Defence Committee

Oral evidence: Naval Procurement: Type 26 and Type 45, HC 221

Tuesday 07 June 2016

Ordered by the House of Commons to be published on 07 June 2016

Related publications:

- Secretary of State's response to Committee's topical letter concerning Type 45 destroyers, 03 March

Watch the meeting

Members present: Dr Julian Lewis (Chair); Richard Benyon; Douglas Chapman; James Gray; Johnny Mercer; Mrs Madeleine Moon; Jim Shannon; Ruth Smeeth; Mr John Spellar; Bob Stewart

Questions 1-134

Witnesses: **Rt Hon Lord West of Spithead GCB**, **DSC**, **PC**, former First Sea Lord and Chief of Naval Staff, **Admiral (retired) Sir Mark Stanhope GCB**, **OBE**, **DL**, former First Sea Lord and Chief of Naval Staff, and **Peter Roberts**, Senior Research Fellow for Sea Power and Maritime Studies at RUSI, gave evidence.

Chair: Welcome to today's session, which is to examine issues surrounding the Type 26 global combat ship, or replacement frigate, and the Type 45 destroyers. I would like to ask our distinguished panel members to introduce themselves briefly for the record.

Sir Mark Stanhope: My name is Admiral Sir Mark Stanhope. I am a former First Sea Lord, retiring three years ago.

Lord West: Admiral Lord West of Spithead. I was First Sea Lord and later Minister for security for three years.

Peter Roberts: Peter Roberts. I am a senior research fellow in sea power at the Royal United Services Institute.

Q1 Mrs Moon: Thank you, gentlemen, for coming. The number of Type 26 global combat ships was reduced in the strategic defence spending review from 13 to eight with the addition of five lightweight frigates making up the shortfall. How does this affect the capability of the Royal Navy?

Lord West: Some time ago, back in the strategic defence review '98, we did a very detailed assessment of how many escorts we need—I use the word loosely because it is

not liked very much within the Ministry of Defence, but they are frigates and destroyers. It said we needed about 30. I still believe that is roughly the number we need. Because of pressure on resources, our numbers have declined. For example, originally we were going to have 12 Type 45s, which, added to the 13 Type 23s, would have been 25, moving up towards that 30 figure. In fact, we ordered only six, again because of pressure on resources, and we have ended up with 19 destroyers and frigates. Some of the Type 23s are beginning to get quite old and need replacing. The Type 45s, which you may well come to, have a couple of issues and I am sure we will discuss that later. It was imperative that we started ordering a new batch of frigates to replace the 23s and also, I believe, to enhance numbers. The Government have said they want to increase the number of ships in the Navy. We need that because although, for example, a Type 45 is five times as capable as a Type 42, the destroyer it replaced—I think that is the figure they gave, although how they calculate that I do not know—and is much, much better in air defence terms, if you have one of something, it can only be in one place. Lots of things happen around the world, and you need one of something for all of them. Therefore, to reduce numbers too much constrains you very dramatically.

I believe Britain still is a global nation. We have huge amounts of imports and exports by sea. We are the biggest investor of the European nations in south Asia and south-east Asia, and that does a lot for our balance of trade and everything. We need global stability, and historically the Navy has provided that. We have whittled the numbers down now, I believe, to an extent where that is at risk, which is not good for Britain, for British people globally, or for the world.

Q2 Mrs Moon: The current size of the Royal Navy is smaller than the taskforce we sent to the Falklands. Does that create problems for us, in our capabilities to reach out where there are problems?

Lord West: Well, I think it does. It is almost self-evident. I am delighted that we are getting the two aircraft carriers. It has been a long gap—we took a huge risk—from the 2010 SDSR, when we got rid of Ark Royal, which had just had a refit, and the Harriers, to when we will have the new carriers and the F-35Bs. That is a long gap and a big risk. I think we regretted it during the Libya crisis, but—touch wood—we have been extremely lucky that something has not happened where we really regretted and missed that.

One area I could mention—not that I believe the Argentine want to do anything militarily at the moment, but if they did and could do a coup de main and capture the airport, you could take that island back only if you had carriers. They are running out of time now for that—not that I am suggesting that they should rush. That was a real gamble, and I am delighted that we are getting those carriers because they are crucial for the global reach we have.

You need to have in your holster these frigates and destroyers, because if you look at the size, they are the smallest capable unit that can operate separately, on their own, around the world and apply pressure, presence and all the things that the maritime is so good at. We have reduced that number too much, and what we seem to keep doing is delaying the order. Not only is that a problem for our defence capability and the security of our nation and our people; it is a problem for our shipbuilding and our defence industries. That is a real issue as well.

Sir Mark Stanhope: I want to come back on your first question, with regard to the capabilities. It is worth recognising that we have 13 Type 23 frigates, all of which were built ASW-capable. We have, since their build, upgraded eight to be much more sophisticated in their ASW capability, with the fitting of Sonar 2087, a low-frequency active sonar. All the 13 hulls we have are ASW-capable, and should the need arise and the resources be available, the five that are not converted could be swiftly converted to ASW capability of the first order.

It seems to me that we have, by selecting eight as opposed to 13, diminished the flexibility of our service quite considerably in terms of its future ASW requirement, whatever that might be, and in terms of the deployment of the fleet. We used to have a mantra of being ready in location—any warship of frigate size and above was able to go and do business in many different theatres. If it was stationed fighting pirates in the north Indian ocean, it could quickly deploy in days to the strait of Hormuz to be present there. We have lost that flexibility, I would decree, by having only eight ASWs.

In terms of the numbers that Admiral West described, I was there for the 2010 SDSR when we, through recognised formula, decided that we needed 23 frigates and destroyers to match the global requirements of the Navy at that time. Because of resource limitations and suchlike, 19 was the figure that we secured on, and that is still the figure with eight and five. It seems to me that the risk associated with taking a risk on the four that were there in 2010 is still there. So 23 would be the number that came out of the sums in terms of the usage of frigates, which is determined by their maintenance requirements, their training requirements and their deployment cycle. One frigate for deployment, one going to the deployment and one training for the deployment gives you a one in three usage factor.

Peter Roberts: Numbers are critical. The Secretary of State is using language about a level of Russian submarine activity that we have not seen since the 1980s, with several Russian submarines penetrating down towards UK waters concurrently. That poses a significant threat for the UK—one at which the current level of ASW capability from the UK alone is arguably unable to protect against or deal with. Going below that to a level of eight towed array submarine-hunting ships is going to be, one would argue, below the minimal sustainable number of hulls and, critically, people—those skills are absolutely key in this—that can deal with that threat.

While we talk, on the one hand, about a language relating back to the 1980s and a level of activity and threat linking back to the 1980s, we have a force design that is linked to 2001, or maybe even 2005, but that ignores the real increase and reality on the ground. I am afraid that doesn't look like six or 16, it looks like the original future surface combatant programme in 1988, which had 28 hulls, all ASW-capable, which were all capable of fulfilling this role.

Q3 Chair: Is it your understanding that the lighter, general purpose frigates won't have a significant ASW capability?

Lord West: Yes, it is. Indeed, it will be very interesting to see exactly what it has got. Call me old-fashioned, but after 50 years—I am still on the active list—when someone says we are going to get this in the future, I call it "jam tomorrow". I don't actually believe anything until I stand on the quarterdeck. I don't believe it will have the same capability,

and as Admiral Stanhope said, the great thing was that we could move a ship from one job to another. For example, in the Falklands war, HMS Exeter was doing drug patrols in the Caribbean. She sailed straight to the south Atlantic and killed more Argentinian aircraft with her SeaDart than any other ship there. That was the high-end capability, and we will have lost that.

Sir Mark Stanhope: I think it is absolutely inevitable that the general purpose frigate will not have anything like that ASW capability, and even whether it has a close-range sonar fitted is yet to be decided. Modern day ASW is about silent platforms. Silent platforms cost and, quite clearly, in cost terms, the general purpose frigate will be nothing like that.

Q4 Chair: The Government would say though, with eight global combat ships and at least five general purpose frigates, having more than five might address the numbers of platforms point. How do you react to that?

Sir Mark Stanhope: I think that is a valid point, assuming we are going to get the x numbers and get up to at least my 23 number. I would still advocate that eight ASW frigates to satisfy, in wartime, the ASW security of the carrier force, the ASW security of the deterrent and the ASW protection of the home base is stretching anybody's credibility quite thinly in all-out combat.

Peter Roberts: Could I add that we shouldn't be under the impression that the Type 26 is going to be this gold-plated, fantastic, world-beating, cutting-edge unit? A lot of the equipment in the Type 26 is being transferred straight from the existing fleet of Type 23s. This is not a bunch of new kit that is arriving, it is a new hull that will take these systems. We don't have a new or massive increase in capability. We need to understand that this is simply a like-for-like replacement for the current one we've got, in order effectively to reduce the risk of hull degradation that we have got from current platforms that are way over their service limit.

Bob Stewart: I've not been in the service for 50 years.

Lord West: You just look it.

Q5 Bob Stewart: Thanks. I seem to remember, didn't we have a 42 frigate destroyer Navy once and we were not going to go below that?

Lord West: It was about 50 in 1982.

Bob Stewart: When we were young.

Lord West: But things change, things do change.

Q6 Bob Stewart: Yes, things have changed a lot but, still, John Spellar and myself were discussing the fact that our ships are now so sophisticated, and you have made the point that we really want ships everywhere, but we have very sophisticated ships and not many of them.

May I ask—to follow up on what Madeleine Moon has said—how the operational capability of the Royal Navy will be affected by any delays? When we reconfigure with this smaller number of ships—fewer destroyers, fewer frigates, fewer offshore vessels that have not got an ASW—how are they going to operate? One little question—it is a pongo-type question about which you would laugh at me Admiral, both Admirals—why do we

need destroyers and frigates? I think I know the answer: the destroyer protects the aircraft carrier. Can't frigates do what destroyers do?

Sir Mark Stanhope: You can't protect an aircraft carrier in its air defence protection by having a frigate—

Q7 Bob Stewart: A frigate can't do it?

Sir Mark Stanhope: Well, it could do, if you put all the capabilities into one platform but actually, you are going to station the frigate at some distance from the carrier where the envelope of its AAW protection will not incorporate the carrier. So you have to recognise the fleet distribution of capability to actually protect the carrier.

Q8 Bob Stewart: So in operational capabilities terms, the carriers require destroyers to protect them?

Lord West: The prime focus of our destroyers is anti-air warfare, and there no doubt that the Type 45 is the best anti-air warfare ship in the world. When I was Chief of Defence Intelligence, one of the biggest dialogues and debates I had was with the Chief of Defence Procurement at that stage, Rob Walmsley, about why on earth we needed the capabilities of our radar within this Type 45. It was because we had heads-up of intelligence about the Russians developing a ballistic missile to try to kill American carriers, and we wanted to have a system that would be capable of defeating that. That is why that system was so immensely expensive. That is what destroyers have as a capability. It can protect the carrier and it is the Americans' preferred ship for looking after their carriers. Of course, it can also protect an amphibious group; it can protect anything else—they are the air defence units.

Q9 Bob Stewart: Do we need one or two?

Lord West: As always, it depends on the level of threat you are facing. For example, if you are fighting terrorists, they cannot get at aircraft carriers when they are at sea. That is one of the great joys of aircraft carriers. If you are fighting the Chinese, and you go right out in the inner island chain—the second island chain—then you would probably want two with your aircraft carrier, so it depends.

As Admiral Stanhope says, the frigates are going to be deployed much further out, probably also working with our own SSNs, also with maritime patrol aircraft, in the future, with other allied ones. It is a very composite problem, and they are doing that job. Then, if you forget about major war, suddenly these things have to work individually and they have to have certain capabilities.

Q10 Bob Stewart: I'm sorry to ask these idiot-type questions, but it is quite important for us to understand how it all fits together. Certainly, for someone like myself, being land-based—not for 50 years, Admiral, but for a long time—I never really understood the difference, the layered requirement, so thank you so much for explaining it.

Peter Roberts: It is possible to use a destroyer for anti-submarine warfare. The United States Navy recognise the anti-submarine threat and at the moment is fitting towed arrays to its destroyer and cruiser fleet. It is using those platforms in place of the outgoing frigate class, because it is without a frigate class at the moment, and it is using destroyers—52 of

them—and building more to fulfil these threats. It has seen that it will try to do more with less, but, in doing so, you have capability trade-offs. It is like getting an artillery battery to preform light infantry duties. It can be done, but there are trade-offs in what they can do—there is specialisation in what they are trained to achieve.

