HOUSE OF LORDS

UK Engagement with Space Committee

Uncorrected oral evidence: The UK's engagement with space

Monday 9 June 2025

4.40 pm

Watch the meeting

Members present: Baroness Ashton of Upholland (The Chair); Baroness Bonham-Carter of Yarnbury; Lord Clement-Jones; Lord Lansley; Baroness Mobarik; Lord Shamash; Lord St John of Bletso; Viscount Stansgate; Baroness Stowell of Beeston; Lord Tarassenko.

Joined by Special Adviser, Michelle Howard.

Evidence Session No. 16 Heard in Public Questions 141 – 146

Witnesses

I: Dr John B Sheldon, Senior Partner, AzurX; Dr Peter L Hays, Professor, Space Policy Institute, George Washington University.

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Examination of witnesses

Dr John B Sheldon and Dr Peter L Hays.

Q141 **The Chair:** Welcome back to the second session of the UK Engagement with Space Committee.

As we think about the US-UK relationship—especially going forward—I am delighted that two extremely well-qualified experts are joining us remotely. First, we welcome Dr John Sheldon, who has had an extraordinary career, beginning at the Universities of Hull and Reading and then moving on to advising many different Governments, including the US Administration; he has written extensively on that. He is a former member of the faculty at the School of Advanced Air and Space Studies, Maxwell AFB Alabama, and an experienced business and policy professional in the areas of space defence and cyber security, among many other things. Dr Sheldon, it would take all day to read out your CV; thank you so much for joining us.

We also welcome Dr Peter Hays, who is currently a professor at the George Washington University Space Policy Institute. He obtained a PhD at Fletcher in Massachusetts and was then in the US Air Force for 25 years before moving to the World Economic Forum, where he was part of the Global Agenda Council on Space Security. He now teaches on space, science, technology, and national security policy, with a lot of input into the Pentagon and the Office of the Director of National Intelligence.

There is much more that I could have read out about you, Dr Hays, so forgive the synopsis, which probably missed out some important parts; none the less it will give those listening and watching a flavour of the expertise we have in front of us. We could not have asked for greater experts.

We will begin the session with questions from members of the committee, and please feel free to add any other comments that you might have. Lord Shamash, you are asking the first question.

Q142 **Lord Shamash:** Thank you. Gentlemen, can you provide a brief overview of the degree of collaboration between the UK and the US in space, notwithstanding recent events in US politics? How would you characterise the US/UK relationship?

The Chair: Dr Sheldon, would you like to start? We will then move to Dr Hays.

Dr John B Sheldon: Thank you very much. First, I thank the committee for allowing me to respond to its questions and share my views. I would also like to say hi to Pete; Pete and I are actually former colleagues, and friends. This is the first I realised he would be my fellow witness.

The Chair: Space is a small world, as we have discovered.

Dr John B Sheldon: It is a small world indeed. To answer your question, Lord Shamash, I will speak from the national security side of things; but the relationship between the UK and the US with regard to space has

been and continues to be extremely close. This dates back to at least the 1960s, when the US started building national security space capabilities in a very serious way. This relationship is deeply rooted in shared intelligence frameworks such as the Five Eyes, and has included the UK hosting key US space-related facilities such as RAF Menwith Hill and RAF Fylingdales in Yorkshire, and several other installations, including those abroad; for example, in Cyprus. The UK also contributes a great deal of analytic and technical capability towards these installations.

In practical terms, the UK relies heavily on the US for critical space-based capabilities, including intelligence, surveillance and reconnaissance satellites; for example, very high-resolution earth observation satellites, and both optical and synthetic aperture radar. It also relies on the US for signals intelligence collection satellites, positioning, navigation and timing—in other words, GPS—and ballistic missile early warning satellites, of which RAF Fylingdales is part of the ground infrastructure. While the UK operates its own sovereign Skynet satellites in geostationary orbit for nuclear command and control, it is fully interoperable with US military communication satellite systems as well.

For other capabilities, such as earth observation and low earth orbit satellite communications, UK defence increasingly relies and depends on US commercial providers, albeit with some diversification.

Although I am not aware of any UK requests for US satellite access or data being explicitly denied by the United States, I am aware of occasional issues with timeliness of data delivery. None the less, the relationship has generally worked to the benefit of the UK. A recent and important symbol of this strategic intimacy is the secondment of Air Marshal Paul Godfrey of the Royal Air Force, who is now in a senior role within the US Space Force, an honour not extended to any other US ally to date. This reflects both the trust and the enduring closeness, at least until now, of the UK-US national security space partnership.

