HOUSE OF LORDS

International Relations and Defence Committee

Corrected oral evidence: Implications of the war in Ukraine for UK defence

Wednesday 17 April 2024

10.30 am

Watch the meeting

Members present: Lord Ashton of Hyde (The Chair); Lord Alderdice; Lord Bruce of Bennachie; Baroness Coussins; Baroness Crawley; Baroness Fraser of Craigmaddie; Lord Grocott; Lord Houghton of Richmond; Baroness Morris of Bolton; Lord Robertson of Port Ellen; Lord Soames of Fletching; Lord Wood of Anfield.

Evidence Session No. 4 Heard in Public Questions 31 - 42

Witnesses

I: Juliana Suess, Research Fellow, Royal United Services Institute (RUSI); Theodora Ogden, Space Policy Analyst, RAND.

Examination of witnesses

Juliana Suess and Theodora Ogden.

Q31 **The Chair:** Good morning. Welcome to both of you. This session will focus on the role of the space domain in Ukraine. It is the fourth public evidence session of our short inquiry into the implications of the war in Ukraine for UK defence. This session is being streamed live on the parliamentary website and a transcript will be taken. Once it is available, we will send you a copy so that you can make any small changes if you need to.

Can all Members declare any interests that are pertinent to the inquiry. On that note, I declare that my wife is a shareholder in BAE Systems. When witnesses answer their first question, could they give a brief introduction. If you do not feel the need to add to what your colleague has said you do not have to. There is plenty to talk about and we will try to keep our questions brief. If you keep your answers relatively brief, that would be very helpful.

I wonder whether you could summarise how space has influenced the Russia-Ukraine war in general. We have heard a lot about new tech and drones, which are obviously related, but can you summarise what is happening in space technology and how it has helped Ukraine and Russia?

Theodora Ogden: I am a researcher at RAND Europe, focusing on space as an operational domain for defence and security. RAND has undertaken numerous government-funded projects on space security, some of which are in the public domain and which I can speak to.

In the Russia-Ukraine war, space has played a supporting role to military forces on both sides of the conflict, including through the provision of sat com, which is satellite communications; PNT, which is positioning navigation and timing; and EO, which is earth observation and which enables space-based intelligence surveillance and reconnaissance, known as ISR.

I will give a few illustrative examples. Ukraine and its Western partners relied on space-based ISR ahead of the invasion in February 2022, where the build-up of Russian troops was identified in the lead-up to the attack. Only an hour before the invasion in 2022, Russia launched a cyberattack on the ground-based infrastructure of Viasat's KA-SAT network, causing thousands of European users, including the Ukrainian government and military, to experience widespread disruption.

Today, the movements of military assets, including warships in the Black Sea, the construction of field fortifications and alleged cases of Russian war crimes, are all being monitored through earth observation and ISR data. Ukraine is obtaining high-resolution imagery, including synthetic aperture radar that can see at night and through clouds. Sat com and PNT remain important for the Ukrainian networked artillery systems and other long-range precision fires. Starlink satellites are also being used to

provide off-grid internet access and connectivity, enabling critical battlefield communications and information sharing, including for uncrewed systems. They also connect the civilian populations that have been cut off by the fighting and Russia's destruction of cell towers and other infrastructure.

Russia sees controlling access to space-based information as key to securing strategic advantage through increased situational awareness for long-range military operations and operating across the various domains. Russia's use of disinformation is also firmly ingrained in its approach to hybrid warfare, although Ukraine-based earth observation and ISR capabilities often seem to override Russian attempts to control the information environment by revealing the truth on the ground.

Juliana Suess: Good morning, I am the research fellow for space security at RUSI, as part of the military sciences team.

We have definitely seen a shift in how the world perceives space. The war in Ukraine has given it a spotlight that we had not previously seen. Two things have become very evident. First, we need space for military capabilities and, secondly, space is a vulnerability that can be exploited, as has already been discussed. The Viasat attack on the morning of the invasion, for example, showed that space can be a vulnerability too. Starlink satellite images have given Ukraine the chance to use space as a capability. It is ironic that Russia is the one that is usually known as a space power but it is actually Ukraine that has leveraged space capabilities to its advantage.

We have seen that Russia has not really been able to use its space capabilities to the full extent that one might expect of a space power, although in the case of Russia its space power status belongs in the history books and not in the realities of today. We have seen that Russia has not been able to rely on its satellite systems. They are outdated. At times they are not integrated at the tactical level that would enable troops to act in a tactically relevant manner. The command-and-control structures are simply not integrated or set up to make use of space. For example, satellite communication structures are often in the hands only of the commanding officers. Even then, we saw that, at the beginning of the war, commanding officers were relying on unencrypted channels of information.

