:** There are two components to it. One is that the export sensitivity barrier is perhaps overcautious. Other countries are moving very quickly.

Q184 **Chair:** Exports of what to where? Give us an example.

**Professor Sweeting:** Its satellites to developing countries and some developed countries. For example, we are looking at exports to Egypt, Indonesia, the Philippines, China and Russia. Each of those has different levels of sensitivity. Sometimes, I feel we take an overly cautious approach because the capabilities that exist in those countries, or the threats that they represent, are taken rather over-cautiously.

Q185 **Chair:** Give us an insight into what happens. You have to apply to the Department for International Trade, presumably, for an export licence for these technologies. How long does that take? What discussions happen?

**Professor Sweeting:** Typically, we do a soft sounding first to say, "We want to do this. Is this particular country and this particular export likely to be sensitive?" If it is, we submit a more detailed account. The two issues are that it takes sometimes a very long time to get a—

Q186 **Chair:** For example?

**Professor Sweeting:** One example—and this is one I know that is very contentious—is where we had a repeat contract with Russia for a system that we had provided over the last 10 years, and they just wanted an



additional one. We submitted a letter requesting a formal decision this time last year, and I still have not received it.

Q187 **Chair:** One could understand these sensitivities in Russia. Are there other countries that are less problematic than Russia where these frustrations apply?

**Professor Sweeting:** As I mentioned, Egypt is another area that is not perhaps a very easy decision to make where that has taken quite a long time and taken a lot of effort. There are opportunities in China where it could be very good business for the UK, and we have to be very careful what we sell to them. When we look at their capabilities and why they want to buy from us, we need to take sometimes a slightly more enlightened view. These exports provide us with an opportunity to present our way of responsible behaviour in space. It opens channels where we can not only deliver the contracts but also have insight into what those countries are doing and have some degree of influence in putting forward our views of how space should be executed.

Q188 **Chair:** I see. Clearly, that is a calibration of national security for some particular countries. Are exports to countries that do not engage with national security concerns straightforward?

**Professor Sweeting:** That is much more straightforward. I have to say that the Ministries are quite responsive, although it takes some time for it to go round all the various tick boxes in Ministries. A number of the developing countries are working on a tempo that is more aligned to new space where they want to put out an RFP and they want a response in four weeks. Export licences do not tend to work on that timescale yet.

Q189 **Chair:** In your experience, is the slowness of that out of a concern that you could export to a benign country and they may then sell it on to a country that would have been prohibited? Is that the reason for it?

**Professor Sweeting:** I am sure that is part of the calculus. It is quite clear that there are some countries where we would be very comfortable and others where we would have concerns about what that might lead to. I fully recognise that some of these decisions are not very easy, particularly when you have to take into account the inputs from different Departments—MOD, FCDO and so forth. This whole process can take rather a long time. The world now in space is moving at a much faster tempo, so that is becoming an issue.

Q190 **Graham Stringer:** From your businesses' perspective, you obviously want a "yes", but would a quick "no" be better than being kept waiting for 12 or 18 months? When you are not kept waiting, does the Department keep in touch with you and tell you of any progress that is being made or ask for further information?

**Professor Sweeting:** A quick "no" providing it has been thoroughly explored. A quick "no" is an easy answer.



**Graham Stringer:** Yes.

**Professor Sweeting:** If you have a difficult country, it is much easier to say “no” rather than to engage and say, “What are the real risks and benefits?” Being able to have a more intimate discussion on those risks, benefits and concerns with industry would help to lead more rapidly to a “no” or a “yes”, and that would be very helpful. At the moment, the formal responses are very lengthy, but we have good informal links into the Departments. They are very helpful, but those are only informal, and it takes time for the formal mechanism to make its way.

Q191 **Chair:** Sir Martin, you are very well versed in the industry internationally. How do these delays compare to other like-minded countries? Do your counterparts in the US have a similar frustration, or are things done more rapidly there?

**Professor Sweeting:** I am sure they have a similar frustration. One might argue it could be even worse. Their internal market is so great that they are not so dependent on exports. For the UK, our internal market is relatively small, and it is the external international market that provides us with the greatest opportunities.

Q192 **Chair:** I see. Ms Ibnyahya was nodding at that. I assume you share that analysis.

**Yasrine Ibnyahya:** Yes, I agree with a lot of the things that have been said. Inmarsat generated \$1.3 billion this year, and 92% of it was export. The UK market is not large enough for the UK industry, so we have to go global to grow.

**Chair:** I understand. Thank you.

Q193 **Rebecca Long Bailey:** You both spoke earlier about the need for the balance of Government and private investment to be just right, but we know that compared with other EU space nations Government investment is lagging far behind. How do you think the UK should balance its involvement in European Space Agency programmes with direct funding for UK-based programmes?

**Yasrine Ibnyahya:** The European Space Agency programmes in which the UK is involved brings a lot of returns to the UK. It allows ESA to co-ordinate a relationship with the rest of the member states, and it brings the UK industry as a strong leader within the whole global Europe. That is very valuable. The UK is just behind France, Germany and Italy in investments, so that is very powerful.

When it comes to national programmes, as I mentioned earlier, we also need to find that balance, particularly in the post-Brexit environment. We have lost opportunities in the Copernicus programme and the Galileo programme, and therefore there needs to be a shift to creating alliances with other countries. The UK has pushed for a relationship with the US, Australia and Japan—and this needs to continue—and has used



Government-led initiatives as an anchor, customer-first customer, and is injecting capital in the UK to demonstrate capability for the benefit of the UK. It has to be a balanced distribution of funds. I would definitely keep the investment in the European Space Agency but grow the other budgets to be more balanced.

**Professor Sweeting:** I fully agree. I would only add that national programmes strengthen the UK's ability to play a fuller and more important role in ESA. If we do not have national programmes, we will be much weaker in bidding into the ESA programmes. It is now even more important that we have that balance. How you make that balance is difficult, but we need to make sure that we have an active national programme to provide the capability for us then to participate fully in the ESA programmes and get the best value for our investment back into ESA.

Q194 **Rebecca Long Bailey:** Thank you, Sir Martin. How will the new National Satellite Test Facility benefit the UK satellite manufacturing industry?

**Professor Sweeting:** It is a very welcome move. Having that test capability means that there is a one-stop shop for industry to be able to go to these test facilities. The test facilities are very expensive to implement, so it is not practical for every industry player to have their own. Having a central capability is important. One industry does not need to have one of those and use it every day, so having a central one makes a great deal of sense. Having a really modern test facility will simulate and help industry to be competitive in the UK.

**Yasrine Ibnyahya:** I totally concur. It is very important to have those facilities and share them among different satellite manufacturers, and that, for me, is also one step to enable new players to come into the country and share access to those facilities, so it is very welcome for innovation and diversity of supplier.

Q195 **Rebecca Long Bailey:** You both mentioned problems with the UK manufacturing supply chain. I am sure we all agree with the points that you raised. Are there any specific asks you would make of Government to support the growth of that supply chain?

**Yasrine Ibnyahya:** Diversity of supplier for a large geostationary station operator. We would definitely encourage good diversity in small satellite manufacture, perhaps less in the larger, because we are the biggest investors in the UK when it comes to procuring satellites, so we would like to see more choice.

**Professor Sweeting:** I agree, but the only thing I would add, which is a little to one side of that, is that one of the key constraints at the moment is skilled personnel. That affects both the SMEs and the larger players. As the whole space economy grows, our skill base is not growing at the same rate. Inevitably, there is a five or 10-year time lag in education



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before that new workforce comes through. That is certainly at the moment constraining the rate of growth.

**Rebecca Long Bailey:** Thank you both.

**Chair:** Thank you, Rebecca. That take us neatly to Carol Monaghan, who has some questions on skills.

Q196 **Carol Monaghan:** I will start with Sir Martin since you have moved on to skills because I would like to talk a bit more about this. You are talking about the challenge of finding people with the right skills. What exactly are you looking for in an individual who is coming to work in the space industry?

**Professor Sweeting:** That is an interesting question. When we recruit people into my company, I look for two things: first of all, a threshold of education. They need to understand the basics of the science and technology associated with space.

