Space Power in the 21st Century

Dean Godson Good Morning. Welcome to Policy Exchange. My name is Dean Godson. I am Director. It's my pleasure to be able to welcome you all here today. I say the word welcome with particular feeling since everybody will be issued with a good conduct medal for braving the demonstrations outside and various tube obstructions. Today we're delighted to be able to put this event on for so very many reasons but particularly because Policy Exchange exists to keep the policy debate in Westminster and beyond, fresh, novel, on a multi partisan basis, and to be able to inject new ideas into the policy bloodstream. It's perhaps one of the remarkable features that has been much great scientific work done in the area of space policy. But on both sides of the Atlantic, perhaps too little policy work done and that's what the creation of Policy Exchange's Space Policy Unit is intended to rectify, and to inject those new ideas into the political and policy bloodstream. There's been much talk because of the growing importance of space, description of new space, Space 2.0, many other ideas and of course the whole question of space industry amounting globally to over a trillion by 2040. It's clearly of growing importance to all aspects of our civilian life, of our defence life, national security and perhaps more particularly cross piece to the rules based order in space a topic which has been neglected and which many of those here have written about so eloquently, and that's why we're looking to integrate all of those into a single Space Policy Unit. It's a particular privilege to have Secretary Wilson come here from over the pond for this event on her last official visit as U.S. Air Force secretary. She will be introduced by Chris Skidmore MP, present space minister and we will then have a discussion with a winding up and summary from Lord Willetts who has been so important, an intellectual driving force in the area of science, technology and space over several decades, and whose own work on this subject for us 'eight great technologies' I commend to you all still to this day and very far seeing it was too not least on matters of space policy. So Chris, overdue, looking forward to hearing your introduction. Thank you.

Chris Skidmore MP Thank you Dean. I'm delighted to be here as the UK's space Minister. Not only is it a true honour to listen to this forthcoming keynote speech from Secretary Heather Wilson, but also to be here at the launch of Policy Exchange's Space Policy Unit. Now I believe this is incredibly important. It is the first of its kind. As a former research fellow of Policy Exchange, I'm delighted to see them leading the way on this, and since becoming minister for science research innovation and that includes space, I've come to realise fairly quickly that space is a key underpinning, an emerging technology that affects all areas of scientific endeavour. Obviously recently we've seen some key announcements that affect not just space exploration but also the spin offs in those technologies such as in healthcare for instance, where we're looking at adaptation of space technology to help dementia patients for example. But I also recognise there is a crucial amount of myth busting that still needs to be done when it comes to looking at the UK's position when it comes to space. Though we are leaving the European Union we are not leaving the European Space Agency. Contrary to what several members of parliament still seem to insist when we turn up to departmental questions. And in fact our space industry is thriving more so than ever before. It's grown 91 percent since 2008 and the whole industry is worth an estimated 15 billion

pounds today and employs forty two thousand people, and as the work by the UK Space Agency and UK Space prosperity has shown, there is tremendous potential going forwards for the future we need to invest more, both in terms of research and also in terms of people. The government made recent announcements of 99 million pounds for a national satellite test facility at Harwell or 152 million pounds for our international partnership program. But we can and we must do more in our race towards achieving 2.4 percent of GDP spent on research development by 2027. But I hope also that the Policy Exchange space unit will help me, and certainly help my officials, look at some of the bigger questions that we still need to grasp when it comes to looking at UK space policy. What does a joined up government policy towards space look like for the future? If we look at civil contingencies, military, Earth observational capacity, space exploration, obviously satellite commercial opportunities. But how can we make sure every department is aligned on these priorities. Should we be creating a national space framework as a government and should we be also creating a national space Council for the United Kingdom along the same lines as the USA? And what can we do to learn from our key partners like the United States? Above all I believe that cooperation and collaboration must be our watchwords. And I'm delighted that we continue that close collaboration with the United States from whether it's the 23.5 Million pound grant to Lockheed Martin to establish launch operations in Sutherland and Scotland, the NASA insight mission, to our ambition is to play a major role in the NASA led Mars sample return mission. The US and the UK have a long and rich history of collaboration when it comes to science. Twenty six Nobel Prizes have been awarded jointly between our two countries and obviously with the first UK/USA Science Technology Agreement signed in 2017, I really look forward to working with our US partners going forwards into the future. So please put your hands together to welcome Secretary Wilson to give the keynote address. Thank you.

