

Defence Committee

Oral evidence: One-off Session on Undersea Activity, HC 1689

Tuesday 10 February 2026

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Members present: Mr Tanmanjeet Singh Dhesi (Chair); Mr Calvin Bailey; Emma Lewell; Mike Martin; Jesse Norman; Ian Roome; Michelle Scrogg; Fred Thomas; Derek Twigg.

Questions 1-83

Witnesses

I: Commodore (Rtd) John Aitken, Underwater System Services General Manager, Thales, and former Deputy Director Submarines, Royal Navy; Brett Phaneuf, founder and chief executive, Submergence Group LLC (USA) / M Subs Ltd (UK); and Professor Peter Roberts, Associate Fellow, Centre for Public Understanding of Defence and Security, University of Exeter.

Examination of witnesses

Witnesses: Commodore (Retired) John Aitken, Brett Phaneuf and Professor Peter Roberts.

Q1 **Chair:** I call to order today's one-off House of Commons Defence Committee evidence session on undersea activity. I am very pleased that we have an eminent and experienced panel. I welcome Commodore (Retired) John Aitken, an underwater systems services general manager at Thales and the former deputy director of submarines in the Royal Navy. It is also a pleasure to welcome, albeit virtually, Mr Brett Phaneuf, the founder and chief executive of Submergence Group LLC in the US and MSubs Ltd in the UK. It is also a pleasure to welcome back Professor Peter Roberts, an associate fellow at the Centre for the Public Understanding of Defence and Security at the University of Exeter, who has given evidence to the Committee before.

Gents, thank you for taking the time out. Many of us find undersea activity fascinating, but the aim of our session is to inform not just Defence Committee members, but the wider public, of the importance of undersea activity. We want to get into the nuts and bolts of this thought-provoking area of defence and wider national security. To set the context, what value do submarines and autonomous marine vehicles have that cannot be easily replaced by other platforms? Commodore, will you start?

Commodore Aitken: The first thing is their invulnerability; they are very difficult to find. I will talk about submarines first, because that is my real area of knowledge, and they are extremely difficult to find. We have invested heavily in quietening technologies and in ensuring that they are difficult to find. People tend to think of the sea, and water in general, as a homogeneous body of water, but it is not; it is made up of layers of salinity, temperature and pressure. All those affect the way that sound is transmitted through the water. If you can understand the environment you are in, it is much like wearing a camouflage suit in a forest—except that the forest keeps changing all the time, so you need to change your camouflage as you move through it. The submarines that we have and the submarine technology that we have developed allow us to understand the environment that we are working in and to camouflage and hide ourselves.

Submarines can provide you with strategic reconnaissance that could not be done through any other method in the way that submarines can deliver. They provide you with a continuous at-sea deterrence in a way that could not be delivered by anything else. The invulnerability of the Vanguard-class submarines is absolutely unchallenged. They are incredibly difficult to find, even for another submarine—and I have tried; I have been involved in exercises with Vanguard-class submarines, and they are disappointingly quiet. Trying to find them is like looking for the proverbial needle in a haystack—worse, in fact. They are incredibly quiet submarines that are incredibly well driven by very capable commanding officers.

As well as strategic reconnaissance and continuous deterrence, we have deep strike through the Tomahawk land attack missile. That gives you a stand-off range of approximately 1,000 miles, but it is delivered from a platform that can put a missile into a building and pick the window as we do it. It has incredibly accurate weapon targeting. It is also one of the most proven systems in the world.

Then there is the threat to potentially hostile shipping and/or submarines. The submarine is the key weapon delivery platform against any other submarine and holds other ships at risk and imposes cost on the operators of those ships. UUVs are developing, but are helping to spread a network of interconnected platforms in the undersea area. We need to be careful about understanding exactly how much the technology is ready, what we can develop and whether the answers are as we expect. The good thing with anti-submarine warfare—which we refer to as ASW—and the undersea environment is that there is a lot of well-developed and proven science. That helps us to be pretty clear about the answers on the technology we are using.

Q2 Chair: Professor Roberts, what do submarines and autonomous maritime vehicles offer that nothing else does?

Professor Roberts: A threat to an adversary that cannot be seen. Let's express it very clearly: submarines only fulfil a niche part of a naval or a national security mission. They cannot do naval diplomacy or alliance building. They do not do any of that multi-domain operation stuff that everyone loves to talk about. They are a very specific niche function. Within that, the submarines operated by the larger states that we are talking about pose a very real threat not just to other military assets, but to political levers and instruments and critical national infrastructure.

They do that in a way that is frustrating, if you are sitting on the receiving end because you do not know where they are. Lots of people talk about the ability to make the oceans transparent. The last time we saw something like that, NASA tried it by layering several sensors that covered an area of coastal water—relatively small, in terms of naval experience: about 25 miles off the coast. It was able to see everything from the surface of the seabed, whether it was metal, organic or whatever, through a series of overlaid sensors. However, you cannot do that across the entire ocean.

As it stands, the oceans are a big black space. If you are on the receiving end of another state threatening you with a submarine, you have no idea where it is—genuinely no idea. As John said, it is the needle in the haystack, but the haystack is the North sea, the north Atlantic and the High North. You are trying to find something within that with a limited number of assets. That is frankly impossible without some excellent intelligence and cueing to start you off and then some very boutique, bespoke, specialised platforms with people at the end of them who can turn that data into something where you can find out where it is.



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Yet, even when you find out where it is, the question is: what can you do about it? Again, you are caught in a number of really difficult conundrums that constrain what you can do. Sure, you could surface another submarine next to it, or you could put noise in the water so you know where it is—but an hour later it might well be gone. The threat that they pose is constant, difficult to detect and is not manifested by any other existing capability. We know of nothing else that can replicate what a submarine does in terms of posing a threat. That is why we have seen this expansion since the 1980s of states wishing to operate submarines and building their own to perform those specialist functions.

Q3 Chair: Mr Phaneuf, could you talk the Committee through submarines and autonomous maritime vehicles? What are your views on what makes them so special that we cannot get that capability with any other platform?

Brett Phaneuf: It is hard to add to what my two esteemed colleagues have said. They are 100% correct that submarines are a key deterrent and national capability that should be invested in at great haste. Without a doubt we should have more submarines. The advent of uncrewed and/or autonomous systems will be helpful in defraying some of the cost and delays in building submarines by having a capability that works in concert with them.

Often people tell me that we can do away with submarines if we have better autonomous vessels, but I think the opposite. Submarines are the key capability that enables the clandestine deployment of all manner of uncrewed and autonomous sensors—whether they are propelled or sit on the seafloor or in the water column. They also allow us to reduce our own risk while holding other adversaries at risk, given the small number of submarines that can be brought to bear.

The development goes hand in hand and submarines, in particular, are not limited by range as we are with unmanned systems. That is largely a power problem and a communications problem; the latter is being solved in a bunch of different ways by increasing the sophistication of the operating software in the unmanned systems. They rely on surface vessels and/or submarines, and I think the best argument for more submarines, beyond the things that we have discussed already, is we need them to be able to deploy a vaster array of intelligent sensors subsea that are uncrewed. While that will not make the ocean transparent, by any means, it will give us a little bit more capability to perhaps make our adversaries think twice about where they are manoeuvring to our disadvantage.

Q4 Chair: In your opinion, have we seen a huge increase in undersea activity? Is that something just in a particular region in our part of the world in the Atlantic, or is it something that you are picking up around the globe?

Brett Phaneuf: We are seeing a lot more people get into the sea at a lower cost of entry using a panoply of uncrewed systems, microelectronics and acoustics technology. Much of that is driven by advances in design, material science and data processing capability. The undersea domain in



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uncrewed systems is catching up with the microelectronics explosion in the 1990s and early aughts. That is what is driving a lot of it; the cost to entry is very low. The strategic value of those things is questionable for small states, but there is an ever-increasing number of sensors in the water and devices that can act in a way that might be to our disadvantage.

It is certainly proliferating. I think the most obvious example of all that is what is happening in the Black sea. We are seeing sophisticated CONOPS deploying surface and subsurface systems, which are fully uncrewed, against capital assets. They are sort of the very definition of asymmetric warfare. Those technologies are proliferating; we have seen similar very low-tech capabilities in Yemen, put together with parts that are bought in hardware stores and on Amazon, eBay or Alibaba. That is frightening. It is about will more than it is about technology at this point.

Those are not going to overall threaten the nation; those are things that will harass and weaken us through abatement of trade, changing how we do things and making things more financially costly. Our key adversaries have been very rapidly developing a considerable mass or number of extremely sophisticated capital assets, both crewed and uncrewed, that we are going to find hard to match in Europe or in the United States in the near term.

It is not so much Russia, but definitely China, although the Russians have a long history of proliferating their excellent capabilities in subsea design and we underestimate that capability at our peril. It is a very different approach from the way we build things. They build tractors, to some degree, which are very sophisticated, robust and reliable; we tend to build Ferraris. I think ours are better, but the Chinese in particular are going to have a lot of them and that is something we are going to have to contend with.

Q5 Chair: We will come on to the detail of the capabilities of other nations later. Professor Roberts, it is interesting that Mr Phaneuf mentioned about the Black sea and Ukraine recently using underwater explosives to attack Russian submarines. Do you sense a proliferation of undersea activity and if so, why?

Professor Roberts: Yes, there is proliferation, yet it is quite localised and very contextual. For example, you might see the Houthis in Yemen trying it, but it does not work effectively for them even around the chokepoint that you would expect. We have seen huge experimentation by the IRGCN—the Iranians—who are now operating a whole variety of home-made platforms in the straits of Hormuz. The North Koreans have been experimenting for a long time with lots of undersea capability. We are now seeing the Taiwanese, the Indonesians, the Filipinos—everyone is trying to get into this game, but it is questionable how effective it is. Exactly as has been said, it is about the concept of operations, because you can buy all the stuff you want and you can field it, but if you cannot marry it together and use it effectively, you are really pouring resources into a hole that has no use. It is about how you use it.