To return to your question about how it is possible for them to operate, there is no concept of operation that dictates how an integrated British carrier task group will operate. There is no CONOPS to it at all. There is nothing out of the Ministry of Defence, nothing linked to Joint Force 2025 and nothing in the Future Navy Concept that says, "This is how we envisage it operating." The Australians are writing one and the Americans have one, but there is nothing in the Ministry of Defence at the moment.

Finally, I will return to the point about how many you need. An operational analysis was conducted in 2007-08 to look at the requirement for a UK carrier group against a near-peer adversary—someone who matches up with you very much in the same way. To protect the carrier required four Type 45s, and to protect an amphibious task group required five. We are obviously unable to provide both those capabilities simultaneously, and that's absolutely fine, but those numbers were also predicated on the fact that you had a capability called CEC—co-operative engagement capability—that allowed the numbers to be reduced to give this so-called fivefold increase in capability. So there are ways of trading off between these capabilities. You can share them across, but you reduce your overall outputs in defence terms.

Q11 Bob Stewart: I am going to shut up, Chairman, but the summary is: we have just enough.

Lord West: No, I think we have insufficient.

Peter Roberts: We have insufficient.

Q12 Bob Stewart: So what do we need in addition?

Lord West: We need to have more frigates.

Peter Roberts: And more destroyers, so the—

Lord West: Well, it would be lovely to have more destroyers, but you have to, in a sense, cut your cloth. I accept that Governments have to do that. I didn't accept that when I was just a sailor, but having been a Minister, I realise it, and I think that for us to go and get lots more destroyers would just be beyond what our country is willing to afford at the moment. Mind you, views change when you actually come up against something nasty and have to fight, I have to admit. But it's beyond that. Therefore, I would focus at the moment on frigates.

Bob Stewart: So more frigates, and that's the end of it.

Q13 Chair: We're going to have to crack on, but I just want to get this clear. You are saying that the existing total of 19 frigates and destroyers is inadequate for the tasks that are laid upon them, so if there were to be any delays—an issue that we are about to explore with my colleague, Jim Shannon—in the coming into service of the Type 26 that took us effectively below the total of 19, we would be going from inadequate to grossly inadequate.

Lord West: Absolutely, and we have seen recently that Governments are very willing to suddenly take on new tasks, whether it be saying, "We'll put a frigate off Libya," or "Oh, we might put a frigate in the Channel because of the problems in our territorial waters." It is wonderful saying that, and yes, we do need them, but if you say it, you have to have the basic numbers there to actually achieve it.

Sir Mark Stanhope: What will result is fewer frigates available. That does not mean that they have been decommissioned, but they are in maintenance. As they get older, they get more prone to defects, which increases their time in maintenance. So we have fewer frigates available, and the Government and then the Navy itself will have to prioritise the deployment of those frigates as best they can.

Chair: Thank you.

Q14 Jim Shannon: Following on from what Bob and Madeleine said, we know the numbers have been cut. We also now know that the production timetable has been pushed back, and obviously that causes great concern. Many of us have questions, but first, will there be enough Royal Navy ships to form a carrier group and will that prevent the Royal Navy from doing their tasks? Lord West, you mentioned a number of the areas that we are in. The Royal Navy were involved in dealing with Ebola, in Sierra Leone—they were tasked with that. They were tasked with dealing with piracy in east Africa. They were also tasked in relation to the Falklands, which you mentioned, Libya, the Middle East, Suez, Cyprus, which we as a Defence Select Committee recently visited, Gibraltar, Malaysia, the far east—don't forget the Royal Navy have a role in the far east as well; we have lots of things to do there. We have a role in the English Channel in fishing patrols, which lays things on for us as well, and we have the issue, as you said yourself, of drugs in the Caribbean. So the question we ask is this: with that multitude of responsibilities, not enough ships and not even a production timescale yet—we should have had that—which one of those things is going to fall by the wayside? Which of those things will we not be able to do? Will it be many?

Lord West: Well of course that is a Government decision finally, isn't it? The Navy will provide ships where it can for the tasks the Government asks of it. The problem is that as these ships are getting older, they need more maintenance, as was said. We do not have enough of them. It is all very well the Government saying, "Right. We'll put a frigate here, a frigate there, and a frigate there." What then has to happen is that within the MoD, the Navy has to say, "Well, actually, we can't provide a frigate in these places." It is up to the Government then to say what the most important one is, wherever it might be—off Libya or whatever—and there will be a gap in the other one.

We have seen this already. For example, we always used to have a destroyer or frigate in the West Indies for disaster relief or counter-drugs work and available as the North Atlantic ship to be able to go and do other things. That has become an offshore patrol vessel. The Navy does its job, it has got brilliant people and it goes and does what it can, but that does not have the same capability as a frigate or a destroyer. It is no good pretending that it does; it just doesn't. That shows how this pressure is already coming on. One has the feeling that, more and more, the Government are saying, "Well, let's take a risk and we'll use an offshore patrol vessel. Let's take a risk and we'll use a light frigate." I am not saying I am totally anti them—I think there is some merit in them in the future. However, we need to have capable ships and we need enough of them and we have delayed. We were told 13 were going to be ordered and that has been knocked back and

knocked back; they have been delayed and now we are only ordering eight. I think that is very poor.

Q15 Bob Stewart: Excuse me, could I just ask on question? The West Indies guard ship—is that the one that visited the Falklands as well, as part of its routine?

Lord West: Yes, that was Exeter.

Q16 Bob Stewart: In that case, that goes deep south? That is quite important.

Lord West: No, no, that is the Atlantic Patrol Task (North), effectively. So that is different. There is one South as well, but we gap that almost, effectively.

Q17 Jim Shannon: Very quickly, on the potential to deliver a carrier group, with all those responsibilities and all the tasks of the Royal Navy, can we have that carrier group potential, with all the ships that are needed, and at the same time maintain our responsibilities elsewhere? Have we got that kind of capability?

Sir Mark Stanhope: We have to prioritise some of those world or global responsibilities.

Lord West: The answer is, though—just in case some people think we won't be able to—we will be able to protect and have a full, proper carrier group, but what it means is you don't have ships doing lots of things all around the world. Where you are not doing them, that is when, suddenly, things happen. The great joy of having ships in the Navy in places is that it stops wars happening. That is what we like to do. If you are not there, wars happen and then suddenly you need a full carrier group.

Q18 Jim Shannon: It is a case of either/or, then, really, isn't it, at this moment in time?

Peter Roberts: While you say we have the hulls to generate a carrier group—absolutely true—we might not have the people. The people who are manning these ships who are going out for nine months at a time—the engineers who come back and, instead of going to see their families, then sit on board the ship and mend the kit that has gone wrong, replace the broken stuff so it can go out again—these people are going to leave in their droves. They are not going to stay. The engineers that we really want, the skills and expertise that are absolutely critical to these platforms, they are not going to be there. So that is the real worry. While we can produce the platforms, while we can gap the tasks and we can send ships off, the people won't be there to sustain the capability.

Chair: Madeleine and then Douglas and then we move on to Type 45s.

Q19 Mrs Moon: Very briefly, the Government might argue that we now fight in coalition, we do not stand alone—though the Brexiters might disagree with that. We are going to fight in coalition, so that is okay, because NATO will pick up the slack. Is that right? Does NATO have the naval capability to pick up that slack on our behalf?

Lord West: Well, of the European nations in NATO, we are the most capable and that, I have to say, is being whittled away by not having escorts and frigates. Normally, we will fight in coalition, that absolutely makes sense. One doesn't want to fight at all, let's face it—if you have been in a war a couple of times, you do not want to be in a war again, I can tell you—but if you have to be in it, you will do it in coalition, generally. However, we know from our experience that there are occasions when there are things we have to do

nationally. So there are two pressures: one is that within coalition we are expected to provide certain capabilities—I don't believe any more that we are capable of providing the level we used to—and if we want to do things on our own, we are in danger of losing the ability to do that and maintain our capabilities around the world doing other things.

Q20 Douglas Chapman: In terms of what we have heard about cutting steel on the Clyde, that will be delayed from 2016 until possibly the first quarter of 2018. Are you aware of any technical or design problems that necessitate that delay in the production of Type 26s? If it is not design, what is your view on where the bottleneck might be? Is it just that as a nation we cannot afford it, and we are having to cut our cloth according to our resources? Is it the Treasury not really understanding the capability requirements of the Royal Navy and turning a blind eye to that? Is it a lack of political will? We have two former Sea Lords here. If you were the current Sea Lord, would you not be spitting feathers at the fact that you were not getting the capability you needed to do the job?

Lord West: Shall I tell you what the problem is? Notwithstanding having said how much extra money there is for defence, in the near years there is not. There is almost no extra money available this year, and we are really strapped next year. The Government aren't coming clean about that. I think if they did, people would understand. The British people are not stupid. If the Government said, "Bloody hell, we've actually got figures that are not very good here. We've got no money. Therefore, we've got to delay these things, even though we really need them," I think people would say, "Well, that's pretty bad, and maybe you ought to think about priorities, but we understand." But to pretend that, "Oh, no, we're going to order all of these—these are really important—but there are little problems of design and things," is, I'm afraid, being economical with the actualité.

The reality is there is not enough money in the MoD this year and next year. We have run out of money, effectively. Therefore, they have pushed this programme to the right. That is bloody dangerous, because whenever you do that, you end up costing more money. We did it throughout the early '90s—John Major's Government, I'm afraid—for the Astute class submarines. I was in Naval Plans and every year we used to go up and say, "We've got to start ordering these submarines. If we don't order them, we will lose all our skill and it will be a nightmare." Finally, the order came in for the Astute class, two months before the general election. It has taken us almost 20 years to get submarine building properly back on track, and it has probably cost us an extra just under three-quarters of a billion more than it would have cost us if we had ordered them then. The Treasury do not see these long-term things. We are in danger of doing the same thing with our surface warship building capability for the Type 26.

Q21 Chair: And isn't the same pattern what happened to some extent with the aircraft carriers as well?

Lord West: Well, they were delayed and chopped around—it was a similar sort of thing. That partly was Gordon Brown's Government delaying them for a year; immediately, there was more cost. I'm afraid that for some reason the Treasury does not seem to be able to look at these things over the long term.

Q22 Chair: So what you are saying is that the effect of decisions of this sort—to delay—is that you both lose capacity for longer and greatly increase the cost of the units.

Lord West: Correct. Every delay costs you money. These delays all cost money. You need a steady drumbeat of orders to keep high-tech industries going. Our complex surface warship building industry, like the submarine one, needs a steady drumbeat of orders. That is the most cost-effective way of getting them. You will get them for less and it probably gives you an ability to get export orders as well, because you have this steady flow going, but somehow we do not seem to be able to see that. We have now understood it in the submarine world; we have to understand it in the surface warship world.

Peter Roberts: I think at the moment there isn't a capability question, but there will be as we go ahead. I just hope that we cut steel before 2019, but something tells me that we are not going to. The problem with money—this year, in the Type 26 programme, the difference between what is allocated and the actual cost is somewhere around £750 million—is going to have a significant impact and may require capability trade-offs. We may start to have to see some redesign, and now we have potentially up to three years to do that redesign.

What is that going to mean? On one side is what it means for the ships and the fleet, and we have covered some of that stuff already. What it is going to mean for the Clyde is very significant, and we could not get a national shipbuilding strategy at a more important time. It might well be that we then see further OPVs being turned out on the Clyde. The Royal Navy has not asked for that and the Future Force 2025 and strategic defence review do not require it, but it might be a national requirement to put it out, or it might be that somehow we create some bespoke Type 31 light frigate that we have been talking about before we get a Type 26—without even a mature design. I think there is going to be a commitment—we see that from the Government—to continued shipbuilding orders, but the Type 26 is going to continue to slip.

Lord West: But in amongst all that has just been said by Peter, he is quite right that effectively, the First Sea Lord's programme is between three-quarters and £1 billion just not there. That is why we are not ordering these things. When you do not order them, you lose the drumbeat and they will be more expensive. It is not clever.

Q23 Chair: So is it a false economy, Sir Mark?

Sir Mark Stanhope: It is. The Navy is structurally underfunded. I think they have admitted that that is the case, and more money within the defence programme for the naval build programme would help, but there is nothing new here. This is the way it has always been, frankly, as Admiral West indicated. If there is not money, and the programme does not facilitate early spend, they are going to push it right and prices are going to go up.