Q197 **Carol Monaghan:** Are we talking about a STEM degree?

**Professor Sweeting:** Yes. The next thing is their personal interest. If you have somebody who is really excited and stimulated by the job that you are offering, that is one of the most important things to my mind. Of course, they have to have that basic level of STEM capability, and, currently, we are finding it difficult to attract those sorts of people. It is made worse, unfortunately, by not being a member of the European Union.

Q198 **Carol Monaghan:** Yasrine, could I ask you the same question?

**Yasrine Ibnyahya:** That is a very good question. We care about skills because skills are the people who are bringing the engine of innovation. What we look for is diversity of thought—cognitive diversity—and we want to recruit from a wide range of profiles. We are struggling—not just the space industry, but the tech industry as well. There is a real shortage of people joining the industry.

We are also struggling in the sense that the big primes are not as attractive as they might have been in the past because the start-ups and the SMEs are becoming more attractive for a particular generation of young graduates. The work around that is basically to have graduate programmes within the company where we rotate them within different functions. We make sure they have the right fundamentals and the right knowledge in science and technology.

Q199 **Carol Monaghan:** What are you looking for? For example, if you have a graduate, do you need a data science degree or a programming degree? What is it you are after?

**Yasrine Ibnyahya:** Today, there is a shortage of software people, in computer science, artificial intelligence, data science and cyber-security. Those are the domains we have the most struggles with. We would invite



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graduates from universities that have those centres of expertise. Those who are more passionate about space but have more of an RF background will learn on the job through rotations. Because of their passion and education level, they will adapt and learn on the role. Even if I give you a list of skillsets today, I am pretty sure in five years we will be looking for completely different skills, so we need to have our staff continuously adapting.

**Q200 Carol Monaghan:** Both of you have talked about good practice in the industry. You take people with some knowledge and enthusiasm and you offer them some training. What we are hearing—certainly in evidence that has been given to us—is that it is very difficult for companies to recruit. There is poaching among different groups. There is not enough new talent coming in. Is industry doing enough to exploit the potential of young graduates who do not have the exact match of skills that you would be looking for?

**Yasrine Ibnyahya:** All your points are absolutely right. There is a shortage. We need to attract them more. There is a lot of work trying to make space more attractive to sectors and university programmes that are not necessarily familiar with space. We need to continue doing that within universities, within industry and within support from Government. A lot of initiatives are happening around that. It is absolutely a problem. It takes us six to nine months to find the right talent, and then fall back on a scenario where we say maybe we should upskill our people because we cannot bring in a large enough pipeline of talents within our sector and the company.

**Q201 Carol Monaghan:** Sir Martin, is industry taking enough responsibility in upskilling? A lot of the evidence was, “Government need to...”, “This has to be provided...”, “Universities should...”. What should industry be doing?

**Professor Sweeting:** I can only speak from my own experience. We have a very active graduate programme. It is very heavily over-subscribed, interestingly. I think we had 150 applicants for what eventually was something like 12 positions in the company for this year.

**Q202 Carol Monaghan:** That does not sound like a skill shortage.

**Professor Sweeting:** That is right at the very beginning of the staff pipeline. That is very good to get them in and then we train them. The skills shortage is in the more experienced people at the moment where we want to bring people in who have some industrial background and some experience. That is where the real skills shortage is at the moment. Bringing young people in at the front end, at the moment, is not so much of the problem, although we have a limited capacity to take on graduates and train them, but that is something we do.

**Q203 Carol Monaghan:** Can I stop you for a second? I did a bit of googling before this session. I looked at some of the jobs that have been offered in the space industry. A lot of jobs have been offered in the space industry



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across the UK, but a lot of them are looking for experience. How does a young person who wants to get into that industry get that experience if they have none?

**Professor Sweeting:** That is always the chicken-and-egg problem in industry. If we are delivering programmes, we need people with experience, but at the same time we need to invest in the young people. That is why we have the graduate programme. The graduate programme takes a couple of years, and then they move in and gain that experience. We move them around the company, as Yasmine mentioned.

The problem, however, is that for that generation they look outside the established industries at the new start-ups that, with venture capital, are offering very attractive packages. We are seeing some evidence that the graduate intake comes in, gets some experience, gets excited, and then they see a really interesting start-up, and at that age they are prepared to take the risk. "I can go and work for them at twice the salary for two years, and if the company folds I can always come back." That is a bit of a risk that we are seeing, and the only way we can counter that is to try to make it so attractive and interesting to work for us that they do not look over the hedge at the greener grass.

Q204 **Carol Monaghan:** Yasmine, is it only graduates who have a role within the space industry? Is there a role for apprentices and technicians—that sort of individual?

**Yasmine Ibnayahya:** We provide apprenticeships as well. This is part of the diversity of thought—having people coming from different backgrounds not having necessarily all gone through the same university master's programme and getting them early on in the company and getting exposure. This is very much welcomed and supported within Inmarsat.

Q205 **Carol Monaghan:** If we had a centre that was for developing skills for youngsters without degrees, what skills would be developed? Where would the centre be? Who would it cater for?

**Yasmine Ibnayahya:** That is a difficult question. It is having basic STEM knowledge—we are back to science, technology, engineering and mathematics—and giving them the foundation so that they can then learn the applied roles on the job. I would particularly focus on those four pillars. Where should it be? I do not know. It can be anywhere. It does not have to be in London. It can be anywhere.

Q206 **Carol Monaghan:** Thank you. Sir Martin, do you want to add anything else?

**Professor Sweeting:** There is a real need for technician-level input in the industry, but, increasingly, the ratio between that and the experienced people with stronger backgrounds is changing. It is still a smaller element, but it is a key one, and one that we do. In my experience, we have people who come in at a technical level, get



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experience and then take degree courses part time to upskill, and that has been quite an attractive thing.

The last point I would like to make is that we do not recruit primarily from a space background. A lot of our recruitment into the company at systems, software and other levels is from the automotive and other industries, not necessarily from the space industry. That sometimes brings with it a rather refreshing view. We encourage applicants from industries outside the space industry.

**Chair:** Thank you very much indeed. This has been a fascinating session, and we could go on much longer, but we have other witnesses whom we need to hear from. Thank you very much indeed for providing such a well-informed overview of the industry perspective. I am very grateful to both witnesses.

### Examination of witnesses

Witnesses: Hina Khan and John Styles.

Q207 **Chair:** As our next panel of witnesses joins us at the table, I will introduce Hina Khan, the senior project manager for Spire Global Limited. Spire operates over 100 CubeSats—small satellites—which I think is the second largest constellation of such satellites, and provides data analysis for maritime, aviation and weather forecasting applications.

John Styles is a director of Assimila, which brings Earth observation data to Government and commercial clients to monitor, understand and predict aspects of the environment.

Both of you are users of satellites and providers of information that goes to other clients across the industry and around the world.

Hina Khan, tell us where the UK is on the applications of the use of satellites and the analysis of its data. How do we compare to other countries?

**Hina Khan:** Thank you very much for inviting me to the panel today. The UK is both a really good user of data and a provider of applications on a global platform. We have a number of assets that we can access both in terms of long-term assets from a European and US base and the ability to do data applications and think about the wider picture of how space and satellite data can be used in our day-to-day life as well as commercial market opportunities. We have the capability to be able to do things like weather monitoring and looking at logistics information.

A number of key sectors—hubs of activity—are in the UK. You have had evidence from Satellite Applications Catapult and things like that where there are key areas where application data from satellite resources to deliver on applications is a key asset for the UK.

It is really interesting to think that, while we talk about satellite technology, manufacturing and launch, all these things are there to



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enable how we use that data and how we benefit from that to make the world that we live in a better place and the resources that people can use to make their lives more economical and valued.

**Q208 Chair:** Thank you. What is on the horizon in uses of data? There are the uses that are practised at the moment, but what excites you in your firm and your industry that might be within grasp shortly?

**Hina Khan:** It is a really interesting question. From our perspective, Spire has a large constellation of satellites that we use in a variety of different ways. Key areas are weather forecasting, aircraft tracking and aviation. Those are only the core elements that we look at. There is a whole host of different applications such as cryptocurrency and blockchain applications looking at security.

