HOUSE OF COMMONS

Defence Committee

Oral evidence: Progress in delivering the British Army's armoured vehicle capability, HC 659

Tuesday 6 October 2020

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Watch the meeting

Members present: Mr Tobias Ellwood (Chair); Richard Drax; Gavin Robinson; John Spellar; Derek Twigg.

Questions 1 - 71

Witnesses

I: Francis Tusa, Editor, Defence Analysis; Nicholas Drummond, Director, AURA Consulting.

II: Peter Hardisty, Managing Director, Rheinmetall BAE Systems Land (RBSL); Carew Wilks, Vice President, General Dynamics Land Systems (GDLS); Lee Fellows, Vice President and Managing Director, Lockheed Martin UK.

Examination of witnesses

Witnesses: Francis Tusa and Nicholas Drummond

Q1 **Chair:** Welcome to the Defence Committee's study into the progress in delivering the British Armed Forces' land warfare vehicle capability on Tuesday 6 October 2020. I am delighted to welcome five guests to help us explore this important issue today. Our panel is divided into two, the first of which is Francis Tusa and Nicholas Drummond. Francis and Nicholas, you are very welcome indeed. We are going to go straight into it.

Francis, could you give us an overview? We have this integrated review coming over the horizon sometime soon. Can you describe very shortly, just to open us up, how you see the advent of the character of conflict changing and land warfare specifically?

Francis Tusa: Having read the comments by the Chief of the Defence Staff and various others from the chief of the General Staff, I then, apropos of this hearing, looked back to the FRES programme, the future rapid effect system. It kicked off in the late 90s. The language between then and what we have just heard with the new operating concept is very close to identical. The concept was fundamentally flawed when it was FRES and I do not see any difference now.

Looking at the Chief of the Defence Staff's comments, he is looking to take the Army, specifically, into areas it really should not be going. I am not seeing the clear vision for what should make up the Army. That problem about clarity is the heart of this hearing. Since Gulf War one, in terms of infantry fighting vehicles, there has not been a single new vehicle, let alone a significant upgrade. Remember the lessons learned from Gulf War one. In 1991, one absolutely critical lesson had been learned: Warrior needed a stabilised cannon. The other one was the recce vehicles. They were listed as being close to lethal.

Q2 **Chair:** We are going to really dive into all four vehicles, the Warrior, Challenger, Ajax and Boxer, as the mainstay of where we are going. I want to take a step back before we do that and talk more generally about land warfare today. There is even talk of just removing the concept of the tank on the battlefield, given the character of conflict. That is what I am interested in.

Francis Tusa: Personally, I still think the tank has value. We had a very strong feeling from the Army in the late 2000s that the tank was irrelevant, as was anything heavy armour. The great phrase of General Richards was, "We are at a 'cavalry or tank' moment". His belief was pretty obviously that he thought the tank was redundant. We then saw British forces in Afghanistan—I suspect you were there at the time—relying on Danish Leopard 2s to provide vital support on the ground. With some of the video coming out of the Azerbaijan-Armenian conflict, I do not see that the tank is finished yet.

Q3 **Chair:** Nicholas, what are your thoughts on this?

Nicholas Drummond: The greatest thing about the integrated review is its questioning of the Army as we knew it and the Army as it needs to be. The fundamental question is the importance and relevance of heavy armour. That is the question that is most on everyone's minds. To Francis's point, it is not a sunset capability. We still need it. Recent conflicts in Ukraine in particular, where we have seen heavy armour used, and more recently between Azerbaijan and Armenia, show that heavy armour is extremely important.

Q4 **Chair:** Maybe I can encourage you to take a step back even further and say what kinds of threats Britain would wish to step forward and be involved with. When we visited Lulworth last week, we saw these high-tech, high-spec, formula one bits of kit that are wanting to be rolled out and, indeed, that the Treasury pays for. We have the high-end capabilities, meeting peer-to-peer adversaries, with T-14 coming on board as well. Is that going to happen? Is it the high risk but low probability? Are we more likely to see stability and insurgency operations, Afghanistan-esque type activity? The third area I could suggest is more upstream engagement, helping countries such as Kenya and so forth to improve their defence posture, working with them and strengthening relationships. Those are three different scenarios requiring a wider spectrum perhaps than what we are looking at today.

Francis Tusa: For the moment, let us base this on Ajax and the family of vehicles there. On peer-to-peer high-end war fighting, yes, absolutely. Having that type of capability also acts to a certain extent as a deterrent. Even if you are looking at the slightly lower end of war fighting, having that type of vehicle works. In Afghanistan the Army basically had a bit of a brain freeze. Most of its vehicles were ruled out of court completely. "No, we can't use them. We have to buy a completely new vehicle fleet". If you look at the experiences of most other forces that deployed to Afghanistan, they took along conventional infantry combat vehicles. The Canadians took main battle tanks. They actually bought new ones. It was only the UK that claimed that the standard vehicle park was irrelevant. You can look at that and say that was probably a mistake.

Q5 **Chair:** Yes, I recall visiting Afghanistan. Each time we went to one of the bases, you would see myriad vehicles: the Cougar, the Vector, the Ridgeback, the Mastiff, the Jackal. There were so many different operational requirements purchased very quickly for that environment. I think the South Africans made the R-31. It was something you could have bought off the shelf there was well. We do not want to go through that again. That is why I am asking about the spectrum of capability in this integrated review of what Britain's Armed Forces might be expected to do and prepare for.

Francis Tusa: That is why certain items of equipment will actually cover a number of the scenarios. Perhaps, if we go back to the whole Afghanistan thing especially, there was a bit of golf club buying—"I want

a special 3 iron and I also want a sand wedge"—whereas some items of kit would have covered a number of different scenarios. Taking your example of Kenya, would deployment of Challenger 2 regiments, if we end up with any after the review, be a sensible option? It is probably not that well connected with the terrain, so you would be looking more at things like Jackal. Fundamentally, you are asking, "Should the UK, on the land side, have the capability to go from far left to far right?" I think we are going to have to wait and see.

Nicholas Drummond: The issue that we have with heavy armour is that it has become very difficult to deploy. The fundamental question the Army has to wrestle with is how it delivers a high-end capability but also has an expeditionary capability. Actually, that was the plan behind Army 2025. On one side, it would have Challenger and Warrior, the high-end tracked capability. On the other side it would have the Boxer, which was a wheeled vehicle and highly deployable. That was a very logical, sensible plan, until we decided to put Ajax in the strike brigade. That, being a tracked vehicle, cannot keep up with Boxer. That is probably a level of detail we do not want to go into yet. The plan needs adjusting somewhat, so that we are expeditionary and can do these things we want to do and be very flexible.

Q6 **Chair:** The other thing we notice with these four vehicles is that we are moving to a more modular capability. With Boxer, you could easily see the actual runs where things are slid out and put back in. If you want a medical vehicle, a recce vehicle or whatever, you put in another kit. I did not see any ability for whatever you put inside the Boxer to then go in the back of the Warrior or the Ajax. There was no inter-modularity between the four systems.

Francis Tusa: We are 20 years too late to do that. There have been options to buy modular families and then spread that out. Yes, I am going to have to go back into a bit of history. My first briefing on the future family of light armoured vehicles was 1988. That was literally common chassis and common mission modules, and this was to replace the entire FV432 tracked vehicle fleet, which has been in service since the late 1950s. There were great ideas and plans, but here we are, 32 years later, and we have not actually advanced any of them. This is the heart of the problem. There has been a great deal of talk about modernising but, quite frankly, when the metal hits the road, there has just been failure. That is why we are running on vehicles that have not been upgraded in any significant sense for 15, 20, 25 or 30 years.

Chair: We have some challenges and some questions to face today.

Q7 **Gavin Robinson:** Good afternoon to you both. Francis, to pick up on that, there are hard choices. It would be interesting to hear whether you feel they are being grappled with as part of the integrated review. More fundamentally, if you were the person making the choices, which programme, either currently under operation or profiled and planned for the future, would you sacrifice to provide the funding required?

Francis Tusa: To give an overall answer to your question, if you look back to the start of the 2010s and what the budgets were, and then look what the Army believed it could buy, it was looking to buy about £4 billion more kit than it had budget for. It had £6 billion to £8 billion for new armoured fighting vehicles and it was looking to buy about £12 billion. It is not a question of money. Do you know what? If you had given the Army £2 billion more, it would have introduced three new programmes and would still be overspent. The current plan is not affordable. If anyone tries to say, "We can squeeze it", no, it is not squeezable.

The easiest, quickest one is always to not follow up with programmes that are not under contract. On that basis alone, and I am not saying I agree with it, you would get rid of a Challenger upgrade or a new main battle tank. The multi-role vehicle protected, MRV-P, is not on contract. Get rid of it. That would not yet settle your budget problems, but it would go a long way to doing so. That leaves the possibility that you have to can one of Ajax and Warrior. I know Nick has the same sort of problem. There are voices from every single side and this is even forgetting the manufacturers. There are Warrior supporters and Ajax supporters. Quite frankly, you can get evidence from any and all sides. Both of them have the possibility to be cancelled. At the moment, it depends which day of the week you speak to people. The siren voices change.

Nicholas Drummond: I have a fundamentally different view here. I served in the Army at the height of the Cold War. In Germany, we had three whole armoured divisions, an infantry division in the United Kingdom and an artillery division. That is five divisions. The Army is asking for one division today. If we are saying that one division is not affordable, what kind of army do we expect to have? It is absurd.

Q8 **Gavin Robinson:** That is not entirely the question. Of all the options that are there, both currently under programme or to be profiled for the future, if there was an affordability question that required you to sacrifice one, which it would be? I understand you are disagreeing with the premise and you think the money should be found. In the scenario where that decision had to be made, do you have a view?