I would like to emphasise the significance of it going right. The Type 23 frigates were designed for a life of 17 years. That is a feature of the hull life—how thick you make the steel that you build the ship with: 17 years. The last Type 23 frigate, which I think was St Albans, was commissioned in 2001, so we are looking at the remaining 13 being decommissioned over the next period. We would have hoped that for every one that is decommissioned a new one would come off the build line, but that is clearly not going to be the case unless the new shipbuilding strategy reaps some miracles. There are going to be some very, very old ladies in the mid-30s that we are using to protect brand new carriers and the strategic deterrent in ASW terms.

Chair: Thank you. That is something that we can explore with the later panels, but we now have to move on to the problems with the Type 45 destroyer.

Q24 Mrs Moon: The problems with the propulsion system are something you can wax lyrical on, I am sure, and is all well documented. Was using a unified system the right idea?

Sir Mark Stanhope: If you take the need for innovative solutions in the future and if you want to turn up on the battlefield with battle-winning capability, you have got to take some risk. It is questionable whether we took too much risk in the Type 45 by having 80% of the ship novel. By novel I mean not just the propulsion system, but the anti-air warfare system—radars and missiles and suchlike. You are focusing on the propulsion system. There was evidence at the time, as I understand it, that this was a sensible way of improving maintenance requirements, fuel usage and survivability. Therefore, to go that route at the time was a sensible way of making sure we remained ahead of the curve in terms of the capability of our future ships.

Lord West: I have no doubt at all that going for integrated electrical propulsion was the right thing to do. We had already got our Royal Fleet Auxiliary using it, we were getting quite good at it and we were learning all the errors and things that were difficult. I think it was the right thing to do—far fewer people, lots of maintenance benefits; there was a huge raft of benefits in terms of quietness and being able to move your generators to different positions away from the electric motors. There were masses of benefits in it.

I think that where there was a problem comes down to a real problem within the structure at the MoD now. Going back to Jackie Fisher as First Sea Lord, which I know was a long time ago, you were bloody well responsible—totally—for the ships that were there. You had engineers around you, everyone came and you went through every bit of it. Now, as First Sea Lord, you are seen to be remote from that. You do not have that; it is being done by someone within the centre and DE&S. Even things like the Commodore Naval Ship Acceptance—all those things have gone away now. The fact is that we went for the WR-21 gas turbine because it was very economical and it had an intercooler unit—I do not want to get into complexities—but there is no doubt that there were real design flaws with that intercooler unit. There were real design faults. I am slightly surprised that with our amazing engineering expertise within the MoD, both naval and other, someone did not bowl that out.

The practicalities of where we are now are that we have very good engineers—not enough of them; as Peter said, there is a real problem with numbers—and we are keeping the Type 45s going pretty bloody well. They have gone on deployments and the Americans love having them with them. But it is not a good position to be in when, on the day of the race, like one was in the Falklands, with aircraft coming at you from every direction, you suddenly lose your power. That is not a good thing to happen. That gives you a very bad day. That needs to be resolved, and as I understand it they have a programme for resolving it, but my real worry is that it should be being done much more quickly. Part of the reason they are not doing it quickly is that there is no money, as I have said, in the early years. This is the sort of area where I believe there should be extra money from the Treasury.

If there were a major war—none of us knows what is going to happen tomorrow—our 19 destroyers and frigates are effectively 13. We might well have air-defence units that are not able to do air defence. That cannot be satisfactory. We know now what has got to be

done and it needs to be done quickly. There should be extra money for this. I think that our nation is making a terrible error in allowing this to happen. They are incredible ships, but if at that moment that thing went wrong—it might not, you might be lucky, get through the raid and kill them—that would be a terrible thing. We really need to move on it.

Peter Roberts: Can I present the opposite end of the argument? I don't think IEP was the right decision. I think it was a flawed decision, particularly because it embraced this whole culture of innovation, which the MoD is now mad about. It just shows the failures that innovation can lead you to if you don't do sufficient rigorous understanding and modelling of what you are doing. We now have ships that are placing themselves in huge danger when they have total electrical failures, in very high-threat areas of the world, with an inability to react in any way.

The MoD now almost acknowledges that this was a failure because it has had to change the concept of how the electricity is generated and how power is supplied in the ships. It will move from an integrated electric propulsion system to now an entirely different way of operating, with gas turbines providing boost and new electric motors being powered by additional diesel generators, in order to make the thing run on a normal day-to-day basis.

It was a disaster. It was a poor innovation approach. With a very small ship size it took an optimistic view of the world that said, "What works for a commercial ship can work for a warship." That did not accept any of the realities of combat or war, such as the shock requirements—when a missile or round hits the ship, the shock that goes through it and the impact on the system. It did not acknowledge the high-power densities and the differences in load that a ship suddenly requires at the drop of a hat, which you don't get in commercial ships. None of those things was looked at, and it was a grossly optimistic application of innovation doctrine.

Lord West: If I may come in quickly, I am sure these things were looked at. In my decisions when I was Chief of Defence Intelligence, talking with Admiral Walmsley who was Chief of Defence Procurement, we did occasionally stray off into areas I was not responsible for, and things such as shock mountings and all those things were being looked at. But I do not think that the engineers within the Navy applied their minds enough to the implications of this intercooler unit and those sort of things, because there was a major design fault, no doubt about it.

Q25 Mrs Moon: Sir Mark, did you want to come back?

Sir Mark Stanhope: I go to my original point. I agree with Admiral West; I can't believe that all of these things were not looked at in some way or another. R&D might not have been as thorough and comprehensive as it should have been, but you cannot really spy into a system that is as novel as that and bowl out all of the likely faults. Every ship we have ever commissioned, from Dreadnought on, has had integrated faults that take some time to bowl out. I think the decision was right but the areas that have been found in terms of the propulsion system need to be resolved. I absolutely support Admiral West; we have got to do this quickly, because of the risks involved in total power failures at the wrong time.

Q26 Chair: So we are talking about a possible risk to our inadequate number of 19 frigates and destroyers caused by a delay in Type 26 production, and that being compounded by the

non-availability of our existing six Type 45s that comprise a third of that fleet. So it is a great picture, isn't it?

Lord West: Absolutely right.

Sir Mark Stanhope: It's not necessarily non-availability of those Type 45s; it is the risk inherent in using them.

Q27 Chair: Yes, indeed. They could be available and then suddenly not available.

Sir Mark Stanhope: Absolutely.

Q28 Richard Benyon: There is a long-standing acceptance that we need to encourage a domestic defence capability. Do you think that the decision to go with the type of system we used in these ships was taken to support a British engineering company, and that actually it would have been much better to have got a bespoke package, even if that were from abroad? Do think we are paying a price for having this culture of British companies first?

Sir Mark Stanhope: Regarding British companies, I am not competent to answer the question, because I was not there at the time. As I understand it, the American system with the Zumwalt-class destroyers, which were going to use this propulsion system, was an example of how we were going to use the system for ourselves, but we did not necessarily do it for British companies' sake. The Rolls-Royce decision on the engine that we used took us to a better place in terms of fuel economy, and I think that was the driving force.

Q29 Richard Benyon: The Secretary of State at the time wrote a letter quite recently to *The Times* saying that he was proud to take it because it was Rolls-Royce and they were a British company.

Lord West: Certainly, Rolls-Royce wanted the WR-21 and they did it in conjunction with—I've forgotten which American firm. It was a joint thing they were working on. But I don't believe that these faults are because we have an indigenous defence industry. I am completely convinced that we need it. We are still a world power. Lots of people don't like it—the chattering classes—but we are global and we have defence capability that should match that. We are a permanent member of the Security Council. We have 14 dependencies worldwide and I believe that we need and require a defence industrial base to support quite large chunks of what we've got.

The decision as to exactly which bits are totally necessary for us is hard. Successive Governments have found it very difficult to say, "There is no way we could ever lose this area of expertise from our nation." That is quite difficult and always has been. Overall, I believe we need the capability to produce complex surface warships. That is one of the areas that I think we should have.

Peter Roberts: I think you are on the money, but not with the integrated electrical compulsion system as a whole. The electric ship was something that was on its way to happen at what stage we got on board. On the selection of the gas turbine to run it, I think you are absolutely right—it was a sovereignty decision. General Electric's LM 2500 engine was cheaper to buy; it had lower technical risk and more proven background to it. The Rolls-Royce WR-21 was a complex cycle, brand new engine, and far more complex than anything else, but it was a national capability. Sponsoring a national capability was, I

think, a sovereignty decision, rather than one based on whole-life costs or anything else. Indeed, a report by a previous Committee has noted that there were significant political and industrial considerations inside those decisions.

Q30 Richard Benyon: Can you tell an old landlubber why it is taking longer to design and implement the replacement of a power transmission system—that's not the technical word, but you know what I mean—than it took to design, launch and commission a Dreadnought battleship in 1906? I simply do not understand why we have made our system so complicated or tied ourselves up in such procurement nightmares that we are creating delays that could be strategically damaging to our capability.

Peter Roberts: We build exceedingly complex warships. We build exquisite, bespoke world-beating, world-class ships, as Lord West has said, and then put a new engine inside a ship that it wasn't designed for. That is effectively what we are doing under the Project Napier plans: we are going to add additional diesel generators to this ship and reconfigure the way that it was designed to operate. We are going to change how power is generated and sent to the propellers. We are going to change the way that power is distributed around the ship. We are going to change the whole doctrine of having gas turbines that will run the ship the whole time and we will have these other diesel generators to back up. We are reversing it entirely. It is like taking a house off the National Grid or adding some incredible capability to your washing machine. It's not something you or I can do; it takes engineers an exceedingly long time in order to mesh it inside that. They have to join it up with miles and miles of cable fibreoptics control mechanisms. This is no longer a chap standing beside a—

Richard Benyon: A stoker—

Peter Roberts: Exactly—who is throwing coal on it. That's not there anymore. This whole thing is run electronically from miles away from the actual location where it happens. It is exceedingly complex and the fact that throughout the whole design of the ship we were never envisaged to change these means that we are going to have to cut holes in the ships in order to put this stuff in, find a place to put them, make sure they are shock mounted, understand how it changes the signature performance. Does it sound different underwater? Is it going to be really noisy? Is a new Akula II class coming down from the Northern Cape going to be able to hear this thing from several hundred miles away? These are very real challenges and things that need to be considered when we do it, because hopefully, we will only do it once.

Lord West: So, Richard, in answer to your question, they are very complex, but going back to the Dreadnought, we had the most powerful and biggest shipbuilding industry in the world. We were building 80% of the world's merchant fleets. We were able to outbuild Germany—how lovely to outbuild Germany in things, isn't it?—in terms of producing Dreadnoughts. When you have that capacity, you can do things quickly, even though they weren't as complex as they are now. And we have lost that.

Q31 Ruth Smeeth: On that cheerful note, I had the privilege of visiting HMS Duncan when it was in London and it is an extraordinary ship, but given what we are talking about and the novel nature of this build, would it be fair to suggest that we did not do enough onshore testing of the propulsion system before we deployed it?

Sir Mark Stanhope: Probably, with hindsight, which is of course an exact science, we could have done some more onshore testing, but at a cost and at a delay in terms of the build of the ship itself. I don't know what the cost and time dynamics were.

Ruth Smeeth: But that would be why we didn't do it—because of the time delay and the knock-on costs?

Sir Mark Stanhope: I suspect so, but—

Lord West: I don't know exactly what onshore testing there was—I know, for example, that in terms of the superstructure, the capability of the radar and the missile system, a huge amount of onshore testing was done. That, of course, has paid off because it works amazingly well and is brilliant, but I am afraid that I just don't know what was done in terms of that propulsion aspect.

Peter Roberts: There was a land-based, integrated electric propulsion site that was funded and ran for several years. It discovered that there were flaws and they were fixed before it was put in, but what it was not funded for was to run sufficient hours to understand that there were significant design flaws across the whole thing. A system will run for so long and then suddenly it will break. Unless you run it for a whole lifetime, how are you going to understand when it breaks? This is part of how much you de-risk, how much you buy up-front and how much you invest, and it was not achieved.

Q32 Ruth Smeeth: So we think the problems in the system were because of the way they were originally designed and not because we were changing the design.

Peter Roberts: I think you would probably have to ask the next series of—

Lord West: The thing that is the problem is the intercooler unit. That is the thing that was designed wrong. It is where the heat is reused. It was to help increase the fuel efficiency, and that is the key weakness that has caused the problem.