Dean Godson Thank you Chris. Thank for those kind words and all distinguished alumni always welcome back here of course Policy Exchange. A great privilege now to be able to introduce Secretary Wilson, be known to many of you here, but just by way of a brief resumé of her career and achievements. Third, I think, graduating class of women at the Air Force Academy at Colorado Springs holder of a private private pilot's license. Congresswoman from New Mexico. Distinguished Service on the armed services intelligence and energy committees, distinguished service on the National Security Council staff of George H.W. Bush and of course most recently now since 2017 as U.S. Air Force secretary superintending the new space force that's been created by the current United States administration. Also I should add a distinguished collegiate rower for Oxford University where she took her DPhil. I'm proud to say that James Cracknell who was our nutrition fellow as you all know age 46 won in the Cambridge boat a few weeks back. So perhaps that will be a return to the colours for you in that capacity as well in the Ladies boat but we're honored to have you here and look forward to hearing what you have to say. We will then have a Q and A and look forward very much to hearing what you have to say. Thank you secretary.

Heather Wilson [00:08:37] Well thank you so much Dean. I gave up rowing when I moved to a state that had no water. New Mexico has no water but it's wonderful to be back with you today and thank you for the invitation to come to the Policy Exchange and my

commendation to you for setting up a Space Policy Unit. There is not enough thinking going on in this area and I appreciate your willingness to support that thinking Lord Willetts thank you for your leadership here and on so many other things and of course Chris thank you for your leadership and advocacy for research and for the research investments required for great societies to flourish. I very much appreciate that and of course air marshal Stu Atha is here. Thank you sir for joining us here today.

Heather Wilson [00:09:22] About four weeks ago, airmen at the 11th space warning squadron in Buckley Air Force Base outside of Denver Colorado detected and warned of a missile launch. It came from Abdul Kalim island off of the coast of India. The missile flew for three minutes before making impact with an Indian military observation satellite about 300 kilometers above the earth's surface. Three minutes from launch to impact at low earth orbit. The combined space operations center at Vandenberg Air Force Base just south of San Francisco California immediately began tracking and cataloging about 270 pieces of space debris bigger than about 10 centimeters in diameter. Tracking space debris has been one of the missions the United States Air Force has done for the world since the 1960s.

Heather Wilson [00:10:27] In fact as kind of an it's kind of ironic when in 2007 the Chinese launched a missile and destroyed one of its own dead weather satellites creating almost 3000 pieces of debris. The United States started tracking that debris and when that debris might interfere with a Chinese satellite it's the United States Air Force that warns the Chinese of that fact.

Heather Wilson [00:10:54] India's space program started in the early 1960s. But last month they became the fourth nation ever to demonstrate anti satellite capabilities. The United States of America is the best in the world at space and our adversaries know it. Our missile warning satellites detect rocket launches and calculate where those rockets are going in near real time we feed information to a global monitoring system. The Royal Air Force has long been a partner in this effort jointly operating the ballistic missile early warning radar at RAF fylingdales. They have been watching the skies since 1953 and they have been operationally part of the global ballistic missile defense system since August of 2007. But missile warning isn't the only thing that we do from space. The United States military has a little less than about 100 operational satellites at the moment. It's not a lot of equipment when you think about it.

Heather Wilson [00:12:04] The biggest one is probably as big as a school bus and the smallest one is a cube about that big. Hundred pieces of equipment that enable operations in every other domain. We monitor and predict the weather. We operate global satellite communications ensuring that the American president can give orders to field commanders any place any time in any conditions. We also buy time on commercial satellites. That's one of the things that the Air Force and Space Command now does for all of the United States military and Department of Defense. In fact that a couple of months ago we signed a contract with IntelSat for expanded support for our remotely piloted aircraft. IntelSat, just so you know, also helped millions of Americans fall in love with a place called Downton Abbey. Never seen it myself but I guess this makes it a dual use satellite.

Heather Wilson [00:13:08] Thirty three of our 100 satellites deliver position navigation and timing for much of the world. The atomic clock on the G.P.S. Satellites is the timing signal for the New York Stock Exchange and for every automated teller machine in the United States of America. So for about a billion people every day the blue dot on your phone is produced courtesy of the United States Air Force.