Nicholas Drummond: If you say we should sacrifice Warrior, for example, because it is the most problematic programme, it does not change the need. The Army still needs an infantry fighting vehicle. It will be 380 vehicles short if it does not get Warrior. If you do not have that vehicle, that means you have to send troops into combat without protected mobility and that will put their lives at risk. That is the situation we got into with the Snatch Land Rover in Iraq in 2006. Many lives were lost because of that decision. If we decide to sacrifice a programme, we have to decide to sacrifice lives.

You can make that choice based on what the most problematic programmes are. I would say the legacy tracked vehicles are most problematic. You would need to sacrifice those programmes now in the

hope of renewing them properly when the budget was available. Does that answer your question?

Q9 **Chair:** On protected mobility, are you saying that you cannot up-armour a Boxer in the same way that we did with Warrior? When Warrior first came out, I used Warrior in Bosnia and we had the Chobham armour that came out. It is actually similar. Is it not the case that you can do the same?

Nicholas Drummond: No. Boxer is a fantastic vehicle, but if you get rid of Warrior, for example, you are going to have to buy another 380 Boxers to use that in the same role.

Q10 **Chair:** Right now we are not questioning the numbers, because your point about having a division is very important. That is a decision to be made as to the size of our armed force and then what you do with them. The question being asked here is which one you are willing to procure. If you had to drop a project, which would you then drop?

Nicholas Drummond: I have always thought that putting a new turret on a legacy vehicle was a difficult proposition. Warrior has certainly proved that to be the case. I would say that is probably the same issue with Challenger 2, although I had a slight conflict of interest in saying that, because I represent somebody else who makes an alternative to Challenger. However, there is no disguising the age of these vehicles. Warrior is 40 years old. It was developed in the late 1970s. Challenger can trace its lineage all the way back to Chieftain, developed in the 1960s. Of course, it has been upgraded and improved all the way along, but it is still the same basic concept and layout.

Q11 **Chair:** Is the Abrams not the same? If you jump into a VW Golf, it is the same name, but there are different variants compared to when it first came out.

Francis Tusa: This is perhaps the issue and, again, one that has to be understood and recognised. The United States has, often at great expense and slightly wastefully, kept upgrading the Abrams. They have gone from the M1 105 millimetre gun to the M1A1, 120 millimetre. Every time you have had a brigade coming back from Iraq, back in the 2000s, they have gone in for a reset where the tank is literally stripped down to the bare metal. They have actually replaced a great number of the systems, introducing new sights—you name it.

For an Abrams, the reset cost was about $1.5 million to $1.75 million a time. For the Bradley, the equivalent of the Warrior, they were regularly spending $1 million a vehicle each time they went to reset. I will tell you the average reset, and I use the term incredibly loosely, for a Warrior coming back from Iraq in the 2000s. You were lucky to have a budget of £30,000. Down in Bovington, at what was ABRO, the Army Base Repair Organisation—it is now Babcock—they said, "We're doing our best to keep this vehicles running. It's depressing". They did not even have the money to do a respray. The vehicles were arriving in appalling shape.

They were doing mechanical fixing and had to send the vehicles back to the units looking as bad as when they arrived. They talked about the morale impact in those units of getting the vehicles back and being told, "They are fine".

That is the difference. The M1A2 in the US army today has been upgraded probably three to four times, receiving new systems and new electronics. That is not what has happened to Challenger 2, where base overhaul ceased in, I think, 2006. They have been allowed to rot.

Chair: We are wandering a little into the procurement part of this, so it is probably wise to bring in John Spellar.

Q12 **John Spellar:** Francis, you mentioned the 1988 programme. What derailed it?

Francis Tusa: I suspect it is one of these things that have derailed a lot of the AFV programmes ever since: "Events, dear boy, events". That was 1988. Then you suddenly had the fall of the Berlin Wall. People were reassessing what they needed to do. The Gulf War comes along. One of the other problems was the constant pressure of wanting to get the best, so people looking at something their predecessors had drawn up and going, "I'm sorry; that's not good enough. We must do something better".

As one example, but it is not the only one, in the early mid-1990s, post Gulf, you had people saying, "Let us go for electric armour", as opposed to just steel and so forth. "Let's go for high-tech digital vehicles". There was a lot of experimentation. Experimentation is not new. The problem is that it ran into the technical issues. You could not do a lot of the concepts they wanted to realise with the technology at the time. You actually cannot do them with the technology today.

Q13 **John Spellar:** Why would that have derailed the modular concept? If you take conventional vehicles, they can incorporate all sorts of changes within some standardised components.

Francis Tusa: It is a question of it being far too sensible. Look at the original aim of that programme: the future family of light armoured vehicles. It told you exactly what it was and what it was intended to do. Within five years, you had the future rapid effect system. What is that?

Q14 **John Spellar:** What did our main allies, for example the French, do with regard to modular vehicles?

Francis Tusa: The French are bringing in a system at the moment under the guise of the Scorpion programme. The flash to bang, from the decision to go for this until the vehicles were delivered, has been just over four years. It is not just armoured vehicles; it is also communications, command control—the whole lot. They have a completely modular armoured fighting vehicle system around the Griffon vehicle and as much commonality between the other two vehicle types as

they can get. It is an incredibly well-wrapped up, co-ordinated programme and it is delivering vehicles today. Yes, they have had problems with covid-19, but there are vehicles now out in Africa and the Middle East. It shows what you can do when you have a coherent, sensible, co-ordinated programme.

Q15 **John Spellar:** Did they not offer to partner with us on this modular programme at one stage, with BAE?

Francis Tusa: They have offered repeatedly to partner.

Q16 **John Spellar:** What derailed that within the Ministry of Defence?

Francis Tusa: There has often been an issue of "not invented here" and British exceptionalism. Just because the French do something—"No, I'm sorry, but we do things differently." You could say that one reason why we still have a rifled 120 millimetre tank gun and no one else does. It is the British exceptionalism that says, "We're different", which hinders thought across the piece. Look back at the number of programmes in the 1990s, the 2000s and the 2010s, and the options the Army has had to buy existing equipment and concepts. They tend to have been derailed because someone has said, "That's great, but I want to change that, I want to change this and I want to change this". Suddenly, you are not buying off the shelf; you have made a bespoke system.

If half the things I hear are true, we have seen elements of this happening already with Boxer, which is an excellent vehicle. It should be because it was designed for the British Army. The talk is that the Army is saying, "That's great, but can we change this, this and this?" If that is happening, that is catastrophic.

Q17 **John Spellar:** How do we go about remedying that?

Francis Tusa: We have to stop specifications creep. By the way, this has been covered by the National Audit Office for the 25 or 30 years. We have to accept the 80% solution. That has been known about for probably 50 years. We have to accept that, okay, it is an armoured fighting vehicle that we rejected back in 2003 and we are now buying it again. This is with Boxer. Is it perfect? No. Does it do pretty much what we want? Yes.

To give an example of that, back in 2006 or 2007, Lord Drayson, the then Defence Procurement Minister, one of your colleagues, ordered the trials of truth down at Bovington. He said to all the main armoured vehicle manufacturers, "Bring your vehicles to Bovington. Stop PowerPoint engineering. We are going to run trials and we will base our decisions on that". The problem is that the Piranha version was selected and the Army then started changing it and going, "I want to add this, this and this". It was a pretty disastrous outturn.

Q18 **Chair:** Can I probe this Procurement Minister piece? This has come up again and again. I heard that the Type 26s were delayed by a year, or

the carrier was delayed by a year, to keep the shipbuilding capability alive, a decision made by a Procurement Minister. It is tricky because whoever gets the job will take it and do their very best, but they may come with very limited experience of the military or, indeed, the industrial capability in the UK. I am looking through some of the reasons why all four projects have been delayed. A lot of it points to decisions made by the Procurement Minister or by the MoD.

Nicholas Drummond: Can I challenge that? I work with KMW, the leading western manufacturer of main battle tanks. We had a discussion about this before the hearing. Their view is that it takes 10 years to bring an armoured vehicle into service. You can do it more quickly if you want to, but it becomes much more expensive because you have to apply massive resource. Their view is that 10 years is the planning time.

If you look at the gestation time for Abrams, the original Leopard 2, it was 10 years. For Boxer, it was 10 years. For Ajax and Warrior, it has been 10 years. We say, "We have spent £2.5 billion and nothing has happened yet". Actually, these programmes are a little delayed, but not that far behind the curve. We need to manage expectations here. It is a very complicated process. For instance, the safety case just for a new gun or a new ammunition type can take three years. There is good reason for this, because, if you do not get this right, the vehicle fails on the battlefield. That is the worst place to fail, so it has to be got right.

Q19 **Chair:** If a new Procurement Minister comes in and is persuaded to change the characteristics of the gun, for example going from smooth bore to rifle, that brings inherent delays into the overall programme. You mention a 10-year gestation period for a tank or an armoured personnel carrier. How many Procurement Ministers does that go through? I am not blaming the Procurement Minister at all. It is also the entire team that is behind that. Unlike industry, where you promote people within, my concern, and I ask if you share this, is that we have very well-intentioned people who become experts in their field and are then rotated out and moved back to another part of the MoD.

Nicholas Drummond: It is a big problem.

Francis Tusa: It is not just the Ministers. It was highlighted by the National Audit Office in the very late 1990s. The time in service for procurement officers, be they uniformed or other, frequently does not even last two years. They are moved on. One problem the Army has had, and I have seen this through, sadly, three decades, is that procurement is not valued as a skill in the Army. I have even heard Chiefs of the General Staff who have gapped, as in not replaced, procurement officers at Army headquarters, because they do not think it is important and it is not a soldierly position.