Q33 Ruth Smeeth: So it is very much to do with the people that were designing it and not that we were making it more complicated.

Lord West: Well, I think there were both aspects: it is complex and it was a brand-new way of doing things.

Chair: Thank you, gentlemen. We have finished only slightly over time. It has been of great value and we are most grateful to you.

Examination of Witnesses

Witnesses: **John Hudson**, Managing Director, BAE Systems plc, **Andrew McKeran**, Marine Business Executive, GE Energy Connections – Power Conversion, **Dr Andrew Tyler**, Chief Executive Europe, Northrop Grumman, and **Tomas Leahy**, Director, EMEA Programmes, Naval Marine, Rolls-Royce, gave evidence.

Q34 Chair: I would like to welcome the members of the second panel. I will begin by asking you to identify yourselves and to say a quick sentence about your roles, please.

Tomas Leahy: My name is Tomas Leahy, and I am the director for Europe, Middle East and Africa for Rolls-Royce—for the naval business within Rolls-Royce. Within my region I have responsibility for the delivery of new equipment as a tier 1 supplier to prime contractors, invariably—for equipment into the new-build programmes, but I am also responsible for the in-service support of our equipment. So, Type 26 and QEC are new build programmes and Type 45 and Type 23 are in-service support programmes.

John Hudson: My name is John Hudson. I am the managing director for BAE Systems' UK maritime businesses. That is our submarines business, our shipbuilding business, our support business in Portsmouth, and radars and torpedoes.

Dr Tyler: I am Andrew Tyler. I am chief executive for Europe for Northrop Grumman. I am responsible for all of Northrop Grumman's business across Europe.

Andrew McKeran: I am Andy McKeran. I work for General Electric. I am the marine business executive for our global marines sector.

Q35 Chair: Thank you. The structure of this is that we have about three quarters of an hour, and we are going to start off with a few questions about the apparent delays to the Type 26 programme, and then we are going to move on to some fairly detailed questions about the problems with the Type 45 destroyer, so obviously there will be a degree of self-selection amongst yourselves as to which questions you answer.

I am probably looking to you, John, for some of the responses on what I am initially going to ask about, which is the Type 26 programme. The first question I would like to ask you is this: if the Ministry of Defence were to ask that construction of the Type 26 global combat ships begin pretty well straight away, would you be able to achieve this?

John Hudson: The ability to start the construction of the Type 26 will depend on a number of factors. These include the maturity of the design, the ability to mobilise a supply chain, and the relatively modest infrastructure work that we need to do on our site on the Clyde. We would need to accelerate some of those activities to accelerate the build of these vessels.

Q36 Chair: We've heard from the previous panel their belief that the main problem is simply that the Ministry of Defence does not enough money available at this point of time, and that that is the principal reason for the delay—for the moving of the programme to the right, as they say.

John Hudson: As we advised you when you invited me to come to this panel, we are in detailed negotiations with the Ministry of Defence as to the build programme for the Type 26 programme, and we continue those discussions. We will be able to advise you more on the conclusion of those discussions.

Q37 Chair: Yes, I was hoping for a little more than that. Would I be right in saying that the original plan was to cut steel for ship No. 1 of Type 26 in 2016—this year—and to hand over ship No. 1 in about 2021 so that she could be in service in about 2023? That was the original plan, wasn't it?

John Hudson: Back in November 2013, when the whole naval shipbuilding programme was announced, there was an understanding that we would build three OPVs, followed by

the Type 26 programme. Following the 2015 SDSR, the Ministry of Defence advised us that they wished to procure another two OPVs. Clearly that is going to have some impact on when we commence the Type 26 programme, and those discussions form part of the detailed negotiations that we are having with the Ministry of Defence to understand exactly what programme they wish to pursue on Type 26.

Q38 Chair: Yes, but the original plan was to start cutting steel now so that the first handover could be in about 2021. It appears that the new plan is to start cutting steel only at the end of 2017. The effect of that, if it is true, would be that the handover would be around 2023-24, and therefore full commissioning around 2025-26.

John Hudson: As I tried to explain, we are in discussion with the Ministry of Defence as to exactly what programme they wish to re-baseline the Type 26 programme on. Until those discussions are complete, I am not in a position to be able to advise what the cut steel date would be for the Type 26 programme.

Q39 Chair: Well, surely you can advise us hypothetically. I appreciate that they have not decided which option they are actually going to go with, but let me put it to you again that if we had started cutting steel now, we would be handing over ship No. 1 in 2021 and it would be fully in service in 2023. So if we only start cutting steel at the end of 2017, is it not bound to be the case that the handover would be around 2023 to 2024, and the fully-in-service date 2025-26? In other words, everything is going to slip by about two years.

John Hudson: I do not feel in a position to answer hypothetical questions when we are engaged in a discussion with the Ministry of Defence.

Q40 Chair: Do you think my estimates are wrong?

John Hudson: I think there are different ways that we can cast the programme, so there may be different options that we could explore.

Q41 Chair: Okay. Let's just have a quick word about the drumbeat. The idea is that as each Type 23 frigate goes out of service, a Type 26 and subsequently a general purpose frigate replaces it. Am I right in thinking that the original plan—this isn't a matter for your discussions, John, this is a fact—was to have a drumbeat of 12 months, with an out-of-service date for each of these ships? For example, if the first one—the Argyll—goes out of service in 2023, which is when we were hoping ship 1 would be coming in, she would be 31 years old at that time. The idea is that each of these ships would go out of service at 12-month intervals, and each of the new ships would come in at 12-month intervals, thus keeping our numbers the same. Am I right about that?

John Hudson: I don't believe that the drumbeat was decided or declared in 2013, and the drumbeat is a very important part. It is not only about the first-of-class programme, the cut-steel date and the duration of that programme, but the subsequent vessels and the frequency with which we will build them are still very much part of this discussion.

Q42 Chair: The drumbeat for out-of-service dates is a matter of public record. Answers to written parliamentary questions have revealed that the planned out-of-service date for the Argyll—the first one to go—is 2023, and the others are planned to go out at 12-month intervals. So unless the drumbeat for the new ships coming in is at 12-month intervals, we are going to see a very considerable reduction in the availability of ships, aren't we?

John Hudson: I think that is a matter of mathematics.

Q43 Chair: Exactly. So is the question of keeping the Type 23s in service part of the discussions that you are having, or are you only having discussions about bringing the new vessels into service?

John Hudson: We are only engaged in discussions about bringing the new vessels into service, and therefore that is a question for the Ministry of Defence.

Q44 Chair: So there seems—don't worry, I am drawing this to a close—to be a widely held belief that, as well as delaying the delivery of ship No. 1, the drumbeat could slow down to a new ship every 18 months. It presumably follows that if the fleet is to be maintained even at its rather limited number of 19 frigates and destroyers in commission, then they will have to revise the out-of-service dates from 12 months to 18 months. Otherwise we are going to see very considerable reductions, aren't we?

John Hudson: Again, I think that that is a question for the MoD. The mathematics is clear. The only thing I would advise is that there is a discussion of the light frigate programme and whether that would contribute to fleet numbers.

Q45 Chair: We heard from one of our witnesses just before this session that there is a possibility that perhaps we could try, if not to accelerate the Type 26 programme, then to bring in the new general purpose frigates a bit earlier. But surely they are not even designed at this stage, are they?

John Hudson: I don't believe that there is any design to meet the UK MoD requirements for the light frigates. That is clearly an option, and I believe that the naval shipbuilding strategy will review it.

Q46 Chair: Finally from, the defence review says that there would be at least five of the new light frigates, with the implication being that there might well be more than five of these ships. Have you been given any indication to suggest that the Navy is seriously thinking about ordering more than five? That would perhaps restore some of the depleted numbers of the frigate and destroyer fleet.

John Hudson: It is very early days in the development of the naval shipbuilding strategy. Again, that question is more for the Ministry of Defence.

Q47 Chair: We are in the position, then, that unless the Ministry of Defence comes up with more money we are going to see a big slowdown in this programme, aren't we?

John Hudson: In terms of frigate numbers, that is a case of mathematics.

Chair: Thank you very much.

Q48 Ruth Smeeth: Thank you, gentlemen, for coming. I would be really interested in hearing from all the other companies about whether, if the MoD requested building to start straightaway, you would be able to meet that. Specifically—unsurprisingly, I am sure, Mr McKeran—I am interested to hear from General Electric, given the 243 jobs that have just been terminated in my constituency, some of which relate to maritime. I would be interested in hearing from all of you about your ability to deliver on this going forward.

Andrew McKeran: Absolutely. Shall I go first? We are working in full collaboration with BAE Systems on the Type 26 programme to look at any of the impacts that John was referring to. With specific reference to the Kidsgrove site, obviously, as you are aware, we are in the early stages of a consultation, so it is premature to speculate on those manufacturing capabilities for the propulsion converters. What I can say is that GE has 22,000 employees here in the United Kingdom, we have depth and breadth of manufacturing capabilities and we are fully confident that we can deliver on all existing and future commitments to BAE Systems and to the MoD.

Q49 Ruth Smeeth: You will appreciate that this is slightly personal for me, given what is currently going on, and while I appreciate that we are in the early stages of the consultation—I seek your indulgence, Mr Chairman—the concept that there is going to be ongoing manufacturing capability at that site is unlikely, as far as I have been informed. Given that some of the work on that site is about ongoing manufacturing, yet in February you were still investing in the site and signed a new lease for seven years, you will understand my queries about your ability to forward-plan and be able to pick up an MoD contract going forward.

Andrew McKeran: I can only repeat that we are in the early stages of the consultation. As you know, we were in discussions with you last week, so we are obviously looking at all the alternatives available to us under that consultation. As part of that consultation we will obviously be looking at forward planning, depending on the outcome of the consultation.

Q50 Douglas Chapman: Going back to a question I asked the previous panel about some of the design and technical reasons why the Type 26 could not be started almost immediately, you mentioned in your first answer maturity of design, supply chain and the idea of the frigate factory—

John Hudson: Infrastructure.

Douglas Chapman: Yes—infrastructure issues. How much would it take to overcome these? Are these big issues? I imagine that the supply chain would be fairly mature, for example, in terms of knowing that this project is about to kick off.

John Hudson: The design is well developed, more than 60% mature, so we have a very good understanding of what the design is. It is in nobody's interest to rush the design into production; we want to make sure that the design is at a certain level of maturity before we cut steel, therefore if the Ministry wants to advance cut-steel, we would have to invest a little more in engineering. We would need to recruit some more people to bring that forward. Likewise, to advance our colleagues in the supply chain, we would have to place orders with them and increase investment in the supply chain.

Q51 Douglas Chapman: Lord West mentioned the increasing cost of delays. Are you in a position to tell us today your anticipated increase in the cost due to cutting steel at a much later date than was previously anticipated?

John Hudson: We are in discussions, but we do not know what the programme is going to be, and therefore I do not have a figure that could advise you of what the increase will be.

Q52 Douglas Chapman: Have you not made some assumptions about what that delay might mean? We have had examples today. The Type 45, for example, started at a promise of 12, and was reduced to eight and then reduced to six. That must have a huge impact on your cost

structure, your unit cost per ship. You are probably part of the management team that saw the last of the 45s coming out of the Clyde shipyards. Are there no figures that you can look back to on the Type 45s, to say "These were the percentage increases in costs from the original figures?"

John Hudson: Lord West highlighted that when programmes slow down, there is a tendency for them to increase. In terms of specific numbers, it would depend on what set of specific assumptions one was making. I do not have any specific numbers, but there is a theme there.

Q53 Douglas Chapman: Okay, nice one.

In terms of business planning, we have huge investment in personnel on the Clyde. There is an impact that that might have on skills—I think the Chair and others mentioned the drumbeat. The unions came out a few months ago and said that if we did not get this right and the delay went on into 2018-19, the skilled workforce might disintegrate, go elsewhere or not have the same sense of purpose and so on. How concerned are you about that coming to fruition? I think the number is that maybe 800 people will be losing work—losing their jobs—through that process. How concerned are you about whether, if that 800 go, you can start to deliver the rest of the programme at the drumbeat that the MoD expects beyond that?

John Hudson: It is important for us to retain that skilled workforce in order to deliver these complex warships. That is absolutely essential to what we do. Depending on what the programme outcome is, we will then have to look at what the implications are for our employees. We are fortunate in the sense that we have the carrier programme and the submarine programme; we would look to explore how we could use our employees on the Clyde to support those programmes if there were any break in load on the Clyde.