Heather Wilson [00:13:40] About 40 American airmen at [?] Air Force Base outside of Colorado Springs Colorado provide that service to a billion people every day, and their average age is 22.

Heather Wilson [00:13:55] It's just terrifying.

Heather Wilson [00:13:58] We also operate America's launch facilities for both civil and military uses. The United States Air Force doesn't build rockets anymore. We buy launches from commercial launch providers. But we've done these missions since the 1950s. Last month several national representatives of allied and partner space organizations came together at a symposium in the United States. It is the largest space symposium that happens annually in the world. Many represented the emerging space nations and were there to develop great relationships with other space faring nations because space is rapidly becoming a common domain for human endeavor. Things that were far too expensive for anything but the largest nations in the world to participate in heretofore are now becoming within the realm of possibility for countries, and companies, and even individuals. The cost of launch has plummeted. At the same time the size of payloads has declined and technical advances have made space more accessible and more useful so more nation states and individuals have greater access to space than ever before.

[00:15:21] Much of that is to the good but not all activity in space is peaceful.

[00:15:29] Our potential adversaries have watched how we use space and they are developing the capabilities to deny us the use of space during crisis or war. Our satellite systems were largely built for a benign environment. We built glass houses before the invention of stones, but now China is deploying satellite jammers deploying operational ground based anti satellite weapons and directed energy weapons. Russia is developing ground based anti satellite missiles, directed energy weapons, and sophisticated satellites to interfere with our satellites on orbit. To remain dominant in space to continue to rely on space in crisis or in time of conflict the United States must see the world as it is, not as we would wish it to be. We have changed our strategies and our programs that support those strategies in order to remain dominant in space. Two years ago we made a significant shift. Backed by a significant increase in the budget in order to adjust to emerging threats. Last month the Air Force completed a 90 day review to validate and update the work that was done two years ago. This study critically examined our current strategy the vulnerabilities of our space architecture our concepts of operations for providing space capabilities to military forces and command authorities and defend our vital national assets during conflict. We used the best intelligence estimates that we had. We used red teams to help us determine what we need and when we need it. So how does the United States now think about strategy in space as a contested domain rather than a benign domain? Since Teddy Roosevelt, America

has spoken softly and carried a big stick. While 24 hour news cycles and social media may be less soft than in earlier eras the United States military would always prefer that an adversary choose wisely and choose not to fight us. We all prefer that space remains peaceful. Because if war extends into space, everyone loses. But we are developing the capabilities to deter and if necessary to fight and win in the space domain as we do in all other domains so that our adversaries are more likely to choose wisely and deal with our diplomats and not with our war fighters. As I mentioned our satellite systems were designed when space was a benign environment. They're actually quite fragile things. Exquisite systems built to last years and not easily replaced. We didn't outfit them with self-defense mechanisms because those defense mechanism to work necessary we now have to rethink how we protect what we have and how we design new constellations of satellites to be able to defend themselves. If a conflict extends into space our satellites must be able to take a punch and fight back. Let there be no doubt, we will fight back. Our way of life our economy our national defense depend upon it. We have the will and all the authorities we need to defend our vital national interests. Deterrence is the goal. And to achieve deterrence we will hold adversary space systems at risk.

[00:20:02] We have been exercising our ability to conduct war fighting operations in a contested space domain and every news scenario sharpens our skills and our knowledge about our satellites and how to protect them. But a boxer who is able to stand in the ring and take punches is not enough. We must be able to swing back to stop an attacker. But there are other elements of our strategy for a contested domain beyond just protection and being able to stop an attacker. Through complexity we will seek to create multiple dilemmas for our adversaries. There are advances in commercial satellite systems at low cost that open opportunities for proliferated resilient and redundant systems and mesh or web of capability in space. In addition to small numbers of high value asset nodes gives us more options in crisis or in war proliferation of low earth orbit satellites alone is a losing strategy.

[00:21:13] But as one dimension of a multi-dimensional strategy to dominate in space, it is a useful addition. With our joint forces and allied partners we are developing a global network of war fighting capabilities and expertise. We want any adversary to pause, to wonder whether they know what all of our capabilities are and we want them to doubt whether they really know exactly what we can do in space. Uncertainty itself can create a pause and cast doubt in the minds of decision makers that their own plans will work. It is an important element of an effective strategy of deterrence.