The Chair: Is there enough bandwidth to use the space assets properly? We know that most communications are done via fibreoptic cables under the sea because there has not been enough bandwidth. Are they increasing that?

Juliana Suess: Do you mean bandwidth on the Ukrainian or the Russian side?

The Chair: Both.

Juliana Suess: There have recently been reports that Starlink is not working to the extent that it was a couple of weeks ago. There are a couple of rumours or reports that say why that might be the case, including that Starlink might now also be being used by the Russians. I have not seen these reports be fully verified so I would not want to submit it as evidence, but that is a potential reason why that might be the case.

On the Russian side, there are certainly bandwidth issues in terms of their satellite communications capabilities. They have limited coverage in any case and, from the sources that I have seen, limited bandwidth.

Q32 **Lord Houghton of Richmond:** I declare an interest: I sit on the Thales UK strategic advisory board. The organisation is involved in space, particularly within the sensors rather than the bearer vehicles.

My question is about commercial partnerships, building on the involvement of SpaceX and others, and the degree to which they have contributed to Ukraine's defence against Russian aggression. However, I would rather develop the question into the area of what this means for the UK in terms of our own space policy and the extent of our capability in the face of the enormous commercialisation of this capability. I refer not just to SpaceX. As experts, you will be aware of Amazon's Project Kuiper, which will, over the next few years, put over 3,000 satellites into low-earth orbit, effectively dominating the space-based satellite communication systems. It will cost about £20 billion. Amazon will be able to do this with an agility and freedom of spend that most sovereign governments cannot match.

In answering the question, can you expand into the challenges that this gives to the capability owners within the Ministry of Defence? To what extent must they surrender sovereignty to access the commercial offerings of companies such as Amazon?

Juliana Suess: The partnership with SpaceX has highlighted the utility of new space and the commercialisation of space, but it has also highlighted the dangers of such an arrangement, specifically if it happens on such an ad hoc basis. Starlink was implemented with Ukraine and a contract was not in place through the US Department of Defense for quite some time.

There are definitely lessons to be drawn for the UK, specifically as a medium space power, in the sense that the budget is not unlimited and priorities need to be set in terms of what the UK needs to own, where might it find capabilities through partnerships and where might it be able to buy commercial capabilities. The word to keep in mind is resilience. In order to have a resilient space system, which we will need, a system of systems is in order. That means the fallback options that are not only sovereign but through partnerships and in the commercial domain. That will enable space powers to have capabilities and assets in different orbits, that work through different frequency bands, for example.

Project Kuiper, which you mentioned, that Amazon has set into motion, touches on a couple of those aspects of where we see new space going

but also where we see the resilience question of satellites going. Another element of that is the intersatellite links that the constellation will have, which Starlink has also implemented in its newest generation. This means that, if a ground station is compromised or not available over a certain area, satellites can send links or signals to each other until a ground station can be reached for the signal to be projected back down towards earth.

Your point on surrendering sovereignty is a very valid one. We have obviously seen in the case of Starlink that service was not always available to the extent that the Ukrainians would have liked. Crimea was one such case. However, most of those discussions about the availability of Starlink and whether it can be used for offensive purposes happened before the contract was set in place. We do not know exactly what the terms and conditions of that contract are, so it is hard to tell from an open-source perspective to what extent that contract solved the issues.

Theodora Ogden: Russian reporting itself suggests that the support that Ukraine has received from foreign commercial imagery providers has given it a distinct advantage over Russia in the space domain. This is due to the sheer number of Western observation satellites. Commercial earth observation satellites can provide more coverage, added redundancy and improved revisit rates compared with the high-demand and low-density government-owned spy satellites, such as those operated by Russia.

In practice, this means that commercial assets can supplement government space capabilities, reducing costs and offering capabilities such as electro-optical sensors, synthetic aperture radar and AI-assisted data analytics and mapping. Private companies are arguably more agile than government and able to launch new systems quite rapidly. As a prominent example, within day s of Russia's invasion, SpaceX had sent 5,000 Starlink terminal kits to Ukraine, enabling communications via its mega-constellation of small satellites in low-earth orbit.

There are, however, challenges regarding the potential exposure of commercial services to targeting by Russia, such as through jamming and hacking. It is important to consider the implications of reliance on systems that are not designed or hardened against conflict but are instead intended for commercial use. It is also worth considering the spillover effects of attacks on commercial systems. For example, the February 2022 cyberattack against Viasat did not only affect Ukrainian military users. It also cut off tens of thousands of Europeans' access to high-speed internet and turned off just under 6,000 German wind turbines for several months.