Q54 Douglas Chapman: One more supplementary. Your trade union convenor said today that this would create a bit of a hiatus in people's level of skills and in their commitment to the job—maybe "commitment" is not the right word, but it is about being on site, being part of the project from the start and using their skills. If they are pulled on to other responsibilities or other jobs, you might lose some of that skill level.

John Hudson: As part of our responsibility to our employees and the customer, it would be very important for us to make sure that those skills were maintained and that the activities done were relevant to the skills we need to sustain. We would work very hard to avoid losing those skills.

Chair: I know Ruth wants to come back briefly.

Q55 Ruth Smeeth: We are hearing a great deal from BAE, which makes absolute sense, but it would be really interesting to hear from everybody else about the impact of the delay in this contract on your business planning and on your workforce. Obviously I have a specific interest, but I would be interested to hear the knock-on effect on jobs, investment and even R and D within your own businesses because of this delay.

Dr Tyler: The answer from me is very simple: we are not involved in Type 26.

Ruth Smeeth: So you're alright.

Tomas Leahy: From a Rolls-Royce point of view, we have been selected for the MT30, the gas turbine on board. We signed the contract with BAE for the first three vessels back in July last year. The first of those engines underwent a factory acceptance test in January this year; that engine is currently being packaged and will be due for delivery in December this year. The product will be available, but we are looking at how and where we deliver that at the moment. Obviously there is an ongoing debate.

In terms of the security of the supply chain going forward, MT30 is a successful product globally; we have a number of programmes that we have been successful in, so we are able to manage any movement if it happens. Today we have a programme that we are working to, but were that to change, we would be able to accommodate that with the other engine programmes that we have been successful in on a global basis.

Andrew McKeran: My answer is very similar to Tomas's. The Type 26 that we are supplying to BAE Systems has the propulsion drive plus the propulsion motor, which is normal business to us in the marine world, so we have the capability to manufacture this.

Q56 Ruth Smeeth: You have the capability. Will you have the ongoing capability, even with your current reductions in workforce?

Andrew McKeran: Yes, we will have the capability to meet the commitments to BAE.

Q57 Ruth Smeeth: And that will be consolidated at Rugby?

Andrew McKeran: It is too early to say at this stage, because of the consultation period.

Q58 Chair: Thank you, gentlemen. Before we turn to Type 45, let me say that we appreciate that your company warned us, Mr Hudson, that you would be restricted in what you could say in open session. Is there any prospect that BAE Systems would be prepared to share a bit more detail on the Type 26 programme with the Committee if we had a private closed session in confidence, or private written correspondence in confidence?

John Hudson: These discussions are ongoing. We would not want to prejudice those discussions in any way, so I think that would probably be difficult for us at this time.

Chair: Okay. Well, let's hope that the people taking part in the discussions take note of some of the points that have been aired today.

Q59 Richard Benyon: Are you still working on the basis that is in the SDSR of eight?

John Hudson: Our current assumptions are entirely consistent with the SDSR—eight Type 26s built on the Clyde. For the initial contract, we anticipate three.

Chair: On to Type 45s—John Spellar.

Q60 Mr Spellar: Okay, let's move on to that. According to the Secretary of State, the MoD's independent review of the propulsion system identified "design shortfall" and "reliability problems". Any idea why those failings were not found out at an earlier stage?

John Hudson: The Type 45 story is quite complex. I will attempt to start it and my colleagues can join in as we go through. There was an ambition in the 1990s among the marine engineering community of the Royal Navy to move towards all-electric ships.

There are tangible operational benefits to doing that. When combined with a highly fuel-efficient, recuperated gas turbine, that provides real fuel efficiency. You get fuel efficiency even with a very fuel efficient prime mover, but that adds to it. There are operational reasons, in terms of training and crewing, where you can simplify support. In an era when we still think that directed-energy weapons will play a role in the naval battlefield of the future, having the ability to generate large amounts of electricity on board warships is a very desirable thing to do. That was the ambition in the 1990s.

The Royal Navy team then developed some new innovations around electric propulsion. They developed the advanced induction motor and were looking at drive technologies. Coincident with that was the technology of the advanced intercoolers—the WR-21 gas turbine. In the same period, the company was contracted to build the Wave class fleet tankers and the Bulwark LPDs. They were, indeed, electric propulsion. There were one or two teething problems in the first instance, but those were very successful.

So, when it came to Type 45, it was natural that there would be an ambition to move towards the fully electric propulsion system. There was a degree of prototype testing of the engine and of the electric drive system, but, as one of the admirals said, with 20:20 hindsight, that testing was not rigorous enough and exposed some vulnerabilities in reliability and in systems integration. What we saw through 2011 was the manifestation of some of those risks.

Q61 Mr Spellar: And was that failure of testing at the company level or at the MoD level?

John Hudson: It was a combination of things, including the integration of the equipment into the ship; there was an element of design integration where some things were unanticipated. The test facilities did not exactly replicate the situations on the ship and therefore failed to expose some of the issues that became exposed when the ships entered service. We have also heard that some of the testing proved that the functional integration of the system—that is, that the system would work—was not run sufficiently long enough to be able to demonstrate that they were reliable.

Dr Tyler: I think that is a generic challenge that you always have with a complex engineering system, particularly when there are new and novel bits of technology being introduced to it. We see that on all sorts of different complex platforms from airliners to ships to cars. It is very difficult to fully simulate a lifetime's worth of realistic conditions in a test regime of any sort. That is an extremely difficult thing to do, so there is always a risk of some discovery once a system enters service and then goes through its operational duty cycle. That is almost certainly what we have found out with the Type 45s' power and propulsion system.

Q62 Mr Spellar: Was it just that specifications were built into the design and, when you tried to integrate them in real-life conditions, they did not come off? Or was it that, as so often happens with these projects, the specification and the energy demands changed during the lifetime of that project?

John Hudson: I don't think it's an issue with changing requirements. This is more to do with reliability and systems integration. The requirements were pretty stable through the design phase.

Q63 Mr Spellar: So would it be prudent in these, therefore, to err on the side of simplicity in designs rather than over-complexity, in spite of the theoretical advantages of the overly complex system?

John Hudson: These are the decisions people have to make. There are tangible benefits going to the integrated fully electric propulsion system, but that is at the expense of simplicity.

Q64 Mr Spellar: Well, perceived benefits might be better than tangible.

John Hudson: Perceived benefits, yes.

Dr Tyler: I think Admiral Stanhope made the point very well that all of our battle-winning equipment requires a technological edge. When you are aspiring towards a technological edge, you're always going to be taking on a level of risk. Actually, for Type 45, there is a whole system of systems, including its weapons systems. A lot of technological risk was taken on it. A large amount was mitigated and dealt with, and we still have the finest air warfare destroyer in the world as a result. If we had erred on the side of caution, we wouldn't have put anything like the innovation into that ship, and we would have had a ship that wouldn't have given anything like the operational advantage to the Royal Navy that this one clearly does.

Q65 Mrs Moon: Two things: you've got a very fine ship; it's just that you can't rely on it actually being able to sail, which is fairly serious. We have heard about the onshore testing, and the fact that it didn't go on long enough. Can anyone tell us how long it was tested for, and how long onshore testing should really be?

Tomas Leahy: For the WR-21 gas turbine, because it was a product development, it actually underwent over 8,000 hours of testing during the development cycle. That was a mixture of development testing and endurance testing. There was a change in the design after about 5,000 hours of that, on the recuperator itself, so that had only about 3,000 hours of testing. The problems that we have experienced in service have come between 4,000 and 5,000 hours. So did we do enough testing? No, with hindsight, we didn't. It would have been good to do that extra testing.

Overall, the gas turbine system—the intercooled recuperated system—was proven, in that the concept worked and it delivered the fuel efficiency that we were expecting. Yes, an element of that system, the recuperator, because it was changed late in the design cycle, has proved not to be as robust as the rest of the system.

Q66 Mrs Moon: Who made this decision not to carry on with testing when the changes were made? Was that an MoD decision, or was it a company decision, not to run it for a further 8,000 hours?

Tomas Leahy: It was a mix. When all of this happened, the US navy were running the programme at the time. It was a US navy programme, so WR-21 was designed to a US navy specification. Northrop Grumman were the prime contractor, and Rolls-Royce were a subcontractor into that for the gas turbine element of the system. The change was made by Northrop Grumman, and there was also a very challenging cost target within the WR-21 development programme. The change was made to the recuperator and in a number of other areas to try to drive that cost down.

So the US navy was still very much in the driving seat when there was the initial issue with the recuperator. Following that, the US navy withdrew from the programme. Almost coincidental with that, WR-21 was selected for the Type 45 programme, and the MoD took responsibility for the subsequent testing of the recuperator and WR-21. So the 1,900 hours of testing that were done post the modifications to the recuperator were funded by the Ministry. It was a Ministry-led programme.

Q67 Mrs Moon: So it was the Ministry of Defence that decided not to put the extra hours into testing following the modifications.

Tomas Leahy: It was the Ministry that decreed the 1,900 hours it would take. At the same time, we were also installing and delivering the first WR-21 to the first of class on 45s, so there was an issue of timing playing into all this. They didn't want to hold up the build programme, obviously. The engines are one of the first things fitted in the build sequence, because of the size.

Q68 Mrs Moon: Is that normal practice?

Tomas Leahy: Yes.

Q69 Mrs Moon: It is normal practice to cut the testing hours?

Tomas Leahy: No. At the time, the testing was deemed sufficient. Given all the running that had been previously done, it was deemed that that was sufficient testing. In any testing, it is a cost versus risk benefit analysis, and at that time, it was decided that was sufficient testing. With hindsight, it would have been good to have done another 4,000 or 5,000 hours of testing. We may then have seen some of the problems we have had in service.

Q70 Mrs Moon: Has it taught you a lesson? Do you now decide, "Yes, we need to carry on running it."?

Tomas Leahy: It is very difficult. You do an analysis of what you think the risk is and what you think you will realise through testing. Have we learned a lesson on WR-21? Yes, because we now have empirical data and over 90,000 hours of experience of running WR-21 in service. It is very difficult to imply that for another programme. When we developed the MT30, for instance, we took a view on the level of risk that we had embedded within that marinisation programme, plus all the experience we had of that engine as an aero-product with over 4 million hours of running behind it, so we didn't do as much testing. We didn't do the 8,000 hours that we did on the WR-21 because of the inherent risk that we felt was in that product.

Dr Tyler: You are never in a situation where you can do enough testing, but in any engineering programme, you have to deliver a product. The ultimate test of a product is to look at it through the entirety of its operational life. That is really where you understand whether you've got everything right or not, and we spend our whole lives making judgments in these complex programmes about the point at which you have to get on and produce the product and stop the test programme, because you could just carry on forever.

Q71 Mrs Moon: But clearly the judgment was wrong in this case.

Dr Tyler: With the benefit of 20:20 hindsight, in this particular area of the ship system, history has shown that, yes, we should have done some things differently in design, and maybe additional testing. As I said, if you look at it in terms of the overall ship system, there are plenty of other areas where we might have ended up with a similar risk manifesting itself, but we didn't because the judgment call was right. This is an incredibly sophisticated product by any engineering standard.

Q72 Mrs Moon: What I find difficult is that here we have a critical defence capability that basically doesn't work and is not reliable. It places the country and the people who serve on it at risk, and none of you seems to be saying, "Yes, really sorry about this." It is almost as if it is, "Yes, we got that wrong."

Tomas Leahy: That is unfair on the industry involved in the Type 45. We are actually very focused on improving the reliability of the system, and the equipment embedded within the system, going forward. We are working extremely closely with the MoD, and we are working extremely closely with the crews to support them in service on the Type 45s. We have seen considerable improvements in the reliability of the equipment in service. We have a number of programmes running that we have either completed—we have seen the improvement directly from those programmes—or on which we are working very closely with the Ministry to develop and deliver cost-effective solutions to give Type 45 the level of reliability that it deserves.

Q73 Ruth Smeeth: I think it is a level of reliability that the service and the country deserves. Taking us back a step, focusing on Mr Hudson, in a statement to the House the then Secretary of State, the right hon. Geoff Hoon, said: "The prime contractor advised us that both engines met the programme requirements, and that either would be acceptable to the Royal Navy." As the prime contractor, what evidence did you have at that point to make that assessment?