This may go quite some way to explaining the armoured vehicle programme at the moment. Nick said £2.5 billion. I can produce and justify expenditure since 2000 of about £5.6 billion and not a single new

armoured fighting vehicle has been delivered. It is difficult to cover that up and say, "It's not a problem. Everyone else does it". No, they do not.

Q20 **Richard Drax:** Before I ask the question, because it is linked to this, could you tell me how you see a future war being fought? I am not necessarily talking about a low-key out-of-area operation. I am talking about a conventional war. How would you see the main battle tank and the armoured fighting vehicle fitting into the battlefield, bearing in mind that we now have drones and all kinds of other things coming on line that can very easily take these machines out?

Nicholas Drummond: The battlefield of today is much more lethal than it was 30 years ago, with air-launched anti-tank missiles, mass artillery, dual artillery, rocket artillery, smart munitions and drone-delivered munitions. Everything is targeted. The challenge is to counter that through electronic means, so the electronic space becomes very much more important. We certainly need to invest in that. Also, if we want to manoeuvre, we will need to manoeuvre under armour. That is the only way we are going to take the fight to the enemy.

At the moment, we are not equipped to do that. We have to change. We have to be much more agile in the ability to move formations from A to B. This is all the thinking behind the strike brigade, the idea that a unit becomes deployable, deploys long distance under its own steam and supports itself in theatre. That is a big change that we are seeing. At the same time, you need the very heavy stuff to go in there and take out the enemy. It is much more lethal, much more mobile and much more electronic, with smart munitions.

Francis Tusa: I would agree with most of that. Coming back to perhaps a change in perception or ignoring a degree of reality, if you can take any lesson from Ukraine, it is that a lot of that warfare is not much different from what you would have seen at the end of World War II, with massed artillery, a lot of it not precision. You have rockets being fired en masse at kilometre grid squares. Everyone talks about Ukraine as being the green men. I think there were four armoured divisions that did the real damage, in terms of getting into Ukraine.

We have been lucky. I know the breaking battles in both Gulf one and Gulf two were not exactly risk-free, but look at the weight of firepower and so forth that can be deployed from some of the forces, specifically in Russia. Let us be honest: the British Army is never going to really be a power in Asia. It is just too far away. The Russian threat, which the chief of defence intelligence highlighted, is the one that represents a serious threat to this country today. I agree with Nick. You could, for the sake of argument, send people in Jackals and Land Rovers to counter the Russian threat, but not if you want them to come back. A peer-on-peer war would mean frightening levels of casualties to which Iraq and Afghanistan were nothing. That is not to downplay the sacrifice of people who died in those conflicts.

Q21 **Richard Drax:** To pick up on that point, under those circumstances Ajax and Boxer would not provide a good alternative to the tank.

Francis Tusa: We now get on to the classic one: "What is a tank?" If you spend any time on military Twitter, you can get people very exercised very quickly. Could you put a 120 millimetre turret on Ajax and have something tank-like? You pays your money and takes your choice. You can honestly line up 20 people, tankies, and you will get 25 opinions. Could you replicate some of the capabilities? Yes, but I would fall on the side of people who would say that, until active protection systems have really shown their worth or electric armour has come into being, there is little to replace quite heavy metal and explosive armours. That comes with a main battle tank.

Q22 **Richard Drax:** We were told that the advantage of the Ajax is that it can keep out a 0.5, if I remember. The Warrior cannot do that, as I understand it.

Francis Tusa: Once you put slab armour on the side of Warrior, it is about as well protected as anything will be. I would be surprised if anyone was suggesting, in going up against a peer enemy, putting in vehicles without add-on armour packs. I would be amazed.

Q23 **Richard Drax:** You think the tank and the armoured fighting vehicle for infantry are still key today on the battlefield.

Francis Tusa: Yes.

Nicholas Drummond: They are very important. This goes back to your earlier question about the kinds of conflicts we would be involved in. Wheeled vehicles are great, because they deploy quickly and can do lots of things. They are very easy to look after and so on, but you cannot take a wheeled vehicle to northern Europe in the middle of winter. You need a tracked vehicle. We cannot invest completely in a wheeled fleet. It is a lovely idea, we should definitely have wheels, but we would still need tracks for those out-of-area operations. That is why you need a tracked fleet and that is also why you need a main battle tank. If you try putting a 120 millimetre gun on a wheeled vehicle, you will have problems pretty quickly.

Q24 **Chair:** Thank you for that. To explore those points a bit further, first, there is the peer-on-peer situation, which gets spoken about an awful lot. We absolutely must prepare for it. I do not think anybody doubts that, but 95% of the time you are not doing the peer on peer. It was mentioned earlier that merely having the stuff is actually a deterrent and that is very important indeed.

I would argue, particularly from the political side, having worked in the MoD and been a soldier myself, that there is space, in addition to having these high-end formula one capabilities, to have presence as well. You are right. You place, say, a six-wheeled APC on the front line in the Baltics. It will be no match for the Russians. For the Russians to take out

that six-wheeled vehicle would be a massive political statement, triggering something much larger.

The question is this. Do we invest entirely in the high-end stuff, which means that you are waiting around for the high-end stuff, or do you, in your suite of capabilities, also have things that expand the presence? If I have one criticism about our Armed Forces, it is that we are overstretched. When we send Tornados to Afghanistan, for example, we are sending very high-end capability. When we are sending battle tanks to do training, say, in Africa, we are sending very high-end capabilities.

From a soft power perspective, we are advancing engagement, befriending countries and perhaps preventing them from tipping towards the lure of China and Russia, which are, I am afraid, our competitors in working with allies across Africa. Much as we claim that the Commonwealth are all our friends and so forth, and of course they are, they are being subdued into buying Chinese kit. They are being subdued into looking at protocols and doctrines from China. We do not have the ability, in that period when we are not doing the high-end fighting, to do that outreach. We do not have more basic kit that will make it cheaper to achieve that mission.

Francis Tusa: If you look at the fact that there is still, largely in storage, protected mobility, Foxhound, Jackal and things like that, that type of kit should be pretty much fine for Africa.

Q25 **Chair:** So we have that in storage now.

Francis Tusa: There are vehicles. My worry and question is this. Are those fleets being basically ignored so that they become rusty and obsolete? Bearing in mind the history of some other armoured vehicle fleets in British service, yes. I have the track miles.

Q26 **Chair:** Is this a cunning plan by the Army? Is that what you are suggesting?

Francis Tusa: If it is cunning, it means that they will lose capability. If you look at the underfunding of maintenance and support, which has been a constant issue over the last 25 years, how much of the protected mobility fleet will actually be available in even five years' time? Sadly, that is going to be a very interesting question. If you are looking at a country like Kenya, Jackal and some of the PM fleet should be fine. They are not interested in main battle tanks yet.

You then come back this. If you are—and this is almost certainly using the 1 Div specialist infantry units—spreading across the globe, that is brilliant, but they need support. They need combat service support and so forth. At the moment, that is going to come at the expense of the high-end war fighting. We are at a moment where the country, the Army specifically, has to decide what it wants to do. I think you put the case. We probably cannot afford, and we are simply not big enough, to do all of it.

Q27 **Chair:** No, that is right. This is where the integrated view is interesting. I should make very clear that this is not a collective Committee view, but I genuinely see us in direct competition with our friends. Africa is a great example of us being shunted out. By doing so, we then lose trade opportunities. The very vehicles that you are talking about in Kenya, when you think of the counter-poaching and the Al-Shabab threat, are absolutely perfect. A Boxer, an Ajax, even a Warrior, and certainly a Challenger, would be absolutely inappropriate. Something far cheaper would have greater long-term prosperity support.

Nicholas Drummond: The Army already has plans to do that. The Army has its MRV-P programme, which is obviously subject to the integrated review as well. An MRV-P would be an excellent capability.

Q28 **Chair:** Explain MRV-P to the uninitiated.

Nicholas Drummond: MRV-P is multi-role vehicle protected. That will be a family of two vehicles. One will be a light command and liaison vehicle, an armoured Land Rover basically. We are buying the American JLTV. That is the current plan. The second package of that is a troop carrier, an ambulance and other variants, which is slightly larger. The Australian Bushmaster and the General Dynamics Eagle 6x6 are the two vehicles under consideration. These two vehicles are fully capable of performing the role you have outlined and the Army will acquire them in large volumes.

Q29 **Chair:** I do not think it has acquired them yet. Our understand is that there is absolutely no intention to buy any of the things, which I would absolutely support, on the briefing that we received. In fact, as we are exploring here, there is not enough money to buy these four vehicles.

Francis Tusa: They are short, depending on how you calculate, between £2 billion and £3 billion in the equipment plan. This is despite the fact that the Army received an extra £5 billion in 2016 to fund underfunded programmes. It has just not been particularly well managed. One of the problems you hinted at was vehicles we could potentially sell to other countries. Great, MRV-P is made in North America. We would not get any value out of that at all. It is strange. If we are to buy 2,300, it is entirely economic for those to be built in Britain.

Chair: That leads us nicely into the future.

Q30 **John Spellar:** Earlier on you mentioned British exceptionalism. Has the net result of that not been that, basically, we are now incapable of designing and producing these, and are basically, except on a subsidiary basis, going to be out of this business? Is that not extraordinary?

Nicholas Drummond: That is the wrong view of British exceptionalism. Armoured vehicles have become so expensive. They are like combat aircraft almost because they are so sophisticated in the electronics and weapons that they carry. Any future armoured vehicle, like the next-generation tank, will be an international collaboration. You will have a

design group comprised of British, German and French experts. Together, they will produce a design that will be produced and manufactured. That is exactly what happened with Boxer. Boxer is an exceptional vehicle and it followed that route.