The Ukrainians' reliance on Starlink has also revealed some of the risks that come with depending on private actors, especially from overseas, for key services. On several occasions, Elon Musk, the CEO of SpaceX, has reportedly risked Ukrainian access to the communications network and limited the use of Starlink, particularly in controlling Ukrainian unmanned systems in the Black Sea.

Lord Houghton of Richmond: As a direction of travel, sometimes you get the impression from the literature that governments are the big space players and that the commercial things are nice add-ons. However, will it not be the case that the commercial world will dominate space and the direction of travel is that governments will have to determine what their irreducible minimum sovereign capability is for certain things?

Is that your general sense of the direction we are going in and how government policy in the UK is? Government policy is a bit airy-fairy. They have written a big tome on a hologram of what our capability truly is. Is that where we will have to go—make some hard decisions about what the true irreducible minimum might be?

Theodora Ogden: Absolutely. The UK Government will have to consider quite carefully what sovereign capabilities should look like, considering the proliferation of commercial off-the-shelf products and the availability and accessibility to all actors. Essentially, most militaries today depend to some extent on commercial providers. This all needs to be taken into account, along with the risks of that.

The Chair: The boss is not necessarily the most stable individual, is he?

Juliana Suess: On where the future of space lies, we have obviously seen, with new space, the commercialisation of the domain. That can often seem like the future of technology. I agree in terms of innovation and where we will see that going. The commercial sector is definitely pulling its weight. However, the majority of funding for commercial ventures still comes from states and the majority of clients are still states, so we must be quite careful about assuming the causality of where the money is coming from. Companies like SpaceX would not be around if it were not for government funding, and its main clients are governments. That should be borne in mind.

Q33 **Lord Robertson of Port Ellen:** I declare an interest: I am a senior counsellor with the Cohen Group in Washington, which has some clients in this area.

The role of this committee at the moment is to draw lessons for British defence from the conflict in Ukraine. Can you address that and also tell us a little more about the Russian capability for jamming, interfering and even physically disrupting the assets that are there? As you say, a lot of these assets are not hardened for military conflict but purely there for commercial purposes and so are vulnerable in a way that military hardware might not be. Can you direct your attention to what the British defence posture should be in relation to what we have seen experienced in Ukraine?

Theodora Ogden: First off, it is worth pointing out that, while there are insights that we can draw from Ukraine, I would hesitate to characterise these as lessons, since the conflict is ongoing and there are substantial distinctions between the UK and Ukraine. As well as the obvious geopolitical differences, the way of fighting is different. Ukraine is not fighting as part of NATO and the supporting role of space might differ. All

this needs thinking about when considering the applicability of lessons from Ukraine in the UK context.

One of the key insights from Ukraine is the importance of access to space-based capabilities over necessarily owning capabilities. I can go into some more detail about the UK's approach to collaboration versus owning satellite capabilities in later questions on that theme. However, as the majority of commercial enterprises offering advanced commercial off-the-shelf products are Western, customers such as Ukraine have an advantage over Russia, which would have a harder time accessing similar products. The sheer speed with which commercial actors can fill gaps and provide access to capabilities is remarkable, as we have seen. Knowing that there is accessibility is important for the UK going forwards.

It is important to note the reliance on space capabilities within modern conflict, as can be seen in the Russia-Ukraine war. While space systems are a great enabler and can lead to strategic advantage, there are vulnerabilities across the chain from the space-based system to the transfer links and the ground segments, such as ground control. An insight that can be drawn from the current conflict is understanding the importance of resilience and redundancy within space, for example through multiple satellites and services, as well as the need to invest in non-space-based solutions to provide a fallback means of command and control.

Another core insight is that counterspace operations are likely to leverage cyber and electronic warfare, emphasising the need for defensive countermeasures. For example, after the early attacks on Viasat, Russian attempts to hack, jam, spoof and otherwise disrupt Ukraine's use of space-based services have become an embedded feature of the conflict.

In terms of kinetic attacks—physical attacks against satellites through anti-satellite systems—these remain feasible and Russia has demonstrated this capability in recent years. However, the cost effectiveness and the wider implications of such measures are considerable—for example, generating orbital debris, which also affects Russian satellites and cruise systems.

However, it is important to broaden our thinking about what space means, what counterspace means and what the threats could look like. They could also include kinetic attacks on the ground segment to disrupt key capabilities. Ground control, uplink, downlink, industry and supply chains can all be vulnerable to cyberattack, IP theft or kinetic attacks during crisis or times of war.