**Q209 Chair:** How does blockchain relate to satellites?

**Hina Khan:** It is the cryptology of that—looking at the cryptocurrency, the security aspect of using a space-based asset to be able to monitor and access currency on a global platform. Whereas previously you would use the internet or LAN-based uses to transfer currencies and banking transactions across the globe, you can use that on a space-based system. We have worked with organisations that have deployed software on a constellation and then used the technology to make a secure transaction over a satellite network, which is more secure than a terrestrial environment. It means that it is encrypted from source to the transaction.

**Q210 Chair:** That is fascinating. Thank you very much indeed.

Perhaps I could turn to Mr Styles now. What do you see as the applications and uses on the horizon that are most interesting? Will you say a bit about the current work of Assimila and the services that you provide to clients?

**John Styles:** Thank you. We have heard a lot about a lot of different applications of satellite technology. The list is very long. From our experience, we work with Earth observation satellite data, processing that data and integrating it with other kinds of data into models to monitor and to predict the environment.

The data that we use includes a lot of world weather data. It is an important point to note. It is not always appreciated when we look at the weather forecast that a huge amount of satellite data goes into generating and improving the quality of those weather forecasts.

We take satellite data alongside weather data, we integrate it with models, and we use that to predict in areas mostly of agriculture and agricultural production risk. We work in integrating data that helps us to model the health and the growth of crops, enabling us, ultimately, to predict crop yields. We look in the area of agricultural risk, particularly in the area of pests and diseases and other risks to crops, to work in a



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predictive mode to try to help advise farmers how they can maximise their yields and how they can reduce the risk of yield losses from their crops. That is the area that we are mostly working on.

You asked about strengths. We build on a tremendous academic heritage in the UK of quantitative use of Earth observation data using physics, maths and modelling techniques. We are building upon that.

Where I see it going in the future is the convergence of vast amounts of new data that is freely and openly available with high-performance computing, allowing us to derive models that are more predictive on smaller spatial scales so that we can provide information to people—farmers on the farm and field scale, populations in cities being affected by climate change, looking at the way in which the environment works on a small scale, and then, importantly, being able to integrate with models to predict that and to allow people to take action.

**Q211 Carol Monaghan:** Hina, you talked about the use of satellites for blockchain, cryptocurrency and that sort of thing. The UK has certain skills and expertise in this area. Are we marrying the skills in the UK with your use of those skills in your satellite constellations?

**Hina Khan:** Yes, absolutely. That is really critical for us. We heard in the last session the panellist talking about the skills environment that we need to think about more carefully and how we make best use of that, both the skills coming through of graduates and the existing skills within our own organisations and within the sector. What is interesting for us is that while we have the need to have those experienced skillsets—the four to five years after three years' experience within the industry—that does not necessarily preclude us from looking outwith the space environment for those skills.

It is bringing in the expertise from other areas like oil and gas where there is a high crossover between the skills in that sector from not just the technology but the risk environment, the manufacturing and the areas that are needed in a high-end industry to develop robust technologies. Once you have an asset and it is in space, you cannot go back and fix it. You have to make sure that it is robust and reliable enough the very first time you do it. It is very similar in some ways to the offshore industries where they have to make sure that these processes and the technology is robust to be able to do that. We look at these other sectors and we try to bring in that talent, as and how applicable.

When we talk about very specific applications, generally, we are working with partners to do that. We work with people who already have that capability. We work with them in a collaborative partnership to make that asset a reality for them in a space environment and then help them to access the information.

**Q212 Carol Monaghan:** Do you deal more with the hardware—the satellites—and your partners deal with the data analysis?



**Hina Khan:** In some instances, but Spire have the end-to-end capability to do both the technology development—payload design, the hardware and in-orbit application—and the data processing. Our business is to take the data and to provide it in a useful manner to our customers and market sectors.

Some of that requires us to develop the technology in-house, so we have done that and built an infrastructure to be able to deliver on that. It is on that application.

There are other aspects where partners are not really interested in the technology. They have an application, they have a need and they have a market that they would like to get into, and they do not want to have to go through the pain of developing a constellation and access to datasets and ground station networks, so we work with them because we have that already in place and are able to provide them with essentially an API-type access to what their value is, which is the datastream into that environment.

Q213 **Carol Monaghan:** Thank you. John, do you feel you are able to marry up different types of skills—for example, in AI—with what you are doing in space data?

**John Styles:** It was mentioned in the previous evidence that we often struggle to get the right skills. We have a highly skilled workforce. We tend to emphasise in our recruiting strong quantitative skills—maths and physics—and we recruit more from environmental science for the purposes of our business than from what you might call the space industry. We aim for strong analytic and maths skills because we think we can teach some of the rest of it.

It is an issue to attract and retain the right skills. As has been mentioned, as an industry, we have to think beyond just the confines of recruiting people into a space industry and more into a bigger end-to-end industry that takes data that is received from a satellite and turns it into useful information. We need all kinds of skills in that sector. We are managing, but it is a constant battle.

Q214 **Carol Monaghan:** Thank you. If I could change lines slightly, we are talking about vast amounts of data and a whole variety of different applications. Are the Government good at enabling the sharing of data? Is that the Government's job? Where do the Government sit in that? Are we good enough at sharing data that is collected?

**John Styles:** There has been a lot of progress over the past few years. I mentioned at the beginning that we use data from a lot of sources. We use a lot of meteorological data and we use data from maps. Both the Met Office and the Ordnance Survey have taken big strides over the past years to open up their datasets. In doing that, it greatly increases the value of the end product and the economic benefit to the country by



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making access to those datasets more straightforward and more cost-effective.

There is a lot of space data that is openly accessible. Much of it comes from the Copernicus programme, and that has been a game-changing advance in the availability of open data. We are going in the right direction. The Government have always supported, at least in our discussions regarding Copernicus, the open data policy of Copernicus. That has been an important thing. Most of the applications that we deliver could not function without access to the datasets that I have mentioned.

Q215 **Carol Monaghan:** If I could change topic again slightly, some of the evidence we have heard has been on the disjointed nature of the space strategy trying to do too many different things. Should the UK be concentrating on one thing? For example, should we be an expert in space data analysis, or should we continue to try to do spaceports, launch, constellations, and so on?

**John Styles:** You will get a different answer on what the focus should be depending on the person you ask and their background. The fact of the matter is the space industry covers a very wide range of different applications, uses and technology all the way from satellite navigation, communications, and Earth observation. It will be very hard to say we are just going to concentrate on one of those things. It will be a difficult thing to do. All of them have benefits to the UK. Even within the domain of Earth observation, there is a wide range of applications. I would not say, "Just pick one of them."

Q216 **Carol Monaghan:** Is there not a danger that we spread ourselves too thinly?

**John Styles:** We do. It has been mentioned already that the investment the UK makes is a lot smaller than many other comparable countries. We could increase the thickness of the spread by increasing the size of the pot we were spreading from.

Q217 **Carol Monaghan:** Thank you. Hina, I will change the question slightly, but you have heard John's answer. If we have all these different competing or collaborating sectors within space, who is going to take the lead in the UK's space strategy?

**Hina Khan:** That is an interesting question, turning it on its head a little bit. I agree with Jon, but I would be slightly more pointed in my response. We need to think about where the UK has real strengths. There are a number of aspects we can talk about. There has been a lot of discussion in both this Committee and the sector of launch and infrastructure and the need to build up our space infrastructure. Do not get me wrong: those things are very valuable in providing that avenue for growth within the space sector.



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However, the UK has real strength on the data side and we could become a real leader in key areas if we focused our attention a little bit more. Jon mentioned the weather side as a key area, and there is a host of open source data that is available, accessible and ingested by the Met Office, but you also have this new space industry Sir Martin talked about where Spire sits. That is a slightly different data resource, but it is equally as important as the other assets we access—weather and other applications.

We have within the UK that nascent technology and data resource that can be leveraged to provide a more robust and global forecasting model for weather in areas of the world that do not necessarily have access to met centres and suchlike. We have an opportunity to capitalise on things that are quite unique to the way we are in the UK.