Dr Peter L Hays: I thank the Lords for this opportunity to speak to you, and to give a shout out to John; it is great to see you.

John gave a great overview. I would simply add that among the many partners that the United States has in space, the United Kingdom is in the first position. I cannot think of many areas where there is not extremely close collaboration between our two nations.

John talked about Air Marshal Godfrey. I had the opportunity to work with him in the Pentagon, and I can tell you that he is making very specific and important contributions to how the space force operates on a day-by-day basis, from that level on down through the many explicit connections that John called out, at the important bases at Fylingdales, Menwith Hill, Molesworth, et cetera. Those are all really important and, in some ways, irreplaceable co-operative ventures that we would be in trouble without and that have greatly benefited both nations.

Lord Shamash: My question mentioned the political stability of the

States at the moment—if stability is the right word—but you did not touch on that. The closeness is there, it is obvious, and thank you for your confirmation; but do we just discount what is happening between Musk and Trump and whatever, and move on as we have in the past? You smile, but I just wonder where we are with that.

Dr Peter L Hays: I do not think you can discount it; you have to be aware of it. One thing I am not sure people understand as much as they should is just how dominant a player Musk has become across the entire space enterprise. What he has accomplished is simply unprecedented. Since 2019, he has launched more satellites than the rest of the world combined; that is a stunning achievement. There is no way for the United States to ferry astronauts to the International Space Station except through Musk's vehicles. The United States paid about $4 billion to the Russians between 2011 when the space shuttle was retired and 2020 when we had the first crewed missions on the Dragon capsule from SpaceX. Those are data points that show how important he is; he is irreplaceable.

When it comes to the national security side, he is launching about 70% of all our national security space missions, and he has over $2 billion worth of contracts, not just for communication satellites but for imagery satellites for the National Reconnaissance Office and early warning satellites for the Missile Defense Agency. He has created a vertically integrated space monopoly in ways that I do not think are very well appreciated.

I do not know how that feud will be resolved. They are both very eager to post things, as you know, but I do not think either one of them is in a position to really move very far away from where they are. They really cannot. The United States is dependent on Musk, and Musk has a great deal of his space work tied up in contracts with the US Government.

The Chair: I want to bring in Lord Clement-Jones, who has the next supplementary question on this.

Lord Clement-Jones: Thank you, Chair. That is a very interesting insight; my question is rather broader.

We have heard that essentially the UK looks towards Europe for civil space and towards the US for defence space, and I suppose one should add security. Broadly speaking, is this the correct strategic orientation from the UK as far as you are concerned, or is it too much of an oversimplification?

Dr John B Sheldon: In terms of how you have characterised it, that is correct. If I understand your question properly, it is whether this is the correct strategic orientation for the UK; please let me know if that is not the question. I would say that Britain could afford to be a little more diversified in how it approaches both. Going along with a particular strategic formula where we look to the US for our national security space needs and then to Europe for a lot of our civil space activities has served

the UK very well, but it would not hurt Britain to diversify a little more; especially with some European allies in defence space where it makes sense, but on the civil side—on a bilateral basis rather than through the European Space Agency—to engage more with emerging space powers, such as India and Japan. It would benefit UK industry and UK science as well as the UK national interest.

The Chair: I am going to bring in the next question from Lord Tarassenko, because it fits into this group.

Lord Clement-Jones: Can I just follow up with John on one small point? You said, "It makes sense". Clearly, it makes sense, but do you think there is somewhat of an imperative now to move further into defence aspects with European partners?

Dr John B Sheldon: Yes, I do. There is an imperative.

The Chair: Let us take this to Lord Tarassenko; trust me, it will add to the mix.

Q143 **Lord Tarassenko:** On this side of the Atlantic we kid ourselves, perhaps, that we have a special relationship with the US; maybe it is not always perceived the same way on the other side of the Atlantic. But the context of the question is that, when I was a director of a research institute in engineering at the University of Oxford, we twinned with MIT and UCSD; we had a fantastic relationship with our colleagues in those two US universities, and I can truly say that we worked together really well as part of a special relationship, with very similar views on the big research questions.

However, as engineers, we also do worst-case analysis. You have pointed to the space monopoly with Musk and so on. As part of that worst-case analysis, our dependence in strategic capabilities such as PNT is entirely on the US. Is it time for the UK as a country to start thinking of potential alternatives, either through developing sovereign capabilities or indeed getting closer to the EU? We need to think about the worst case.