Juliana Suess: I echo what has been said. We know that there is a great reliance on space within the UK military, even though sometimes space goes unnoticed because it is working. It would be more noticed if it was not working. We need to prepare for the degradation if not the destruction of space assets and the effects that go with it. In terms of resilience, I spoke about the satellite constellations that are being used, but we also need to think about training with terrestrial and other

alternatives in order to be ready for the non-service of satellite assets that we are so reliant on at the moment.

In Ukraine, we have seen jamming and spoofing, although, especially at the beginning of the war, not as much as was expected. We know that Russia has integrated electronic warfare significantly into its military operations. There are a couple of reasons why Russia had not fully achieved its force posture at the beginning of the war, which is why it was not used to the extent that it otherwise would have been, but Russia is capable of jamming GPS and satellite communication receivers. Viasat has been mentioned. Cyber remains a vulnerability and often an unseen one, especially when we are talking about commercial assets. Going back to the point earlier, that is changing slightly. Viasat led to the realisation that commercial partners are not necessarily safe because they are commercial.

In terms of counterspace capabilities and physical direct-ascent anti-satellite weapons, we know that Russia is capable. However, on the specific threat, as Russia sees it, of Starlink and a physical attack in the form of a direct-ascent anti-satellite weapon, that would not work. We are talking about a constellation of more than 5,000 satellites. You would destroy the orbit at worst and at best degrade it for yourself as well. There is also evidence that Russia is developing, or at least researching, co-orbital weapons. That is something to bear in mind as well.

Q34 **Baroness Crawley:** Continuing on the UK's current strengths and weaknesses regarding its space capabilities, since leaving the EU's Galileo programme, we now rely on the US's GPS and the non-encrypted parts of the Galileo programme. What should the Government do to enhance their capability to respond to potential hostile attacks from and within space?

Juliana Suess: One thing that has already been mentioned as part of the defence space strategy is the improvement of space situational and domain awareness. That is knowing exactly where our satellites are, who is approaching them and what is around them. The same goes for allies and partners. At NATO level, it is something that we need to look into on a much more granular level. The current problem, as I see it, is that we have been using space and everything so far has mostly worked; we have not been in a conflict specifically where space has been threatened for the West.

What needs to happen at the alliance level as well as the national level is coming up with response options now and being able to plan for such a scenario. Unprecedentedness is no excuse for unpreparedness at this point. We have had anti-satellite weapons since 1959, so it is time that we have response options in place and that we know what is happening at any point. At the moment, the UK and most of Europe are very reliant on the US for their SSA[1] data. The UK is also feeding in through RAF Fylingdales. SSA and SDA[2] are the basic functions that a space power

1 Space Situational Awareness
2 Space Domain Awareness

ought to have sovereign capabilities of to know where its assets are, whether they are safe and what response options are feasible.

Baroness Crawley: What serious plan has been set out in order to ensure that sovereignty in the near future?

Juliana Suess: The *Defence Space Strategy* simply mentioned that it was being improved and worked on. There may have been further news that I have missed—I apologise if that is the case—but I have not seen concrete plans.

Theodora Ogden: That is the extent of my knowledge as well. One thing to point out about the UK's strengths is that we are incredibly adept at collaborating within our country, in industry, government and academia. The R&D clusters across the UK, such as Harwell space campus, are good examples of good practice for other spacefaring nations. They enable knowledge exchange and sector growth and provide opportunities to small and medium-sized enterprises. Creating an environment where innovation flourishes and access to critical technologies is ensured is essential for the UK so it can maintain its competitive edge in the international arena. Continuing to foster such collaboration is particularly important to develop awareness of risks, threats and challenges across the sector and to develop key capabilities.

However, I point out that there is potentially a general mismatch between the resources and stated ambitions of the UK. Emerging technology is helping to drive new space capabilities, but barriers, such as a shortage of suitably qualified and experienced personnel—SQEP—in the UK, could limit the realisation of those benefits. The space sector skills survey of 2023 revealed that more than half of UK organisations report skills gaps in their current space workforces.

The survey also showed that organisations struggle to remain competitive and are less likely to introduce new technologies. Skills gaps in the UK are reportedly most noticeable within electronics systems, engineering and spacecraft development. Although entry level opportunities are abundant and oversubscribed, the pool of suitably skilled individuals atrophies at the higher levels due to intense competition for key software and data skills across other sectors with higher pay. This has the potential to limit UK space sector growth, as well as the ability to respond to challenges.