John Hudson: I think that assessment is not entirely complete, because we did also advise that the WR-21 carried higher risks. When we said that the technical specifications of either engine would meet the requirements of the ship, we advised that the WR-21 had inherently greater risk because of its development nature and we pointed out that it had higher through-life costs. I think we tried to give a balanced view to the Ministry of Defence when we made that comment.

Q74 Ruth Smeeth: Are you saying that it was a political failure to choose this, or are you saying that it was an MoD failure and that you had covered your back?

John Hudson: No, I am trying to say that we tried to give professional advice to the MoD. It is a decision for the MoD as to what benefit and risk they wished to take in the programme.

Q75 Ruth Smeeth: Okay. Given that there was higher risk, were you surprised when the engine failed to deliver to the required spec?

John Hudson: We were anxious about the risks in this novel engine. The propulsion system does require a highly reliable engine, so we were anxious about risk, but that decision was made by the MoD.

Q76 Ruth Smeeth: You say that you were anxious. How did you choose to communicate your anxiousness about this risk?

John Hudson: I have said that, when the recommendation was made to Government, it was made in an explicit way, but it was for the MoD to choose which solution they wished to take forward.

Q77 Ruth Smeeth: So after the initial ship had been deployed, was there any point when you continued to articulate that there could be additional challenges?

John Hudson: There was a study done in 2005 where some of the issues associated with the recuperator were identified, and we did a short study to ask the Ministry of Defence whether they wished to reconsider the decision to integrate the WR-21, or whether they wished to consider putting a different prime mover into the vessel. That study was not taken any further; it was not progressed.

Q78 Ruth Smeeth: Who made the decision not to progress it?

John Hudson: I think it was a collective decision that the balance of the ongoing risk of the WR-21 and the potential programme impact of change did not warrant a change.

Q79 Ruth Smeeth: At that point.

John Hudson: Yes.

Q80 Chair: Can I talk a little more about the WR-21 test process? Would it be fair to say that it was rushed in any way in order to secure orders, first for the US navy, though that never transpired, and secondly for the Type 45 ships?

Tomas Leahy: No. The WR-21, as I have explained, was a development programme run by the US navy. The speed of testing and of development was very much dictated by the US navy office that was running that programme, subsequently joined in 1994 by the Royal Navy. The programme was very much run by the Governments involved in it. So in terms of whether it was rushed to meet a particular programme, no it was not. The development testing was an organised level of testing that ran its course.

Dr Tyler: It was 14 years of research, development and testing from the initiation to the factory acceptance testing of the first engine.

Q81 Chair: How quickly did the problem emerge with the first of the ships to suffer?

John Hudson: We are focusing a lot on the WR-21, but in fairness, there have been a broader range of issues that are not unique to the WR-21. We have also had problems in other aspects of the propulsion technology.

Q82 Chair: What I am trying to get at, with that little question, is this: were there indications of something seriously wrong with HMS Daring early enough for steps to have been taken with the later-build ships, or were they all beyond that stage?

John Hudson: The nature of the failures is quite complex. In the early days, there was a proportion that were related to the WR-21; there was a proportion that related to the drive mechanisms themselves; and there was a proportion that was a consequence of the way the

system had been integrated into the ship. It has taken industry some time to really analyse those failures and to be able to articulate which bit is contributing to the failures of the ships. In the early days, it would not have been immediately apparent what had to be done to resolve the problem.

Q83 Chair: When did the first really serious incident of a total power wipe-out take place?

John Hudson: Early on in Daring's commissioning.

Q84 Chair: At that stage, where was the build with regard to the propulsion systems for the later ships?

John Hudson: They would have been largely procured, and some of them would have been very much built into existing second and third class—

Q85 Chair: So you are saying that by the time the major problem became apparent, it was already too late for the later ships.

John Hudson: Yes.

Q86 Chair: What control did Rolls-Royce have over the replacement core design submitted by Rand Energy Systems and chosen by Northrop Grumman on cost reduction grounds, before Northrop Grumman themselves subsequently pulled out, following the withdrawal of the US navy from WR-21?

Tomas Leahy: Rolls-Royce was a subcontractor to Northrop Grumman. We were not involved in that decision-making process. We were given a concept—"This is the change. What is the impact on the system?" It was almost a fait accompli—"This is the change in the recuperator. What impact does it have on your gas turbine?" We were only doing that one element—the rotating part of the gas turbine—and WR-21 is a very complex gas turbine system, with an integral number of parts.

Q87 Chair: Would it be true to say that, once these things started happening, you were all keeping your fingers crossed a bit that it was all going to be right and work out well in the event? But you must have had misgivings from the first time this happened onwards.

Tomas Leahy: I'm not sure we had misgivings. We understood that introducing a significant change in the design that late in the programme could have had some consequences, but the 3,000-hour endurance test was already programmed and the view was that that would shake down the new recuperator and we would get some understanding of its performance.

Q88 Chair: Although the Government took the decisions about how long the testing process should last, were there any people from within industry who felt the Government were taking a wrong decision?

Tomas Leahy: The programme works very much hand in hand with both Governments—the US Government and the UK Government—and decisions were taken jointly. The funding was coming from the two Governments, of course, but on engineering decisions the Governments decided on advice from the companies involved.

Q89 Chair: So it was quite a joint endeavour.

Tomas Leahy: Very much. Yes.

Q90 Douglas Chapman: A quick question: I read somewhere that the ambient air temperature or sea temperature could affect the operation of the units. I find it really surprising that that was not part of the spec that was set down at the start. The MoD must have realised that it would be using Type 45s globally and it almost comes across that we cannot use this ship in the Gulf, for example, and a full-complement, battle-ready ship is a sitting duck if there is lack of power. Could you give us a bit more of the technical background to that?

The other point is about poor fuel quality. I was watching something the other night about how, for example, aviation fuel is protected to make sure it is absolutely clean and without water particles and so on. Surely, that level of care and attention should be taken with fuel for naval ships.

Tomas Leahy: I will answer the first question initially. From a WR-21 point of view, there was a specification for the Type 45. The engine met that specification, which was the same specification that was applied across the whole system. The system met that specification. Are the conditions experienced in the Gulf in line with that specification? No, they are not. The equipment is having to operate in far more arduous conditions that were initially required by that specification.

Q91 Douglas Chapman: Was that in the first scheme?

Tomas Leahy: That is really a question for the Ministry because it lay down the specification for the warship.

Q92 Mr Spellar: But don't you have some responsibility as a contractor and one of the few companies that can do this to say, "Your specification will not match up to the conditions that you are likely to meet." You don't just take the spec straight off and implement it if from your knowledge and experience it would be inadequate or insufficient.

John Hudson: Part of industry's response to that was that there was an upper limit for environmental temperatures and we sought to produce a design that would have graceful degradation beyond those temperatures. We have found in the Gulf that it takes the gas turbine generator bit into an area that is sub-optimal for the generator, and we also found that the cooling system created condensation within the drive units, which caused faults, and that caused electrical failures as well. We found two additional problems, but we designed the ship such that it would have a graceful degradation and not simply stop functioning.

Tomas Leahy: We discovered that, with the integrated electrical propulsion system, it was very different in the mode of operation than we had previously experienced and the Navy had previously experienced. All gas turbines previously had been a mechanical drive, so there was a gas turbine connected to a gear box connected to a propeller. The laws of physics say that if you run a gas turbine in a hot environment it will not generate as much power as in a cold environment. It is a mass flow machine and air is less dense when it gets hot. So if you take a Type 42 or a Type 22 into the Gulf and run it, yes, its engines will not deliver as much power as in the North Sea. All you would see though would be a bit of drop-off on top speed; that is all they would be aware of.

In an integrated electric propulsion system, the electrical system loads the WR-21 up to its 21 MW power rating, and that is what it is expecting to see. If you then operate in a hot environment, the WR-21 cannot deliver 21 MW any more, but the electrical propulsion system does not know that and still demands it. It continues to load it, saying, "Where's my 21 MW?" The net result is that the engine cannot deliver any more fuel or power, so the speed of the generator starts to drop off. We then have under-frequency protection as part of the system design and eventually the breaker will open because of the low frequency of the gas turbine. That is when you get your total electrical failure. Suddenly, you have lost your main generator on your system and you are plunged into darkness. It is not a fault of the WR-21; even if it were a single-cycle gas turbine it would still suffer the same fate in those circumstances. It is a law of physics.

Q93 Mr Spellar: Maybe, but as those were the laws of physics, why were they not taken into account in the specification? Or, when the specification came to you, why did you not say, "This offends against the laws of physics."? You do sometimes have a duty to educate your customer.

Tomas Leahy: That was more about the system design. The gas turbine was delivering what it was required to do. It is the system design that probably did not take that into account as well as—

Andrew McKeran: The system design was probably sound. I think that this is traditionally where you probably would have used a—

Q94 Mr Spellar: You mean the play was a success but the audience was a failure.

Andrew McKeran: A diesel gas turbine mix in a slightly different way, whereas WR-21 at the time indicated that it would operate across those ranges in an efficient way. The concept of integrated electric propulsion was right, in the fact that it does allow an agnostic prime mover configuration. To add to Tomas's point, it was designed right at the start and it had been tested during shore testing, in terms of its operation.

John Hudson: It was compounded a little by people's thinking at the time around the capabilities of the WR-21. The WR-21 is a unique gas turbine in that it is very fuel-efficient at low power, and the aim and the aspiration of the Ministry of Defence was to use the WR-21 for as much of the operational time as possible. Therefore, the diesel generators were sized very small. So we have a very large gas turbine unit, at 21 MW, and we have quite small diesel generators at 2 MW, which are insufficient to propel the ship and provide the electrical supply to the ship's systems. In those circumstances, when you have a failure of the gas turbine, it has a cascade effect on the ship and causes total electrical failure. Had the prime movers been more evenly sized, it would have had different consequences.

Q95 Mr Spellar: I understand that, but none of it, surely, is unpredictable. The basic physics—the basic calculations—should have taken that into account, should they not? This is not a completely exogenous impact; it is just your basic engineering design and physics.

John Hudson: Assumptions were made that the WR-21 would be a very reliable prime mover, and therefore the system design was built around that assumption.

Q96 Chair: For how many years do you think the Royal Navy has had a naval presence in the Gulf? Would it be measured in decades, scores of years—a century? Why should it have come as such a surprise that there would be these sorts of climatic demands and obstacles to be overcome by a new design of ship?

John Hudson: I think that the Navy have operated in the Gulf for many, many years and were aware of that. The operating profile that was considered at the time was that there would not be repeated and continuous operations in the Gulf, that they would not form a part of the operating profile for the ship. Therefore, it was not designed explicitly and uniquely for operations in the Gulf.

Dr Tyler: I think we have also got a confluence of two of John's points. One is around this concept of graceful degradation, which is something that we apply a lot in engineering systems at the upper or lower threshold of their specification because you do not just want the thing to stop; you want it to be able to carry on and operate, albeit sub-optimally, once you move outside that specification. It was designed that way. Then another of John's earlier points was to recognise that, if this is a failure, it is at a systems of systems level in an extremely complex system, which isn't just the gas turbine and isn't just the architecture of the integrated electric propulsion; it's a combination all of those things acting together. And when you really stress a very complicated system of systems and put it to the outer edge of its specification, sometimes you find that that gets a system failure that you hadn't anticipated before, and I think you could point to many, many engineering systems where, when they are pushed into those extreme situations, you get that sort of unintended outcome.

Tomas Leahy: Just to follow up on that, I think what is important, though, is this: have lessons been learned? Yes, they have. Both the QEC and the Type 26 environmental conditions are very representative of what's actually experienced in operating in the Gulf. So, yes, they've been embedded into the new vessels that are currently being built and being planned to be built.

Q97 Chair: Yes, one always hears this thing about "lessons being learned", but one would like to think one could learn lessons in a less costly way than building a ship that doesn't work in the environment where it is deployed.

Douglas Chapman: It wasn't a further question; I'm just absolutely stunned that you've given the answers you have. As the Chair has just alluded to, to have such an asset—it's a £1 billion asset—that you're putting into perhaps a war zone, and we don't know if these people who are making up the complement on that ship will go in there and come back out alive, because there might be a problem with the power system on the ship. I just find that—I'm just astounded. I'm sorry.

Chair: Any further observations on that point?