Dr John B Sheldon: Is this is directed at me, your Lordship?

Lord Tarassenko: It is for both of you, please.

Chair: We will have Dr Hays start and then move to Dr Sheldon.

Dr Peter L Hays: I appreciate that question, and I would say that it is really incumbent on all space actors to think about diversification at this point. I believe the world has become over-reliant on SpaceX. There were some good reasons for that; it delivered quickly and reliably. But, as you have pointed out, there are shortfalls and dangers associated with that. So to the extent that the United Kingdom and others can reduce their over-reliance on one provider, that would always be a good policy, in my estimation.

Dr John B Sheldon: I concur with Pete regarding SpaceX. In fact, I would argue that some people in the Pentagon—although they would not

want to say it publicly—are increasingly looking at the SpaceX monopolisation, as well as Elon Musk's political activities, as a national security risk. London should follow suit in that assessment.

Regarding Lord Tarassenko's question on worst case scenarios vis-à-vis the UK and the US, I do not worry about our access to PNT such as GPS, not least because there are other plausible alternatives, such as Galileo and others; but I do worry in the long term about our access to the more niche capabilities that the United States provides that may, in the medium to long term, be either constrained or denied to us for whatever reason. This is usually the back-end stuff that does not get much public attention. Given recent geopolitical events regarding the North Atlantic Alliance, I have noticed debates in Europe about how we need to build more satellites for earth observation, and some alternative to SpaceX's Starlink. I agree with all of this, but it misses the point. What we really get from the Americans are signals intelligence, extremely high-resolution earth observation, and very niche capabilities that would be difficult for us to replace in quick order. We need to have some diversification, from a UK standpoint, and that decision needs to be taken soon, given the long lead times and expense in finding alternatives to those systems.

Lord St John of Bletso: Could I ask a very brief supplementary to your comment about the space monopoly? We have heard a lot about Amazon's Project Kuiper and the constellation of satellites, predominantly next year. Will this change the landscape in terms of the monopolistic position that Starlink finds itself in?

Dr Peter L Hays: Over the long term, it is possible that it will emerge as a significant competitor to the Starlink system, but it is going to take a while. The position of dominance that Musk has established is really stunning. He has an order of magnitude more satellites up there than anybody else, including the Chinese. The Chinese have very ambitious plans with Project Kuiper, and they may, over time, establish a significant level of competition with Musk.

A final thing I would mention is that Musk's company, SpaceX, has very opaque financial structures. It is truly hard to determine whether this is a commercially viable enterprise over the long term, and to me that creates one of the greatest uncertainties; if in fact SpaceX is just burning through a bunch of money from various actors and does not have long-term commercial viability, a lot of people may be chasing the wrong thing here.

Dr John B Sheldon: If I may add regarding Project Kuiper, my understanding is that Amazon, the company behind Kuiper, may have to rely on SpaceX for getting those satellites into orbit, which again puts everybody in a bind. From a UK perspective, the Amazon Kuiper may provide an alternative, but it is still going to be a US company, and, again, geopolitically in the long term this could provide a risk for the UK.

Baroness Stowell of Beeston: Can I add a quick supplementary to Dr Sheldon? You said earlier that you thought it was imperative for the UK

that it diversifies its approach to its partnerships, but not necessarily with Europe—or, rather, ESA. Is that because you have a view on ESA, or is it because you think there are opportunities in those countries that you mentioned—India or Japan—and we must not miss out on those opportunities? I just wanted to understand a little better what was behind your comment.

Dr John B Sheldon: Thank you very much for that question. To clarify, the European Space Agency is an excellent conduit for a lot of the activities the UK wants to conduct in civil space, but not exclusively. India and Japan are big players in space exploration. We saw India with its fantastic lunar mission, Chandrayaan-3, last year; Japan is also a very big player in lunar exploration as well as deep space science and astronomy. There are opportunities there for the UK to collaborate with those countries on a bilateral basis, as well as through the European Space Agency.

However, when I said it is imperative for the UK to diversify, I was referring to its national security space infrastructure. It is imperative that the UK starts in a very measured way to find alternatives with other countries, primarily in Europe, to the back-end capabilities I mentioned in a previous response; for instance, signals intelligence, extremely high resolution earth observation, both optical and synthetic aperture radar, and other niche capabilities. I am thinking, for example, of Germany, Poland, Italy, France, and some of our Scandinavian friends and allies as well. As those countries also depend on the US for a lot of these capabilities, I think you will find that they are going to take a similar view: that now is the time to diversify.