The next-generation main ground combat system being developed by France and Germany at the moment will be an international collaboration. That is the only way that we can procure armoured vehicles in the future. It is only when you have the economies of scale, of several armies using several thousand vehicles, that they become affordable for you. Once you have agreed what that design looks like, you then want the capacity to produce that in your own country and we can definitely do that.

Supacat, by the way, is the company that makes the Jackal. It is an excellent company. It is very capable of designing and developing all kinds of armoured vehicles. I fully agree with Francis's point that MRV-P should be designed and produced here.

Q31 **Chair:** Where are all our Jackals? Are they in storage as well now?

Francis Tusa: Some of them are. As for the track mileage—I know they have wheels—it is a statement of the bleeding obvious, but, because we are not in Afghanistan and on that type of operation, the use rate has declined significantly. Actually, it is one of the vehicle types in the British Army that is the most used. I know Nick will recognise this, as will you, probably. The Army is always carping: "This vehicle is rubbish". Jackal seems to have been one of the best-received vehicles in British Army service for some time. It has its roles. I wonder whether sometimes people try to overplay the fact that we can use it in peer-on-peer warfare. Lack of overhead protection strikes me as a significant problem.

To speak to the issue of whether the UK could design and participate, one problem, and you saw it through the 1990s and into the 2000s, was that armoured fighting vehicles were viewed almost as a retail item. You could literally just go shopping and get exactly what you wanted. "Do not worry; it is not a problem". The design capability in the UK has been run down. It is reflected in the problems, which you will have heard some of, with both Warrior and Ajax. There was not a mature AFV design and project management capability. It had been got rid of. As a country, we have been rebuilding this capability from scratch, nearly. That is one of the reasons why both Warrior and Ajax have been troubled and why the costs are not looking brilliant. If we see programmes like that through, speaking back to Nick's one about the main ground combat system, the UK will be in a position to participate seriously.

Q32 **Chair:** To pursue John's question a bit further, if we were to—blank sheet of paper—jump into bed with other countries to develop land warfare vehicles, the French seem to be an obvious choice. Are there political reasons for why we do not do these things?

Francis Tusa: Sadly, across the piece anything Anglo-French at the moment is viewed as toxic. Elements of it stem out of Brexit and so forth. Look at the successes of MBDA, the missile house. That is an incredible example of co-operation that has led to great weapons, reduced costs—you name it. In a broad sense, European is viewed as bad, which is silly.

People should try to remember history. We have had a lot of very unsuccessful attempts to collaborate with the United States on armoured vehicles, just as one area. I would go back to the early 2000s. At a land warfare conference in 2002, General Sir Mike Jackson was asked, "Should we not just join the American army's future combat system? That is the way ahead: the Americans, interoperability. It is brilliant". He said, point blank, "No, we should not". That caused people to go, "What?" He said, "We should fight alongside the Americans, not like them". He said, "American equipment is expensive and they fight at a scale we will never be fighting at. We cannot afford what they are doing".

It was true then; it is true today. In tanks, Nick works with Krauss-Maffei. Leopard 2 is a very good tank. I suspect that whatever Krauss-Maffei and Rheinmetall come up with for Leopard 3, if we call it that, is going to be an incredible tank and would be affordable.

Q33 **Chair:** These are all platforms and it is the firepower that they produce that makes them interesting, not just their mobility or, indeed, their protection. What I noticed, which I am afraid is a constant theme that we see in all militaries, and Britain is no exception, is that they all develop their bespoke arsenals of munitions that they require. It is not just in munitions themselves. It is not just in munitions themselves. It is also in other bits of equipment and assets that you might want to plug and play. Would you agree that there needs to be greater modularity and consistency in the firepower we have in our arsenal to be deployed in all these vehicles?

I give you a simple example of the Brimstone. We saw a mock-up, I think at Bovington, of a tank with a Brimstone mounting on it. The cavalry would love to have that. When I asked about this with the four vehicles, there were absolutely no plans to have what I think is one of our most potent weapons systems based on any of our land warfare vehicles.

Nicholas Drummond: That speaks to the missing capabilities that the Army needs to invest in. Maybe it needs to sacrifice a programme in order to afford those missing capabilities. The first is artillery. It needs to do a wholesale renewal of its artillery systems. Then, to your point, it needs to have the ability to fire anti-tank missiles from under armour. It does not have that ability. It urgently needs that. The third missing capability is air defence. We are woefully short and we would get absolutely spanked if we went to war without investing there.

We need modularity of weapons systems, unquestionably. We need to have commonality with our allies. The good thing about the Challenger 2 life extension programme is that we are adopting the 120 millimetre

smooth bore, which is used by America, Germany, France and other NATO countries. That is definitely a step in the right direction. With the 40 millimetre on Ajax and Warrior, that is more problematic because we decided to go a different route. The rest of NATO is using 30 millimetre and we decided to develop our own bespoke cannon. In one sense, we are painting ourselves into a corner with another gold-plated weapons system that only we use. I would much prefer that we went with 30 millimetre and, with the money we saved by going that route, had anti-tank missiles on the side of Warrior and Ajax.

Q34 **Chair:** Is that the decision? We do not really find out what caused it—that we have gone a separate way from the rest of NATO—until the respective general writes his or her memoirs and it is revealed. You mentioned the smooth bore. We have appreciated and learned that this has been a very painful journey to make this decision itself. Are you aware of what caused such a long delay?

Francis Tusa: How far back do you want to go?

Nicholas Drummond: We tried to put smooth bore on Challenger in 2006. We put a smooth bore gun in the turret and then we discovered that we could not use the turret as it exists because it could not cope with the very long ammunition nature of 120 millimetre smooth bore. The only way we could do that was to put a brand new turret on Challenger. In 2006, people were saying, "Sorry, mate, the tank is finished. Go away". Now, with everything that has happened in Ukraine, people are saying, "Absolutely, we need to put a new turret, with that gun, on Challenger".

Francis Tusa: Going back to when Challenger 2 was selected, so early 1990s, all these arguments were being worked over. At the time, you would have had tankers going, "HESH, high-explosive squash head, is the best thing since sliced bread. You cannot fire it out of a smooth bore gun". There were some very inbred views about what you required from a tank gun, the issue of all the ammo being kept under the turret ring and so forth. This was being trotted out well into the early 2000s. Would I detect someone saying, "We cannot buy a German tank. We invented this. We have to keep going"? Yes, I can detect some view of that, so a degree of British exceptionalism and you could say some prejudice.

Q35 **Chair:** What about the 40 millimetre cannon?

Francis Tusa: I am slightly more in favour. Why keep on doing things exactly the way you have done them for 50 or 60 years? The problems we have had, in the UK, with the 40 millimetre cased telescoped ammo have not been replicated in France, where they have taken the system, all of it, as designed. It is now in full-scale production. They now have a turret that would fit if we wanted to, just for the sake of argument, put it on to a Boxer. It works absolutely fine. Yes, there have been problems along the way, without a shadow of a doubt, but it works. That is because

they had a much more co-ordinated approach to the development, design and then how they were going to put it into production.

Q36 **Chair:** Are you saying you can or cannot take the 40 millimetre and put it on a Boxer? Is it too big?

Francis Tusa: Yes, you can.

Q37 **Chair:** Richard, you probably remember the Scimitars. These were nippy little vehicles. The Ajax is enormous in comparison. There is nothing subtle about that.

Nicholas Drummond: One thing must be said about the turret that Lockheed Martin developed. Their approach was different from the French approach. The reason why they did not adopt the system was that they wanted to fully compartmentalise the ammunition from the crew compartment. If the vehicle was hit, an ammunition fire would not burn the crew and go into the crew compartment.

Q38 **Chair:** The Challenger 3 now does that, doesn't it?

Nicholas Drummond: It does, and that is a very worthy goal, but it has taken 10 years to achieve. If it saves lives on the battlefield, it will be a worthy investment.

Q39 **Chair:** It is still hand fed. It is still hand loaded, though, isn't it?

Nicholas Drummond: No, the 40 millimetre is all fully automatic.

Q40 **Chair:** No, I am talking about the Challenger 3. There is still a person having to load each round.

Nicholas Drummond: Yes, but the ammunition is contained behind a blast-proof door.

Q41 **Chair:** I appreciate that. I just wonder, if this day and age, how come we have not moved to—

Francis Tusa: It is another of those areas where you will find people who are absolutely in favour of autoloaders and others who say they are still tricky. If they jam and so forth, they cause problems. I would note that, more often than less often, autoloading tanks have won the various tank competitions that NATO runs, most recently in Estonia or Lithuania, where the French Leclerc autoloading cannon won. At one level, yes, it is surprising it has taken so long to get these systems in place. They are quite expensive and can be quite complicated.

Nicholas Drummond: We are going to an autoloading world. The next main battle tank will definitely have an autoloader, no question.

Q42 **Chair:** I think this is what really scares us as a Committee, when you are saying, "We are going to an autoloading world". Here is us, upgrading to Challenger 3, and we are still using yesterday's technology, hand-held loading by a person. It is another person in the actual turret.

Nicholas Drummond: We need to find a pathway to the next generation main battle tank.

Chair: Challenger 4.

Francis Tusa: It will not be a UK standalone programme.

Q43 **Chair:** Yes, that is where I was going with France or the United States. The pressure on us to have greater collaboration is surely the direction of travel.

Nicholas Drummond: We should join MGCS.