Dr Tyler: Well, except to say that, as I think the Secretary of State outlined in his letter to the Committee, the Type 45 has been doing sterling service around the world, including in the Gulf, where it's a very, very highly respected asset, respected not only by our own Navy but by the US navy. So I think there's a certain element of black and white that's been introduced here, when perhaps this is a situation more of shades of grey.

Q98 Chair: Well, it sounds to me that this is a situation whereby the more complex we build these machines, the greater the problem that if one element goes wrong then it has a catastrophic consequence potentially, in that over-complexity is not always compatible with reliability.

Dr Tyler: I think that there is a point where you have to be in the optimum place, between the complexity that gives you a technological edge and the complexity that then gives you, in this case, reliability issues, and finding that sweet spot is not always easy. A lot of our jobs is around trying to predict where that is going to be and de-risking it through appropriate means like testing and so on, and also, on occasions, bailing out of something that has demonstrated itself to be a risk too far. And we don't always get it right. We're not sitting here saying, "We got it right," because the evidence is that in this particular specific area we didn't get it right; I mean, that's pretty clear. So I don't think we're trying to duck the issue at all here.

What we are very focused on now, and I think what the Committee should be reassured that we are very focused on now, is working very closely with the Navy and the MoD in fixing this, and we've been doing that over some extended period of time already now—since, I think, 2011, although I defer to colleagues here—in an improvement programme, which continues to this day and which has already had meaningful effect and improvement.

Q99 Richard Benyon: I think that last reply was refreshing. We have heard a lot of corporate and Government-speak about this, and we just felt that the issue is being kicked from one to the other, and it is frustrating.

I am not actually very interested in pointing a finger of blame just for the sake of pointing a finger of blame. What we really want to know is that lessons have been learnt. At the end of the last Parliament, this Committee produced a report on decision making in procurement and operational matters. I urge you to look at it, because it seems that at certain times and in certain ways a sort of cognitive dissonance can come into the whole process, and the inevitability of something is what drives it, rather than being able to say—even people quite low down in the process in your businesses, or in the MoD, or in the armed forces, being able to say—"Actually, this is not working, this won't work and this is why it won't work", and to have the ability for people to be part of that process, rather than it having got a momentum of its own.

Andrew McKeran: I was going to say, just to reiterate and to come back to Mr Chapman's question as well, that this is being taken very, very seriously by all the companies that are obviously sitting here. Specifically from the GE perspective, I was also on board HMS Duncan last week, and down in Plymouth the week before. So, not just as an organisation but obviously as individuals, we are taking this exceptionally seriously and working through some of the issues collaboratively. I think that's the point—some of those unforeseen errors that we have had, or issues that we have had associated with the early performance of some of the equipment that's being deployed on to the Type 45, is obviously being put through some very, very rigorous quality processes and root-cause analysis, etc., to get to the true root cause, to make sure that we do eliminate it and to make sure that that is passed on, not just to the deployment of these vessels but obviously to the deployment of future vessels as well, in terms of QEC etc.

Q100 Richard Benyon: The MoD has said that funding for the Type 45 power and propulsion improvement programme is to be contained within the budget allocated to Navy command. Do you feel that other items, as a result of this, are being pushed to the right—or off a cliff, to overuse that analogy? If this is coming out of the existing Navy command budget, there must be something else happening in other directions. Are you seeing projects you are working on being elongated?

Tomas Leahy: It is not something we have visibility of in Rolls-Royce. We are working very closely with the Ministry to develop a solution, particularly for the recuperator improvement. That is being installed in a testbed in Bristol at the moment, so we will be doing a trial on that in a month or so. That programme is running forward. Is that having an impact on other areas of work that we do with the Ministry? No, I am not aware of that.

Dr Tyler: I think that you are talking, in the grand scheme of things, about a relatively small element, finance-wise, in a large naval equipment and support programme. The MoD is consummate at veering and hauling its resources to meet different events that occur, operational needs and so on, and I expect that is what they are doing now. I think it is really a question for the Ministry, to be honest.

Richard Benyon: For those of us who went on HMS Duncan and spent some time in what I still call the engine room, you get a feeling of the scale of this, and therefore the scale of this contract. There is still uncertainty about how the existing machinery is going to be removed and replaced with the new one. You sort of get the feeling this is actually a ship rebuild, as has been said, with miles and miles of wiring and completely new systems. I would not expect you to say no to this, but we need you to be as frank as you can with the Committee: are you absolutely certain that this is going to deliver the solution that we are after? This is an enormous contract. This is not a great day for the history of ship procurement, and we want to have total confidence that the Napier solution is going to work.

Q101 Ruth Smeeth: May I just add a supplementary to that before you answer? One of the things that was clear when we visited HMS Duncan is the likely ongoing additional capability that the ship is going to seek. Given that the propulsion system cannot cope with what it is currently being asked to do, what are you doing to make sure you are future-proofing it, given that the experiences of all of this have been an absolute disaster? The fact that we have seen suggestions on Twitter in response to this debate, as we have been sitting here, that the ships have been in the wrong kind of sea, suggests that this is an absolute nightmare. How are you making sure that this is future-proof?

John Hudson: This is a complicated problem, and therefore, unfortunately, it has complicated solutions. It is not as simple as fixing the WR-21 or fixing the drives or fixing the various integration aspects of the ship. This has to be a multi-channel approach. We have to make the equipment inherently more reliable. That means embodying the change to the recuperator, making some changes to the drive technology, reconfiguring the platform management system and changing the cooling system. There are a raft of detailed changes that have to be implemented. That is described as the equipment improvement plan.

Notwithstanding those improvements, when those improvements have been delivered the disparity of power between the WR-21 prime mover and the two 2 MW diesel generators

will leave the ship slightly vulnerable to those power transients that cause part of the problem. A secondary part of the solution is to increase the electrical generating capacity on the ship via diesel generators. There are several options that the Ministry has been presented with as to the number and size of the generators, and they have different impacts on the benefits they will give to the ship. There is a slight cost capability trade-off to be made with the final solution, but once we have incorporated the diesel generator upgrades and the equipment improvements, I believe we will have a ship that is fit for purpose.

Q102 Richard Benyon: How long will it take in your estimation to refit each ship?

John Hudson: This will depend on the solution adopted, but we are going to be looking at a 12-month type of period to make good the insulation of the new diesel generators.

Q103 Chair: If we are going to find that the new Type 26s will take longer to come into service and we will lose the use of each of these ships for 12 months or more, is there any potential for extending the already superannuated Type 23s even longer so that we do not lose platform levels way below the existing 19?

John Hudson: I think I might have misled the Committee a little, because there are maintenance periods built into the programming for Type 45. There is already programming time for both the recuperative change—well, we can do these in parallel with the maintenance periods. While there will be some additional out-of-service time for Type 45, it will not be of the order of 12 months.

Q104 Chair: Okay, but I still come back to this point: do we have any potential for further life extensions of the Type 23s given this terrible combination of what has happened to the Type 45s and the potential delays to the Type 26s?

John Hudson: There are always ways to extend ship lives. It is a cost-benefit trade-off, and that would be a matter for the MoD to determine.

Q105 Chair: Is that part of your discussions with them?

John Hudson: That is not part of any discussions we have had.

Q106 Mrs Moon: First, thank you gentlemen, because you are in an utterly invidious position of taking questions from a group of very aggressive MPs who are demanding answers to questions that you feel, because of your commercial relationship with the MoD, you cannot really answer. We have to ask them, because the public need to know that our naval capability is there and, quite honestly, that the platforms we are sending people to serve on are capable and safe. It is not good enough to think they are fine so long as we only send them to cold climates. Please do not think that we do not appreciate that or do not recognise it.

I want to go back to Richard's question, because it exercises our concerns. We are very aware that our naval capability is weaker than it should be. To be told that the repairs to the Type 45 have to be within the current envelope of the naval budget is very worrying when we are also waiting for delays to move forward in terms of the Type 26. Are you able to give us any sort of assurance that it is not because of the ongoing problems with the Type 45 that we are hearing about the delays to the Type 26 and the reduction in the numbers?

John Hudson: The Navy's budget is a matter for the Navy. It is very difficult for us to comment on that.

Q107 Mrs Moon: Are you being told, "Look, guys. We are going to have to slow things down", or is that commercially confidential? You can say if it is commercially confidential—that is fine.

John Hudson: No, no we are not privy to those types of discussions.

Q108 Mrs Moon: But you will be told, "We are going to delay that. We are putting that back."

Dr Tyler: You are talking about a very substantial, very integrated programme across all the Royal Navy's assets, and they are managing their budget dynamically to respond to their day in, day out needs. Taking two elements of it and saying there is a direct causal link between them—I think that would be very difficult for anyone to claim. If it was the case, it would not be a question for us; it would genuinely be a question for the MoD and the Navy.

Q109 Mrs Moon: If you are saying, "Don't ask us; ask the Navy," that is fine, but realistically, I cannot have my new bathroom if my kitchen has problems with the piping underneath the floor. I am going to need to dig it all up and lay completely new pipes, and that is going to double the price of my new kitchen. It is as simple as that, in my very humble housewifey analogy.

Dr Tyler: But the Navy is trying to manage a whole household and a large garden in addition, so at any point in time it might be looking at the kitchen and the bathroom but it is also trying to manage a whole property on an ongoing basis. Trying to take two elements of that and say, "Well, because the kitchen has gone over budget, I now cannot afford the bathroom"—you need to look at that in the context of the overall estate, to extend your analogy.

Q110 Mrs Moon: And I do. Extending my analogy, you cannot have it all, and if there is a big cost in the kitchen—in the engine room of the Type 45s—you cannot possibly be thinking you can afford everything else you want to do with your Navy.

Dr Tyler: As I say, I think that is fundamentally a question for the MoD and the Navy, who have the unenviable job of trying to balance this entire budget across everything that they are doing.

Chair: I think that we have to leave it at that. Gentlemen, thank you very much for your endurance of a marathon session. We will now move to our final panel of one, which is the trade union representative.

Examination of Witness

Witness: **Duncan McPhee**, Manual Convenor (Scotstoun), Unite, gave evidence.

Q111 Chair: Duncan, welcome. Thank you for agreeing to do this final session. I know you have had a very stressful and arduous journey—I believe specially—down from Scotland.

Duncan McPhee: Thanks to British Airways.

Chair: Oh, dear. Well, we are very grateful to you. We will try not to add to the pressure. I understand that both you and the BAE Systems management preferred that you give your evidence in separate sessions, so it is not a decision of ours, as you know. Would you like to introduce yourself briefly and say a few words about yourself and what you do? I shall then ask Ruth Smeeth to start off the questions.

Duncan McPhee: My name is Duncan McPhee. I am the Unite trade union convenor at the BAE Systems Scotstoun site—you have Govan as well; they are one business unit, basically. I have worked there all my life. I started as a marine plumber and I have been a trade union convenor since 2001.

Chair: Thank you very much indeed.

Q112 Ruth Smeeth: Good afternoon. I should make a declaration: I am a former member of staff at the Amicus part of Unite, so you're all right. What is the size of the workforce committed to the building of the Type 26 global combat ship?

Duncan McPhee: Well, it will be the whole workforce, because that will be the major programme. There are around 2,300 involved in that between the two Glasgow sites. Obviously, there are some people who work down in Portsmouth, and in Filton as well on the design part of that, but mainly within Glasgow there are about 2,300.

Q113 Ruth Smeeth: How is the workforce? Are they concerned at the moment?

Duncan McPhee: Yes, they're very concerned, because we thought we would be starting the Type 26 programme this year and now we are being told there is a delay, particularly on the manufacturing part of it, until late 2017, which means you will be talking quarter one of 2018 by the time manufacturing starts in any meaningful way. While we are working on the offshore patrol vessels at the moment, as most people are aware, they are nowhere near the size of ship that a frigate or a destroyer is. We basically have a workforce geared up for the Type 26 programme, and obviously they are working on the offshore patrol vessels, so we have problems with the size of workforce we have at the moment.

Ruth Smeeth: We're going to come back to that in a bit.

Q114 Douglas Chapman: In terms of Scotstoun and Govan, do you currently have the necessary skills on site to start the Type 26s? If somebody made the decision today to make progress—gave you the green light to actually go ahead and build—are there any capacity issues that you think need to be overcome before you would be able to get to that stage?