I should also make it clear that this view is not based on more recent political events coming out of Washington with the current Administration, although that certainly puts a line under this particular line of thinking. If you step back and take a look at the evolution of the transatlantic alliance in previous years, we can say that the drift started because of diverging geopolitical interests. For example, the US is now more focused on the Indo-Pacific, understandably so, as well as within its own hemisphere. The United States has made it very clear under numerous Administrations—not least the current one—that Europe has to do more for its defence, including in the space domain. That is where the imperative lies.

The Chair: I am going to move us on to another area.

Lord Shamash: Can I ask a question if we have time at the end?

The Chair: Absolutely. I am going to ask Lord Lansley and then invite the supplementary from Baroness Bonham-Carter.

Lord Lansley: Thank you. I wonder whether our two witnesses might like to talk to us a bit about the civil space relationship between the United Kingdom and the US, particularly the relationship with NASA, and perhaps look at the collaboration in space science on issues such as

climate, the impact on the environment, and opportunities in space for examining climate issues. Perhaps starting with you, Dr Hays, where do we stand in terms of the uncertainty about some of those space science collaborations?

If I could add a supplementary, particularly to you, Dr Sheldon, does this represent a risk to UK scientific collaboration, or does it represent an opportunity for us to perhaps pick up some activities that should be taking place but which the United States is less willing to fund?

Dr Peter L Hays: Thank you for that question. As you have seen, the budget proposal for NASA this coming fiscal year is a 25% cut overall, which places great strain on the Artemis programme, as well as space science and the continued support of the International Space Station. The previous nominee to be the NASA administrator, Jared Isaacman, has been withdrawn and no replacement has yet been named. All those things create great turmoil with what is going on in NASA right now.

It is clear to me, however, that there will be far less emphasis on space science in this Administration than there has been previously. It is easy to draw a distinction between Democrat and Republican administrations; Democrats in general have given more support to space science—Mission to Planet Earth and things such as that—so we can see that there is going to be less of that kind of thing. But with respect to the overall direction of NASA, things are so unsettled that it is difficult to say what the specific fallout will be, except that it is very likely that there will be a lot less space science in the coming years for NASA.

Lord Lansley: Dr Sheldon, what does that mean for the UK? Is it a risk and/or an opportunity?

Dr John B Sheldon: I would not necessarily characterise it as a risk, although obviously opportunities are lost as a result. I would say that when it comes to UK co-operation with the US civil space programme, that is mostly done through the European Space Agency; the Artemis programme is a prime example. But if you go below the governmental level, when you think about UK universities and UK industry, there is a lot of collaboration with the civil space programme on a bilateral basis, and here, of course, there may be impacts from the NASA cuts that Pete just described.

Whether the UK is able to step up and pick up the slack, I would say from a technical, scientific, and engineering perspective, absolutely; but politically and strategically, I do not think so. I will explain the reason why.

Successive UK Governments of all political stripes have failed to articulate a coherent national vision for space. Space remains largely misunderstood by the political establishment, with the exception of this fine committee, of course. It is all too often dismissed either as an elite scientific pursuit or something best left to major players such as the US. This failure of imagination and of policy prioritisation means, I am afraid

to say, that the necessary political will and the commensurate budgetary commitments for civil space leadership just do not currently exist.

Baroness Bonham-Carter: Coming back to your imperative for UK diversity, Dr Sheldon—it has been repeated about three times now, so it is clearly sticking in the committee's mind—you were being quite dismissive about our ability to step into a void. What about the environmental area, which has been cut by the present Administration and would fit in well politically with this country?

I asked our previous witnesses the question that Lord Clement-Jones has asked this time, about the civil/defence dichotomy. They very much said that it was one thing, that you cannot separate civil space from defence space. I appreciate there are two different questions. I will start with Dr Sheldon, please.

Dr John B Sheldon: Thank you for the question. If I am being dismissive, it is based on my bitter experience, if you will, in the UK. It is not an opinion I have arrived at lightly, but I am happy to explain why, either off the record or in a follow-up question.

With the environmental thing, yes, you are right, it is in Britain's national interest to engage in environmental monitoring from space where NASA is unable to do so. But again, as an old mentor, Bob Butterworth, once said to me, and people know who he is, "Policy without technology and budget is just poetry". So even if there is political will, show me the technology and show me the budget, and then I will take the UK seriously. Given the very tight margins within the UK budget across the board, as we have seen just recently with the strategic defence review, for example, a lot of that capability will probably remain unfunded. We are in that position. So if I am being dismissive, again, it is just based on actual reality in terms of how the UK politically and strategically has traditionally approached space.