I also want to talk about the previous point on the funding and resource that Government might have. Clearly, available data is great and it is important that that continues to be the case, but within the UK we have other available data resources that could be used as a method to allow academics, researchers and agencies to add value to their models.

**Q218 Carol Monaghan:** What sort of data?

**Hina Khan:** For example, on the weather side we have small satellites or commercial entities that are gathering that data on a commercial basis, but of equal importance is that going into the met centres.

Getting into those Government agencies can be quite difficult for a commercial entity, so having Government backing or support is quite important. We have seen that in other countries. In the US, there is almost a procurement programme that allows commercial entities to be able to provide their data into a pot that is accessible to researchers and agencies to look at the value of that data.

**Q219 Aaron Bell:** Mr Styles, in the written evidence this inquiry has received, a number of stakeholders stated that the Government need to do more to support the scale-up of SMEs. What has been your experience so far, and what do you think the Government may need to do to ensure that companies like yours continue to grow?

**Jon Styles:** We have been in business for 14 years and have done well. We have grown. We have benefited from a number of programmes through Innovate UK and the UK Space Agency, but we have always been careful not to depend on them. The programmes that have been running have been successful and contributed to growth.

Alongside that, primarily we want to address a market, not collect a subsidy. We would like to see a market we can sell into. We would like to see increased adoption of the use of Earth observation technologies and services within government for use within the territory of the UK and to provide information and intelligence globally.



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The primary thing is that we would like to see a stronger domestic market we can sell our services into rather than receive a grant only to develop some technology.

**Q220 Aaron Bell:** But you would expect the customers in that market to be mostly the public sector.

**Jon Styles:** Not entirely. Traditionally, that has been the case, but increasingly we see customers coming to us for information—for example, on agriculture risk and climate risk—and they are not the public sector. There are public sector interests in the realm of food security and development, but there are also interests from investors, for example, in potentially new agricultural projects, or farms coming to us for information on how the changing climate will affect their investment, or what the risk will be to their investment. As has been mentioned before, having an anchor tenancy and strong domestic market is important for us to build on, as well as to go outside.

**Q221 Aaron Bell:** You say that you are determined to make sure that everything is commercially viable. We had the same experience when we spoke to the launch sector before. There were people reliant on Government grants and people who were determined not to have them and wanted to be commercially viable themselves. Is it your preference that everything always works with the market, as you say?

**Jon Styles:** It is a preference. I would not downplay the role that grants, funding and R&D programmes have played and we have benefited greatly from them, but, to follow through, ultimately you must have somebody to sell to, and our company has been very careful not to depend upon only R&D support and make sure we are developing products that people want to buy.

**Q222 Aaron Bell:** I put a similar question to Dr Khan and Spire. What support have you had from Government programmes in the past? Could the Government be doing more, or are you relatively comfortable with where we are on funding in particular?

**Hina Khan:** Probably the view overall is that the Government can always do more. I think the question is what we have taken.

Spire specifically has had some funding through the UK Space Agency that has come through access to the European Space Agency technical programmes. These are co-funded opportunities where we have worked in partnership with the technical teams at the European Space Agency to develop new capabilities and demonstrate the reliability of service that Spire has to offer.

We have been able to develop a number of key and critical technologies on orbit. I mentioned the Met Office. The data analysis study was done through the support of the UK Space Agency and the European Space Agency. We were able to provide data for the UK Met Office to try to ingest into its weather forecasting model. That has now resulted in a data



buy through ECMWF, NOAA and other agencies across the world that now recognise the value of having this slightly different dataset through small satellites in their forecasting models, but it is also about being able to develop new technologies in space. Jon has mentioned high-performance computing. We have developed that capability on orbit, and that is now also being used from a commercial standpoint.

We have found that working with Governments and the funding aspect that you mentioned gives us a lever to access markets and customer points that we are looking to leverage. The technology has stemmed from our understanding of where the market is going and we have underpinned that through the support of UK and national funding opportunities to get the kind of tech demonstrator model up to the point of production, and now it is being used in the open market.

**Q223 Aaron Bell:** I know that you were listening earlier to Professor Sweeting. That was the point that he made. It is about the right investment at the right time for it to be commercially viable.

Both of the companies you represent have received funding from the UK-Australia space bridge. Are you able to talk us through what that funding was for, and do you think international agreements like this could be used more to leverage further funding or collaborations?

**Hina Khan:** Absolutely. That has been a really interesting partnership and was mentioned in the previous evidence session. Given the changes in our international programmes with leaving the EU, we have to start thinking about these other partnerships, of which the UK-Australia space bridge was one. Our part in that programme is partnering with other UK entities, the British Antarctic Survey and others, where Spire is providing a data resource. I believe it is looking at Antarctic sea ice monitoring. My research colleagues are doing that. We are providing data from our constellation as another resource on top of their freely available data to understand the depletion of sea ice and the monitoring of that. It is an important study when we think of that aspect of the challenges on climate.

**Jon Styles:** We have recently started a project under the space bridge. Our project is related to collaboration and the pooling of resources on CalVal, which is the calibration of instruments on satellites and the validation of products that come from that. That picks up another UK strength that may not have been mentioned. We have a particularly strong track record and capabilities in high-fidelity Earth observations, with the capability to generate measurements of extremely high quality that are well calibrated and characterised in terms of their errors. We are building on that capability in the UK and collaborating with Australia. We have plans in the UK for the TRUTHS mission, which I am sure has been mentioned in evidence before. Australia is planning a similar mission.

**Q224 Aaron Bell:** Are you collaborating directly with Australian companies on this project?



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**Jon Styles:** We are working with one Australian private sector company and a couple of Australian public sector organisations.

Q225 **Aaron Bell:** Obviously, you would welcome similar international collaboration.

**Jon Styles:** Yes, it is important. There have been a few good bilaterals between the UK and other countries in the past, but there have not been very many. Other countries may have had more of them. I think it is another string to the bow, alongside the multilateral collaboration that we have through the European Space Agency to be able to focus on particular areas. This is a particular area of UK strength.

Q226 **Chair:** You will have heard Sir Martin talking about the export control regime for manufactured goods. You are in the services business. Do you find any restrictions on your ability to supply particular countries?

**Jon Styles:** So far not. Most of our products are in services in the realms of environment, climate change and agriculture, and so far we have not suffered from that.

**Hina Khan:** Some of our applications, industries and areas of expertise are in manufacturing, so obviously we do build part of our satellites. All of that global technology development is done here in the UK, but we do have supply chains and get components from other entities.

Spire works in a global environment and has offices in the US as well as across Europe, so there is a little cross-collaboration in technology and hardware. Exports cover both the ideas and the technology, so we need to be a bit careful about how we manage those resources.

Internally, we have set up export control systems. It also depends upon on what the application is. Some of the work we do is on inter-satellite capability, looking at optical length, and we have some military applications within the US domain. Those need to be carefully contained and thought about. It is definitely something we are aware of and we do need to continue it.

Q227 **Chair:** Have you experienced any of the frustrations that Sir Martin described?

**Hina Khan:** Not in that sense, because all of our satellites are Spire-owned assets, so we are not selling assets to any of our customers. What we are selling is a service. We sell access to that platform, but all of the asset is owned either within the UK or the Spire entity as a whole.

Q228 **Chair:** I am particularly interested in the selling of services That is not a field in which either of you has experienced any difficulties.

**Hina Khan:** Not that I am aware of. I may not have full visibility of it, but all of our services are accessible through an API, so generally it is all done remotely and via the Cloud. I am not aware that there have been any difficulties.



Q229 **Rebecca Long Bailey:** To go back to skills, the Space Skills Alliance identified that the space industry is struggling to recruit employees with the correct tech-based skills. What skills are you struggling to recruit at the moment?

**Hina Khan:** This is an ongoing question. The comments of the previous panel were interesting. When you look at the numbers, the university intake and university students coming out, we have the skills coming through. When you look at the output even in STEM-related subjects but also the other softer skillsets in our sector—management and other aspects of administration, all of which are relevant—we are getting that skillset coming out, so the blockage is not necessarily at that end of the scale, as Professor Sweeting said; it is a little bit further in.