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If you asked the Ukrainians, for example, whether they would want a nuclear submarine if you could give them one, of course they would—they would give their right arm for one, and it would be the same for the Houthis or anyone else around the world—but that is beyond them, so they are using what they have to use at the moment to deliver a disproportionate operational effect, which is what people have started to see in the underwater domain.

It is area that has been underused and under-invested in, and it is exploitable with a very low cost barrier to entry, certainly compared with previously. Before, if you wanted to operate a submarine, you were talking about decades of building experience to understand the water column, and needing master's-level mathematicians to help you understand pressure hull designs, periscopes and targeting—all the things that need to operate underwater. It is really complex stuff. Now, you can do it with electronics and information available on the internet, so the barriers to entry are much lower. That stuff has allowed for the uptick in activity that we are seeing around the world.

Q6 Chair: Commodore Aitken, when you gave evidence to the Joint Committee on the National Security Strategy, I remember we were enthralled hearing you talk about what is happening in the north Atlantic. You described how extremely difficult it is to operate in the Atlantic because of the depth and various other factors, but are you sensing an increase in undersea activity in other parts of the world? If so, why?

Commodore Aitken: There is, for reasons my colleagues have already described. The cost of entry has reduced. We need to be really careful about taking lessons from Ukraine and the Black sea, because the Black sea is a pretty small area of water. The Atlantic is 1,600 square miles and it goes down to 4,000 metres, so it is a very different picture from the Black sea. While the cost of entry has decreased, the ability to impose cost may not. You can hold things at risk, and drones or unmanned vessels may be able to pose a threat that you need to deal with, but their ability to do something significant may not be as great as traditional submarines or other platforms.

There has certainly been a massive increase, probably because of awareness of the importance of undersea infrastructure and the part it plays in global trade. During the JCNSS session, I likened it to bridges and roads previously: you would strike at that infrastructure because it is infrastructure, in the same way that the cables and pipelines across the world's oceans are now part of the infrastructure that facilitates trade across the world.

That is why we are seeing that increase, and there certainly has been an enormous increase, as has just been described, in the number of people getting involved—people who traditionally have not been involved. I think we would describe the Houthis as a non-state actor; it is pretty unusual to get non-state actors involved in this sort of activity. But it is still really difficult to do. The Chinese are increasing their ability exponentially and have outperformed every prediction that I have ever seen. They have

done incredibly well. I challenge the idea of the Russians' submarines being tractors—if they are, they are very good tractors. The latest class of Russian submarines is first rate—excellent.

Chair: We will get into the nuts and bolts of it; I just wanted to set the scene.

Commodore Aitken: Certainly. There has been an enormous expansion. It is an awful lot busier now.

Chair: I am grateful to you. Now that the scene has been set, we will do some precision striking on specific areas. To display that, we will move on to Derek Twigg.

Q7 **Derek Twigg:** It is interesting that Putin's father was a submariner. We know from open source—read any book about him—that he takes a great interest in, and is very proud of, his father's service. Probably unusually for a leader of a country, he takes a specific interest in this area of warfare. Could you explain what the Russians have—their capabilities—and how they want to use it, compared with what we have?

Professor Roberts: The Russians operate a mix of 64 submarines in their navy. They have ballistic missile submarines, so one of the arms of their nuclear deterrent is held at sea. They have 18 of those. They have 10 land attack submarines—dedicated platforms that throw long-range missiles at targets. They have 16 hunter-killer submarines that are rather sophisticated. All the fleet is undergoing a massive recapitalisation. They have 21 conventionally powered submarines. That is just in terms of the scale.

They also have a directorate called the GUGI, which is the main directorate of deep-sea research. That operates 50 ships and submarines of its own, which operate down to 6,000 metres. There are a variety of specialist ships. Their primary role is in the protection of their own critical undersea infrastructure, but they also have a secondary role, which is to strike at others' critical undersea infrastructure. You have these two arms, which are a really significant submarine capability.

The Russian idea of submarines is built around their idea of assured second strike capability left over from the cold war. Their whole naval ethos was built around that capability of submarines. It did not come with aircraft carriers first; they came with submarines first, and everything else built out from that. The numbers for both their surface fleet and their submarine fleet are all built around this assured second strike capability at sea, which they retain at sea at all times, up in the High North, in their own bastion—the original bastion, we call it in naval terms. Outside that, there are layers of protection, and crossing those layers entails certain things. They operate their fleet really as a bastion for their nuclear deterrent first, and then everything else comes second. Whether it is naval diplomacy, expeditionary warfare or striking land targets—whatever it is, it is built on that key capability of submarines.



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To illustrate that, during the cold war, other arms of the Russian navy grew and built up, but post the cold war, when there was the massive reduction in funding for the Russian navy, the submarine fleet retained the professionalised ethos that was absent elsewhere across the Russian military forces. It retained the amount of investment, certainly in research and development and in engineering pathways, and continued to build up capability in specialist, particularly deep-sea, missions. Their under-ice capability under the Arctic, planting flags, was all done on post-cold-war money, when everyone was stretching for funds for hard power.

The submarine fleet has become a critical tool for Putin and the Kremlin, because they are fighting wars at the moment in—I think I have said this to the Committee before—a counter-value proposition. This is where you strike not at targets that are military but at those that undermine the political will and societal will to fight. If you look at Ukraine, they are going after power plants, undersea infrastructure, telegraph cables and oil pipelines. In the same way, if you look at their activity across Europe, IISS produced a very good report earlier this year that talks about what they have done, whether it is sending parcel bombs through the mail in Denmark, shutting down airports or cutting off electricity supply to Berlin such that the city was without power for a week earlier this year, sewers did not work and there was no water.

That is how they are fighting. They are not doing traditional military on military stuff that we like to imagine as a war; they are fighting a war in a very different way. We are calling this hybrid or grey zone—whatever unhelpful term we tend to use. Their submarine arm, both in the Russian military and through GUGI, has become an essential task in how they wage that war. They are having a direct impact on political will, on societies and on publics. But for them, it is helpful because it cannot necessarily be attributed and therefore they add a degree of obfuscation within the whole thing.

Q8 Derek Twigg: In terms of the first line of defence and the land battle, we are clearly further away from the eastern front, but underwater we are pretty much on the frontline, aren't we?

Professor Roberts: Yes, absolutely. The UK hosts 119 data cables and—whatever it is—\$17 trillion-worth of trade passes through the data cables that are hosted here. It is the gateway to Europe; it is the gateway to the Mediterranean. In data cable terms, it is the gateway for Europe into the United States. It is huge. Not only that, but the energy pipelines are enormous connectors through the UK, so the UK is on the frontline and, more than that, President Putin has expressed, both in his doctrine and in his speeches, his desire to strike at the UK directly.

Q9 Derek Twigg: Basically, any tiredness or lethargy in building up our own capabilities there could be pretty serious.

Professor Roberts: Indeed.

Q10 Derek Twigg: How would you compare the capabilities of the Russians with those of the west and the UK? How would you compare what their



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vehicles—their submarines—can do with what we can do? This is on detection, for instance.

Professor Roberts: It is the breadth of capability they bring. They have the ability to operate down to 6,000 metres and they operate all the time under the ice. Their expertise in operating in the Arctic, in a really different area—I suspect Commodore Aitken will go into this in a second, but operating under the ice is very different from operating anywhere else in the north Atlantic or North sea. There is their ability to operate at depth and at scale—they have 64 submarines compared with us. There is the specialisation they have, the professionalism of their forces, and the assured funding streams that they have for maintenance and development. They also have huge political support. The Poseidon 6 system that has been talked about, the nuclear torpedo that they have, is designed to create tsunamis that will flood ports. This is President Putin's personal project. He has assured the funding for it, so the political investment in this force as a tool is absolutely clear. It also gives them resilience, in terms of the sheer number of platforms they have.

It is not only that. For President Putin, knowledge and expertise about submarines has been something he has been able to trade. It used to be that to get North Korean weapons or North Korean soldiers to fight in Ukraine for him, or for him to be allowed access and basing, he would trade away ballistic missile technology and knowledge. Well, he has done that; it has sort of gone. You are now starting to see what is potentially the leaching and offering of submarine expertise to states like North Korea and Iran in exchange for key capabilities, whether that is mass drone manufacturing or engineers being put to the frontline in Ukraine. This is the area of expertise that he is willing to start thinking about trading. Previously, nuclear submarine operating knowledge was something you never shared. It was kept within a strictly confined group of people. These were the crown jewels of military knowledge.

Q11 **Derek Twigg:** Sorry—just because of time, and because other people want to speak, can we get a short yes or no answer? Are we matching their capability or are they ahead of us?

Professor Roberts: I think they are way ahead of us.

Q12 **Derek Twigg:** Thank you; I just wanted that to be made clear. I am interested in their command and control. Do the Russians have much autonomy compared with, say, what our commanders have, in terms of what they do?

Commodore Aitken: I am not sure we can go into that, with the classification of it.

I will just follow up on the Russian capabilities. That is exactly as Peter has just described. I would say that they also developed the submarine capabilities over decades to offset American superiority in carrier strike groups. That is one area where we offer threat now; there is a carrier strike group for the Royal Navy that can offer threat against the Russians as well. That is something that can impose cost on them.



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The whole purpose, apart from an assured second strike, was to impose risk on carrier strike groups and amphibious groups that were trying to get across the Atlantic in order to reinforce Europe in the course of a major war. The capabilities are as described. The Russian submarines of the latest generation are extremely capable. The Borei-class SSBN—the ballistic missile-carrying submarine—and the Yasen-class SSN are first-rate submarines; they are very difficult opponents.