Regarding your other question, yes, space is inherently dual-use. So an environmental monitoring satellite that is used, for example, to measure carbon capture or methane emissions, can also be used for national security purposes, and similarly a satellite designed for military purposes in terms of intelligence, surveillance and reconnaissance can also be used for monitoring Arctic ice melts, deforestation, and so on. But I would say there are some key differences at a level below that, and it is how those systems are architected.

An example is the difference between GPS and Galileo. GPS was originally designed to be a military system and it is essentially that in all but name. The way it is architected, the way those 30 satellites operate in orbit, is that if they were to be attacked, they would degrade gracefully. It would not end with the attack of one or two satellites. If Galileo were to be kinetically, physically attacked—and by the way, Galileo and GPS are attacked daily in terms of cyberspace and electronic warfare—it would quickly collapse like a pack of cards. That is because of the way it is architected; it is not designed to degrade gracefully, it is designed to be a

commercial system, and of course it derives cost efficiencies in its development through being architected in this way. If you were to architect it like GPS, it would cost more.

These are the choices we face. It is not enough to say, "Well, we can use a commercial civil capability for national security purposes", when those capabilities are not necessarily equipped to withstand a very hostile environment should things get hot.

Baroness Bonham-Carter: I am going to strike out dismissive and, let us say, robust. Dr Hays, do you want to add anything?

Dr Peter L Hays: I would just say that another way to look at this is that the diminished interest in environmental science on the part of the Trump Administration presents an opportunity for the United Kingdom and for ESA to pick up the slack. Basically, if it does not happen across the Atlantic, a lot of that work may not get done, and it is critically important. So I would try to see it as an opportunity rather than a risk.

To your broader question about convergence, there is absolutely growing convergence across all space sectors. They increasingly support all kinds of things that were not originally envisioned in the reasons why the missions were designed, or the satellite architectures were designed. That is a growing and intensifying trend. You cannot design that out of any system and it is going to help you in a lot of different ways.

I like that John said that the GPS system is less vulnerable than Galileo, and I am sure that in certain dimensions, and from an architectural perspective, that is true. But another thing I do not think people have a good appreciation of is just how vulnerable all these things are. The signal strength on earth from a GPS signal is extremely weak. It can easily be jammed or spoofed, and we are seeing orders of magnitude more of those things around the world.

We just had a conference at GW about GPS. Commercial airliners routinely turn it off now in certain regions; they anticipate that they will be vectored away from where they are supposed to go because people are interfering with the GPS signals. So, again, what I am trying to highlight is that these are pretty vulnerable capabilities and there is not necessarily a great appreciation of that.

Q144 **Viscount Stansgate:** Just thinking about your last point, in some areas of northern Europe, are there not aircraft that have been at risk of being affected as they fly through that area? Anyway, my question is slightly different. The UK is already a member of NATO, the Five Eyes alliance and AUKUS, which is going to be a future area of growth. All these are important, but if you could try to look at this from a UK point of view, how do you think the United Kingdom could leverage its membership of these various organisations and bodies to help our own UK space development, in particular our economy and what we would call our own national security? John Sheldon, could you start, please? I should have said good afternoon because for you, it may just be

afternoon.

Dr Peter L Hays: It is now afternoon, yes.

Dr John B Sheldon: I am in Abu Dhabi so it is well into the evening.

Viscount Stansgate: Sorry about that.

Dr John B Sheldon: I am more than happy to stay up late for this committee. To answer your question, I agree that in principle the alliances and institutions, such as AUKUS, the Five Eyes and NATO, could offer a potential gateway to enhance the UK space economy and national security. There are some fundamental challenges that would have to be overcome not least because Australia, Canada and New Zealand are in the Five Eyes as well as the US. In terms of space, the US is, frankly, the only player within the Five Eyes. If we were to start co-operating on some diversified capabilities with, say, Canberra, Ottawa or Wellington, we will face in those capital cities the same challenges that London has, which is that it has essentially outsourced its national security when it comes to space to Washington, so we are all starting from the same position. The Five Eyes is an arrangement, not an institution, so there is no real mechanism within it to actually start capability development, and then of course you would have to overcome various different types of requirements based on different national interests and world views and so on. So I do not rule it out, but it will be a long road to cleave.