Francis Tusa: This is the way you get the modularity. It has worked. Again, MBDA on missiles is the best example. People accept they cannot do everything. Even if you want to keep this capability in their own country, you have to trade. MBDA has done this between France and the UK. They have closed down capabilities in both countries. You rationalise and you accept that, for the sake of argument, the future gun will come from Rheinmetall, because that is what Rheinmetall does. You accept X is going to provide the power pack and you do a degree of sharing out, so people do not feel they are hard done by. Is it painful? Yes, of course it is. Does it ultimately work? If done properly, yes, it does.

Q44 **Chair:** Back to the original question, which I think Gavin may have hinted at, if you had to drop one of these programmes, which one would it be?

Francis Tusa: It is the judgment of Solomon. Accepting entirely that the armoured fighting vehicle programme is unaffordable, so something has to go, with two tracked IFV programmes, one of the two has to go. I would base it on which one has the technical problems and which one does not. We both hear stories. As I say, what you hear varies day by day. If one of them is known to be more problematic than the other, you cut one of those tracked IFVs.

Nicholas Drummond: I would concur with that view.

Chair: Francis, Nicholas, thank you so much for your time. Thank you very much indeed to our first set of panellists.

Examination of witnesses

Witnesses: Peter Hardisty, Carew Wilks and Lee Fellows.

Chair: We continue into our second half of this focus on land warfare vehicles. Welcome to Peter Hardisty, managing director of Rheinmetall BAE Systems Land; Carew Wilks, vice president of General Dynamics Land Systems; and Lee Fellows, the vice president and managing director of Lockheed Martin, so well-represented, long-established companies. You probably listened in with interest. You may have thoughts that you want to share immediately and we will certainly weave those in. Thank you very much for participating here today.

Q45 **Richard Drax:** Good afternoon, gentlemen. Could I ask you all about the programmes you are responsible for delivering? Lee, have you now overcome the technical difficulties of the Warrior CSP? What are the main risks to delivery of this programme? Carew, why was the delivery of the first batch of Ajax vehicles postponed this year? What are the main risks to delivery of this programme? Peter, what is the status of your contracts relating to the mechanised infantry vehicle? How would you characterise the risks associated with that project?

Lee Fellows: You asked me two questions, one to give you a status on what you called technical difficulties. The second one was what the major risks are, I assume to successfully bring it into service. I will take each in turn. My submission to you a couple of weeks ago tried to make it clear that there have been issues on the Warrior capability sustainment programme. I tried to outline some detail around that. It is important that we give you some transparency around it. In essence, they came into three areas.

We have had some technical issues around the initial development of the core product. We have been very open about that. Some of the root causes of that are about learning how to do armoured fighting vehicles in the UK again. We have also had some joint issues with the Ministry of Defence, which we have worked through. I talked about it being 30% of the impact. That is mainly around learning how to bring armoured fighting vehicles into service. It has been a major learning circle for both us and the Ministry of Defence. We went through some tough learning curves there to learn how to do that. Then there were some MoD delays on provision of contractual Government-furnished assets, but we have also had Government change coming in over the years.

One message that it is really important is understood is that there have been delays to the programme because of developing the core product. The opportunity to bring some additional capability in has been taken as well, to make sure that this vehicle, although late going into service, will be current when it does so.

In terms of the risks to bring it into service, it is slightly challenging for me to give you a complete answer because I am not on contract to bring it into service. That is not to make an excuse; that is just to be clear. I am in the middle of a commercial negotiation with the Ministry of Defence to work through a schedule of work and a production schedule. The expectation is that I will put a firm bid into the Ministry of Defence at the end of this year. With the Ministry of Defence, I will then work to get that on contract next year. In parallel with that contract award, we are jointly aligned that we should have design acceptance of the WCS product.

It is really important for both of us that we understand the maturity of the product as we draw a production baseline. That is a different approach than has been taken in other programmes and it is the right thing to do for the Warrior programme. Next year, we are on track, and for the last two years we have been on track, to complete to design

acceptance. At the same time, our expectation is that we would sign a production contract; then we will go through initial production, full rate production and bring it into service. Does that answer your question?

Q46 **Richard Drax:** Yes, thank you very much. Carew, what about Ajax?

Carew Wilks: Thank you and good afternoon. The Ajax programme started its first deliveries this year. In fact, we delivered six vehicles last year for training and development, and the first vehicles towards the initial operating capability were delivered in July. We now are in full production across all six variants of the platform and have a number of vehicles in the pipeline for delivery over the coming days and weeks. We have the full production in progress with over 60 vehicles now built. The design therefore is behind us.

You asked about risks to that delivery. Now that we have the design in place and agreed, and we have full production in operation, we are on a path towards full delivery and towards IOC later this year.

Q47 **Richard Drax:** I have to say, being a former infantryman, I was very impressed by the Ajax and the vehicle we saw the other day. I did not quite catch this. Did you say why the first batch had been postponed this year? Did you explain that or not?

Carew Wilks: We did deliver the first batch in July this year. Seven vehicles have been delivered to the Household Cavalry regiment. The delays to the programme that we have seen over the years come down to a range of factors since the production contract was awarded in 2014. Those really fall into three areas. First, there were some technical challenges that GD faced in the design of the vehicle. We recognise that and took action to resolve that.

Secondly, the cannon, which I know has been discussed previously today, is an item that has been supplied to us by the MoD for the vehicles. There were some delays around the introduction of the cannon and the changes to configuration. That caused some early delays to the programme, which had a knock-on through to where we are today.

Thirdly, as we have discussed earlier today, from a joint point of view, working together with the Ministry of Defence, it has been a learning journey for the whole armoured vehicle enterprise in terms of rebuilding and reconstituting the skills, capabilities and expertise. As a result of that, some joint aspects of the programme have been delivered more slowly than was anticipated.

Q48 **Richard Drax:** Out of interest, we heard from two of your predecessors giving oral evidence that it took 10 years from the first idea to being produced. Has it taken 10 years for the Ajax?

Carew Wilks: The original development contract, the demonstration phase contract, was awarded in 2010 and here we are today, 10 years later, with the first vehicles going into service and IOC close to us.

Q49 **Richard Drax:** Yes, 10 years seems to be the time, doesn't it? Peter, what is the status of your contracts?

Peter Hardisty: Good afternoon, gentlemen. For Boxer, the contract was awarded at the end of last year for just over 500 vehicles. The project is on schedule. The initial preliminary design review took place a couple of weeks ago for all four build configurations. That PDR took place by video conference, bearing in mind covid. The whole project is on schedule. In terms of the risks that we face, RBSL will build some 260 of the vehicles and the industrialisation is probably our biggest challenge area. I am not sure that there are risks at this time, but that is where my challenges lie.

Q50 **John Spellar:** You described your particular programmes, but what are the main lessons you have now learned from your involvement in these programmes? What could be done to improve or even transform how these projects are both planned and delivered?

Lee Fellows: To the question on lessons learned, I point back to the last two years of the track record on Warrior. We have had some challenges. We went through a very tough learning cycle about two years ago, jointly with the Ministry of Defence, and we have put a number of initiatives in. That is what we need to bake into future programmes. Carew talked about how performance on Ajax has improved as well. There is some joint learning that we could all point to.

For me, the cannon change caused some disruption that we had not anticipated. I would like to have seen a closer commercial link between us and the cannon provider to the Ministry of Defence. We would call that a joint change board. That would have helped us to understand the quantum of change that was going to affect the development programme. Bearing in mind that I have just heard two witnesses beforehand talk about the desire for future change in armoured fighting vehicles, my recommendation is a very close scrutiny and review, so that, if there is a desire to change requirements that are outside of the core contract, the coherence is closely maintained.

Secondly, some really good learning has happened on Warrior around requirements definition. We are in a good place on Warrior today, in the way that we work with the Ministry of Defence and the British Army to bring Warrior into service as quickly as possible. One of the key enablers to that has been a really honest review among the three parties about acceptance and compliance of requirements. That is not to say that we should deliver a product that is not compliant or of a lesser quality. That is unacceptable to us. At the same time, sell-off of requirements takes a significant time.

As an example, there are over 2,000 requirement streams on the Warrior programme alone. One of the observations made earlier is that it takes 10 years to bring something into service. Clearly, there is a direct link between the quantity of requirements and the duration of an acceptance

period. Focus on what is really essential, make sure that is clearly understood and perhaps take a more risk-based view in other areas.

That is not to say, "Accept second class". There is a contract we have signed. We should be compliant, but there is an opportunity to take a slightly more balanced view on how it is done. I have seen that done to good effect on Warrior in the last two years. It requires pragmatism from all parties, but that collaboration really has seen good benefit on Warrior in the last two years.

Carew Wilks: As we have discussed already, I would suggest that the skills in the UK had rather fragmented and atrophied in armoured vehicle procurement, development and management. The absence of any long-term strategy around this capability has resulted in that. The first lesson is that you need to retain a skill base and, to do that, we need a longer-term industrial strategy that would keep the skills and facilities alive within the UK. That is not just within industry, but across defence and in Government, where a lot of the expertise that had existed around this capability had dispersed over the years since Challenger 2 was brought into service.

Secondly, I agree wholeheartedly with Lee's comments around requirements. There are better ways of managing this. The first lesson here is to ensure that all aspects of the requirements have been assessed and are ready to be put into a system, to recognise where additional assessment activities need to be carried out and to carry them out jointly and together. Managing these requirements, as you go through the design of the vehicle and the balanced design that is needed to go into production, is an area where, as we heard earlier from Francis Tusa, the 80% solution may sometimes be better than driving for the 100% right the way through.