The platforms operated by GUGI are things that we do not have and reflect the sort of investment that continued during the post-cold-war years by the Russians, who continued to invest heavily in submarines because they always saw that as their point of difference—along with their ability to operate under the ice, which I think is really important. I have been under the ice, but I went with an American submarine. We have a very limited capability under the ice now in the Royal Navy, and we need to reinvest in that. We know that the Russians would likely send their SSBN force to the High North under the ice because it makes them difficult to track and follow. We also know that they have the ability to burst through the ice and then fire missiles into Europe or North America, which reduces reaction time.

While people think that it is incredibly quiet in the polar seas, it is not; it is really noisy because of all the ice movement, and it is a very difficult environment to operate in. In addition to that, they are likely to be able to ice pick—that is, to be able to sit with a fin pressed against the bottom of the ice, which makes it really difficult to distinguish them from ice keels. They have a tremendous array of capabilities, including diesel-electric submarines, which offer them choice in how they behave.

I think that their activities across the submarine flotilla would encompass all of warfare, from the shaping operations at the outset—we are talking about the GUGI platforms, which might be looking after their critical national infrastructure, but they can also strike against ours. If you can turn off people's gas supplies—we have, I think, seven days of gas in the UK—that can have a significant effect. If you can affect online systems through attacking cables and transactions, that can have a significant effect and wear down people's willingness to fight or resilience within a country.

They have options. Then if you talk about the potential, which is not deniable, for strike capability, the Kalibr missiles are going to be fired from submarines. They have deep strike and the ability to conduct grey zone operations—or whatever the current phrase is for it—and to then strike against land, surface and submarine targets. They are a very capable navy.

Chair: Gents, could you be as concise as possible, please, because there is a lot of ground to cover in the hour and a half, and there are various issues that we want to raise? There is a supplementary question from Jesse Norman.

Q13 **Jesse Norman:** First a comment: it is odd that the European nations do



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not understand their strategic dependence on pipelines coming into the UK—that seems to be a surprising aspect of what you have said, Professor Roberts—and data. My question is about the Baltic. I take it that the Baltic is now effectively closed—or semi-closed—to Russian submarine activity. Is that right? How do you read that? What are the effects on the posture of the overall Russian maritime fleet?

Commodore Aitken: They have a base in the Baltic, so they can move submarines from the Baltic and they can operate there—

Q14 **Jesse Norman:** But they are going to go through the Danish straits, which are shallow, contested and controlled water.

Commodore Aitken: Absolutely, it is shallow and contested, but that is why they operate SSKs there, because they can operate in shallow and contested waters. It is more difficult for them, certainly, but they can still operate. I think the last time we saw them, they transited through and out. It is certainly more difficult for them.

Q15 **Jesse Norman:** Is there a posture implication for that in terms of moving assets around or changing investment levels?

Commodore Aitken: Yes. It makes transit more difficult because we can see them. They are more likely to get counter-detected as they come out of the Baltic. But then the UK's ability to operate in the Baltic is pretty limited as well. European nations might be able to, but we find it difficult.

Q16 **Mr Bailey:** I want to take you both back—Professor Peter in particular. When you were talking about grey zone and hybrid activity, you were both slightly disparaging of that term and the characterisation of the war that is being fought against us by the Russians. Can I propose that maybe part of the reason why we collectively do not understand what is happening to us is because of that nature? I think you characterised it very well. Are you aware of Warden's theory of strategic attack?

Professor Roberts: No, go on.

Q17 **Mr Bailey:** Warden proposes that strategic attack—it is a US doctrine—takes place through five strategic rings: fielded military forces, population, infrastructure, system essentials and leadership. If you strike the inner five, you do not have to attack the fielded forces. That is pretty much what you put to us a moment ago. Is that consistent with your view?

Professor Roberts: I think this is the way that Russia sees that it conducts wars. It is ingrained in its philosophy of warfare that you can use military, but it is but one tool. The west talks about that, but Moscow, Beijing and Iran are all rather better than us at actually using the levers of power. It is not necessarily that they are orchestrated better. It is not about some central beautiful singularity that is able to synchronise all these things. They are just more willing to use them, and they are not scared of the consequences.

Mike Martin: Thank you very much; this is very interesting. Brett, I wonder if I could start with you, as the sole American on the panel. I

would be interested in your experience.

Brett Phaneuf: Gosh.

- Q18 **Mike Martin:** Hopefully you will see why from my question. We have spoken about Russia. What about China? What has China's journey been? Where are they at now? What are their capabilities like, and what do they want to do with them?

Brett Phaneuf: Well, I am not an expert on China, but I can tell you that their capability in undersea warfare is increasing rapidly. They are fielding a vast number of submarines and iterating very quickly. Their capability is increasing. Of course, there has been past technical exchange with Russia, which helped them initially, but I think they are moving past that now. They are getting quieter.

Our technology is still ahead of them, but they will have substantial mass by comparison. I think their plan, as we can see with the nine-dash line and how they are behaving in that area in the South China sea, is that they are going to expand their territory in that area and reinforce it. They are going to use all manner of power to do it, including submarines, if they must. I am not sure we are really paying close enough attention to it. One of the key areas that we do not talk a lot about is the shipyard capability there.

- Q19 **Mike Martin:** Is this "we" the Americans or the west?

Brett Phaneuf: The west. From the American perspective—I have to be careful what I say—we are definitely shifting focus to the Pacific. That is our primary concern. That does not mean we are ignoring the Russians. I think the US military would be very pleased to see Europe increasing its work in the north Atlantic. But the Chinese threat is taken quite seriously in the US military establishment. It is our paramount concern, and rightfully so. They are planning to fight that initial war—non-nuclear war—close to home. Their shipyard capability vastly outstrips not just the United States, but the west. That is going to be a key issue beyond just whether their submarines are good—they are good, and they are getting better every day.

- Q20 **Mike Martin:** Can we find their subs?

Brett Phaneuf: Submarines are very hard to find, and they operate in an area that is very hard for us to operate in. There is a lot of counter-detection. There is a lot of hostile action. We can to some degree—I have to be quite careful about what I say—but they are less concerned with that in the areas close to home, where they are operating, than we are when we are there, because we are in their backyard. We are not particularly concerned about Chinese submarines on the California coast. They are much more aware of our submarine operations in the west Pacific.

Commodore Aitken: The thing with the Chinese navy is, as I said earlier, the exponential increase in capability. They have outstripped everybody's predictions. They are operating in a way that is showing them to be very proficient at all-arms ASW.

Q21 **Mike Martin:** Vessel for vessel, UK to China?

Commodore Aitken: In terms of capability, we've got better. I think we have better submarines than they have, but they are increasing their capability.

Q22 **Mike Martin:** Based on their current curve.

Commodore Aitken: I would not like to try to predict, because they have outstripped everybody's predictions. But they are using A2/AD systems; and anti-access area denial systems as well, which imposes costs on us being able to get in there. My colleague was talking earlier about the threat of our platforms being counter-detected rather than theirs operating in their own waters. It makes it a much easier game for them to play.

I think I mentioned the ability to conduct sophisticated all arms, anti-submarine warfare, which is very impressive. I remember listening to a Chinese official—I won't say who—talking at the Defence Academy a few years ago, who insisted that the Chinese navy was an entirely defensive organisation with defensive capabilities, and I noted at the time that aircraft carriers and nuclear submarines are not defensive capabilities; they are very definitely expeditionary capabilities for force projection.

Q23 **Mike Martin:** Who does the hydrology of the South China sea—maybe hydrology is not the right word, but water columns and characteristics of the topography of the underwater world—give the advantage to?

Commodore Aitken: The Yellow sea in the South China seas, and that area, is extremely difficult to operate in.

Q24 **Mike Martin:** Why?

Commodore Aitken: Because of the sonar profile, but also because of the congested nature of the area. There are huge numbers of fishing vessels and other vessels in the area, making the likelihood of visual counter-detection quite high. And Chinese fishing fleets generally have satellite phones to talk back to officials in China to say, "There could be somebody here." So they operate with the PLAN.

Q25 **Mike Martin:** There is an island chain of allies—we have two island chains, in fact. One assumes that you could rig that with sonar defences, so that you at least know when Chinese subs are passing in and out of it.

Professor Roberts: Can I just say, to dig John out of a classification hole here, that in theory you could; but the reality is that the shape and type of the water space, how noisy it is, makes that really difficult. So the options really are to think about this in a new way—perhaps to deploy swarms of uncrewed vessels that would help you detect in the water column: rather than having to sit on the seabed and try to filter out all the noise above, you could localise some of it. The problem is the sheer number of vessels; we are talking about 200 submarines operating in the South China sea.

Q26 **Mike Martin:** Wow!



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Professor Roberts: It is a huge number. That is not just crewed—it is uncrewed as well. Then you have the Chinese state fishing fleet, which is effectively part of its coastguard—

Mike Martin: Naval militia.

Professor Roberts: Thousands of naval militia. So the South China sea is certainly in favour of the Chinese navy, I would say right now, without a shadow of a doubt.

Q27 **Mike Martin:** Super-interesting. Peter, what is China trying to achieve with its submarine fleet?

Professor Roberts: Firstly, it has gone for the Russian bastion concept. So it operates off Hainan island, which is a big naval base. That is where it bases its ballistic missile firing submarines. Outside of that, it has got protection. It would claim that its nuclear hunter-killer submarines are the line of protection around that, and then again outside that. But really it is pushing to contribute as a whole-force concept towards retaking of the first island chain, dominating the water of the second island chain, such that it becomes the regional hegemon and excludes everyone else militarily.

Q28 **Mike Martin:** It is putting our allied military vessels and shipping at risk to make it harder for us to reinforce.

Professor Roberts: The one thing they are worried about is US carrier battle groups—no one else. If they can push those back such that they cannot support Taiwan with massive amounts of air cover, they have succeeded in what they need to do.

Q29 **Mike Martin:** They would have to push them back a very long way, right?

Professor Roberts: With F-35s, you do not have to push them back that far.