I think that part of the reason for that is that some of the proposals in the funding applications that we go through from various different entities are very short term. You have maybe a year or 18 months to be able to sign a contract and deliver on it, so you do not necessarily have time within that to upskill new graduates coming through and deliver something, hence the reason we need people who have a little bit of experience in that.

There is a gap there. How we resolve that is an ongoing issue. We look at skills that are outside our domain, and we look at a global intake; we are not looking at just the UK. Our recruitment is on a global scale. We have employees from the US and across Europe. There are challenges in that given the changes to conditions under EU regulations, but those are just things we manage.

There is still a skills asset. It is not just technical skills. We do recruit for technical skills in some roles, but equally we are looking for people who have a business background, sales experience and transferable skills from other sectors. We look at a wide remit and they are not all tech-based in that area.

**Jon Styles:** I would concur with what has been said. We do manage. We recruit staff, but it can take a long time. Typically, we are looking more in the environmental science field for people with strong quantitative skills, maths and physics, along with a real interest and passion for the environment. That is sometimes a difficult niche to fill. Most of what we do is quite complicated quantitative maths and modelling. We are a long way away from the path of observation, which is just pictures of the earth; probably the same is true of Dr Khan's business. It is not traditionally what you would necessarily think of. We are using a lot of maths, physics and modelling to tease out information.

It is long and difficult and sometimes takes us a long time to recruit, but we have a complement of staff. Sometimes it is difficult to compete, especially in the areas of computer and data science. There are much bigger salaries on offer in financial services that we cannot compete with,



but we can compete in a different way by providing a fulfilling and worthwhile career.

**Q230 Rebecca Long Bailey:** You mentioned the risk that people who have been trained within the sector could be lured into other sectors, particularly because of short-term contracts that Dr Khan mentioned. What do you think the Government can do to support you and retain staff who will have received a high level of training once they get to your company?

**Hina Khan:** One of the things we do—I mentioned this in my previous statement—is work with universities through their doctoral training centres. This is the high academic end of the spectrum where students are coming in. We look at the programmes they have in place and the needs we have as an industry and help them develop the structures and training they are putting in place within their doctoral training centres. We are involved in a number of them on the data science side to make sure that the people coming out have that.

Although some of the funding opportunities are short-term contracts, we as a company do not employ people for that short period of time. My point was on the delivery side of it. We have to deliver in that timeline. We do not recruit for just an 18-month contract as a company.

You are right. We need to think of ways of retaining staff. Generally, once we have staff as part of our organisation we try to ensure that their career path is mapped so they have the ability to try other areas. There was a comment this morning about apprenticeships. We have had 16 and 17-year-old apprentices coming through. They have now moved into a number of different domains within our business. They are well-established in their career path. We try to make sure we support those individuals' needs and that there is value for them in the company as they grow as individuals.

**Jon Styles:** Retention is an interesting and good question. At the beginning of the chain, things are not too bad. We co-operate and work with the space agency and universities in providing some training and job experience opportunities for graduates. The space agency runs a very successful internship scheme. It is a great programme. We have had an intern every year for at least the past six or seven years. That has provided not just good experience for the interns but, generally speaking, we have a great experience as well. We find that people at that level, even with relatively little experience, can make a good contribution to our business.

The long-term stability of funding is important, especially for a small company. This will probably be repeated in every sector, but end-of-financial year cliff-edge funding is a very difficult thing to deal with, especially for a small company. You need longer-term stability or funding to allow us to grow and give us confidence to grow, because when you



grow you can offer more opportunities and give people a reason for staying rather than a reason for leaving.

**Q231 Rebecca Long Bailey:** On diversity, I believe the Royal Astronomical Society said that the space sector was unfortunately overwhelmingly male and white. How do your companies ensure that you have a diverse workforce, and what can the Government do to ensure that we see more diversity within the sector?

**Jon Styles:** It is true. You can go to a conference or big meeting and you will see that. If you are talking about gender balance, I have been a minority for most of my career. It is probably not typical. We have been lucky in our company to have very strong role models. One of the founders of the company provided a role model not just within the company but for women in the space sector to see how they can grow and progress.

From our point of view—I can speak only for us—we focus on competency and skills in the wider sense. As I said, we may be atypical, but over the years generally there have been at least as many, if not more, women as men in the company. We focus on capability, skills and the breadth of what the space industry really means.

I know that in attracting new entrants to the space industry a fair amount of emphasis in the marketing is understandably put on space, rockets and astronauts. I can understand why—it sounds exciting and draws people in—but statistically they are quite a small part of it. Only about 20% of employment in the space industry is in manufacturing; most of it lies in other places. Therefore, broadening the advertising appeal, if you like, to show what it means to work in the space sector might be helpful.

**Hina Khan:** Diversity is a key issue. I am pleased to say that Spire has diversification throughout the whole company, right from C level down to manufacturing and technicians, but that is not generally what you see.

It is difficult. When you go to events and activities there are women and diverse ethnic minorities in the sector, so it is a matter of ensuring they are drawn out into the exposé of the community and sector as a whole. It is frustrating when I go to events. They are not necessarily women, but there are key role models within our community who are not necessarily being identified and brought to the stage in the same way as others are.

What the Government can do to help to resolve some of that is important. I do a lot of work in schools as a STEM ambassador. Girls are very excited about being in space and technology. It is a fun thing to be involved in, but as they go through secondary school and university there is a little movement away and space is very much high-tech with rockets and engineering, so there is a little bit of a disconnect.

It is important that as a sector—there is an onus on our side as well as on Government—we extend the information on what it means to be in the



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sector. There is so much more than just the technology side; there is storytelling, business, the legal aspect and medical science. There are all sorts of things that are non-traditional space aspects that people may not have visibility of.

I think the onus is on both sides of the coin. On our side, we have to make sure that information is laid out for schools and universities, and there is then the opportunity for them to get involved in these areas. It is an ongoing struggle we need to grapple with, but it is definitely better. There are now more women than when I first started, which is encouraging to see.

**Q232 Chair:** On the theme of people coming into the space and satellite sector, you are a sample of two, so it is not very rigorous. Tell us how you got into the industry.

**Hina Khan:** I am a career space scientist and I have been in the field for the past 25 years. I did physics and astronomy when I was at school and university and then went into an academic environment of space science research. Over the years, I realised that I was very interested in applications of space science rather than the hard research. World-leading research was all exciting and very good, but I needed it to be a little more useful, so I moved into a more industry-facing activity.

I ended up coming back to Scotland and realising there were opportunities to make a real difference in how the research background that I had within the sector could be used positively to make commercial decisions and involve the public in being able to make decisions that ultimately affect all of us. Climate is a huge example of that. Space is a real player and can be an asset in making decisions to make this world better.

**Q233 Chair:** Do you remember back at school what caused you to choose that direction?

**Hina Khan:** Yes. It was very science based. My father was very keen for me to become a doctor. I am a doctor, but perhaps not in the way he wanted. It was a very science-driven background. When at school you went through the careers. I was going to go to university anyway, but I was told that the only job you could have was to become an academic within the university. It was not really something I wanted to do at that time, but I had a pathway. It was not until much later, after I did my PhD and a little bit of research work within universities, that it became apparent there were other areas to be able to use space as a resource within the sector.

**Q234 Chair:** Mr Styles, what brought you into the sector?

**Jon Styles:** It is a similar story, but maybe from a slightly different direction. I am counting the years.

**Q235 Chair:** We are not going to press you for numbers.



**Jon Styles:** I started from a geography background. I did a PhD at the University of Reading and finished that in 1989, so it means I have worked for 32 years in the industry, but I came to it more from the environmental perspective when Earth observation was quite new technology at that time. I was at the University of Reading, which had quite a pioneering department in the use of Earth observation. I moved into a company where we developed ground segment and data-processing software immediately after that. It was quite a rare thing. I was probably one of the few people coming out of my graduate and postgraduate studies who was working in what we now call the space industry. I do not think we thought of it as the space industry at the time. I worked in a series of companies and have been in the industry ever since working on software development and then management, and now I am running our own company doing applications development.