Thirdly, I would add a comment about pace and collaboration. We are building excellent relationships with the MoD for delivering the programme and we are in a better place now than we had been. We have joint decision-making and collaboration over a common objective to get Ajax into service quickly. That is a good lesson for the future.

Q51 **John Spellar:** Could I follow up on that? This may apply to the other two as well. You talk about relations with the MoD. Is that relations with Abbey Wood or is that relations with the Army? Are there some differences and maybe some problems on those interfaces?

Carew Wilks: I am principally talking about the relationship with DE&S, which is our principal customer here, but we look to the Army as well. I am talking about the whole enterprise having the skills and experience necessary to be involved and to manage a programme of this complexity. That is the learning curve that all parts of the enterprise have taken over time, certainly at the Ajax programme.

Q52 **John Spellar:** Having a clear view about the project—is it because the

Army itself does not really have a clear view? I know it is your customer, so you want to be a bit careful on that.

Carew Wilks: Just looking at it from an Ajax perspective, the requirement is very clear in terms of an advanced battlefield intelligence and reconnaissance capability using the most modern technology with a digital backbone. They have been clear in that objective and that is an important aspect of the programme that we have seen through.

Lee Fellows: One of the lessons for the Warrior programme has been about the coherence between the Army, DE&S and Lockheed Martin, and indeed our suppliers, because the whole value stream needs to be involved in this. One of the successes is that that is the case now. Certainly, I have a very close relationship and it is a truthful one. Sometimes we disagree with one another, but we do so truthfully. I genuinely think there is a joint understanding of the need of the Warrior programme and very good collaboration between the three parties.

I would point to the ability to spiral procurement items quickly. I know that a number of you were down at Bovington last week. You saw enhanced storage solutions; you saw the Bowman fit—all the good things that you would need to do. They were not in our technical baseline a year ago. They have been introduced at pace and we have done that because the Army has identified an additional requirement. We have been able to brigade and focus very quickly to do that. That for me is part of the health check of the three parties being able to work together quickly.

Peter Hardisty: The most important thing, if we look over our shoulder, particularly with regards to Boxer and to a lesser extent Challenger, is that the failure to have a land industrial strategy has led to changes in direction and in requirements. I would suggest to you that a land industrial strategy is the essential template. It is the template for today; it is the template for tomorrow, whether that is a collaborative procurement of a new fighting platform. That strategy needs to look forward some 40 years. That would deliver staying power, which you have undoubtedly seen that we, the Brits, have not been good at over the past few years.

Boxer is a good example. The Germans and Dutch stayed with the platform. They assessed it; they deployed it to Afghanistan. We left the programme in 2003. We are re-joining it now. We could have been in it and we could have had a vehicle that would be useful to us in our recent conflicts. Clarity of requirements is central to ensuring that we specify things that are achievable, we procure and we upgrade in spiral procurement. We have discussed than and other witnesses have made comment. Requirements creep is a threat to us all. That goes hand in hand with a lack of clarity, the changing of people and staff churn, whether that be at headquarters Army or DE&S, and things evolving because tomorrow's is a bit better and we can have it now.

Finally, on timelines and the overambitious nature, we have talked about procurement taking 10 years. We often see desires to bring equipment into service in timelines that are frankly unrealistic. Then we have to deal with the output of missing a deadline, having to extend our delivery dates and so forth. Realistic timelines at the outset would help us all.

Q53 **Chair:** Thank you, gentlemen. I just want to be provocative, if I may. I am comparing the Ajax with the Warrior. To the uninitiated, they look rather similar. That is the first thing that strikes you. When you then look at the details, our troop carrier is actually smaller than our recce vehicle. The recce vehicle you are proposing today is substantially larger than the Scimitar and Samaritan programmes that we had before.

Did General Dynamics consider saying, "You have this Warrior programme. It looks really interesting. I like the chassis. I can stuff it with some really interesting electronic gear, ISTAR and so forth, and save you a lot of money, rather than procuring a new vehicle that does remarkably similar things from a capability perspective on the land to the Warrior"? Carew, do you want to begin as promoter of the Ajax?

Carew Wilks: Yes. It is certainly the case that Ajax is configured as a reconnaissance vehicle and that is its primary role. It has the sensors, the technology and the systems on board to deliver that. It is not being brought into service as an IFV in the same way. It is a completely different requirement set and has been designed with that focus in mind. It provides the capability for the crew to operate those systems, to bring together that integrated reconnaissance picture and to share that across the integrated battlefield, by accessing the battlefield at any point 24/7, in any conditions.

To do that, the vehicle needs the mobility that it has, exceptional mobility in all terrains, but also the crew need to be protected. The lessons that came from campaigns in Iraq and Afghanistan were very influential in setting the requirements for protection for Ajax. The platform has been designed to deliver that protection and has modular armour available, to suit different conditions. That drives, in overall balanced design terms, a particular configuration to achieve the reconnaissance capability, packaged with its lethality, the cannon. Then, to enable the access on to the battlefield, you need the mobility and you need the protection for the crew. That is the balance that has been achieved in Ajax.

Q54 **Chair:** Let us turn to the case for Warrior. How come you did not bid for the rollout to stuff a Warrior chassis with all the goodies that we have just heard Carew speak about, or did you?

Lee Fellows: We did not bid a counterproposal to General Dynamics on the Ajax Scout programme. We do not own the hulls. They are owned by the Ministry of Defence. We would have to have brokered a deal with the MoD to do those hulls. Honestly, that would have been an extremely challenging thing 10 years ago.

We do make the turrets for Ajax for General Dynamics. There is a huge amount of commonality at the turret level between the two products. There is a lot of modular design. I heard earlier some evidence from one of your witnesses about modularisation. There is a massive amount of modular concurrence between the Ajax and the Warrior turrets. You can literally change LRUs between the two units in a lot of areas. We did not look at using the Warrior hulls for an Ajax requirement, specifically because it would have been non-compliant to the Ajax requirements that the MoD stated. It was not really practical.

Q55 **Chair:** I am sorry, but I need more convincing that there was not a way that you could use the basic chassis. Carew, you spoke about lethality, about mobility and about armour. There must be a way that we could synergise what is going to be the same capability in both, with the modularity that you can change depending on the scenario, the terrain and the circumstance in which you might be using it. The ship has sailed; we know that. It is just an example. I understand why you need to justify where we are today, but it concerns me that we perhaps did not even consider this or we dismissed it for the arguments that you are putting forward.

Lee Fellows: Perhaps I can give you one example. You have seen both vehicles. The rotating base joint, the thing that turns the turrets and interfaces with the hull, is significantly different in size between a Warrior and an Ajax. It does not fit on a Warrior, so we would have to have designed a different turret to bring the Ajax requirements to a Warrior. At a top level, in the capability descriptions that we use, we can talk about lethality and survivability. Warrior and Ajax both bring those to the table. At the requirement level, that does not work. It would require a new design.

I am not disagreeing with you that 10 years ago somebody could have sat down and said, "Why do we not have a recce variant of a Warrior, a 525 or whatever, that could do it?" Absolutely, that is a question for the British Army, but from a technical capability perspective, as an industry, I would not have been able to successfully bid a Warrior as the Ajax solution and be compliant to the requirements. I am trying to give you a very focused answer there, rather than the broader piece. At a very focused level it would not have been compliant. It does not mean it is not a good broader question. I am just trying to give you the accuracy from an industry perspective.

Q56 **Chair:** You are leaning on the MoD requirements. I am saying the MoD requirements could have been a bit more flexible to allow that. Can I just confirm that both vehicles fire the same 40 millimetre round?

Lee Fellows: They do, yes.

Carew Wilks: That is correct.

Lee Fellows: Correct, yes. Lockheed Martin makes the lethality on both of those products.

Q57 **Chair:** Essentially, the turrets could have been exactly the same, had we specified. You could have had the same turrets.

Lee Fellows: Yes, if you had specified the same turrets or had common requirements across the two, absolutely, you could have done.

Q58 **Chair:** Right, and you can stick the same modularity of armour on the outside as well.

Lee Fellows: Both products have modular armour capabilities.

Q59 **Chair:** You see where I am going with this. This is the sort of thinking that we would hope to have happened a few years ago. I have made the point. One question, before I move to the Challenger, is to do with what is modular between all four new vehicles that may come online. This is quite a moment in procurement when the planets align. Challenger 3, Ajax, Boxer and Warrior are all coming into fruition at the same time. There are huge possibilities for sharing capability. Is there anything, apart from the round that we have established, that can be used by all four vehicles, bearing in mind ISTAR capabilities or things that we have yet to invent?

Lee Fellows: Bowman is a good example. They are digitised, so they will be able to talk to each other.

Chair: That is good.

Lee Fellows: Communications systems will be consistent. That is because the MoD, through the British Army into DE&S, has required us to design it to a common standard. There are good examples where the MoD has faced into the need for coherence and driven that through. BCIP and Bowman communications is one example that springs to mind.

Carew Wilks: For Ajax, we have six different variants and there is very considerable commonality across them, in terms of the common base platform that underpins them all. Within the systems on the platforms, as well as the cannon system and some of the fire control systems that go with that, as Lockheed Martin pointed out, there is some commonality between the two turrets.

I would really point to the open digital architecture that provides the opportunity in the future to have common subsystems across all these digital platforms. I am looking ahead to potential future capabilities, such as active protection systems. Because of the nature of these modern vehicles and the open electronic architecture and the digital backbone they have, we can have common systems across these in the future. The variance in shape and size is driven by the specific requirements that each capability has, but there is tremendous opportunity for commonality of systems and subsystems, both today and in the future. They have been configured for that.