Baroness Crawley: There may be a change of Government in the US this year. Would that in any way affect our dependence on the US GPS system?

Theodora Ogden: It could. The UK's level of investment in key space programmes has been historically low due to the reliance on the US. In comparison to peer countries, such as Japan, Germany and France, we are playing catch-up. Despite this, the UK has been able to access these valuable space capabilities through the US and participation in the European Space Agency, as well as through co-operation in the Five Eyes

alliance on military space programmes and, more recently, the combined space operations initiative. Due to these partnerships, the UK can access a lot of exquisite space capability, but this means that we are behind European peers in developing our own. That is something to consider.

Q35 **Baroness Morris of Bolton:** On the lack of the necessary skills, what are we doing to grow them, and has it been impacted in any way by our changes to access to higher education for people coming to the UK to study?

Theodora Ogden: There are initiatives under way to improve the retention and recruitment of key STEM skills, but it is important that the resourcing of that increases, for example through more fully funded PhD programmes and through ensuring that there is integration with industry, academia and government through secondments and placements. All of those will be important to ensure that, going forward, there is a better understanding across the sector and better co-operation. Ultimately, we need to foster an environment in which it is financially and professionally viable, if not attractive, to be a scientist or an innovator in the UK.

Q36 **Lord Soames of Fletching:** Given where we are now with the capabilities that we use, what ones do you anticipate coming in the future, and how will they reflect our wider security position?

Juliana Suess: Do you mean in terms of our capability?

Lord Soames of Fletching: Of the capabilities we have now, what do you anticipate as being the future capabilities that we are likely to encounter?

Juliana Suess: There are a couple. One has been mentioned: intersatellite links that allow satellites to speak to and send signals to each other to lend resilience. Another one that we will increasingly encounter, and that was mentioned in the *Space Industrial Plan*, is in-orbit servicing, manufacturing and repair. This speaks to the sustainability effort undertaken now to make satellites longer lasting, so that we do not send up too many satellites that end up having relatively short lifetimes.

With all of these, we also need to take into account the dual-use aspect of space. Some of these can already be used as weapons in space. Specifically, the debris-removal element has already been discussed at length. For example, the Chinese capabilities include a robotic arm that could take defunct satellites out of their orbits by moving them out of the way. The immediate fear was that that could also be used to move a functioning satellite out of the way, but of course we need to keep in mind that, depending on the orbit, we would have several days or hours of notice before such a thing were to happen. We will increasingly see the politics on earth projected into space, and that will continue with innovation and technologies as well.

Theodora Ogden: Two of the key overarching technologies that are due to have a significant impact, not just in the space domain but beyond, are

AI and quantum. AI can help automate repetitive tasks and improve situational awareness and decision-making, particularly within tight timeframes. It provides insights into large quantities of data. Insights from AI will help unlock new design and maintenance approaches for space assets and increase their performance, efficiency, safety and resilience, boosting the value for money of these systems. AI will also increasingly help with aircraft and spacecraft design, manufacture and operations, for example through the autonomous docking and navigation systems. Similarly, autonomy and robotics will provide new space systems with hardware capabilities, such as active debris removal.

Quantum computing, sensing, simulation, measurement and materials all have the potential to revolutionise computing, communications and navigation. Within the space sector, these technology developments could be applied to improve communications and operational efficiency. In the coming years and decades, quantum will be the one to look out for, with applications across big data analysis, weather forecasting, computing, transportation and so on, enabling new communication channels to be secured through physical properties rather than simple encryption, which can be hacked. Enabling quantum communication technology could secure intersatellite and long-distance satellite-to-ground optical communications, and it could lead to significant improvements, particularly in times of warfare.

Q37 **Baroness Coussins:** The Outer Space Treaty is well over 50 years old now and is quite narrowly drawn, not covering the private sector or academic research, for example, as I understand it. Yet there seems to be some reluctance for the world to get together and organise any kind of movement to update it. How do you account for that reluctance, and is an updating of that treaty needed? More broadly, what is the role of international co-operation and agreement in helping to prevent escalation and promote responsible behaviour in space? Perhaps you might incorporate in your answers a comment on what, if any, useful role the UN has.

Juliana Suess: The Outer Space Treaty is from 1967, as you said. It has been a little while, and space looks radically different to how it did then. However, the OST is basically a contract of principles, so the fact that it is so basic is almost its greatest strength, in the sense that it would be quite difficult to break it, despite rumours about the Russians currently developing a nuclear weapon for space. Those principles are relatively set in stone.