Of course, NATO does not procure satellite capability; it is contributed by individual member states and the UK already does this through Skynet, as other allies do, including the US, but France, Italy and Germany all contribute capability. Should the UK build further capability, especially in defence space, such as intelligence, surveillance and reconnaissance capabilities, there is no reason why it cannot do the same through NATO. In fact, I would argue that the more the UK builds and contributes, the more it would get in return from other allies, including the US. There is obviously AUKUS pillar 2, where this is a possibility. But again, we have fundamental problems within AUKUS, not least because we have never-ending requirements for a lot of the capability that is supposed to be developed, especially the submarines. There is still a lot of political confusion as to the purpose of AUKUS.

This is not necessarily germane to the committee's topic here, but on a broader perspective, just like Dulles once said that "Britain is a power looking for a role", I would argue that Britain has essentially said that AUKUS is our way of being a global power, and that is it, which is a rather shaky leg to be standing on. I am all for AUKUS in principle, but in reality it has a lot of challenges to overcome, and space is going to be way down the priority list for AUKUS given all the other challenges that it faces.

That said, if the UK starts seriously building capability that the MoD and other government departments use—I do not mean the test beds that the MoD has already built and developed but actual operational capability

beyond Skynet—then it would have something to offer to other allies that it could then get more for in return; that is the way to go about this. Obviously, it would help the UK economy in terms of maintaining excellent high-value jobs within the UK space sector and it would improve our national security by extending our space coverage and access.

Dr Peter L Hays: John's political and strategic analysis is spot on from a technical and economic perspective, but I would recommend that the United Kingdom and other middle space powers—as I categorise you—focus on a few small strategic areas where they believe they can be world-class, because the space economy and ecosystem is really organised in a very hierarchical way. Winners and losers emerge, and a lot of actors will converge on the suppliers that can deliver world-class components because everyone wants those. I am not sure what it is for the UK. You can point to the Swiss and timing signals, the Germans with optics and radar, and the Japanese with some of the same things. I am not sure what it is for the UK but, in my opinion, those are the kinds of things that you need to focus on and become absolutely world-class at and then people will march to your door to get those components.

Viscount Stansgate: Might they be, for example, financial services, insurance and those space debris things that we have already talked about so far in this committee that are not as high-profile but are niche areas that will still have a use?

Dr Peter L Hays: Yes, absolutely. Perhaps the UK is the world leader in insurance and setting up some of the financial structures for these companies. I was talking more about the hardcore technical pieces, which may not be your niche.

The Chair: Thank you. We have two questions left, and I am sure there will be at least one supplementary on one of them, but we will try to keep the pace going because I am conscious of the time.

Q145 **Baroness Mobarik:** My question has already been discussed, which was: how worried UK policymakers should be about the dominance of a single commercial entity of launch services and satellite communications? Should the UK be aiming to develop capabilities independent of SpaceX? Dr Hays, you pointed out earlier that since 2019 Elon Musk's company has launched more satellites than the rest of the world put together. Lord Tarassenko spoke about this, and Dr Sheldon has already said that there is a strong case that we should develop autonomous end-to-end launch capabilities, not only spaceports and launch services but perhaps a national launch vehicle. We have companies such as Orbex, Skyrora and Rocket Factory developing launches for the UK launch market but of course they require government support and funding. I get what Dr Hays has said about specialising, but at the same time, strategically there is a case for that end-to-end launch capability. Any comments would be appreciated. Perhaps Dr Sheldon could answer first.

Dr John B Sheldon: First, I fully concur with Pete when he answered the previous question regarding SpaceX. We need to be clear that SpaceX

has done a lot of fantastic things. It has revolutionised the space industry, and we should give credit where credit is due, especially when it comes to space launch and access to space. SpaceX has dramatically driven down the cost of getting to orbit in terms of dollars per kilo. What used to be $10,000 per kilo is now $2,000 per kilo, depending on where you want to go and so on, and for that it has to be commended.

As a technology, Starlink is great in terms of bringing internet access to remote and underserved areas, but again the issue is not the technology or the engineering; it is the nature of the ownership and the character, frankly, of the ownership. Let us not beat around the bush, there are a lot of people within Pete's and my industry and sector who do not like what Elon Musk is doing, both as an individual and in terms of his tenure at SpaceX. I would not say they are afraid, but they are very cautious about speaking up about it, but when I speak to my colleagues, including colleagues in the US, both in the Government and the commercial sector, there are not many kind words said. We need to be clear about this: Elon Musk, as he currently stands in terms of his political outlook, character and so on, does not in any way converge with UK interests or values. That is my opinion, but I do not think I am on shaky ground when I say that. From a purely national security/economic point of view, SpaceX is emerging as a monopoly which is not good in any context or for any country, including the United States. It is in this context that we need to look in terms of the national interest.