[00:22:05] We will develop the ability to be unwarned, unpredictable, and deceptive in space.

[00:22:14] So these are the four elements of American space strategy. Protect and defend our satellite systems. Hold attacking systems at risk and stop them from attacking. Proliferate systems to complicate an adversary's choices and create doubt that they really know what is going on. All of those without multi-dimensional strategy rides on a foundation of well-trained people with the awareness of what's going on in space so that they can decide and act. Our people make all of this happen from introductory space courses through a joint and

allied training and exercises to real world coalition deployments, our people are developing experience together. They're developing the hands on knowledge on how to integrate space, cyber, air, sea and land components faster and to greater effect. Speed to decision or what airmen like to call the OODA loop. Observe, orient, decide and act faster than an adversary even knows what's going on so that you can overwhelm before they can understand what they might even be able to do about it. Allied partners are working together combining strengths and perspectives to create asymmetric advantage. Former Secretary of Defense James Mattis was fond of saying that nations with allies thrive and those without whither. Seventy years ago this month, 12 nations signed the North Atlantic Treaty, and has helped keep the peace ever since. What is true on land, sea and air, is also true in the space domain.

[00:24:12] Last October we explored some of the complex issues that we will face as allies. It's something we call the Shriever War Games held in the United States at Montgomery Alabama at Maxwell Air Force Base. Over three hundred and fifty people participated from the United States, United Kingdom, Australia, Canada, New Zealand, France, Germany, and for the first time ever last year Japan. The war game considered what a space engagement might look like in 2028 given the technologies that are on the horizon and what are some of the questions and policy issues that decision makers would have to make and on what timescale. It was collaborative and it revealed how we might fight in a multi domain conflict as a coalition of allied nations. It also reaffirmed the importance of having resilient systems and gave us insight into what contributes to deterrence and the policy struggles and the choices decision makers could face. Training and education among like minded spacefaring nations is one key to continued dominance. The United States Air Force has opened the doors at our national security space institute to current and emerging allies and partners from our introductory to advanced levels. We lengthen the introductory course, opened it to more emerging nations and elevated the classification of our upper level courses to enable more candid discussions with our closest allies including the United Kingdom. Creating space professionals with a common operating picture is critical to being able to work together seamlessly. Last July we changed our joint space operations center in California where we track those objects and space to what the American Air Force calls ‘combined space operations center’ and combined means with our allies. There, allied Space Forces execute command and control operations around the globe in a variety of missions including missile warning, position navigation and timing, and space defense. The team includes space operators from the United Kingdom, Canada and Australia. In January we certified and awarded space wings to three Canadian space operators. Now while we have always had a very close special relationship with the United Kingdom, between the United States and Canada, Air Defence has been integrated since the 1950s. In fact it's a little known but when a hurricane hit Tyndall Air Force Base last fall causing us to evacuate our air operations center there that protects and commands the air defense of the United States of America we have a fallback plan and the air operations center at Langley Virginia, it took up the cause and for three weeks the air defense of the United States of America was commanded by a Canadian general and no one ever even noticed. Britain was the third space faring nation in the world and has a legacy of supporting cutting edge space capabilities from the Black Knight and the Black Arrow, thankfully there was no Black Adder, to the Cassini mission and a new Mars