**Chair:** You both constitute role models and it is good to know about the pioneering instinct at the beginning of your careers, which I am sure is still important to you. Thank you very much indeed for your evidence. We are very grateful.

## Examination of witness

Witness: Chris McLaughlin.

Q236 **Chair:** We turn now to the last witness. We are pleased to welcome Mr Chris McLaughlin, chief of government and regulatory affairs at OneWeb, which is the world's second biggest satellite operator and is the recipient of major UK Government investment in the past year of \$500 million.

Mr McLoughlin, thank you very much indeed for coming. First, perhaps I may put a background question. You operate a satellite network; it is a work in progress. When do you expect to have completed the OneWeb satellite network?

**Chris McLaughlin:** First, may I thank the Committee for inviting us here? It is good to tell the OneWeb story. There have been a lot of stories about OneWeb and it is nice to come and talk to you all on the subject.

When do we aim to complete? Certainly, by the middle of next year we will have delivered an entire global network of approximately 588 satellites, plus spares. We are currently at 358 satellites in space. We are launching another 34 on 27 December. For a rocket launch, I always have both fingers behind my back firmly crossed, but that is the next intention. Our service is already covering the whole of the United Kingdom, and we have just begun beta testing in Alaska, Canada and the UK. We would anticipate being able to offer initial commercial services going into the early part of 2022. It is an enormously fast turnaround from where we were in March last year.

Q237 **Chair:** Give us a flavour of what other services you provide and will be



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providing to businesses.

**Chris McLaughlin:** The OneWeb satellites were designed as data carriers. Effectively, they are broadband in space and are LTE and 5G compatible.

Q238 **Chair:** What does LTE stand for?

**Chris McLaughlin:** It is the next generation technology for 5G. The thrust is to connect the unconnected parts to be able to reach into the more rural and distant areas and those not being served by fibre or currently by BT or others. The interest for UK Government was to see how they could bridge and accelerate a broadband roll-out by using space as another element of communication.

We are dual use, so you can expect that we will also be used to help government and governance around the globe, but especially the United Kingdom.

Q239 **Chair:** By “dual use” you mean civil and military use?

**Chris McLaughlin:** Yes. I am sorry for the jargon. We anticipate that we will be providing connectivity to everything from an embassy that wanted to have secure communications without going to, say, a Chinese fibre network in Africa or somewhere like that, through to perhaps a military camp that wanted welfare communications. The great problem of retention among young people who join the military is that they find they cannot communicate with their families, so we would be providing additional communications there. Effectively, we are a backbone in space. We are a fibre backbone for the telecoms industry and we can be integrated into the different formats people want.

Q240 **Chair:** Why was it necessary to have the injection of capital—in this case, from the UK Government—given the commercial prospects? Why was there not a commercial investor who was readily available, and why did it need this injection?

**Chris McLaughlin:** You are quite right to probe. Government did an extraordinary thing last year, and I am very glad it did because it has secured an extraordinary asset.

To answer your question, at the time OneWeb had invested approximately \$3.4 billion to build out its network and it was due to get a final \$2 billion from the investor SoftBank. It had every prospect that it was going to get that. Just at that moment, a little thing called Covid threw the whole financial market up in the air. SoftBank had a number of challenges with other investments. We work with one of them, which hit the headlines at the time. It found itself in a situation where it could not put in the \$2 billion.

The options at that point were about what to do. At the time, much of the OneWeb management was US based and determined that an American style chapter 11 bankruptcy protection would provide the best way for it



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to try to find a new buyer, new investors and new finance. At the time it was intended that perhaps other sovereigns would come in and put money into OneWeb and it may then have gone from the United Kingdom elsewhere.

As we know, the reality was that everything stopped. I do not believe any of us had an idea of what was going to happen. We began with a very simple request to the UK Space Agency: "Do you think we could have a Covid loan of a couple of hundred million dollars while we try to find the investment we need to get this thing up?" The answer was: "We haven't even printed the leaflets yet. Why would we do that when you do not have any revenues at the moment?" The debate about what we could do and how we could generate the money became more existential.

We determined that what we had was a unique asset. I am sorry to jump into the whole saga of satellites, but there is something called the master register for spectrum, which you can effectively call the IP. That is the money-making element or, if you like, the land grab. By launching the first 74 satellites OneWeb secured global rights on the spectrum band for the low Earth orbit satellites that we operate over and above our friends at SpaceX, Amazon Kuiper, the Chinese and everybody else. Therefore, the asset was there and powerful, but could we get the money together?

We reached out to the UK Government and said, "We know this is a big ask. Would you consider a commercial loan on commercial terms for up to \$500 million while we put the other things together? You will not pay a penny if we fail to get any of the other money. Would you consider that?" That was how the process began. What became apparent was that the UK began to realise this was a unique asset and something the United Kingdom should have in its list of strong and soft power capability if it wanted to have a space industry going forward. There was an evolution of view at No. 10 and the Treasury that they might be better with an equity stake. I cannot talk to Government's actual process; I am sure others will be able to open up on that, but from our perspective on the outside we could see a growing interest in what it could do with this.

Q241 **Chair:** What you say is interesting. You wanted a repayable loan of \$200 million and you ended up with the Government taking an equity stake of \$500 million. What you are saying is that this was at the Government's request and instigation. All the company wanted was a loan to tide it over through Covid to be able to get through what you expected would be temporary difficulties in financing.

**Chris McLaughlin:** I think I should characterise it as the company having an element of hope and wishful thinking at that stage. At that stage, the idea was that, if we could just get a loan, the finances would be out there and different banks would do this, but no one could anticipate just how much of a shutdown there would be in the financial markets at that time. Effectively, the tap was turned off and the handbrake got pulled and nothing was getting done.



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I cannot speak for the Government perspective, but, looking at it as an outsider, the evolution of it was: here is the asset, OneWeb, with global spectrum and global orbital opportunity, and it is to be sold in a process through the New York courts and someone will have it. Three of those were the Chinese; a couple of them could be American; another could be Canadian; and there could almost certainly be a European option as well. Was it content? That was something the Government had to weigh up in their own right, but the option was that it is going to be sold.

Q242 **Chair:** What you are saying is that, as far as you understand it, the Government's motivation was to stop someone else buying it rather than saving it from collapse on the basis that a loan could have done that.

**Chris McLaughlin:** I cannot speak to their intentions, but I can see the benefit of securing the asset for the United Kingdom.

**Chair:** We will be hearing from the Secretary of State in our final session of this inquiry.

Q243 **Dawn Butler:** Can I touch on the global rights that you mentioned? What is it that OneWeb can do that no other satellite company can do?

**Chris McLaughlin:** It is slightly arcane, but Mark Twain once said in his advice to young men, "Buy land, dear boy. They're not making any more." Nowadays, it is "buy spectrum", because there is only so much radio spectrum available in the globe. One is forever trying to compress waves to use it and find new uses for it. Everything that we do from Bluetooth to basic radio requires a bit of the spectrum.

One way of doing it is to secure at the International Telecoms Union the rights to use certain banding in the 12 GHz part of the radio spectrum. By doing that it had a requirement to launch 10% of its fleet within three years, or the next person down the list would get the opportunity to do that.

Q244 **Dawn Butler:** Other organisations can do this?

**Chris McLaughlin:** Absolutely.

Q245 **Dawn Butler:** It is not unique.

**Chris McLaughlin:** It could be if it was not secured.

Q246 **Dawn Butler:** You say that you have 358 satellites at the moment. How many does SpaceX have?

**Chris McLaughlin:** The last time I counted, it was at about 1,600. It has a filing that it modified in January of this year from 1,450 at 550 km above the Earth; we are at 1,200 km. It changed its filing through the FCC to 4,400 satellites at 550 km. That is an order of magnitude far greater than anything we are planning to do. If you imagine the Earth as a football, the closer you are to it the more satellites you need to cover the Earth because you cannot see as much of it when you are close in.