A glaring hole is weapons that are not weapons of mass destruction, because the OST says nothing about those. There have been efforts since then. We have seen quite a lot of these discussions over the last couple of years, and a crystallisation of two camps has become evident. In 2008, Russia and China put forward a joint proposal on the prevention of the placement of weapons in outer space. That proposed treaty simply says: do not put weapons of any kind or form into space. However, it was lacking verification measures to show what kind of satellites are actually being put into space. The West has come up with its own proposals. In

2020, the UK put forward a proposal for responsible behaviours in space. All of this was on the back of decades of discussions of all of this.

Looking into the responsible behaviours open-ended working groups that took place, a heartening element is that there seemed to be a general agreement to bring forward this approach. The responsible behaviours approach simply asked what responsible behaviour in space looks like, in terms of close approaches and spying on or interfering with other satellites, to add to the weaponisation fear in space. It was a comprehensive bottom-up approach that could have added real value if it had not been for actors that tried to do away with the whole process.

Looking through the transcripts of that open-ended working group, you see that Russia specifically, at every moment that it could, tried to completely do away with the whole process, saying that organisations should not be present at those discussions, even though an open-ended working group is, as the title says, open-ended in terms of its membership. It tried to do away with the process to avoid discussing the issue and the content, because the majority of members of that group would probably have found a consensus. In the end, primarily because of Russian and, at that time, Chinese opposition to the proposal, nothing was submitted to the General Assembly, so we have not seen an outcome.

We are going into further phases of this, and we will now see a parallel approach. The Russian and Chinese proposal is back on the table, but so are responsible behaviours. It is a frustrating process to witness and read the transcripts of, because I think, from what I have read, that there could have been agreement. So this has to continue to be pushed over the next couple of years. Quite frankly, the current geopolitical dynamics do not lend themselves to discussing an issue that is so controversial and has been so deep-rooted over the last couple of decades. I do not see an agreement that leads to an actual signed agreement taking place in the next couple of years, sadly.

Baroness Coussins: Are there any specific initiatives that the UK could take to give some momentum to this process?

Juliana Suess: If the UK keeps pushing responsible behaviours, it will find willing allies. We have seen that coalitions of the willing in these settings can work. The US published a memorandum against the testing of direct-ascent anti-satellite weapons, and it has found quite a lot of support for that. Obviously, those memoranda do not immediately solve the issue, but they show, on a multinational level, that consensus can be reached. Further down the line, this can help with the signed agreements that we ultimately hope to achieve.

The Chair: I do not want to be negative, but is it likely that the agreements you are talking about can be reached when some principal actors are at war, either directly or via proxies?

Juliana Suess: No, I do not think it is. But that is what I am saying about coalitions of the willing: the bigger the groups we can form, the better. In the meantime, until we can get to a point where this can be discussed perhaps a bit more neutrally, they can be a step in the right direction, however small.

Q38 **Lord Grocott:** I am a bit lost on the definitions of what might be regulated and how it might be policed on an international level. Many international agreements relating to defence, for example, are quite specific. With something like the non-proliferation treaty, you know whether it is working and you know exactly what you are trying to achieve: non-proliferation. Can you offer a reasonably precise area that would be the objective of any international co-operation or agreement in the area of space? Space is a big place. There seems to be a lack of clarity, which you referred to yourself in talking about things like responsible behaviour—what the dickens does that mean? All nations having equal access to space is another one. We are operating in a very woolly area, are we not?

Juliana Suess: One of the main difficulties with space, which you touched on, is the verification measures: how do we know what is on board a satellite until we are able to open it up ourselves just before it is launched? An added difficulty with space is the dual-use element that we discussed. Someone's earth-observation satellite can be someone else's intelligence-gathering tool. A satellite could also be made to collide with another satellite and, in that instance, become a weapon, even though it has no actual weapons on board.

So we need to take into account a lot of elements. There is the weapon element—placing weapons into space, which we want to avoid—but there is so much else around it, which is where the responsible behaviours come in. It is not just about not placing weapons into space but about how close we come to each other's satellites and whether there is any fear of interference or of overhearing or capturing signals, et cetera. By coming up with responsible behaviours, which, as you said, is quite a broad category, the UK was hoping to capture the whole difficulty with dual use, weaponisation and the behaviours in space. There have been discussions in the past about states, for example, saying that Starlink satellites came too close to their assets, et cetera. So there are a lot more elements to this than simply the weapons aspect, which is why a discussion about what counts as responsible behaviour would have been a good start in the right direction.