Commodore Aitken: And if you have hypersonic missiles the whole platform is at risk; that is an issue too. So you don't have to push them back that far to get lodgement on to Taiwan. And once you have got lodgement on Taiwan, it is very difficult to get you off.

Professor Roberts: If you can push them back 400 nautical miles, then you have reduced the amount of time that the airpower can spend over Taiwan.

Q30 **Mike Martin:** That is super-interesting. Is there anything else before we move on from China, or anything else that we need to know about China?

Professor Roberts: Brian's point is really important. The rate at which they are accelerating is shocking. I don't think we have ever seen anything like this in terms of a state developing technical capability as quickly as they have. They started from a really, really low ebb, but they have accelerated and grown with speed and continuing speed—faster than I think we have ever seen in submarine warfare before. Their ability to push out whole submarines at a rate of three, four, five to one, against all of the West every year is pretty shocking.

Chair: Before we move on to other nations, Emma Lewell wanted to come in on China.

Q31 **Emma Lewell:** What is the under-ice capability of the Chinese navy?

Commodore Aitken: I am not sure. I think they have a programme to invest in icebreakers, but I don't think they have under-ice capability. I know they have announced themselves as a near-polar nation, whatever that is supposed to mean. Well, I know what it is supposed to mean. I don't think they currently have an under-ice capability.

Q32 **Emma Lewell:** But they are developing it?

Commodore Aitken: I think they would want to, because if you are looking at the potential for what the Americans call a blue pole, with a permanent trans-polar sea route by the 2040s, then everybody will want to have more. It is not going to turn all blue. You will have a trans-polar route that would enable trade and/or other activities, and they would certainly want to be able to develop that.

Emma Lewell: Thank you.

Q33 **Mike Martin:** Do any other countries pose a threat to the UK with underwater capabilities?

Commodore Aitken: It is difficult to say whether they pose a direct threat to the UK. The expansion of underwater capabilities across the globe makes it more difficult to operate securely. North Korea was mentioned before. I am not sure that North Korea could hold us at risk, but it might be able to hold some of its neighbours at risk.

Q34 **Mike Martin:** What about in our near neighbourhood?

Brett Phaneuf: One thing we have not mentioned that I have been a bit involved with peripherally is the prevalence of underwater technology in narco-trafficking. That is a real thing. It is a bit regional right now, although we are starting to see semi-submersible vehicles turn up in Europe carrying tonnes of cocaine and other drugs. They are equally capable of carrying weapons and other things we would prefer not to see transported.

We certainly have a problem with them in the Gulf and the Pacific, up the Mexican coast. Most of them go undetected. They are not particularly sophisticated, though they are increasing in sophistication rapidly. That is one area where the Russians have been active that most people do not want to talk about. That is kind of an odd adjacent underwater threat. It's not anything like the nuclear capability we are talking about, but it is still something we have to keep an eye on.

Professor Roberts: It is worth highlighting the risk posed by the Iranians in underwater capability to the trade routes and supplies we get out of the Gulf, and their ability to surge that into the Indian ocean, which could be a real bugbear on international trade and stuff that we rely on coming from the far east. They could delay Christmas by a week without too much of a



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problem, if they wanted to. And again, they are building indigenously built capabilities that could do that relatively easily.

- Q35 **Jesse Norman:** We have covered a series of potential threats, including to pipelines and data streams, to surface shipping, to subsurface armed combat vehicles of different kinds. Brett just touched on undersea importation of drugs. Are there any other threats to the UK that you see coming through this domain as an emerging matter? Has that more or less covered the—dare I say—waterfront?

Commodore Aitken: I think the ability to attack subsurface cables is important. Their ability to conduct operations against those cables, whether they are fibre-optic cables for trade or gas pipelines, which are generally more resilient, is a significant threat. We have seen all this dragging of anchors, which is a bit of a one-trick thing, isn't it? Once you have dragged your anchor, you have dragged your anchor. Eventually people get bored with it and will come and rescue you. People will get the right legislative framework in place to be able to do that. But they still have very well-developed capabilities to operate in that area.

- Q36 **Jesse Norman:** Do we have the ability to track shipping that drags anchors in the merchant marine even if they have turned off their transponders and are trying to be as innocuous as possible?

Commodore Aitken: Yes, once you find them and realise what they have done.

- Q37 **Jesse Norman:** Something goes off.

Commodore Aitken: Yes. The depth of the water is a limiting factor as well. You cannot do that once you are off the shelf. It is the ability to do something about it that is important. We do not yet have the legal framework. It was mentioned earlier that the Russians' willingness to do things that flout international law is completely different to ours. We are kind of constrained by international law, which is not necessarily a bad thing—I am not saying that—but international law is not necessarily keeping up with the threat posed to us.

Brett Phaneuf: The Russian capability for deep-sea action is profound, but the Chinese are catching up. They have a very aggressive programme for deep-sea research that will without a doubt enhance their capability to hold critical national infrastructure at risk in the very near term. That is accelerating very quickly.

- Q38 **Jesse Norman:** The Russian ship Yantar has got a lot of attention doing similar kinds of things.

Commodore Aitken: I always think that if Yantar is waving its hands around saying, "I'm over here," I would be interested in what else is somewhere else.

- Q39 **Jesse Norman:** It is a demonstration of capability and a reputable model for people like the Chinese.

Commodore Aitken: Absolutely. Yantar is definitely capable, but if Yantar is being obvious about where it is, I would be looking somewhere else.

- Q40 **Jesse Norman:** Is there anything we should know about what GUGI is doing now that is not in the public domain as we think about trying to raise the level of discussion?

Professor Roberts: There is probably lots that GUGI is doing now that the security services would love to know about. They are operating 6,000 metres under the ice where no one else can go, so no one knows what they are doing and, frankly, we are not going to know. We have the ability to find ships when they turn their transponders off and might be dragging their anchors, but we do not do it regularly. It requires specific effort to go after each individual ship. Yes, the capability exists. Do we do it? No. That is the same around the world.

More worryingly, going back to the other threats, this is not just about the UK or our interests; this is about our overseas territories as well.

Jesse Norman: I was going to ask you about that.

Professor Roberts: Gibraltar, the sovereign base areas in Cyprus, the Falkland Islands, TCI, Ascension Island and Diego Garcia all have key parts. They are not necessarily linked through undersea critical national infrastructure, but they may have it close to them or be susceptible to sabotage, espionage and other malicious acts coming from the underwater domain. We really need to pay attention to that. The UK is perhaps better protected than the overseas territories, but neither we nor the overseas territories are in any way protected enough for what is happening around the world.

- Q41 **Jesse Norman:** Quite. That answers the question I was going to ask, but let's go a little bit further on that. Many of the things you mentioned are sovereign capabilities, but we have lots of interests that are potentially soft targets to a hybrid aggressor.

Professor Roberts: Yes.

Commodore Aitken: Yes.

- Q42 **Jesse Norman:** Our overseas territories essentially give us a global footprint that we will be under enormous moral obligation to defend.

Professor Roberts: Yes, and they are a soft underbelly. Putin would like to emasculate the UK as the sort of moral voice of Europe, particularly against Ukraine, as we have spoken about. Demonstrating the vulnerability of the overseas territories would achieve his aims and distract the mother of Parliaments, the armed forces and society at large. Exactly as John said, while this is going on and everyone is looking at it, the rest of it is happening underneath.

Commodore Aitken: The other thing is that although it is difficult and expensive to do, they are spending the money and doing it. It is also really difficult to defend. This requires significant investment.



- Q43 **Jesse Norman:** There is a whole raft of things coming out of that. There is a series of asymmetries that you have already touched on, but let's talk about the asymmetry in industrial manufacturing and automation. How will that and AI start to change the nature? It seems to me that they potentially turn the seabed into a battlefield in a way that we have not anticipated or begun to prepare for.

Commodore Aitken: The sea and the seabed have been a battlefield for—

- Q44 **Jesse Norman:** The sea has, but I am thinking particularly of the seabed.

Commodore Aitken: The seabed is certainly becoming a battlefield in a way that we have not seen before.

The technology that is used there is very difficult to develop, because it is a really difficult environment to work in, even for platforms that are operating at relatively shallow depths.

If you have to be supported or delivered by a surface platform, then even something as prosaic as the weather affects you. Above a certain sea state, which the North sea is most of the time—I know; I am from Newcastle, and I know what the North sea is like, and it is pretty rough most of the time—and the north Atlantic, which gets pretty rough during the winter, it is pretty difficult to be able to put those platforms in, and to be able to support them. And the Russians have been doing this for years—I mean, decades. They have spent a long time developing their capabilities and we are now in catch-up.

In terms of AI and its ability to help accelerate processing and therefore the classification and tracking platforms, I am not an expert on the subject, but I know there are step changes that will be made.

Communication for me is always one of the biggest problems in the undersea environment, because it is really hard to communicate at range once you are underwater; it just is.

- Q45 **Jesse Norman:** Brett, do you have anything more you want to add on that from a technology standpoint?

Brett Phaneuf: It is much as my colleagues have said—power and comms are always what we worry about, submerged. Do we have enough power on board to do the thing we need to do? With uncrewed systems, that is not the case, generally—we are at the mercy of the state of the battery technology, which is pushing up on the limits of physics. It is not going to double, triple; it is not going to be an order of magnitude more per unit volume, so it will be required to be deployed by other vehicles, either on the surface from a ship or from a nuclear submarine.

That is why I think these are force multipliers that need to work co-operatively, as opposed to developing an undersea autonomous system that is akin to a nuclear submarine. That is not anywhere in the near term for us.



AI will help with deploying autonomous systems and collecting and processing data, and will give a better understanding of what is happening, but it doesn't have intuition and we still need people. Much as we need crewed platforms to deploy uncrewed platforms, we need crewed, trained teams to understand what the threat is that is emerging.