Baroness Mobarik said that we need to do end-to-end services. There may be a case for that on particular sovereign capabilities that the UK absolutely has to do for itself. It may include launch, but I have to say that the UK's geographical position, given its northern latitudes and so on, is not really geared up to launch beyond low earth orbit. We need to have access to all orbits, including medium earth orbit and geostationary orbit, which cannot be reached from the UK using current technology. So when I say diversify, we need to look for alternative launch sources, which may include the European Space Agency with Ariane 6, and countries such as India and Japan that also have their own indigenous launch capability and could provide an alternative, if the case merits it, for our access to space. It may involve the UK co-developing launch capability, even if that launch capability is not launched from the United Kingdom. That is something we need to think about.

There are a few case studies here in terms of the actual, if you will, toxic effects that Elon Musk's control of Starlink is already having. Ukraine relies on Starlink for its defence against Russian aggressors. He has publicly threatened on Twitter to stop and switch off Starlink. Ukraine has announced in the past few weeks that it intends to build its own sovereign space capability to dramatically reduce its reliance on companies such as SpaceX. Taiwan has publicly stated unequivocally that it will not use Starlink because of Elon Musk's business ties with and geopolitical outlook towards the People's Republic of China. Taiwan simply cannot rely on him to keep Starlink on should China decide it is going to take Taiwan by force, to the extent that it is willing to pay out of

its own taxpayers' money for an alternative system that it will build itself for its own national security.

Obviously, the United Kingdom is not necessarily in the same position as Ukraine or Taiwan, but there are lessons to be drawn here. It is not just London that should look at this particular lesson; countries all over the world are. There are a lot of countries now, especially in the developing world, signing up to Starlink to try to mitigate some tariffs that have been put in place by the Administration, but they do so under great reticence and reluctance because there are concerns about digital sovereignty, regulations and national security for these countries. Again, the UK should consider this.

Dr Peter L Hays: I second all John's great points there. I will go at this in a slightly different way and remind you of an old joke in the space world: what is the best way to make a small fortune in space? The answer is to start with a large fortune.

Everyone is focusing on SpaceX, but what I try to highlight is that it is unclear whether SpaceX, given all its great success, is still a profitable company and whether it will be sustainable over the long term. With respect to your question about whether the United Kingdom needs to develop its own indigenous end-to-end capabilities, I would suggest that it is a more strategic than economic issue. It may be that the United Kingdom needs to make that a priority, but I believe the economic viability of many of those things is so difficult to ascertain, and it is not clear to me that the United Kingdom has a specific niche in trying to develop those things.

I would also like to go back to the nature of Elon Musk because that is one of the most critical aspects here. Musk has said for a number of years that he wants to die on Mars, just not on impact. I believe him. If you look over his entire career, the thing he has been most focused on is space. He created SpaceX way before creating all these other companies, with the exception of his work to support PayPal. He has devoted most of his time, energy, and money to SpaceX; it is his first love. As good as he is at making rockets, he is even more brilliant at making money, so he is going to go where he perceives opportunities are in that regard, which is not necessarily economically rational things that states or sovereign wealth funds particularly would find attractive. There are a lot of variables here, but you are dealing with a very powerful, well-endowed monopoly now that is pretty tightly controlled by him.

John talked about Elon shutting off Starlink in the midst of Ukrainian operations against the Crimean peninsula. They lost all those forces because he just shut it off in the middle of the engagement. It is interesting to me that Operation Spiderweb, which just took place, involving 117 kamikaze drones hitting four widely separated airfields across Russia that were thousands of kilometres apart, could have been controlled only with satellite communications. I am not saying that SpaceX's Starlink did that because we do not know—it is one of the things that the Ukrainians have not talked about—but if Musk allowed

that, or did not know about it and enabled it to happen, it is a really interesting dynamic because it seems the more he knows about it, maybe the more nervous he gets about certain aspects. John talked about the divergence between likely support for Taiwan versus Ukraine. I could not agree more fully. Musk is completely embedded in the Chinese economy in ways that he could not disrupt or upend to support Taiwan in a conflict with China.