Q39 **Lord Alderdice:** I will follow up on this. One area where Russian, American, British and other scientists have continued to meet and talk on the space question is planetary defence in respect of meteorites. Might that practical collaboration have a better possibility than trying to reach complex international agreements in the context of war, as other Lords have been saying?

This does, however, raise the question of weapons in space, because one of the likely requirements for dealing with an incoming meteorite is a

weapon outside earth that can react, by laser, nuclear or other means. Are you aware of the conversations and meetings that have been going on concerning this and, if so, are they likely to get anywhere?

Juliana Suess: I am not an expert on planetary defence specifically. I caution that, just because we see international co-operation and collaboration on space, that does not necessarily mean that the politics behind it is being sorted. A great study was done by Dr Aaron Bateman in the States. He looked at the Cold War space steps that were taken between the Soviet Union and the US and found that, rather than the space collaboration that was taking place furthering diplomatic relations, it was the other way around. All these space achievements usually happened right after diplomatic achievements. Therefore, in terms of causality, we need to be careful about where that trust can be fostered.

Q40 **Lord Bruce of Bennachie:** You have answered some of the questions I was going to ask, but I will explore a couple of things further. You mentioned the UK's position on sovereign capability. We seem to be behind the curve compared with most of the other nations. How important is it that we accelerate that?

Baroness Crawley made the point that we decided to leave Galileo on the back of the Brexit decision—but long before the current situation had evolved. Was that a good move, in hindsight, or is it perfectly proper for us to build our own platform and also find ways of collaboration? Would that collaboration be bilateral or would it be with some arrangement with, for example, Galileo?

Also, you made the point about the interdependence of the commercial and the sovereign sectors. A number of things that you have said since have made it even more apparent. You said that the commercial sector is being driven by state spending and that its commercial reasons mean that it has not thought about defending its assets, but it must now be thinking about that. Therefore, it is looking for state support for that.

The other political point is that everyone is talking about increasing defence spending across the board. Can it help to drive a defence-focused industrial strategy to build our technical base? How do we make all these things work? Is there a danger that we will go off in two or three different directions? That is often what happens with defence: you spend billions of pounds and achieve very little.

Theodora Ogden: RAND's work includes a lot of publicly available information that was released in support of the defence space strategy for the MoD. We developed a decision-making tool to navigate UK decision-making on own, collaborate and access. This essentially asks which systems we should go for: our sovereign capabilities versus accessing or collaborating with partners. As mentioned before, the UK is heavily reliant on the United States for capabilities and access to data information and expertise. Through this collaboration, the UK has developed niche pockets of expertise but, arguably, has become overdependent in most space capability areas.

Similarly in the civil and dual use arena, the UK has relied heavily on international collaboration through the European Space Agency and other frameworks, as opposed to developing sovereign solutions. Given finite resources, the UK should own space capabilities only where necessary, collaborate wherever possible and access space data or services from the markets where prudent. In general, there will be a need to balance across own, collaborate and access capabilities across the UK's portfolio.

It is worth mentioning here that collaboration can look different in different cases. The UK could be a lead partner, an equal partner or a junior partner alongside other nations. Similarly, access can look different. This could include commercial off-the-shelf products or service agreements. There are of course trade-offs to consider. Focusing on one area can take away from another. Resourcing remains the key deciding factor in realising the UK's strategic ambitions. Ultimately, this is a policy decision that should be taken with consideration for the required long-term resources and the trade-offs. Here there is a need for market intelligence and horizon scanning to provide up-to-date information and identify the key risks.

Lord Bruce of Bennachie: Can you be specific about what our strategic priorities should be and what our technical capacity is best suited to?

Theodora Ogden: The UK aims to lead at the forefront of technology R&D overall, which is an incredibly ambitious aim. It is also important to focus on broader technology areas, such as AI and quantum, as these have applicability to space and wider uses. This means sustained investment in those key areas and areas such as advanced manufacturing and robotics. Increasing the quantity and value of R&D grants will be important, as will enabling access to small and medium-sized enterprises and, essentially, overcoming the challenges of SQEP—suitably qualified and experienced personnel. Resources are likely to be a determining factor in positioning the UK as a meaningful actor in space.

Juliana Suess: I agree with everything that has been said. The Americans have put this much more succinctly: build what you must, buy what you can. Obviously, the UK has a very different space budget from the US. We need to be much more diligent about setting priorities and seeing exactly where the UK can fit in. That has happened to an extent. It has been mentioned that there are quite a few niche capabilities and expertise levels that the UK has been working on.