rover being tested in a Chilean desert right now. However the Galileo debates work out it is clear that British scientists and engineers played a key role in its success. United States Air Force Office of Scientific research has been collaborating with UK universities, government research centers and industry from our office located here in London for years. Places like the University College London Leeds, Hull, applied Space Solutions and [?] research. At Strathclyde they're developing reconfigurable agile spacecraft constellations that could rapidly change course and coverage over targets of interest. United States is funding that research with British universities. We also just kicked off a three year research initiative with the Defence Science and Technology laboratory that has focused on space situational awareness. As an example researchers at Warwick University are using sophisticated machine learning techniques to help us distinguish between dead and dormant satellites. You know we monitor every piece of debris in space. In the past we looked at it like a catalogue. We just check to see if things are there last week where we saw them last week. But in a contested domain that isn't good enough we need near real time space situational awareness of every object in space. In the event that something that we thought was debris turns out not to have been debris this is world class fundamental research to keep both of our nations on the cutting edge of space defence. As a young officer when I finished my graduate degree from Oxford University I was stationed here in the UK at RAF Midenhall. My job was to be the liaison with the British Ministry of Defence and to advise the American commander of U.S. forces here. It was the Cold War. A time of heightened tensions as the Soviet Union built up intermediate range nuclear missiles in Europe. I worked on the upgrade to the ballistic missile early warning radar at our RAF Fylingdales the bed down of cruise missiles at RAF Greenham Common in RAF Molesworth. While there were differences between our countries at that time, we worked it out along the way. The depth of our partnership with the United Kingdom was evident then as it is today. We are stronger together than either of us is alone. Thank you.

Dean Godson: Secretary Wilson very kindly agreed to answer questions. Usual Policy Exchange house rule no question too outrageous you just have to state your name and organization first. Whom do I see? Gentlemen there in the middle with the white pen name in organisation.

Hello Josh Arnold-Fauster I'm an independent consultant. I notice how much the bigger role that the private sector plays in space policy in the US, and no doubt you have views about how foreign investment is allowed or not allowed to participate in the U.S. space industry. We're currently in this country looking at that. There's a white paper called national security and investment. What is U.S. policy on that and how do you implement that to ensure that your space industry continues to reflect your national security requirements.

Heather Wilson We have some very explicit security requirements for who we do business with. It's much more open to the Five Eyes than it is than it is, by five eyes the UK Canada Australia and New Zealand and the United States, than it is elsewhere or to other countries.

I would say that we do we do have some really…I mentioned that we don't build rockets anymore we buy launches. We just bought a launch…the United States Air just bought a

launch from Virgin Galactic. So we work together we have some joint development kinds of agreements. And it's generally not such an issue between the UK and the US and it's because your standards for things like cybersecurity and national security industry are very similar to our own.

Question

I mentioned that we track objects, we track about 25000 objects in space. They're larger than about I'd say a softball. But I guess that's not a sport here. So 10 centimeters or so. We are improving our ability to see clearly what's going on in space and we have a ground based radar that's that will be operational in [?] in the Pacific later this year that we'll be able to go from.

So we'll go from 24000 objects in space that we track to over 100000. So the size that we'll be able to see will be much smaller. And we'll be able to see out further. So this gets back to the challenge of space situational awareness and being able to watch what is going on and be able to defend ourselves as well as to detect what other people may be doing.

Lord Borwick, House of Lords in Westminster: With the very large increase in number of small satellites produced by private producers. I'm thinking of spaceX and their permission to put up 4000 satellites. Is this going to change the communication abilities in small places in the UK which still suffer from 'not-spots' or not getting decent communication out in the countryside? And what are the implications on the use of radio frequencies for this communication increase.

Heather Wilson Both very good questions. I'm aware of at least two or three companies that have proposals from massive constellations of low earth orbit satellites to bring ubiquitous communications and internet in the sky kinds of things. Those are those are commercial operations. The United States Air Force buys commercial satellite time from commercial satellite providers and so we would probably be one of the customers for one of those kinds of systems. It also creates the potential opportunity to buy off the line a cheap commercial satellite and put something on it. The thing that we're cautious about from the military is we always have to think OK it's not just it's not just for use in peacetime. What is the mission of that particular small satellite and how long would it have to survive in conflict so what is it doing, and then do we care if it's dazzled or blinded or stops working for some reason. So we have to take those things into consideration when we think about relying on low earth orbit satellite systems for military purposes. But we do think, particularly for communications, if you can manage the data flows it may give you a lot more resiliency. A web is much stronger than node to node communications because there are multiple pathways to where you want to go. So if you lose one link in a web you can still get to where you want to go and so there's there is a certain inherent resiliency in web communication. It's a much bigger data problem but we've mastered that on the earth. We do it on the Internet all the time. We do it in cell towers. So if these companies can manage to do this I think it'll be a tremendous commercial advantage. It'll also be a national potential help to national security. You asked about

frequency issues. These are huge issues in the United States and elsewhere. And we have spectrum dedicated for military uses which is always under pressure for other kinds of uses as well and including next to the G.P.S. signal which has been a real issue. So it'll be an issue and will continue to be.