The Chair: Thank you very much; this is really fascinating. We have one last question. You have been extremely generous with your time, and I do not want to abuse it because we have learned so much from you.

Q146 **Lord St John of Bletso:** We have received evidence from US-based firms that have broadened their operations into the UK, and vice versa from UK firms seeking to penetrate the US market. We are keen to find out more about strengthening mutually beneficial collaboration. What should our Government do to enhance the commercial relationship between the UK and the US space sectors? Could I start with you, Dr Sheldon?

Dr John B Sheldon: I know a lot of the US and UK space companies of which you speak; they are all fantastic companies, especially some of the US companies, many of which are present in the UK and are long-standing vendors among the best and most capable in the world for the UK Government, but it is not just a one-way street. Of course, these companies are here not just because the UK is a lucrative market but because the UK provides world-class engineering talent and advanced research institutions. It also has a very highly developed space and wider industrial supply chain that these American companies benefit from. We need to do everything we can, despite the geopolitical uncertainty we find ourselves in, to make sure that this particular element of the transatlantic relationship persists for as long as possible.

From the perspective of supporting UK companies in the US, I have three proposals that the UK Government can do to increase the chances of success for UK companies in the US. The first is to ensure access to US contracts. The UK Government need to work with US counterparts to ensure that UK companies can bid for US government and defence space contracts on fair terms. There have been recent steps, such as designating the UK and Australian firms part of the US National Technology and Industrial Base, and these are welcome. However, implementation remains patchy and efforts must be made to ensure that these privileges are realised in practice, not just in principle.

Secondly, the UK Government have to champion the UK space sector proactively, which is something I am involved in in terms of my day job, and we are constantly having to remind the UK Government, BEIS, embassies, development offices and so on, "Hey, you have a space sector; it is world-class and you need to do more to support it abroad in export markets". Having been involved industrially here in the UAE in procuring satellite systems, I would add that on several occasions when we have approached well-known UK satellite companies, they have

actually declined to participate because their position is that UK export controls would never allow them to export particular capabilities, primarily because they fear stirring the ire of Washington, basically. That has to end. We are losing out on major opportunities.

Thirdly, we need to demonstrate confidence in UK space companies through procurement. US confidence in UK space firms will grow when His Majesty's Government demonstrate trust in those products. If UK companies are to be taken seriously by US primes and government buyers, then UK government agencies, including the MoD and the UK Space Agency must serve as anchor customers.

Dr Peter L Hays: I appreciate your question. One of the things I have arrived at during the course of these hearings is that perhaps the greatest niche for the United Kingdom is the services and the already embedded joint ventures and partnerships commercially that exist with a lot of the US prime space contractors. So perhaps your greatest opportunity is to leverage those existing relationships. If your regulatory and legal structures can adapt to whatever tariffs and other things are being imposed, that might really be the best way to move quickly and effectively through what is likely to be a really unsettled environment for these things in the United States for the foreseeable future. I do not normally look at it from that perspective; I tend to focus on the technical aspects of things, but probably the services end of things and regulatory and legal structures are likely to be of growing importance in dealing with that uncertainty, which might be a really important way to advance and accelerate the effectiveness of these space industries.

Lord St John of Bletso: I have just one very brief supplementary question. We hear that Eutelsat OneWeb argues that "Non-US companies face challenges accessing the US market". You spoke about the need for UK companies to have greater access to contracts in the US. Is there a risk that the UK will become uncompetitive internationally?

Dr John B Sheldon: Certainly, the ability to bid fairly on US government contracts is an issue. I should add that it is an issue for French, Australian, and German companies, as well as the UK. Of course, you also have to overcome the Buy American policy that Congress mandates, although I would argue that an overly restrictive interpretation of UK export controls poses a risk of making the UK space sector uncompetitive in the global market.

Dr Peter L Hays: I agree. A lot of those issues are in the eye of the beholder and how much time and resources are required to overcome them because there are a lot of judgments and interpretations with respect to how they apply in certain specific instances. Another area where the UK and Europe are ahead of the United States is in structuring multi-player public-private partnerships. Those will likely become increasingly important in a variety of areas in space and the US does not have a lot of experience with that. So that might be another way to pursue these things in a more effective way.

The Chair: Thank you so very much. You have been incredibly generous with your time. We have learned a huge amount. As you can tell, we could have probably gone on for another hour, but it is time to let you go back to your real lives. Good afternoon and good evening.