Duncan McPhee: We have the workforce in place to do it, because if you actually go back through the restructuring of the industry in 2013, where the company lost 1,775 jobs and they unfortunately closed the shipbuilding facility down at Portsmouth, Glasgow used to be the main centre for complex naval ships, so that three-year restructuring programme and the job losses were to give us the workforce to do the Type 26 programme; so we had the workforce ready to do it. Obviously, if you are saying could we start immediately, we could do it reasonably soon, I think, but there would be design issues, because obviously, with the date being moved to the right, things have slowed down, because we have had to release some designers last year who were working on the programme; but we could get it

back on track, I think, quite quickly. Obviously, we would need to plan for the offshore patrol vessel programme as well.

Q115 Douglas Chapman: We read extensively about the frigate factory-type approach. How far is that down the line in terms of preparation and so on?

Duncan McPhee: That is off the table, now, altogether. That was one of the unfortunate things that happened. We were told after the restructuring, based on going down to what would have been a single site, but with some major investment going into it, which would have produced what was kind of classed as a frigate factory and would have given us a world-class shipbuilding facility, which would have been based on the Scotstoun site. There would have been no additional job losses, and it would have really helped UK shipbuilding, because it would have given us a world-class facility, particularly to try to break into the export market. It was a real missed opportunity. Also, the investment that would have been put into that could have been reclaimed through the programme, we think, obviously with increased productivity going forward. The trade unions and the workforce think that was a real missed opportunity.

Q116 Douglas Chapman: Was that decision, not to proceed with that, part of the decision to reduce the number from 13 to eight, or was it a decision that was to extend or elongate—

Duncan McPhee: No, I don't think it was anything to do with programmes. I believe it was the investment. I don't have the figures for that but I imagine it was the cost of the required investment; but as I say I think it was short-sighted. I think we have missed a great opportunity for UK shipbuilding, in not proceeding with that plan.

Q117 Douglas Chapman: Just a final question from me: in terms of the impact on skills, retention—how do you think that has been affected by the delay in the start of the programme?

Duncan McPhee: The problem we have at the moment is, with the offshore patrol vessel programme being a smaller programme, we are going to have to keep people at Rosyth longer than anticipated, working on the carriers. We will probably send more people down to the Barrow shipyard to work there, because obviously we need to keep the skills within the industry to do that. While it is a magnificent workforce there, and they have proved that over the years with the different ships they have produced, it is not a good idea to have to send your people to other places, although they can do it. What you are doing—you mess up the drum beat on the production front, on that. So while we have the skills, it means the skills are going elsewhere for that period of time and they really should be working on the programme.

Q118 Mrs Moon: Can I just ask, in terms of skills—obviously this brings demoralisation. Are there other people trying to seduce those skills away? Are there other people who could come in, recognise the difficulties that are being faced in the workforce and say, "Never mind working for the shipyards. Come and work for us?" How much is that happening and what is the risk?

Duncan McPhee: At the moment it is probably—well, these things have happened before when there have been breaks in programmes, and the skills have been lost, and you struggle to get them back in again because you go and do other things. Unfortunately, you

are aware that the oil and gas industry is on a dip at the moment. What was certainly experienced before is that when that is working normally, or, as you say, booming, you will lose people from the shipyards or other places. They will go and work up there because it has a longer-term contract—if you are only working on a short-term one in the yards or other engineering places. But at the moment, it's not too bad. The biggest impact we are seeing now, unfortunately, is on the training programmes. They have been massively cut, solely because of the decision to move the Type 26 to a later date.

Q119 Mrs Moon: When you talk about training programmes, you are talking about apprenticeships?

Duncan McPhee: Apprenticeships, yes.

Q120 Mrs Moon: So basically we are not feeding in the next generation?

Duncan McPhee: Absolutely. Right through the carrier programme, we were fortunate in bringing in really big numbers through the apprenticeship programmes; I'm talking 100 a year. That's great because obviously it helps to bring new blood into the industry and brings down the age profile, which, as in other areas of manufacturing, is quite high at times. We are going to recruit 20 this year, and there are steelworkers who started last August who we have now had to switch to other trades. Fortunately, we are keeping them within the business, but in all my time in shipbuilding, I have never known apprentices to start with one trade and then, six months later, have to switch to another one. They were brought in because we thought we would be working on the steel work for the Type 26. That is the impact on training and young people.

Q121 Ruth Smeeth: If, God forbid, the Type 26 is delayed even more than we think it is going to be already, what will the impact on the workforce be? What discussions have you started having?

Duncan McPhee: Well, the delay we have at the moment is causing us problems; any further delay would be catastrophic because, as I said, we have a workforce geared up to build that programme of ships, so we really need to get on with that.

Our position is quite clear. A major restructuring happened in our industry and company, and some painful decisions were taken at that time. The workforce have lived up to that and have produced, as I said, the carrier blocks and sent them up to Rosyth, so they have worked well all through that painful restructuring. The position of the workforce is that they don't see why they should suffer any longer. They have lived up to their side of the bargain; we expect the MoD and the Government to live up to theirs.

Q122 Chair: Can I check one point? I appreciate that you may not be able to answer this definitively, but is it very much your impression that as far as the workforce are concerned, if the MoD now gave the order to start cutting steel on ship No. 1 of the Type 26, the whole workforce would be ready and able to get on with it?

Duncan McPhee: We definitely have the numbers to do it because, as I said, that whole restructuring programme was geared towards the Type 26. So we definitely have that. I'm not qualified to say on the design part of it, so, to go back to your question, I don't know how quickly they could do it, but certainly the people are in place to do it, so provided that

the design part of it is tied up, it should be able to fit into the workload we have at the moment.

Q123 Chair: Have management given you any explanation of why the delay has been essential and, if so, is that explanation or a large part of it simply that the Ministry of Defence is not making the money available as soon as it should?

Duncan McPhee: We believe it is, yes. Obviously, we have had several meetings with the company on this issue, and we believe that the financial considerations that have been brought into it have caused the delay on this.

Q124 Ruth Smeeth: I'm going to ask a question about the offshore patrol vessels, but before I move on, can you just give the Committee an understanding of the type of jobs that are on site, the average salaries and the skill sets that are currently employed? What type of people are we talking about and what is at risk?

Duncan McPhee: On the production front at the moment, that would be crafts—welders, engineers, plumbers and people like that. We have about 900 at the moment.

Q125 Ruth Smeeth: And the average salary would be?

Duncan McPhee: The average salary would be £25,000 or £26,000. And then you will have well over 1,000 involved in what are called staff jobs: designers, naval architects and various levels of management. So the salaries will go right up to—whatever.

Ruth Smeeth: A lot.

Duncan McPhee: A lot more than my members get anyway.

Q126 Ruth Smeeth: But we are talking about incredibly highly skilled people.

Duncan McPhee: Absolutely.

Q127 Ruth Smeeth: And we collectively, the company included, have invested a huge amount in training these people to get them to the level they are at now.

Duncan McPhee: There has been a marked increase in graduate recruitment over the years. That is good: it's bringing in highly skilled people. Obviously, the salaries will be commensurate with that, I would imagine. As I have said, we need to keep this kind of workforce intact, because apart from the Type 26, there are the new light frigates that have been announced. We are in the concept phase, I believe, on that. We need these people to work with the MoD to design these ships and hopefully break into the export market.

Q128 Ruth Smeeth: Okay. The award of the orders to construct the two additional offshore patrol vessels—is that sufficient to retain the skills and capabilities in the short term?

Duncan McPhee: Not on offshore patrol vessel contracts, no. We will either need to transfer employees to other sites—it is great to retain people but it is not an ideal business proposition—or bring other work to the Scotstoun and Govan sites, certainly for production employees, so that they can actually manufacture. We will need to keep the manufacturing drumbeat going on the Clyde.

Q129 Mrs Moon: You've come down here and are speaking to the Committee on behalf of the workforce. If there was one big message that you want to go back to the workforce and say, "I told 'em, I said this is the top priority," what would it be?

Duncan McPhee: "You have lived up to everything that has been asked of you. You have done it. Every contract you have worked on you have delivered. You were promised at the start of the restructuring process that you would have a sustainable industry going forward. The people who promised that should live up to that." Let's have some joined-up thinking when it comes to producing naval ships in this country. Every delay on any of these programmes has impacts. A lot of people don't find out about the impact of these things.

We don't like putting young people off joining the industry. We want to see that there is a future in shipbuilding and encourage them into it. It's great to see young people coming in to your workplace. It has an effect on the people who are there—they like to see new people coming in because it shows a vibrant industry. We would like the powers that be to deliver that.

Mrs Moon: I think on behalf of the Committee, I can safely say we fully endorse that message.

Q130 Mr Spellar: Do you think the company are pressing the MoD sufficiently on this?

Duncan McPhee: I know that the company are in discussions with the MoD—I'm not privy to what goes on, obviously. At the end of the day, between the company and the MoD, they have to come up with solutions to this, whether it is hopefully to get back to the Type 26 starting reasonably near to when it should be starting, which will overcome the problems we're facing at the moment, or we'll have to come up with other alternatives. We already know the terms of business and we have the workforce in place for that, so we need to use that workforce in a meaningful way. They deserve that.

Q131 Mr Spellar: And so, in those discussions, do you ever have any direct engagement with the MoD or is it just through the company?

Duncan McPhee: Normally through the company. We have good access. We meet from the chief executive down through the business unit. The debates and discussions we have with the company are good. We don't have any direct contact with the MoD, which is unfortunate, because last year senior MoD people did meet us on the Glasgow site. It was an unusual thing. In all my time we've never really done that. We said it would be a good idea to keep that going. At the end of the day, the MoD is a customer and it's good for the customer to engage, not just with the senior management of the company, but also with representatives. Hopefully, that's something we can pick up again in the future.

Q132 Mr Spellar: Do you think from the experience of yourselves and the company that the MoD or the Government, the Treasury in particular, understand the disruptive effect of this lumpiness in the award of contracts?

Duncan McPhee: No, I don't think they understand that at all, to be quite honest. It seems to be a budgetary decision. The impact of that, not just in the short term, but in the long term—the disruption to the whole infrastructure of producing ships—is massive. I think it is very short term as well.

Q133 Douglas Chapman: Just a quick one. I don't know if you caught the end of our previous discussion. We were talking about the possible link between the problems they have with the Type 45s—in terms of propulsion and so on—and any delay into the Type 26s. I have been around Rosyth for a long time, so I know how your people talk and have a great understanding of the industry. What is the talk in Scotstoun and Govan in terms of that link, or is that just something that is not on the radar in terms of the discussion?

Duncan McPhee: Our workforce don't see any great link between Type 45 and Type 26. We produce the ships to the design that was asked for. We basically hand it over to the Navy. After that, it is with colleagues who deal with it. Baseline involvement ends. There is no real talk about Type 45. Obviously, people look and see the press reports on it, but in reality there is no link as far as we are concerned with the Type 26.

Q134 Mrs Moon: The Government promised us that they were going to drive down the movement to the right of contracts; that there would be a streamlining of procurement; and they would drive out delays. You have been there a long time. In terms of the ups and downs, do you see any difference? Do you see it getting better?

Duncan McPhee: No, it's not better. It is probably about the worst I can remember. I can go back to when we used to order batches of three and different yards got them, and the yard that never got them obviously suffered. If I go back far enough, it was Swan Hunter and the old Jarrow shipbuilders. Basically, one yard would go down to literally nothing and then you had to go back and rebuild. It is not as bad as that, but I think the workforce would like to see this Committee visit the Scotstoun and Govan sites. It would be good if you could actually see it. There are two shipyards there operating as one unit. Probably the last time it was really working would have been on the Type 45 contracts. That was coming off a good drumbeat. You constructed at Govan and came over to Scotstoun. It was a throughput and a consistent drumbeat. That was good and I had all the workforce working more or less flat out on that. We have nothing like that just now. As I said, offshore patrol vessels are very small, so we are taking fewer people on that. Basically, you have got your workforce scattered to other sites, so it has not got the feel of what, let's face it, the UK's major complex naval shipbuilders should have.

Mrs Moon: NATO parliamentarians are coming to see you in September. From across the NATO Alliance people will be coming to see you in September.

Chair: Having attended every one of the Type 45 launches, I can say it is a very impressive operation when it is working as it should, so this problem, of course, keeps coming back to the very small numbers of platforms that the Royal Navy is commissioning at any one time.

Duncan, we are much obliged to you. You have come a long way. I am sorry you had difficulties with the transport, but you made it in the end and we are very grateful to you.

Mrs Moon: Perhaps we should send a ship for you rather than a plane.

Chair: Have a more leisurely return. This session is now concluded.