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From 1,200 km we can see more of the Earth, and the further out you go the fewer satellites you need.

Q247 **Dawn Butler:** You talked about unconnected businesses or homes. Are you going to focus on just businesses or unconnected homes? The UK has about 1.5 million unconnected homes. What is OneWeb's focus?

**Chris McLaughlin:** OneWeb is focusing on supporting telecoms operators around the globe. We have an agreement with BT in the United Kingdom, and BT has just begun testing its system. What you can do with OneWeb is that if, for example, you are in the Hebridean isles you can put a OneWeb terminal in or around the village and from that you can connect up a WiMAX system to all the homes. We are doing that in Akiak in Alaska at the moment with a remote community. If you can believe it, at the moment we are testing out how that system is working at minus 50. We would be able to become the hub using one of our terminals with the usual sorts of servers and modems you would experience in your own home and get the signal that way.

Q248 **Dawn Butler:** Is anything working at the moment?

**Chris McLaughlin:** Yes.

Q249 **Dawn Butler:** What is working?

**Chris McLaughlin:** We have throughput to a terminal. I demonstrated to two Governments in the past week at our White City headquarters. We asked whether they would like to do a Teams call, some WhatsApp, surf some 4K YouTube films or ring their friends. We were able to do voice, film and streaming and demonstrate it.

Q250 **Dawn Butler:** That is testing. Is there anything working in the UK at the moment?

**Chris McLaughlin:** White City and Shepherd's Bush

Q251 **Dawn Butler:** People have connectivity that is currently working. You can actually connect to unconnected homes if you want to?

**Chris McLaughlin:** Yes, absolutely. It is early days. We have just begun beta testing, but we have a hotspot in our offices on the third floor in White City that members of staff can log on to. The engineers, being engineers, change the password every day so I cannot always get on; I have to ask for it.

We will be able to connect remote areas in and around the United Kingdom, and we will be serving them through BT using our hub as part of the overall mix. In other places fibre, copper or WiMAX will be a better option and they will determine what they want.

Q252 **Dawn Butler:** Is it correct that the UK owns 33%?

**Chris McLaughlin:** The UK now owns approximately 20% as a result of the further arrival of shareholders. The company was effectively brought



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out of bankruptcy with the \$500 million from the UK and \$500 million from Bharti Airtel Global. That was very important because it meant that you had tech and telco skills.

**Q253 Dawn Butler:** I thought we owned 40-something per cent., and then 33%, and now you are saying it is 20%.

**Chris McLaughlin:** You started off with a 50-50 deal with Airtel Bharti Global when the \$1 billion purchased the company out of bankruptcy. The intention then was to try to raise additional money to complete the global network. By a process, new equity came into the company. It is a great success, which has resulted in a further \$1.7 billion coming into the company. The company is completely and utterly funded now for the entire gen 1, so the UK's stake can already be seen to have appreciated in less than a year by 20%. I say that because the last shareholder to come in, Hanwha of South Korea, had to pay a 20% premium to buy shares to come into the company, so the shareholding is doing well for you.

**Q254 Dawn Butler:** When you buy a certain percentage of a company you keep that percentage; it does not normally depreciate as other people invest, especially if you get in early and you save the company from bankruptcy. Normally, you keep that percentage. Who owns the rest?

**Chris McLaughlin:** The company is a group of shareholders: the United Kingdom Government; Bharti; Eutelsat of France, SoftBank, which returned and reinvested, and Hanwha of South Korea. That has completed the funding round to the \$2.7 billion. Therefore, in less than a year we have a company that is fully equity funded with no debt. That is an extraordinary situation.

**Q255 Dawn Butler:** Does the UK have any say in how OneWeb is run or what the priorities are?

**Chris McLaughlin:** The UK was very clever and initiated a golden share structure. There are A shares for the ownership of the system, which we have just been talking about, and the UK holds a B share, a golden share, which means it can ensure how the company will operate and with whom. You have a unique additional factor; it is like a Rolls-Royce golden share.

**Q256 Aaron Bell:** I want to clarify the funding stuff off the back of that. You now have total funding of \$2.7 billion and of that the UK's stake is \$500 million, which is about 20%.

**Chris McLaughlin:** I should explain that it has gone down to 20% by a process of dilution.

**Q257 Aaron Bell:** I understand. Was there any suggestion that the UK might want to cash in the investment in future—you said the stake had appreciated—or is the UK now seeing it as a strategic investment for the long term?



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**Chris McLaughlin:** I think you should ask the Government what their intentions are. It is not really for me to say as the slave of the shareholders, but I think the position of the Government is that they see it doing well at the moment.

Q258 **Aaron Bell:** Dawn asked about the influence that the Government now have. It has been suggested that we might use OneWeb to replace Galileo for positioning navigation and timing. Is that something the Government have asked you to look at, or is it something you are looking at?

**Chris McLaughlin:** That is a very good point. To put this one to rest, gen 1 was designed five or six years ago. Gen 1 is a basic digital platform for communications. It is not capable of doing positioning navigation and timing. That was a hare that began to run last year. Are they going to do PNT with it? We cannot. What we can do with gen 1 and are working on with the UK space catapult at the moment is to demonstrate resilient timing, which in and of itself is very important to UK critical infrastructure. I believe that we will be doing a demonstration in January with the UK space catapult. That will be the first thing and a new technology.

On PNT itself, the current US and DoD thinking is, "Why would we do another geo when you are parking just an additional target? Why would we not want to put GPS resilience into LEOs like Starlink and OneWeb?" We are thinking about gen 2 at the moment and whether we can put PNT on to the payload for gen 2 as a resilient play. The answer is yes.

Q259 **Aaron Bell:** You are thinking of that commercially and not at the direction of the Government.

**Chris McLaughlin:** It is us; it is commercial. We are speaking with MOD, DoD and others and saying, "We are going to do this," but we are not asking for any money.

Q260 **Carol Monaghan:** I am also struggling with this a little bit. Can you explain why you approached the UK Government? Your manufacturing base is in Florida and you launch from Russia and Kazakhstan. Why approach the UK Government for this funding?

**Chris McLaughlin:** The answer is twofold. The headquarters are in White City in London on the site of the old BBC buildings and the company's regulation is through Ofcom, so it is effectively a British company based in the UK using, as everybody does, international space assets. Why are we launching through Arianespace? It is because they have the best price and best rockets available.

Q261 **Carol Monaghan:** You say that it is based here in the UK, but the jobs are in Florida and possibly Kazakhstan. For \$500 million is there any talk of moving production lines to the UK?



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**Chris McLaughlin:** Completely, yes. The factory in Florida is the gen 1 production line. It is a fascinating thing; it is the most automated creature you can think of. It can knock off two satellites a day. Referring to my last generation of satellites, we would design it and build it over five years and launch something the size of a London bus, and it would cost us only \$450 million. These cost \$1.2 million each and we can make you one in a day.

Q262 **Carol Monaghan:** Maybe I should make a declaration of interest. I visited the OneWeb facility in Florida last year, so I have seen it. I am wondering why for all that investment we are not looking to bring it here.

**Chris McLaughlin:** Because the production line was set up for gen 1 where it was, and to get OneWeb up and rolling quickly, as we have done, there was no possibility of unbolting the production line, bringing it back to Britain and reassembling it, but we are now in the process of looking at a \$3 billion investment in gen 2.

Q263 **Carol Monaghan:** Who will pay that \$3 billion?

**Chris McLaughlin:** The shareholders.

Q264 **Carol Monaghan:** Will that involve the UK Government again?

**Chris McLaughlin:** No. If they do not wish to participate they do not have to. Because we have no debt, if we needed to raise it, we could do so. We believe we can generate enough revenue over the next few years, because we have no debt to service, to build our next generation of satellites. We are pretty confident that there will not be any need or call on the British Government.

To your point about whether we will bring the factory to the UK, the answer is yes. The intention is to build gen 2 and the associated technology in the UK.

Q265 **Carol Monaghan:** What is the timeframe for that?

**Chris McLaughlin:** A gen 1 satellite system lasts between five and seven years because the orbits involved decay. We will start to plan gen 2 in 2022, so by 2024-25 we will be building in the UK.