In many cases, we are now just catching up. Before, we didn't have enough data, particularly in ocean sciences. Now we have a vast amount of data that is almost impenetrable. We are now just getting our arms around processing and reducing that data on some sort of an actionable timeline to have military relevance, but it is still nascent. So it will help, but we do have a force problem. We have a skills problem and we have a force problem that won't be solved by deploying AI alone.

Jesse Norman: Thank you very much indeed.

- Q46 **Emma Lewell:** This might sound a bit daft, but when undersea cables are cut, it is quite obvious, but what about when they are tapped into? How does that work? Who picks up on that? You don't need to cut them to weaponise them. I am not sure how that works and what that looks like. How would you know?

Commodore Aitken: When they are cut, it depends on whether you can localise the cut in the first place. If they are tapped, it depends how well protected they are as well.

Do you have sensors on your pipelines that can detect something that is close to the pipeline or the cable, and is able to defend it? That is the sort of technology that would need to be developed by companies who have laid those cables in order to defend their own cables, and understand where breaks might be, or where taps might be, in order to be able to go and investigate them. It is really hard. This is difficult stuff.

- Q47 **Emma Lewell:** Could there be a situation where Russia, for example, has tapped into some of our undersea cables and we don't know about it?

Professor Roberts: There are a couple of things that are probably more difficult for John to answer than me, so I will do this in a sort of theoretical way—I will try to dig him out of this hole.

Commodore Aitken: I have still signed the Official Secrets Act.

Professor Roberts: The first tapping of an undersea cable was conducted by USS Halibut, in the 1960s I think—Operation Ivy Bells; that is well recorded now—where the Americans tapped a Russian data cable. That has continued.

One of the reasons why everyone has, or the Russians specifically have, seabed capabilities is that they can go down and lay stuff next to cables.

The problem with the digitisation of data transport at the moment is this. You do not know what is in each packet of data. The people who own the data and who own the cables and the ISPs cannot tell you what is in each packet of data, so even if you were able to put a black box beside a



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certain data cable, it would be difficult to be able to unpick that and understand it. In the US, the CSIS, the world's best defence and security think-tank, said, in a report in 2021, that it would be practically impossible to effectively tap, subvert, sabotage, change or maliciously use data coming from an undersea cable. But we don't know; we are guessing. This is what the ISPs will tell you.

The other point is that for the UK there are 119 data cables and, as they approach the shore, they are armoured; they have armouring around them as they come through. For the rest of the way they are laid across the seabed, they have nothing around them, so they can break just because a water current pushes them against a rock. Every year since 2000, there have been 190 breaks in data cables around the UK, and they are all fixed. In the 2020s, the Shetland Islands were cut off because of data cables being broken by fishing vessels. That was fixed within a week. The internet service providers will tell you that there is sufficient redundancy in UK cables that they are not worried about them. They are not worried about these cables at all. You are effectively at a point at which they are not worried about it; they can re-lay them. They are responsible for monitoring their worthiness and that they are fit for task, but they do not know what goes on around them. That is difficult because there are 42,000 km-worth of cables in UK waters alone.

Q48 Emma Lewell: Again, it might sound daft, but how do you know whose cables are whose? If there are that many cables down there, how do you know what cables belong to what country?

Professor Roberts: Somebody is going to place a contract to lay them, and all that information is therefore recorded. You can find it on the internet; you can go out and look at who owns each cable.

Mike Martin: There is an amazing website.

Professor Roberts: Right. And when you drop them on top of the ocean, you know where you are laying them. You lay them from a ship; they come out in a big reel on the back. But as they float down through the water, you have no idea where they are. So when people say, "Here's a line on a map," you don't know within 2 km where that wire is.

Q49 Emma Lewell: I think what I was getting at, Professor, is that when, say, you, Commodore, are under the sea, how do you know what cables belong to whom?

Commodore Aitken: As the professor has just described, it is really difficult to do that. They might well have a really precise position as people are laying them, because the laying platform has a GPS set, knows exactly where it is and knows where it is laying the cable. But as the cable is laid, it drifts, so it could be quite a margin off where you think it is. Then to be able to find it—you have to be pretty close to them in the first place to be able to find those cables. It is a very difficult environment down there and it is pretty congested. There are a lot of cables, and for some of those that were laid earlier, the precision in where they were laid—it is not quite a snake's wedding, but it is getting there.

Q50 Emma Lewell: So if you saw one of our adversaries attacking one of our cables, how would you know it was one of our cables, and what would you then do?

Commodore Aitken: You could spend a long time understanding what is on the seabed.

Emma Lewell: This might all sound a bit daft—

Commodore Aitken: No, no—

Emma Lewell: But I am just trying to picture in my head how it works.

Professor Roberts: They probably have a better idea of what is on our seabed than we do.

Commodore Aitken: Yes.

Q51 Mr Bailey: It is largely impossible to meddle with the data or information that is travelling through those cables. That was the inference from what you said.

Professor Roberts: No, that was the inference from the CSIS report in 2021. I don't think it is impossible with sufficient computing power. If you look at patterns, some good AI analysis could get you there eventually. But I worry that we have slightly overegged, perhaps, the threat that the Russians could break in, tap into the cable, and somehow maliciously change or subvert what we were saying in emails. I think that, to a large extent, is overblown at the moment. That might not be the case in five years' time, but right now I think that the threat is slightly overblown.

Commodore Aitken: It is really hard and really expensive to do, and you could do other things, which would cost you less and be just as effective.

Q52 Mr Bailey: Just a direct comparison, say with a building that you are building over cables, that will also really inflate that vulnerability.

Professor Roberts: It might well be the case.

Brett Phaneuf: Well, they are at least a little bit more accessible.

Q53 Fred Thomas: Thanks so much to the panel. We have heard a lot about the state of play, adversaries and threats, but I want to bring us on to the UK and our own capabilities. Brett, what does the UK currently have, and what is it developing, to counter some of the threats that you have outlined? We have a clear picture of China and Russia, among others, developing at speed, and how important some of that infrastructure could be as a threat. What do we have to defend ourselves, and what is in the pipeline?

Brett Phaneuf: I am probably not the best person to ask about what we have, but I can tell you about what we are doing or where we are going. I am still a very big proponent of crewed vessels. Without a doubt, we need more anti-submarine warfare ships, more submarines, and more systems that are not just autonomous but use sensors. We also need networks.



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We used to have this—we still do to some degree—but we need to reduce the cost to put sensors at sea, including the cost of deploying sonobuoys, subsea gliders, APEX floats and seafloor nodes. All these things produce data, and all that data has to be aggregated back through satellite systems. We have to be very careful; you do not really have an at-sea communication infrastructure if you do not have a satellite infrastructure. The industry has seen huge advances in the amount of data we can backhaul at low cost, but that is also something that can be disrupted.

We need to be really sober about the requirement for crewed assets, training and education, and we also need to build concentric rings of simple and complex sensors that work together to produce a richer set of data that can be modelled in near-real time so that we can better understand the battle space. That is not so much because the enemy will care or know that they are being detected—although they probably will—but so that we can proactively position our assets that can essentially act in a way that we would not allow an autonomous system to act—in a belligerent manner to dissuade an enemy. We just do not have that.

We are moving in that direction. With the Atlantic Net and Atlantic Bastion programmes we are seeing some very interesting technologies come together to reduce the cost of deployment. However, the big issue with all these things is going to be people. Just because the ships are uncrewed, it does not mean that we do not need people. In fact, the number of people we need, and the training they need, is much different than in able-bodied seamen. Engineers are in short supply, and sophisticated technicians, computer programmers and computer scientists are in short supply—we are not churning them out fast enough. We are bottlenecking on the human side of this much faster than on the machine side.

Q54 Fred Thomas: That is a very interesting way to finish your point about risks to UK capability, and you have highlighted people skills. I will move on to the other panellists, but I might come back to that at the end of my questions. Commodore, can you give us a loose sense—maybe only theoretically—of what the UK is able to field to defend itself? What are we hoping to have in the future? By the way, we will have specific questions about Atlantic Bastion and so on later, but this is a general question.

Commodore Aitken: We have some very capable submarines, when they are available—we know the challenges with that. We have reinvested in P-8 maritime patrol aircraft. The Type 26s and the Type 23s that are still in service are also very capable platforms, and the Sonar 2087 deployed from them is a very capable sensor. The sensor fit to UK submarines is among the best in the world, if not the best. I might be slightly biased—I work for Thales these days—but I was on a 2076 fitted platform, and it just felt unfair. My sonar was better than everyone else's, and it gave me a considerable range advantage.

We have extremely well-trained people operating all those platforms. The difficulties in training them and in maintaining platforms for training should not be underestimated, because we need a trained and experienced workforce that we can rely upon. We already have some really high-end



capabilities, and we have some really high-end capabilities coming through. The cost of delivering them is increasing, which makes it more difficult, and we should not underestimate the cost of providing for this.

- Q55 Fred Thomas:** We are all clear about the outstanding capabilities—potentially world beating—of the UK submarine fleet. We also know the challenges of availability of that same fleet. You described tens of thousands of kilometres and miles of subsea infrastructure. We will not get into quite how unavailable some of our submarines are, but clearly they are not going to be there at all times to do all things. Will you talk about some of the other capabilities that the UK has, or might need to have and is developing?

Commodore Aitken: The capabilities that were referred to earlier in UUVs and UAVs, which can also play a part—unmanned sensors and unmanned platforms—will play an important part in supplementing crewed platforms. The UK is making strides in that direction, but I will not go into any further detail because of the classification of them.

Professor Roberts: Can I jump in quickly? A few years ago, the Government decided to acquire the vessel Proteus to be responsible for undersea cables, because you do not send nuclear hunter-killer submarines to protect data cables by monitoring them. That is the wrong platform and the wrong thing to do, so they are a separate bag. Proteus was the one vessel that was going to protect the 28,000 miles of cabling and infrastructure that exists in the North sea, so different from what is around the UK. It is enormous and this vessel was going to do that. That seems frankly ridiculous, but it lay on the back of the UK's amazing success in autonomous vehicles since the 1990s in mine hunting. The Royal Navy has been using autonomous mine-hunting capability since the 1990s: it has huge experience at it and is really good, and it is devolved to the lowest levels. Someone who joins as a sailor, can be driving, controlling or commanding autonomous vessels in a mine-hunting scenario nine months later. It is absolutely fantastic, and it is leaps and bounds ahead of elsewhere.