Stephanie from the Aerospace Corporation. I'm just interested in your 90 day review. What did you find was the most compelling thing that you uncovered?

The big issue, or the one that that I think we need to think about. There are people who say 'well the answer for a contested domain is proliferation of low earth orbit satellites' that you know 'the panacea will be commercial space' and it's not. In fact it's quite vulnerable. The best strategic answer is a multi-dimensional strategy.

And that's why I outlined those four things we're trying to achieve. We're moving from an uncontested domain where we provided a utility service to the world and to our joint forces brothers and sisters, to a contested domain where we have to think about being able to fight and defend ourselves while we're providing those services to the warfighter. To do that, we have to be multi-dimensional. A unidimensional strategy fails.

Antonia [?] Sunday Guardian in India. Are you able to say anything about U.S. - India space collaboration partnership? And is it likely that India would ever join five eyes, making it six eyes?

Heather Wilson: I don't think it's likely in the short term. I think we are seeking to engage aspirant space and space faring nations all over the world in a positive way. And one of the things that we've talked about a little bit privately before we came out here is, and that it might be a useful thing for the Space Policy Institute to be doing thinking about we're trying to encourage it in the United States as well. What are the norms of behaviour? Norms of the behaviour have existed…I mean think about it. I flew here this morning overnight through completely ungoverned part of the world. You know the air over the ocean is not a governed space but there are norms of behaviour and international agreements that govern what altitude we fly at and how we communicate, what we do if we come head to head with another aircraft. And those norms of behaviour developed over a very long period of time and really were derived from the law of the sea which which evolved over hundreds of years. We really don't have established norms of behaviour in space and everything from de-orbiting satellites after they die. So the plan for de-orbiting before launch, space traffic management, space conflict resolution and including the obligation to minimize debris, the formation of debris in space. So I think there are opportunities for establishing norms of behaviour and those norms should be established through a conversation with any space faring nation. But I don't think it's likely that India would join the five eyes anytime soon.

Alice [?] UK Space Agency: Secretary you spoke about space surveillance and tracking data. And historically that's been held in rather close hold in large part to protect a military mission. Given that we're now moving to an age where there are many many more actors in space, many more commercial players, can you envisage a time when those data will be more widely

available because the overall benefits for the safety of all our operations will outweigh that incumbent risk to the military mission.

Heather Wilson We actually are very open we have an open public database that tracks all of these objects that are more than 10 centimeters in diameter and we have done that for the world since the 1950s. So it's completely open. We also have bilateral agreements with companies and countries to warn them of any potential interference or a high risk. So we do the modeling of any potential interference or when a piece of debris might be coming close to someone's satellite. And we have a bilateral agreement them to warn them. The one decision that has been made recently in the United States is to shift that responsibility from the air force to the department of commerce so that they become the front door on notifying countries and companies of potential collisions. We're very happy to do that and the Department of Commerce has been out with us at Vandenberg Air Force Base understanding how we do this how we do the tracking. I think initially they're realizing just how hard this is, to keep all of these things up to date, and what a big effort this will be. But the Air Force will continue to have to for national security reasons track all of these objects. We're quite happy to just share our data and data from any other source into the Department of Commerce to take the lead on space traffic management. We're very happy to transfer that mission over.

Admiral Lord West: A simple sailor. Thank you very much indeed secretary for a very clear articulation of the position of this splendid presentation. Thank you very much indeed. I was very impressed by the openness of it. I worked very closely with NRO in the mid 80s when actually you know you mentioned one word of it you were shot at dawn sort of thing. So it's quite impressive how much more open it is now. My question relates really to the problems we have at the moment with our enemies. You very clearly articulated how you moving forward are going to protect the systems. How are you going to make sure that somebody has a go at them is has got to be worried about what you will do in return. But we know people like Putin and others with their hybrid warfare try and do things which are not attributable so my question really is: Have we got instances where things are being done where we can't easily spot that the damage is being done by a specific player? Or are those things too difficult to do?

Dean Godson A couple more questions in the clutch. Who else wanted to ask?