Q266 **Carol Monaghan:** That is a useful date for us to hear. As to the current benefit, you have told us that the investment has appreciated, but in terms of the benefit for people living here in the UK just now what are they getting?

**Chris McLaughlin:** That is a very good point. The first thing that is going to be achieved is remote access via space via BT, so connectivity will be extendable through BT through OneWeb. That is the first thing that will happen. The positioning, navigation and timing work at the moment—

Q267 **Carol Monaghan:** You have talked about remote connectivity. I know the Hebrides very well and I can tell you that most houses have pretty good broadband. On the other hand, Westminster, or maybe here, is



another story, but in terms of the sort of access you are talking about when can we start seeing that being used?

**Chris McLaughlin:** Throughout 2022. It will be a BT roll-out. Our model allows us to produce the connectivity and then we work with the telco operators in different countries to choose how they want to roll it out and where. It will be for the telco operator—I do not wish to say that the ball is over there—then to roll out what it wants to do, but you will see the benefit of the backbone of OneWeb during 2022.

Q268 **Carol Monaghan:** We will look forward to seeing that. We have heard from an awful lot of space-based industries across the UK that talk about the difficulty in getting funding and everything else, and suddenly \$500 million has appeared. You can possibly understand why we are asking these kinds of questions. You launched a pile of 34 satellites on 27 February last year.

**Chris McLaughlin:** Yes.

Q269 **Carol Monaghan:** And you were bankrupt by March.

**Chris McLaughlin:** It was a very good move by the former management team, which is now gone. The reason it did that was to ensure it held on to the priority in the International Telecoms Union spectrum. It had to get 74 satellites up to be at 10%.

Q270 **Carol Monaghan:** That would not be Covid-related. You said it was Covid-related. If it knew on 27 February that there was a problem and it had to get the things up, it had not had a lockdown or anything at that point.

**Chris McLaughlin:** I was not working for it in February, but I happen to know that when the launch was done at that time it still expected to get the \$2 billion from SoftBank. It thought it was funded; it knew that what it was doing was to get the spectrum up to secure the asset. Getting the 74 meant it had global priority in the spectrum, and that is the key asset.

Q271 **Dawn Butler:** OneWeb did an amazing thing in getting funding of \$400 million from the Government and has done nothing wrong. I understand that Dominic Cummings got very excited by this. Do you know specifically what it was that got him very excited about it?

**Chris McLaughlin:** I never met Mr Cummings. I believe that it was something to do with ARIA or the DARPA model. I think there was a realisation that OneWeb provided a particular asset and there were only two in the world: one of them was American and the other one at the moment was in Britain, but was it going to stay there? I never met him to talk to him.

Q272 **Dawn Butler:** The interesting thing is that ARIA was almost the same amount of money as the funding of OneWeb. There was talk of back-channel communications. I just wonder whether you knew what that was. It think it relates to texts, emails and stuff.



**Chris McLaughlin:** No. We submitted requests to Government. We put in a paper saying, "This is what you could do with it. Please would you listen?" That was when we were asking for the \$500 million loan. That triggered thinking, which I am sure the Government will talk to you about, as to why they went down the route they did. They did an amazing thing.

Q273 **Chair:** When did you join the company, Mr McLaughlin?

**Chris McLaughlin:** I was a consultant to the company in the summer of 2019 and joined the company officially on 1 December 2020.

Q274 **Chair:** Did your consultancy work continue until you were appointed full time, as it were?

**Chris McLaughlin:** Yes. I was consultant until the bankruptcy. Initially, I was asked, "Could you help us? We are getting a Covid loan." I said, "I don't know how you do it, but I will do my best," as every consultant would.

Q275 **Chair:** Therefore, you were involved in the need to get the money into it. Were there discussions with the DCMS as the Department responsible for completing the broadband network, or was it with the Treasury as a kind of financial investment, or was it with the Business Department sponsoring the space sector? Who were the prime interlocutors?

**Chris McLaughlin:** As you can imagine, we looked at Government and thought, "How can we get some traction and be listened to because of the very unique asset?" We went to DCMS and asked it to consider whether this would be part of its £5 billion broadband fund. At the time we had 74 satellites in space. Would we ever get the rest up? They said, "Come and talk to us when you have the whole thing done," so we did not get the buy-in there.

The MOD was focused on Skynet 6 and ensuring that it got its money for that, so it was not something in which it was interested at all. This became an evolution—I do not know—around Treasury and BEIS. BEIS became the home for the decision process that it went through. I think it involved itself with UK SA, the UK space catapult and others. I think it took a lot of different soundings on what it was going to do.

Q276 **Chair:** When we heard from the then Secretary of State at DCMS in our inquiry into 5G he was very clear that there was no DCMS interest, or at least motivation, in the transaction for completing or helping with the broadband network and, therefore, as you say, it was a BEIS and Treasury thing. Was the motivation, in so far as it was revealed in the conversations, about securing a stake that would be valuable, was it a kind of sponsorship of the space industry with benefits accruing to the sector in the UK, or was it an internationally defensive thing to stop this falling into other hands? Are you able to glean the Government's rationale?



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**Chris McLaughlin:** Government will say what it actually thought. I think the process was along the lines of, "Here is a unique asset. What you can do with the asset over time evolves." One of the analogies I made was that gen 1 was the Ford Focus. It is a perfectly functional and very good vehicle that will get you where you want to go, but everybody secretly harbours a desire for a 5 series BMW, but to get that you have to have the factory and know how to build the car before you can do the next thing.

From our perspective, it was a decision to secure the global spectrum and decision to be involved in space, and clearly a global Britain was thinking, "We are going to have to reposition ourselves around the world, and this is one of the things we can do across dual use and deliver soft power as well," but they know best.

Q277 **Chair:** You say you did not have conversations with Dominic Cummings about this, but clearly you were part of the discussions. I am sure you will have heard that he took a particular interest. Is that right?

**Chris McLaughlin:** All I heard was that we had got ourselves a hearing and there was interest, but they wanted an awful lot more detail. We worked extremely hard both there and through the process with other potential shareholders and purchasers to put forward the OneWeb story and articulate that here was an opportunity and it was going to go to somebody.

Q278 **Chair:** Did you discover, albeit second hand, Dominic Cummings's principal motivation?

**Chris McLaughlin:** I cannot shine any light on it.

Q279 **Graham Stringer:** We are grateful for your attendance this morning. You are not a technical person; you are a financial person, as I understand it.

**Chris McLaughlin:** I wanted to bring my CTO with me but, unfortunately, he has Covid and did not think he could come.

Q280 **Graham Stringer:** Can you tell us the structure of the board and the nationalities of the people on it?

**Chris McLaughlin:** There are three appointees from Bharti, who are Indian; there are three HMG appointees. If you look at the OneWeb website, in the investor section you will see our first annual report, which details everybody. I am very happy to send the Committee some hard copies if it would like to have them as well. I will make a note to do that today. When its money is closed, Hanwha will have one person. We assume that person will be South Korean, but we do not know yet. Eutelsat has three, all of whom are French, and from memory SoftBank has two, one of whom is Japanese and one of whom is French.

Q281 **Graham Stringer:** As I say, we are grateful for your attending. Did you consider asking the chair of the board to attend today?



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**Chris McLaughlin:** We did not ask Sunil Bharti Mittal, the chair. Originally, our CEO was to attend and I would happily have been sitting alongside him now. He is engaged in closing another serious commercial opportunity for us. We have already had one with Saudi Arabia, bringing in \$200 million of revenue straightaway, and we have others going on at the moment. Unfortunately, he had to do that, but we felt we should come to the Committee and make ourselves available to you, so I hope I will do.

**Graham Stringer:** That has been very useful. I am just checking.

**Chair:** We are very grateful for your attendance. Obviously, this is very germane to our inquiry into space and satellites as such an important player in the sector, but, as you know, the Committee takes an interest in supporting technology and the relationship between Government and science and innovation. The model of a direct equity investment is a somewhat unusual one, so we will be interested in exploring the implications of that. Thank you to all our witnesses for attending.