One of the other pieces that the UK has that is brilliant is its oceanographic library—what used to be JDAC Farnborough. The library of sounds, effectively, that the UK owns is probably the best in the world, because it is slightly specialised around our waters—the north Atlantic, the High North, the Norwegian sea, the North sea—

- Q56 Fred Thomas:** How is that utilised? What is its benefit?

Professor Roberts: You use that in a sonar, so when you go to sea in a ship or a submarine, you see in a display all those sounds that happen around you that are normal. That allows you to understand what is normal and what is not normal. You will understand, "Ooh, that is not a normal sound, and it is coming from a big black hole in the ocean that looks like a transit route for a Russian submarine, so I think we probably need to go and look at that a bit more closely."

We shared that library with certain allies, which is a massive force multiplier, because it means that everyone is then recognising what breaking ice usually sounds like in the north Atlantic versus what a Russian submarine breaking through the ice sounds like. You start to share that data and you get an ease of training and understanding. It is an explosion in your training capability, what you can train people to do and your effectiveness. So those two are really important.

For the UK specifically, what I would call the Perisher ethos—I know John probably will not want to talk about it—the absolute pinnacle of our submarine capability, which is those commanding officers, is second to none. That is why everyone wants to come on Perisher, and why our submarine captains are chosen to go elsewhere and assess other submarine capabilities, because they are genuinely the very best. There are a few other bits and pieces, but those are pretty key.

Commodore Aitken: Obviously I would say this, but the Perisher course is still the best course in the world—it is. Some of the other oceanographic capabilities are really important as well. It is really important that we invest in survey capability as well, because we need to understand what our own terrain looks like. If we do not understand what it looks like in the first place, we will not understand when somebody has done something to it. That is really important. The library of sounds is really useful too.

Chair: I am mindful of the fact that we have only 45 minutes and there is still a lot of ground to cover. If the panellists feel that somebody before them has answered the question very precisely, please feel free to say, “Let’s move on.”

Q57 **Mike Martin:** Brett, is quantum computing going to make the sea visible so that we can find subs? If so, how and when?

Brett Phaneuf: No.

Q58 **Mike Martin:** Have I missed something?

Brett Phaneuf: No. I think quantum computing is still in its infancy. It is going to take us quite a long time to figure out how to deploy that capability more broadly in a useful way with the computing technology that currently exists. A lot of research is going on in what one might call quantum technologies—not necessarily computing—to aid in precision navigation over long periods of time, which would facilitate submerged operations without worrying about losing touch with where you are. There are some technologies being looked at for very high-speed, long-range, uninterceptable communications using a variety of quantum technologies that I probably should not go into. Those are still quite a long way away.

We still have a long way to go before quantum computing is proliferating to the point where it is easy to deploy on these vast data sets. Britain has a robust quantum computing research infrastructure and it is moving very quickly. However, I am not sure we will see quantum computing emerging in a way that will defeat the physics of the ocean in the near term—certainly not with the current threat profile our adversaries present.



Mike Martin: Excellent. I can take that off my worry list.

Q59 **Derek Twigg:** In connection with Mike's question, but going back to AI, rather than quantum computing, I want to get clear in my head your view of the possibility of AI being developed to such an extent that it is almost impossible for any submarine not to be detected. Will we ever come to that? The survivability would be so low as to be almost non-existent.

Professor Roberts: The oceans are not digital, so you would need to scatter sufficient digital sensors within the ocean.

Q60 **Derek Twigg:** Are we talking thousands or hundreds?

Professor Roberts: You are talking billions. The problem with the water space is that it is so loud when you go underwater that your bubble of detection is tiny for a single microphone. You need to sow billions of them. They need to be at every level in the water column, not just at the bottom. The water column moves. They all need to be stationary. They all need to be grounded. They all need to be able to communicate instantaneously. The issue we are struggling with for both AI and quantum is that no one is going to put billions of hydrophones or digital sensors into every ocean in the world in the foreseeable future, and we do not know of a capability that could do it from space—externally.

Commodore Aitken: They would all need to be linked up. Detection ranges are going down owing to climate change. A warming Atlantic will see detection ranges reduce rather than increase.

Brett Phaneuf: That does not even touch on the issues around providing energy for all these things. That is a huge problem. AI is a problem just in general when it comes to providing energy to run the server farms to operate the software in a way that makes sense for us at the scale that people are contemplating, which I think is a bit fanciful. Probably the best uses I have seen of advanced software capability lately are in the design of discrete elements that reduce the sound profile of submarines and other things underwater to improve efficiencies in the way systems operate and improve their performance underwater, particularly in fields such as computational fluid dynamics. That has been making some strides lately. These are not orders-of-magnitude changes. They are percentage points at best, but that matters underwater because it is highly opaque as it is.

The application that AI will bring is still quite discrete. Ultimately, we will need sophisticated data reduction models to understand the data that we are getting from the sensors. That is still quite a number of sensors, but, even with the limited number in comparison with the need, it is very hard to make sense of it.

AI doesn't have any intuition; it is not creative. You still need people who have a profound understanding of the battle space and the physics of the ocean to be able to look at things being presented at an increasing pace and make sense of what is actually happening.



Commodore Aitken: I think it might also be useful in helping the operator. If you have AI and machine learning, they can help us to say, "With a confidence level of whatever, I think this is a merchant vessel, so don't bother looking at this until later. I do not know what this is, so maybe you should look at this and have your command system and sensor system helping you." I think AI and ML have a lot to do there.

The Americans say, "Don't try to find the needle in the haystack; just burn the haystack." If you know what everything is, but you do not know what one thing is, that is the point at which you look at that thing. That could be a really useful tool for AI and machine learning.

- Q61 **Michelle Scrogham:** Briefly, professor, can you go back to what you said about our capabilities underwater, specifically for mine hunting? That was really interesting, and I am interested to know if you think that that is financed well enough. I recently visited the Royal Navy in Portsmouth. Of the two ROVs that they have for their capability for mine hunting, one of them is out of the equation for repairs and has been for some time. Is that something that we should be focused on to invest more in?

Professor Roberts: Yes. Of all the things that the Navy has on the cards that are deliverable fast, the autonomous mine-hunting capability is right up there. They have a programme, and it is all done; it is a matter of getting the contracts through and assuring the pipeline, then they can pull the whole thing together. Part of this links through to ambition, defence investment plans and defence command plans—all that stuff that we have been hoping to see for the past year or more—and we are waiting for that to come out.

At the moment, the UK is easily at the forefront of autonomous mine-hunting capability in the world. If it fulfils the potential of the Royal Navy's programme, we will absolutely remain there for the next decade. It is almost the most well-considered and researched programme of historical record that can deliver military capability that we have in the British military. It is fabulously exciting and has full support; it just is not funded.

Industry is ready to deliver, and a number of contractors can put this in place. Do we have enough of it? No. The Royal Navy has effectively taken a capability holiday to say, "We are not going to do mine hunting for the next while, while we save the money to buy this stuff." We need to accelerate that to buy out that capability holiday.

- Q62 **Michelle Scrogham:** Thank you. Let me move on to autonomous vehicles, which we have talked about an awful lot. We have talked about submarines and the need for more of them. You won't get any arguments from me on that, because I certainly think we need more of them, but when we are advancing so far into everybody adopting underwater unmanned vehicles, what are their main capabilities? Where are their shortfalls? What are they not able to deliver?

Professor Roberts: For me—and possibly the other two, because they will talk far more eloquently—the key thing we should think about is that autonomous vehicles are on a tripwire, whatever anyone thinks. Yes, sure,



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they can cue you into something happening there, but if an autonomous vehicle or a drone gets destroyed, does anyone care? No. Is there any kind of comeback as a result? No.

When Russia sends armed drones into Poland, they are shot down. Are there consequences? No. When Russia sends armed drones into Denmark, are there consequences? No. When Russia sends drones into shut-down airports around Europe, are there consequences? No. None of this stuff is a catalyst for war. Invest in drones all you want, but they do not give an indicator of your political will. They are not a fighting function. If you had a one-person submarine and they were killed, that crosses a line. When it is a machine, it does not. There is no personal stake, liability or investment. Therefore, there is no political moment to destroying a machine in that way.

Q63 **Derek Twigg:** Sorry, but if that machine kills people, there is.

Professor Roberts: Right, and the machines going into Poland could have killed people.

Q64 **Derek Twigg:** So if they killed someone in Poland, there would be consequences then?

Professor Roberts: Would there?

Derek Twigg: Yes.

Professor Roberts: How do you know?

Q65 **Derek Twigg:** Your argument is that there are no consequences because there are no people involved, but that machine could kill people, so then there would be consequences.

Professor Roberts: Again, we are talking about undersea infrastructure. If you have an uncrewed submarine defending a piece of infrastructure and that uncrewed submarine gets destroyed and there are no consequences, then there is an access point for the undersea infrastructure. They do not offer a tripwire.

Derek Twigg: But they kill people.

Q66 **Fred Thomas:** The point that Derek is making is that destroying something that is uncrewed may be less of a problem, but you can use those things offensively to kill people and there will be consequences to that.

Professor Roberts: Yes, I agree. Sorry, my interpretation was wrong.

Q67 **Michelle Scrogam:** Let us return to the original question: what are their limitations and what are they best suited for?

Professor Roberts: Brett is probably best placed to answer this.