Peter Hardisty: When we looked at our proposition for Challenger, we made a specific decision to use Thales surveillance and target acquisition system. It is the same basic system that has been used on Ajax and that was part of and remains part of our Challenger 2 proposition. That is a major commonality in the equipment, the manufacture and the user's training. A separate example would be the power pack in Boxer. It is the same MTU basic power pack that is in Boxer and Ajax. That is more luck than judgment, because it is the power pack that was in Boxer, but nonetheless it is commonality and should give through-life support aspects.

With regard to both platforms, Boxer and CR2, we ensured and sought to ensure that there were commonalities with those vehicles in service across other NATO allies. From a Challenger perspective, when we fielded the proposition, we wanted to use a weapon that was common with the Leopard 2 A7s being manufactured in Germany or being upgraded for the German army, and the ammunition suite therein, and/or the equipment in Boxer so that it was common with those vehicles in the German, Dutch and Lithuanian armies.

Q60 **Chair:** Something that the CDS and the CGS have spoken of is this common digital architecture, the ability for all assets on the battlefield to communicate and work with each other. That is very much welcomed. But a point we raised when visiting Lulworth was that, if anything new or, indeed, existing today comes on, there is not a standardised plug-and-play location on every vehicle that will allow anybody to put in an automated GPMG, a Brimstone, a Hellfire, a drone launcher, a desalination unit or, indeed, a refrigerator, if you are doing a vaccination programme, for example. There is no anchor point on the back that can lock down any new device or asset that is yet to be invented, which gives extra versatility to any vehicle because it can be strapped on to it.

Is it too late for that to happen? Speaking to the military people, they would love this to happen. Brimstone is exactly the sort of thing that they would like to have, bearing in mind that you would need a soft entry point to allow the software to be run from inside the belly of the vehicle.

Lee Fellows: We have trialled launching anti-tank missiles off Warriors in the past as part of research and development. We have involved the British Army in those assessments. Carew raised a really good point that the reason Bowman works is because it is based on GVA architecture, which is the common vehicle architecture. There are hardware points on a Warrior under the armour already that could hold those launch systems. The software systems are, of course, already in place. I realise that was a specific example against a generic question but, as a specific answer, that is one that we can say we have already looked at.

The Army and DE&S have been clear with us, and they are wise to do this. It has taken a long time to get to where we are today. We have learned to focus together. Carew talked about pace. That pace is achieved with focus. For the Warrior programme, the most important

thing for us now is to get this into service. I do not see it as a major modification in production to do that. We have to get there; otherwise we will never get there.

There is not a generic plate. The mechanical integration of some of these things is not huge. The software is where the change comes from. That is GVA.

Peter Hardisty: Plugging a remote weapon station on a modern vehicle, that has a generic architecture within it is much simpler. There is a mechanical interface, but the electronic interface has been addressed. That is true of all platforms we are talking about and is an essential ingredient to vehicles moving on. Another characteristic, particularly for Boxer, was the requirement set for electronic countermeasure. I am sure it is true of the other vehicles as well. There was an electrical power requirement; there was a mass requirement. The equipment itself is incredibly sensitive, but nonetheless there is the requirement to be able to plug what is already available into and on to any of the platforms we are talking about and to give it the growth potential, as this sort of equipment develops, to address particular threats going forward.

Carew Wilks: To finish off on that point, the risky element of adding systems on to a platform is around the digital integration and the digital architecture. That is resolved on Ajax and these other platforms by having this open, generic vehicle architecture into which that can happen. The mechanical interfaces tend to be more straightforward. I would reinforce Peter's point that the vehicles have been configured for growth in terms of their power. New systems always take additional power and Ajax, alongside these other vehicles, has the capacity to deliver more power for these other systems. The risky elements of future growth have already been taken care of in the design of these vehicles.

Chair: I will not labour the point, but there is no ubiquitous anchor point on all four vehicles for stuff that exists today that is not on there, such as Brimstone, or stuff that might be available in the future. I simply make that request. Even if the MoD has not suggested it to you, you guys among yourselves, because you are the clever people who invent this stuff, could actually offer it to the MoD. This Committee would be absolutely behind you in making that happen, because it will save a lot of money, rather than retrofitting it.

Q61 **John Spellar:** As we have often said on this Committee to companies, you have a duty to educate customers and not work entirely to their specifications. Following on from that, first, do you think we should have a land sector industrial skills strategy? If so, what benefits do you think it would bring? Do we still have the skills and experience to underpin such a strategy?

Peter Hardisty: I feel very strongly that we should have a land industrial strategy, as I mentioned earlier. It would give clarity across industry and across defence, whether that be MoD, headquarters Army or DE&S. It will

assist academia to join and focus its efforts. It will also help defence laboratories such as DSTL to focus their efforts. It should look forward some tens of years. We have already talked about the gestation of a platform being a decade and the in-service period being 25 or 30 years.

It will assist in the development and participation in collaborative procurement and development. One of your other witnesses mentioned the main ground combat system, the Franco-German new platform. I would hesitate to call it a new tank, because it is likely to be several things, including unmanned autonomous vehicles. We have the capabilities within the UK and they exist within the companies that are represented here and other companies. It is important that we do develop and prosecute the development of capabilities, because if we do not possess those within the UK we are not in a position to collaborate with allies. We merely become a customer. It gives focus and will ensure that requirements are clearly specified, timelines are adopted and staying power is part and parcel of the whole agenda.

Carew Wilks: I fully support the need for a land industrial strategy. Now is the moment and I say that because the Army modernisation programme, of which all of our programmes are part, has recreated and reconstituted the skills base across the whole enterprise: academia, MoD, Army and industry. Now is the moment to cement that and retain that for the future.

I would add a couple of other points. It is not just us as the OEMs, the bigger companies, but our supply chains that have been very closely involved with all the systems and subsystems that go into these vehicles. They have regenerated as well. We have worked hard to do that. The opportunity for a spin-off from these defence activities, not only within the UK but for exports at every level of the supply chain, will be tremendous if we can sustain some form of continuous capability and have a long-term plan in which industry can invest alongside other parts of the MoD.

Lee Fellows: I am strongly in favour of a land industrial strategy. It was something that was identified in the NAO report in 2011. From a Lockheed Martin perspective, my corporation has invested £12 million in the Ampthill capability, which makes us a unique and world-class turret manufacture and design organisation. We have had some tough lessons to become that. If we do not have a land strategy, my concern is that that will erode. Warrior clearly is an important programme to us. Supporting and carrying the execution of the Ajax programme is important to us as well.

A land industrial strategy spread over decades, as Peter has mentioned, will allow us to draw context for activation and participation. We invest internal research funds, for instance. You have talked about anti-tank guided missiles. We have done research and development on that in the past. If we had a land strategy, we could make sure we focused on what

mattered, both to us an industry and to HQ Army and, indeed, export, which has not been mentioned yet. There have been good opportunities in export, but I would like to see genuine UK capability sold internationally. I am proud of what we have achieved on Warrior. It has been a tough story. There are export opportunities out there. A land strategy would reinforce that.

Q62 **Gavin Robinson:** Good afternoon. You have touched upon the general thrust of what I want going to ask you, which is to draw upon the comments in our earlier session from Francis Tusa and Nicholas Drummond about the need for international collaboration when considering any future generation tank. Given what you have all just said about the importance of a land-based industrial strategy, the retention of skills, developing that over a longer term and the increased need for collaboration internally on projects, how much do you agree that it will be incapable for us to proceed for future generation capability without involving international partners?

Peter Hardisty: It is central to the proposition that we need to look at international partners to take forward major projects, such as main ground combat system. It is very clear to the French and Germans. They had already established that programme. The British have some observer rights, but only limited. It would be central to any strategy for the British to decide whether it is a European or an American engagement that they would pursue. There is one thing quite clear: we cannot sit on the fence. We must make a decision, we must invest and we must have the capabilities inside the UK if we wish to be part of a collaboration.

Q63 **Gavin Robinson:** You have to have the capabilities to be part of the collaboration, as opposed to having the capacity to do it ourselves alone.

Peter Hardisty: If you do not have the capability to contribute to the development of the platform, you are merely a customer. You will be building to print.

Q64 **Gavin Robinson:** Gentlemen, do you agree?

Lee Fellows: The short answer is yes. There is not the volume of work that will support a comprehensive industrial base for every element. Just like every domain before it, such as air and nuclear, it is about selecting the core capabilities that truly bring intellectual customer capability, both from an industry perspective and from the Ministry of Defence perspective. Unless that is done, either the UK Government will not have enough money to do the job and have a severe capability gap, which is unacceptable to the soldiers, so you will be inefficient with your expenditure, or, frankly, it will fail. We will make commitments that we do not understand because we will have eroded the capability.

It comes back to my previous comment. We have spent 10 years learning how to do this again. If we lose that capability, we will spend another 10 years learning how to do it again. It will just be more expensive. It would be a real shame to lose that now, at this point. Now is the time.

Carew Wilks: To be an effective collaborator, we have to be credible, such that we can both influence and ensure that the requirements that the UK has can be embedded, and be part of the programme rather than, as Peter mentioned, just a recipient of that. For that to be the case, we need to retain the skills that we identify in the UK, and build on the existing facilities, laboratories and so on that have been invested in so far.

Lee has mentioned the Lockheed Martin investment. From a General Dynamics perspective, we have invested significantly in engineering, systems integration laboratories and manufacturing facilities in south Wales. We have the skills and people around that, including graduate engineers and apprentices. We should sustain that and keep it alive such that we can be an effective collaborator. The collaboration would bring the benefits of economies of scale. It may also bring in some other technologies that may be more advanced elsewhere.

I see collaboration as part of the future for some of the major programmes, but that is only successful and feasible if we retain the UK's skills and retain the freedom of action that the UK would wish to have for the future.