However, mentioning Galileo specifically, since it is classed as a security project, the UK was excluded from it after leaving the EU. The prospect of the UK building its own PNT system is unrealistic. It is a huge project and rather expensive, with long timelines, and access to GPS is assured at the moment. This goes back to the terrestrial and other alternatives, bolstering in case of an outage. That would be more realistic here, given the timelines that are involved.

Q41 **Baroness Fraser of Craigmaddie:** You have given us a wonderful menu of strategic priorities and areas where the UK could develop. Our role is

to make recommendations to government. We have not really explored how we expect government to tackle these strategic priorities.

Is there anything else that you would like to add about what might need to change in government's attitude to space? I am thinking of the House of Commons committee's report that said there was no coherence in space policy across Whitehall. You have mentioned skills, R&D and all of that, which is very wide-ranging. Do you have any thoughts on recommendations for how government addresses these?

Theodora Ogden: In a nutshell, funding commitments and resource are important, as is a coherent national approach, a wider understanding across Governments and understanding the value of space, the risks of space and how it impacts the various governmental departments. I also note reliable international partnerships. These three elements are arguably all critical to realising the UK being a meaningful actor within space.

Here it is worth pointing out the UK's unique position and strengths in being a diplomatic broker between nations. We have seen it in the UN OEWG and in other fora. Leading on the diplomatic forefront as an honest broker is a really good position for the UK to be in.

We are incredibly well placed to collaborate with European partners. Despite Brexit, we are still part of the European Space Agency and we have good bilateral arrangements with countries such as France and Germany, and, uniquely, further afield, with the US and Australia, through the UK-Australia space bridge. There is a lot of opportunity there to increase investment and knowledge exchange through those fora. One of the most important enablers for collaboration is the ability to build on existing relationships and past successful collaborative efforts. The UK has a couple of significant long-standing partnerships with some of the key space players, which forms a good basis on which to expand efforts and continue to grow and share good practice.

Juliana Suess: I have three quick recommendations. The first is to stop treating space as niche area, which it is not. Within defence, we see this all the time, specifically with the fact that Space Command is now managed by the RAF, so it is now seen as an RAF thing—but that is not the case. The Army and Navy are very reliant on space, but, as I said at the beginning, if it is working, no one complains about it and how vital space is is not noticed. So increasing the prominence of space and making people more aware of what it does for us specifically in the context of defence is important.

The second recommendation is to be prepared. We mentioned disruption and degradation, which we will have to face in the next conflict. They have not been faced in the previous conflicts that the UK has been involved in, but they will come, so we need to get ready for them through training, alternatives, working with partners, et cetera.

Lastly, a sense of realism is needed when we look at space. We talked about the budget limitations and constraints and about the timelines.

Space Command was set up in 2021, and we have seen these strategy documents come out since then. The UK is very ambitious when it comes to space, and it is great to see that enthusiasm, but we need to be realistic about what can be achieved with the budget available in the time we have. That includes working with partners. Obviously, the US is the space partner of choice for most of Europe, because it is the partner with the most money, capabilities, history, legacy and expertise. However, if the UK specifically also wants to work with more similarly minded and similarly budgeted partners, looking towards Europe is equally important. If we are looking at who in the region has pulled off huge space projects, we see that Galileo and Copernicus were both from the EU.

The Chair: Do you think that, now that some of the tensions around Brexit are over, we will go back into the Galileo programme? Will they have us if we want to contribute to it?

Juliana Suess: If I am not mistaken, I have seen some reports that this is being discussed again, but I cannot say which point this is at.[3] It would be helpful for the UK space economy.

The Chair: It would seem to be to everyone's mutual advantage.

Q42 **Lord Robertson of Port Ellen:** The House of Lords Select Committee on autonomous weapons systems reported recently—I do not know whether you have read the report. It made the criticism that the Government's AI summit did not involve defence. Is anything happening in Ukraine that has a relationship to how we should look at AI and autonomous weapons systems?

Theodora Ogden: We have definitely seen the use of autonomous systems and AI. The conflict within Ukraine has shown the importance of AI-assisted data analytics and mapping, for example, and this is likely to become increasingly important. Continued investment and understanding the linkages to defence and its significance will remain critical.

The Chair: Thank you for your assistance. We have the Foreign Secretary coming in in a couple of weeks, and we hope we will get somebody from the MoD. We certainly have plenty of questions, and you have helped us prepare for that, so we are very grateful. Thank you for spending the time with us. As I said, we will send you a transcript to make sure that you are happy with it.

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[3] Post-meeting note: the witness explained that she has not been able to locate any information indicating that these kinds of conversations are taking place.