Brett Phaneuf: That is a big question. It depends on what you are trying to do. There is no silver bullet autonomous undersea vehicle that will do everything. The United States has form for trying to build all-singing, all-



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dancing undersea vehicles that end up costing billions and not providing capability. That is a problem. I have always advocated—particularly in the UK, where I sat on several panels looking at this—for a lower cost multiple-tiered solution that is a bit more sober about the threats and the risk to the asset. They cost money. We say that there is no consequence to losing them, but I can tell you the soldier or sailor who loses one will definitely feel the consequence—whether you like to believe it or not.

We do not seem to think about these things the way that we think about bullets from a gun and we need to get that way. It is the bullet, not the gun. We still build very expensive systems. The systems that we use for mine hunting, which are probably the best example of a well-deployed capability, are not sovereign assets. That is other than the robotic systems that were mentioned, and which are built by Saab Seaeye—one of the best subsea robotics companies in the world and which is based in Fareham. We have very few of those last mile—or last hundred feet—mine neutralisation deployment options. Capability is great, but the survey capability—the go-find-the-mine capability—is not sovereign. We buy those from the US, Germany and other countries. That is fine and we are very sophisticated at deploying it in the UK. I say “we” because I consider the UK home even though I am not there right now. I have lived there for the last 15 years, so it is home for me.

How we get the larger things further offshore and talk to them is a very tricky problem. It always comes back to power and comms. How do we get enough energy in the system that it can be persistent? How do we protect it against the corrosion and the other batterings that the ocean inflicts upon it? It is the most hostile area in the world. It is easier to build something to be deployed in space than it is to put it under the ocean. Submarines are essentially the most sophisticated underwater spaceships you can imagine and far beyond what the space programme does in terms of their ability to deploy people into a hostile place.

The power problem is solved by a nuclear reactor. However, we do not have that capability on relatively small systems, and we are not likely to have uncontrolled nuclear material powering systems that do not have people on them swimming around the ocean anytime soon—that would be a terrible idea. Therefore, power is a big problem. There is also the question of how much energy you need to stay resident for a period where a threat might emerge. Then how much energy do you have to counter the threat and how will you report it? These are all the basic limits of physics imposed by the sea.

We are certainly solving some of these problems, but the vastness of the ocean means we need to drive cost out of it and have a tiered solution of sensor systems and vehicles that allow us to have rings of control, with data and complexity increasing as things approach, as opposed to building a very small number of exquisite systems. The US is just about to cancel its Orca programme. Boeing, the chief contractor, quit the programme because it is losing so much money on a fixed-price contract. These are

supposed to be 6,000 metre-capable ocean-crossing XLUUVs. I do not think they will ever represent a real capability, unfortunately.

Q68 Michelle Scrogg: Moving on to that, which countries are excelling or doing better than the UK when it comes to research, testing and production?

Brett Phaneuf: The US and Japan are doing very, very well, but from a military perspective, the US invests more than anybody else. China is doing a lot; it is a little bit opaque, but it is accelerating its capability in uncrewed systems. The Russians take a slightly different approach; they have weaponised systems that we do not produce currently. In Norway, Kongsberg Maritime is a world leader in development. Thales is a great group in both the UK and France, developing some very interesting and sophisticated technologies.

It is interesting: from a sensor perspective, almost every uncrewed underwater vehicle in the west relies on parts or components from the United Kingdom. Saab Seaeye is building a thing called Sabertooth, which is not specifically designed for what we are talking about, although it could be, and it is making some strides there. But there is not a domestic producer other than M Subs making large underwater vehicle systems. In fact, M Subs—it is my company, so I will blow our horn—is the largest producer of XLUUVs in the world, based in Plymouth, England. Go figure! It is still a very small number—we are talking less than 10—but in terms of the available technology, the UK is a world leader. Every US system relies on UK technology.

Chair: We only have half an hour. Unfortunately, we cannot overrun because there is an urgent question on defence, which I know many Members, including me, will have to go to. My request to Members is to target precise questions at one or two panellists, and panellists, please be brief. There are lots and lots of questions, especially on Atlantic Bastion, starting off with Emma Lewell.

Q69 Emma Lewell: With that in mind, what is your brief assessment of Atlantic Bastion? I am happy for anyone to take that question—whoever feels more qualified.

Professor Roberts: Atlantic Bastion is a lovely concept. Unfortunately, it is based on promises and vapourware at the moment, so there is not much to back it up.

Q70 Emma Lewell: It is just a plan?

Professor Roberts: You're right—it is a plan. I am all in favour of plans, and I am all in favour of strategies and ambition, but I would rather they were based on something. At the moment, Atlantic Bastion is based on what is not even an experiment yet. When we get past the experimental stage with some of the autonomous vehicles we are talking about and when we understand it, we can develop that into a plan. Doing it beforehand on the basis of a couple of PowerPoint slides and an industry pitch is not wise.

Commodore Aitken: Atlantic Bastion is a really good concept, but it relies upon a number of unproven technologies, and you've got to roll sixes to get them right. It is going to be hard to do.

The other thing with the Atlantic Bastion concept is that you have to be careful about being outflanked. If you are going to do Atlantic Bastion, you need also to be looking at being able to protect the flank that is the Arctic. That is really important.

Q71 **Emma Lewell:** When do you think it might move from a plan to something that actually exists and works? Are you optimistic?

Brett Phaneuf: We need to do a lot more applied research. We need to be at sea all the time with these things. We are ignoring the capability we do possess in favour of things we might develop, but we are not backing it up with the requisite applied research. When you deal with the ocean, you need to be in the ocean operating all the time. We have a long way to go—maybe five or six years.

Commodore Aitken: I am certainly not opposed to it. I am not trying to talk down the technologies they are trying to develop.

Emma Lewell: You are just being realistic.

Commodore Aitken: I am being realistic. Submarines will do a job for you. Whether they be nuclear submarines or conventionally powered submarines, which unfortunately the UK does not have any more, they will do a job and deliver effect. Fact.

Emma Lewell: That is helpful, thank you.

Q72 **Ian Roome:** After analysing Atlantic Bastion and the concepts, what do you see as the major technical challenges? Is it design and integration or operating at scale? What are the main challenges with what the MoD is saying?

Commodore Aitken: First, power source. For any unmanned armed vehicle, it is the power source. We have talked about it multiple times. The size of the platform determines the size of the battery, which determines the amount of juice that you can put into the platform. That determines the detection range it will give you and what it can process. It might be just a dumb tripwire that identifies something is there, but then how does it communicate that? The amount of juice determines the ability to communicate and to process information. In ASW, we are looking to detect, classify and track. All that requires processing power. All that requires juice. Where does juice come from? Batteries constrain the amount, and they are dependent on the size of the platform.

Integration is reliant on communication. I know people are making advances on that, but it is really difficult to communicate underwater. If you are going to come back to the surface—or what we could call periscope depth—to communicate, it is really difficult to keep yourself at that depth and not get caught in surface capture, where you might get

stuck in the surface duct and not be able to get back down, especially when you have limited power to drive yourself down.

The constraints of power and communication are the key ones for all the unmanned assets that are being talked about.

Brett Phaneuf: Reliability is my go-to mantra all the time. Having all the energy in the world will not save you if the systems break every time you look at them. Design always needs to take into consideration applied research at sea so that people have a better understanding of what they are up against. We get a lot of PowerPoint engineering that does not produce capability.

Commodore Aitken: We should talk to the oil and gas industry as well. They operate a lot in this environment and they have things that could be useful. They may be not exquisite, but they could do a job. I am a big fan of using proven technology because you don't end up paying research and development costs.

Mike Martin: Keep it simple, stupid.

Commodore Aitken: Yes.

Q73 **Ian Roome:** Specifically on research and development and procurement, what are the main challenges with Atlantic Bastion?

Commodore Aitken: Cost and having the people to be able to do it. There is a limit to the number of engineers in this country. A whole outreach programme needs to be undertaken to encourage people to come into the industry and be educated. I know that Lord Case is doing some good work on trying to regenerate Barrow. Thales, Rolls-Royce and BAE Systems do it. It is about having academies and trying to have an outreach scheme. If you look at the States, the Portsmouth naval base on the north-east coast really reached out to the population to try to increase the number of people taking on those jobs. We need a major increase in recruitment across all these industries, and it is difficult to attract them.

Q74 **Ian Roome:** Would you suggest that Atlantic Bastion is the right thing to do, or are there other ways to achieve the capability to defend our sovereignty and NATO?

Professor Roberts: It is an interesting question. Atlantic Bastion is not the same naval concept of a bastion that the Russians and the Chinese use. For very obvious reasons, we rejected the idea of, "Our nuclear deterrent will be at sea in this little area here—please come and try to find it." We have left our concept far more as an independent operator, so it remains undetected, but it exploits the utility of the oceans in a way that a bastion concept does not.

The bastion concept therefore must be designed to protect the north Atlantic so that America can resupply and reinforce Europe. I wonder about its utility in five or 10 years, after Trump's third presidency, J.D. Vance's first or whatever it might be. The US has already expressed the



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fact that we are unlikely to see the same number of troops. Why are we expending all this on the western Atlantic? If the United States has said it is not sending over those numbers of troops and we are not expecting them, why are we investing so much into this single concept that provides for a safe passage for something that is not going to arrive? I wonder at the logic behind it. Of course, things may change entirely: a Republican or Democrat might be elected to the White House and the Trump years get wiped away, but I think most of us see that as unlikely. So I do wonder what Atlantic Bastion is striving to achieve.

Commodore Aitken: I acknowledge that, and recognise it. It is not necessarily just for the protection of an American force coming across the Atlantic; it also stops, or tries to stop, Russian assets getting out into the north Atlantic. Once they are out and in, if they are coming for us rather than for an American carrier strike group or amphib group, they are still our problem to have to deal with. Once they are out, they are very difficult to find. Once they are out and into the north Atlantic, they become very difficult to detect and track. Personally, I would like to impose more cost. I like getting on the front foot. I am a submariner; I like offensive.

Q75 **Mike Martin:** Surround Murmansk.