Neil Fraser from viaSat: We do broadband for about a million people at home and also senior leaders. The questions about ESA and where we're moving in the UK, so we're going to remain part of ESA. You've talked about some of the investment that USA forces make in the UK. We clearly have a very long standing light blue relationship and space ops but looking why do and if we ever end up with a Brexit. Do you see a close the UK/US collaboration on a wider government perspective, on a wider industry perspective? How do you see that development. Is that an opportunity for us?

Dean Godson One more question here on this I've neglected this side rather gentlemen who have been waiting patiently as well. Name an organisation please.

Secretary Wilson thank you very much indeed for the talk. [?] from NCC Group. You mentioned cybersecurity a couple of times in your speech. I just wonder whether very quickly you can just talk a little bit more about some of the challenges that you have. Perhaps some of the investment figures related to that. And anything else that you think might be interesting. Thank you very much.

Heather Wilson If I hadn't had a pen I would've missed the first question and answering the third. First with respect to with respect to the NRO and the issue of things being potentially non attributable one of the things about space is if we have the ability to detect, if our detectors are good enough, our space situational awareness which we are also trying to improve as I mentioned it's a little bit hard to hide. With the one exception probably being cyber. Because there is the potential you know potential to interfere with cyber. But jamming, dazzling, directed energy, and certainly direct ascent. Or we generally know where each piece of debris near each satellite came from and if a satellite is getting too close to one of ours we start to wonder why. It was publicly in the press I guess a year and a half ago now where the Russians announced that they had launched a space maintenance satellite. The ability to maintain satellites on orbit. And my question was 'are they maintaining theirs or ours'?.

So with the exception of cyber non-attribution is a little bit harder in space because there's just there's not as much of a place to hide. You mentioned the NRO. Most people don't know this, the NRO is a joint operation was started between the air force and the CIA and was hidden under the air force until 1992, its budget still comes through the air force and half of its people are still air force so it's a great example of a partnership between two entities doing some very good work.

With respect to European Space Agency, the United States has a very close relationship with the United Kingdom we also have relationships close relationships with France and Germany with respect to space and we are trying to strengthen and deepen our alliances and partnerships all around the world. So I think the change here will probably not make a difference to our approach to the UK. We are trying to deepen our relationship irrespective of what choices are made with respect to Europe. And finally with respect to cyber yes cyber is a significant challenge I think for all of us. The United States maintains 39 cyber mission teams which we then give to cyber command for both offensive and defensive missions

[?] Former technical director for the Asia Pacific Safe Space Center and also [?]developing a high altitude long endurance aircraft. I was interested because you didn't talk about high altitude pseudo satellites and they're obviously coming in the near future and I've been working on one. So I was interested to go and see your view as to how that fits into your future strategy in the US.

[?] UK Space Agency. I had a question about the Space Force. Was it intended to actually perform any functions of the US Air Force currently doesn't? And what were the main drivers behind the creation of it?

Nick shave from Inmarsat here in London. Secretary you talked about space traffic management and also norms of behavior in space. When do you think it will be appropriate to create an organisation like the IMO or ICAO for space.

Alistair Donald from the Academy of ideas. I was very struck by the way right throughout your talk you mentioned terms like defense and protection and deterrence. And I think back 50 years ago and the exercise of power in space seemed to be inherently linked to the idea of greater reach and discovering new things and I just wondered if you thought that role of exercising power was gone now or does it have a future.

Heather Wilson Let me start with the last one. My role is as the secretary of the United States Air Force my purview focuses on the security of the United States and the protection of our vital national interests. The broader aspirational part of space and the missions of civil space particularly NASA or outside of my purview. And so my talk today was really about our national security space policy. But no we haven't lost sight of the broader aspirational mission and in fact. The president and the vice president and the director of NASA have set an ambitious goal to go back to the moon and [?]. So there's a lot going on in that world as well. It just doesn't happen to be in my job jar. So I leave that to others.

With respect to pseudo satellites and we had a interesting conversation about that this morning the air force has not really looked at that much. We do have some we had looked at some concepts which we decided to forego probably four or five years ago that I'm aware of. Of course we have satellites, we have aircraft and we do have stationary dirigeables that we use for some things but not the kinds of things that you were talking about very high altitude long endurance kinds of craft. So it would be interesting to see what you find there and what the relative advantages and disadvantages of those are, so interested in looking at that work.