Q65 **Gavin Robinson:** Peter, do you mind if I draw you back to some earlier comments when you were asked about the challenges or risks facing the Boxer programme particularly? Am I right in thinking your answer was industrialisation?

Peter Hardisty: Yes, in terms of the manufacture.

Q66 **Gavin Robinson:** Which part of it is it? Is it not having the skills capacity or not having the production lines in place?

Peter Hardisty: Here in Telford, we will build 260 vehicles. We will do the assembly integration of the drive modules. These vehicles are built today. There are processes and procedures. I need to ensure that the staff here in Telford are appropriately and adequately trained to carry out that piece of work. There is a requirement to fabricate the mission modules, which is a piece of work we will do here in Telford. The welding specification is the German welding specification. That is just what it is and that is the criteria against which the blast and ballistic performance is qualified. We are in the process of qualifying our welding staff and our weld engineers to ensure that we can do that piece of work properly and reliably, similarly with things like small line, adhesive and so forth.

It is ensuring that, for that piece of work, our staff are adequately trained. There is investment that we need to undertake in the facilities, about £20 million worth of industrial expenditure, ranging from simple things like paint bays and weld bays, through to SAP software and the like, which is a similar journey to any other production facility. It is ensuring that we do all those things, we have the schedule and we do

them as we need to, on time, while coping with our current challenges of covid.

Q67 **Richard Drax:** Gentlemen, forgive me for being rude or sounding rude. We have a vote coming any minute now. Could I ask you all three to be as brief as you can in answering this question? What do you view as the most important emerging developments in armoured vehicle technology? How should we in the UK take advantage of these?

Lee Fellows: The Army is doing a lot of good work to try to pull industry together, work across the different domains and bring best practice. My very short answer is that generic vehicle architecture enables us to plug lots of different capabilities on to lots of different systems. Unmanned capability is nearly, not quite, there and needs to be tracked and supported. Also, cyber is the new sexy phrase at the moment. Actually, there is a huge cyber capability in the Warrior capability. There is in Ajax and the other equipment as well, I am sure.

I would go with enhancing cyber EW, electronic warfare. I would go for unmanned capability, but make sure we do it safely and correctly. There are some very easy quick wins that are possible as well.

Carew Wilks: I think along similar lines. In fact, the Army and the MoD have already made the key step, which is to mandate, quite rightly, the digital architecture, the common electronic architecture that will enable these future capabilities and requirements to be put on from the platforms. I would focus on the potential for human-machine combinations, what is currently called manned and unmanned teaming.

In fact, we have participated with the Army on recent experimentation that has demonstrated the capabilities based on these digital platforms, to use them in what has been termed by some as a mothership, providing that crew to be able to safely, from inside the single platform, manage an array of unmanned platforms, whether they be air vehicles or ground vehicles, and therefore extend the reach, depth and breadth of the capability. That is particularly the case for the Ajax's reconnaissance capability. These systems can be quickly integrated into the platform. The opportunity for robotic vehicles to supplement the armoured vehicles is the key opportunity for the future.

Peter Hardisty: I have five very quick phrases. Survivability is key; it is something we in the UK have. Autonomous platforms both my colleagues have mentioned. Robust digital architectures both my colleagues have mentioned. Machine learning I know Carew has just mentioned in some detail. As an industry, we bring first-class surveillance and target acquisition, which is essential to the sorts of vehicles and platforms we are talking about.

Q68 **Chair:** Thank you very much indeed. It is really fascinating to hear where we are going. We have a Division Bell coming. I am very conscious of that.

As with our maritime surface fleet or the F35s, we are again planning for the high risk but low probability event that we need to prepare for. We have to anticipate that, 95% of the time, all these capabilities, these assets, will be used doing other things, perhaps being ready and training for that high-end event. What we need to factor into its design, I would put to you, is not only being able to do stabilisation capabilities at the much lower end, but helping to fight in the grey zone, beneath the threshold of conflict, which is where the character of conflict is actually going, rather than peer to peer.

The third aspect of this is the upstream engagement that we touched on in the first session, which is what the Treasury wants to see the Armed Forces doing more of, developing and strengthening relationships with our friends and allies, to prevent a hostile takeover by China or Russia that effectively nudges us out from the friendships that we have had of old. Would you agree that those are challenges and noble causes for us to be pursuing, in addition to training for that peer-on-peer conflict?

Lee Fellows: We use different words but mean the same thing. For me, a land industrial strategy would enable what we, as industry, call export control, so that we can export to other countries, and I am hearing that defence diplomacy can use it abroad as well. For me, the NAO report in 2011 talked about not making big leaps. Spiral acquisition for me is a classic way of getting something quickly, the art of the 80%, then pursuing to the 100% if you want. I would like to see more of that so we can field quicker. Anything that can take 10 years down to five to field an armoured fighting vehicle is a good thing. Fundamentally, that is about recognising that your initial capability will be less.

Carew Wilks: If I understood the question correctly, we need a modular, flexible and versatile capability that can adapt to different scenarios. These vehicles provide that ability to integrate across other systems on a battlefield. From an Ajax perspective, it is a reconnaissance asset, but it has some other capabilities within and across the six variants that exist. That is integrated with other platforms on the battlefield to deliver whatever effect the Army is seeking. I agree with your summary of the range of effects that the Army might wish to deliver.

It is that capability to adapt, have modular armour, for example, and to be suitable in a range of scenarios. For the strike brigade concept, with the reach that it requires, these vehicles have the ability to fulfil that requirement in terms of travelling a distance. They are reliable. They can be kitted out with modular capability and then mixed on the battlefield with the other systems to create the integrated effect that is needed.

Peter Hardisty: I support the proposition you make. We need a high-end capability that has the utility to be used in any number of different scenarios. The use of modular systems, whether that be armour or other capabilities, should be embraced and expanded. Above all, we need to continue our development, because only by so doing can we attract and

retain the bright young things we need to take forward the technologies into the future.

I support the suggestion that there is a land industrial strategy. It is key. As I have mentioned, investing in and undertaking future projects, including the Challenger 2 LEP, allows us to have the sovereign capabilities to participate sensibly and meaningfully in a collaborative endeavour in the future and support export, which is key to everything we seek to do.

Q69 **Chair:** Can I return to the Challenger 2 and this upgrade programme? Can you spell out what you think the delay was in the turret debate?

Peter Hardisty: There has not been a delay in the turret debate. The project is on schedule. It has proceeded according to the plans laid out by the MoD. They did insert a second assessment phase. I was in Rheinmetall at the time. Looking at it from where we started our journey, we knew that there was a shelf-life issue with the ammunition and the uniqueness of the British proposition.

We understood that, if we were to differentiate and achieve the lethality requirements we suspected were underlying in the MoD, we needed to include a smooth bore weapon with the advantages that brought, in lethality on the one hand, more modern capabilities in terms of a secondary nature airburst and proximity-type fusing, but moreover the ability to procure ammunition that is produced for many other users.

That led us to the necessity, as one of your other witnesses highlighted, if we wanted to put a smooth bore weapon on Challenger, for it to have a new turret. They gave us a blank canvass against which we could undertake our design. We could put the equipment where it needed to go and we could undertake the human factors criteria internally. I have to admit, we learnt from the challenges that we had seen taking place on Warrior in terms of the original proposition. It drove us to a new turret immediately.

Why has Challenger not been updated throughout its life? I do not know the answer to that. It was a very capable platform when it was brought into service, but the British have not been good at developing their capabilities through time. As one of your other witnesses highlighted, that goes for Warrior and, indeed, it goes for other platforms as well.

Q70 **Chair:** I was in the infantry. I am not a cavalry man. I was thrown off the horse when I went for a ride with the adjutant at Sandhurst, which meant I had no chance of getting that sword of honour. If I was designing the Challenger, I would probably put an automatic loader on it. I would probably put a remote GPMG on it, bearing in mind we are not going to be upgrading this again for a little while. Is there any reason why what has not been included in this opportunity?

Peter Hardisty: Addressing the remote weapons, the theatre entry standard for Challenger 2 at the moment includes a remote weapon

station. That can be fitted on to CR2 LEP, or Challenger 3, without any problem. We have already talked about the generic vehicle architecture. That is not an issue. That can easily be installed. There is a coax machine gun and that was a requirement as set out, rightly so.

In terms of the autoloader, it would be developed for the 120. On future journeys, Rheinmetall has a 130 weapon, which is our proposition for a main ground combat system. That is a bigger round and will require an autoloader. In terms of what is needed today, it is the way the Americans work; it is the way the Germans work. It was the simple answer to today's problem within the timeframes allowed.

Q71 **Chair:** Sorry, the Division bell has gone here, so we are going to have to conclude. Finally on Brimstone, we saw a mock-up of this. This is actually what the soldiers would like, for the Challenger 3 to fire Brimstone. Armoured infantry would like it as well. It is a fantastic, potent bit of kit that we have, yet there is no design inclusion.

Peter Hardisty: It has not been included in the requirement. We have seen the vehicle you are referring to ourselves and it is possible, as indeed it is on a Boxer, to install an anti-tank missile on a remote weapon station. All of those things are possible within the concept of a generic vehicle architecture.

Chair: Maybe that can be part of our ubiquitous anchor point that I mentioned, which I am sure you guys are going to go down the pub, given that there are fewer than six of you, to discuss right after this. Peter, Carew, Lee, you can hear the Division Bell is going. We have to end it there. Thank you so much, on behalf of the Committee, for your contributions today and to our other two panellists. It has been a fascinating insight into land warfare capabilities. That brings a close to this session of the Defence Select Committee.