Commodore Aitken: Well, get up and push, because—

Professor Roberts: The Norwegian sea, the High North, the Arctic sea—that is where the fight should be happening.

Commodore Aitken: When they deploy, there is a response from NATO. When we deploy, we should be imposing cost on them—making them work harder. Yes, exactly that: the Norwegian sea and the High North are where we should be imposing costs on them, but at the moment we don't.

Q76 **Chair:** Given what has just been said, Professor Roberts, should we consider investing in conventional diesel or electric submarines? A quick yes or no.

Professor Roberts: Who is we?

Chair: We as in the UK.

Professor Roberts: The UK? No, I do not believe we should.

Q77 **Mr Bailey:** That was fascinating. The issue I was trying to draw out was whether Atlantic Bastion was sufficient to deter nefarious activity and about the imposition of costs.

I am also curious about another issue. Commodore John, I served with the US military, and I know you served in a similar capacity. I do not want to encroach on any of the privileges that have been extended to us, but you will have a unique view on whether NATO has sufficient ice-breaking capacity. Are you aware of, or can you point to, other capabilities where we are exposed and should concentrate our energies?

Commodore Aitken: That is quite a big question. We do not have sufficient ice-breaking capability. We do not have sufficient capability in



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the High North and under the ice. The Americans offer an awful lot of capability, but in terms of European and British capability, we have far less. I think that reinvestment in under-ice capability for the Royal Navy would be a significant benefit.

Q78 Michelle Scrogg: I have a quick question for Brett. As a small business owner engaged in delivering underwater capability, what do you see as the greatest challenges you face at the moment?

Brett Phaneuf: Oh, boy! It is like beating a drum: it is the people. I could probably double the size of my business. How shall I phrase it? I would say that in the preceding few years, we were majority funded by the UK on a major programme in the wake of the drawdown on, or the end of, a 14-year programme that was funded by the United States. We were tapering off, and then we had capability to offer the UK in the Excalibur programme and the Cetus programme, which has gone well. Now we are seeing significant investment coming back in from the US. In the next five years, probably 90% of our business in the UK will be servicing the US, designing and building technology that we export to them. I could probably double or triple the size of the business, but the problem is I just cannot get the engineering staff, the welders, the machinists. That is a big problem.

There is a big gap—I do not know if the others will see this. Those of us who are late 50s and above are people who are retiring out, and the largest proportion of my staff other than that is people 30 and below. There is a big gap in the middle that everybody has been contending with for a long time. The problem is that we are not producing enough engineers, physicists, mathematicians and computer scientists to help us grow and to expand capability, both sovereign and for an export market, which would be good. The time that we are getting with the younger people is getting compressed as the older generation who were committed to the problem are retiring at a very quick rate now. We are facing a considerable shortage in talent and human capital. It is probably my single biggest problem.

After that, it is about access to materials and energy, which are related. I have to buy most of my steels from Germany, which is the only source for the speciality steel that we need to build the things we build. Titanium and all that speciality metal are external to the United Kingdom. That is problematic, and it is indicative of the cost imposed on UK businesses. When they try to make something that I would buy from them, they have the same problem. That is an issue.

On the cost of energy, what we do is extremely energy dense, and we are nothing compared with a major shipyard. The amount of energy required to build even a small vessel is substantial. That cost is problematic. On the upside—this is a weird thing that most people do not know—the cost of doing business in the UK is actually lower than the cost of doing business in the United States. That is for a variety of odd reasons, not least that the staff costs are about half what the same person, in real pounds, would make in the United States. We are seen as very good value for the United



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States. Our engineering costs are a lot less, and it is very high quality. That is fantastic, to a point. The problem is that it attracts talent outside the country, so that exacerbates the problem. We see people leaving and going to other nations to earn more money—not necessarily in defence, but in the hard sciences. Staffing is the No. 1 issue. Sorry for rambling on.

Q79 Michelle Scrogham: No, that was not rambling at all. Can we ask about security clearances for your staff when you are doing things in defence?

Brett Phaneuf: Oh.

Michelle Scrogham: That tells me almost everything I need to know. Would you like to elaborate?

Brett Phaneuf: Getting people cleared is not necessarily the problem, but getting facilities clearances is problematic. Again, it is a staffing problem within the MoD, so getting things moved forward is very challenging. We have a bizarre anecdote about what was then called “List X”—it is called something else now. Somebody decided that our security aspect letter was not really relevant. They did not tell us and decided to suspend our List X designation. When we tried to sort that out and get back on to the new system, the person who suspended it and who had been managing it said, “Well, I can’t really help you. I only deal with List X companies.”

There are some problems. Those are barriers to entry for small businesses. We have been around a long time—not compared with some of our competitors, but it has been well over 20 years—so we are a known quantity. We have classified work coming in from the United States, and some from the UK. That is highly challenging.

The AUKUS accord has really helped, though—that is a bright spot. We were excluded from some work because the US side could not figure out how to give us information. I act as a conduit, because I have clearances in both nations and I can hold them both in one brain and be very judicious about what I ask different people for. It is not ideal, but it functions. But AUKUS has an exemption—I think it is section 126.7—that allows for the sharing of confidential or CUI data, which is not secret. That helps us in dealing with ITAR between the AUKUS nations. It provides an exemption, and that allowed us to take what for us was a rather substantial contract, which is something like \$70 million over the next three years.

Q80 Michelle Scrogham: Do you think that an AUKUS visa would make that easier for you?

Brett Phaneuf: Perhaps, yes. AUKUS is still a bit fragmented. It is going in a lot of different directions, with a lot of different people. We are focused more on the pillar 2 area. But I find that a lot of the activity under AUKUS is driven by personalities—people who know people who have been around a while make some phone calls, and we can sort out something. I am sure there is a formalised AUKUS plan, but I try not to concern myself with those things; I am trying to build little submarines all day long.

Q81 Michelle Scrogham: Professor and Commodore, are there any wider challenges to delivering this programme that you are aware of?

Professor Roberts: For me, there are several. Primes would echo much of what has been said from a SME perspective, and the things you have identified and are well aware of would be there.

There is also a challenge for the RN with delivering this across the MoD. It is about skills—this is a big people thing—and there are risks in terms of removing hardware before the new stuff comes. There is a whole philosophy of change that is really difficult.

One of the biggest problems, however, apart from the timeline and the political will, is the legal aspects behind this. All the activity we have talked about today is governed by three Acts, from 1884, 1958 and 1982. The fact that we are talking about modern military strategy for a war that is ongoing today, governed by a law that was written in 1884 about submarine telegraph cables is frankly frightening. There are national laws that we can put in place, and that is one thing that Brexit might even help us with, because we could do it unilaterally.

Michelle Scrogham: We found one!

Professor Roberts: We found one; I know—it's a shock. The reality is that the legal guidelines behind this are more opaque, more confused and more set on customary procedures than anything else. Legal guidelines—an Act that governs behaviours about what is expected and the consequences—would be incredibly helpful but would also enable business to do things like trials. That way we would not end up in a situation like we had with the Military Aviation Authority and flying military drones in the UK. We could avoid that by taking early action on some of the legal challenges that are being faced by the plan.

Commodore Aitken: There are some things that are not sexy at all, but they are enabling—for example, securing the supply chain, which requires the ability to vet people, and have enough vetters in place. Being able to accredit systems is also really helpful, rather than being stuck for months or even years while you are trying to get a system accredited. Investment in the ability to communicate securely between industry and the MoD would be really helpful too.

These are not really big sexy objects that people can get excited about, but the enablers that go around the programmes and projects are really important. It is also about the security of sovereign capability; we disinvested in heavy industry and manufacturing in this country, and Professor John Bew talked about the importance of that as a part of our national security strategy. That is important too.

Q82 Fred Thomas: For the last few minutes we will jump around a little bit, and I will come to you, Professor Roberts. The country nearest us that has vaguely similar submarine and nuclear capabilities is clearly France, which is a good ally of ours. What is the scope for further co-operation, particularly away from nuclear-powered submarines and towards the



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uncrewed underwater vehicle space? What is the French outlook? Where is France on this? I am sure it has a similar amount of undersea infrastructure. Can you give us a flavour of that?

Professor Roberts: They have nowhere near the amount of undersea infrastructure that we have. Interestingly, continental Europe has a different set of critical infrastructures than we do, because we are an island. Most European data, for example, comes through the UK directly, whether it is bypassed here or wherever. The really vulnerable electricity substations and gas substations that sit in the North sea are unique to the UK, Denmark and Norway.

So it is not reflected; France does not have the same outlook. It is interested in experimentation and autonomy, but it has not gone as far as the MoD in almost putting your eggs in one basket and saying, "Autonomy is the way ahead"—the sort of hybrid navy thing. France is taking a much more cautious approach with it. It is embracing it and using it, but because its shipyards are state owned, it is invested for a longer term in a longer run of shore contracts that deliver what it needs. Its intellectual and conceptual engagement at the moment is really about the investment in a new aircraft carrier rather than anything else.

Q83 **Fred Thomas:** Thank you. Can I bring that question to Commodore John? For context, you work for Thales now. I am sure that, during your military career, you will have worked with French counterparts at various points. Can you give us a sense of the potential for further collaboration?

Commodore Aitken: It is always difficult when it comes to national assets, but there is certainly an opportunity for greater collaboration, especially in the sonar area. Thales is one of the world leaders in that area. Overcoming some of the barriers between the nations would be really helpful, but there is already a lot of work being done on that. I touched on some of the capabilities that are there. There is the 2076, and its successor, the 2176, which will be just as good. The 2087, which is a French-developed sonar, is a very capable platform as well. Given the classification of this meeting, it is difficult to talk about that. There are a lot of opportunities, and across Europe as well.

Chair: This has been a fascinating session. I hope that the wider British public and beyond have gained a great deal from that. Thank you, Professor Roberts, Commodore Aitken and, virtually, Mr Phaneuf for your contributions.