On ICAO and space traffic and norms and whether that organization will likely exist someday, it may. In the meantime I think we need probably and this is not again it's not my job jar. It's more of a state department kind of issue of how do we establish these norms of behavior and make sure we have open lines of communication with other countries that may be considering conducting experiments or doing things which would cause concern. And one of the reasons we opened up our space educational institutions to emerging allies and partners is because it's people that carry ideas and even the simple idea that when you plan for a satellite you must also plan for its deorbit and eventual death and that the death of that satellite has to be controlled as well and how to go through and think about these things as a matter of policy. We believed that it was in all of our common interests to get more people around the world educated in thinking about these matters. And I think that that's probably it. I got em all four. Thank you.

Just before calling upon David Willetts to do the vote of thanks. I would just like to say how delighted we are at the inaugural event of this unit to see so many key players in this space, no pun intended, present not least. Dr Graham Turner on behalf of the UK Space Agency as chief executive. So welcome to all we hope we'll see you many more times this brilliant initiative must be credited to one person in particular Gabriel Elefteriu the head new head of

our space unit. It's been an outstanding work and to put something together like this is absolutely huge. Also our managing director Julia Mizen who helped pull this event together today it looks like a [?] you know the swan looking ironic above the surface while paddling madly beneath it. So congratulations please to all of them for their part.

One final thing. Because the exigencies of exfiltration from this place can be so difficult when David's vote of thanks is complete, if you could let our guest of honour depart swiftly and sharply through that door and remain in your seats. We would be hugely appreciative. David thank you for your friendship through the years and I look forward to doing what you have to say. Thank you.

Lord Willetts Well thank you very much Dean. And above all thank you to Secretary Wilson for her fascinating speech an account of US policy. In fact the speech went so well that while she was delivering it was officially announced that President Trump would indeed be making his state visit to the UK on the 3rd to the 6th of June. So it's clearly gone very well indeed. She gave us some fascinating insights into US space policy and of course people on the defence and security side do think of space as the ultimate high ground. And that observation that it has shifted from a benign environment to a contested environment is crucial in helping us understand the development of US thinking and this development of US thinking about security is matched as we heard in the Q and A by increased energy also being put into civil uses of space. And we have all observed the extra energy commitment and funding that's gone into space in the US in the last couple of years. Thank you to Secretary Wilson for what you said about your collaboration with the UK both with our universities and research institutes today but also of course the security collaboration notably but not only through fylingdales and a key part of the challenge of observing a potential missile attack. I can still remember my visit to fylingdales a few years back. And it's certainly gone down in the folklore there that there was at least one occasion during the Cold War when it was fylingdales that assured the US military that it really was a meteor shower and not a Soviet missile attack. So it's a very important function that it carries out. Looking forward, you drew our attention to the challenge of space debris on several occasions. That was very interesting and significant. If I may declare an interest as a member of the board of Surrey Satellites we're doing a lot of work on space debris and I already have developed both a kind of Harpoon and a net to enable us rather like a Roman gladiator to attack and bring into being under control flying space debris. Now we also benefited from some very important remarks from our minister Chris Skidmore. And you can sense how clearly committed Chris is to space as part of his ministerial responsibilities. And it's always interesting when a minister starts formulating a question and the question that Chris put out before us today about what would be the role of a potential UK Space Council. And I know that is something that Chris is very interested in and of course would be a means for the first time of directly integrating within the framework of a cabinet committee, both military and civil work on space, so potentially a very important initiative indeed. So we're delighted that you have joined us today. I think although I absolutely cannot speak on behalf of our security and defence people I think it is observable has been a real shift in thinking in the past few years. We used to be beneficiaries of this special relationship with the US, and although we did contribute through fylingdales

and other means there was a sense that we were net recipients of data and support from the US. I think there's increased commitment on the UK now to developing autonomous capabilities of our own which can in turn be shared with our key partners in the Five Eyes community. That's a really significant development in our defence thinking. Finally thank you to Dean Godson and Policy Exchange. It's great that we are going to have the UK's first Space Policy Unit. It's a great initiative and we've learned from today's meeting how important it is that we think carefully about this crucial domain. Thank you very much indeed.