

Defence Committee

Oral evidence: Aviation Procurement, HC 178

Tuesday 29 November 2022

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[Watch the meeting](#)

Members present: Sarah Atherton; Robert Courts; Dave Doogan; Richard Drax; Mr Mark Francois; Mr Kevan Jones; Gavin Robinson; John Spellar.

In the absence of the Chair, John Spellar took the Chair.

Questions 78-224

Witnesses

I: Sir Kevin Leeson, KCB, CBE, Director of Military Affairs, Airbus UK; Ian Muldowney, Chief Operating Officer, BAE Systems Air.

II: Anna Keeling, Vice President and Managing Director, Boeing Defence UK; Paul Livingston, Chief Executive, Lockheed Martin UK.

Written evidence from witnesses:

- [BAE Systems \(AVP0013\)](#)
- [Boeing \(AVP0011\)](#)
- [Lockheed Martin UK \(AVP0006\)](#)

Examination of witnesses

Witnesses: Sir Kevin Leeson and Ian Muldowney.

- Q78 **Chair:** Today we have a hearing on aviation procurement, and we have two panels. This first one is with Ian Muldowney, chief operating officer at BAE Systems, and Sir Kevin Leeson, director of military affairs at Airbus. Do you want to say a couple of words to start?

Ian Muldowney: Thank you very much for the invite; it is an honour to be invited to give evidence. As the Chairman said, I am Ian Muldowney, and I am the chief operating officer at BAE Systems in the air sector. I have worked there for 27 years. I started there as an apprentice. As the COO, my responsibility is all our operational functions—engineering through to manufacturing through to support—and also our advanced programmes.

Sir Kevin Leeson: I am Kevin Leeson, director of military affairs at Airbus—a post that essentially seeks to advise the company on matters strategy and defence matters, and also interprets the capability issues facing the Department to talk to the company about, hopefully looking forward and into the future.

- Q79 **Richard Drax:** Good morning, gentlemen. The Government plan to refresh the Defence Command Paper early next year. What are your hopes and expectations for this update in terms of aviation capability?

Ian Muldowney: Building on the integrated review and the Defence Command Paper that was issued previously, from a BAE Systems perspective and from a national perspective, that was very positive. It put combat air right at the centre of that and built on the combat air strategy from 2018. The renewal, like any good strategy, should evolve, with the unfortunate events that we have seen in Ukraine that began on 23 February this year, to allow us to understand what more can be done. What we are looking for is how it reconfirms and solidifies where we are going in the combat air continuum, especially around the future combat air strategy, building on that 2018 release and allowing industry—not just BAE Systems, but the whole enterprise—to have the confidence and surety that allows us to build plans going forward.

- Q80 **Richard Drax:** There was talk of 3% of GDP on defence spending. Now it is staying at 2% until the next integrated review is done. How crucial is it that we have this extra 1%—ideally, more—for your industry?

Ian Muldowney: Given the challenge that is out there, in terms of the economy and the cost of living, we need to make sure that we are balanced, so we would not want to see that damage any other part of the social enterprise in the United Kingdom. Moving forward, from a defence perspective, it is key for us to have a really clear plan against a defined budget that is spent appropriately against key capabilities that deliver sovereign capability militarily, industrially and in terms of prosperity. That differential between 2% and 3% is encouraging, but it is about getting



that surety of plan, understanding how we spend it appropriately and making sure it is spent in the right way.

Sir Kevin Leeson: I would agree with Ian: the stability of the defence programme is the issue. It is clearly for Government to set its priorities across a very complicated tapestry, and perhaps it is more complicated at the moment. While I am sure that all of us in defence would applaud a stronger defence capability built on a higher degree of funding, there are stark realities that the country has to face. The most important thing is to get a stable hook in the programme, so that we can deliver as efficiently as possible.

Going back to the things that would most interest us, in Airbus, to emerge from the new chapter review, the most important thing is understanding the implications for sustainment and sustained military effort and therefore the whole issue of resilience. That goes beyond stock levels. It goes through into people training, long-term ambition—that sort of thing. It's about getting better clarity on sustained effort.

I think we should not be tempted to think that because the Ukraine war has not featured fast jet activity a lot—that is arguably because the Ukrainians have a very good air force and therefore the aggressor knows what he would have been dealing with, so another thing is ensuring that we do not back off the strength of fast air. We have clearly seen lessons to be learned on defensive aid systems' capabilities, so I think protection systems for land, sea and air systems need to feature. Another thing is ways in which we can perhaps force multiply effort that we already have; I am talking about more efficient delivery from our existing systems. Finally, I think the Ukrainians have demonstrated considerably clever ways of moving data around, to the best effect, in their campaign. Therefore there is a lesson, I think, for all of us here—to make sure that, with many things that have been talked about on data sharing and interconnectivity, we really get some progress made to ensure that our systems can benefit from similar data agility.

Q81 Richard Drax: We all know that covid-19 has caused serious disruption to the defence industry. Supply chain resilience has been seriously challenged. The economic situation also poses challenges, with high inflation and a drop in the dollar exchange rate. That is particularly the case for the MoD. What lessons are emerging for both industry and the MoD to improve future defence industrial capacity and resilience, Ian?

Ian Muldowney: I think the lessons learned from the pandemic and also the recent economic shock are about coherence of plan, so that we have a joint understanding of what the outcomes need to be and we can equip ourselves to achieve that. We talk about the supply chain; I would also include in that people resilience—the supply of human capital and the right skills, and having enough of a forward, long plan. It comes back to the point about having surety of the plan and having balance in the plan. That allows us to build on credibility and a solid foundation, give the supply chain confidence and understand where we need to find alternative supply chains. The ventilator challenge was a prime example of what the United



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Kingdom can do collectively; BAE Systems were involved in aspects of that. We have to find different solutions—

Q82 **Richard Drax:** You say, “to understand supply chains”. This problem has been going on for, what, two years now? Have you not understood it yet?

Ian Muldowney: No, no—we absolutely understand it, but it is a case of continually reviewing it and understanding where the source of supply is, where we need to make sure we bring things back onshore and where we need to collaborate further with our international partners. We understand that, but it is a case of continually reviewing it against that plan and making sure we are testing that resilience consistently.

Sir Kevin Leeson: I would say much the same. We have had, actually, many years of the supply chain issue. We started, from an Airbus perspective, by looking at border friction issues, which then took us into the covid period, so we had to fine-tune what we had been doing at that stage. Now, of course, the Ukraine issue has brought sourcing, and the appropriateness of sourcing, into the spotlight as well. Fortunately, in this latter phase, we have really tightened the procurement department’s work. I am talking about the ability to look down into second-tier, third-tier and fourth-tier suppliers. It is really quite intricate analysis. It is about where they are sourcing their stuff from. It is about their capabilities and their own resilience. And of course increasingly, against the current financial backdrop, the health of some of these smaller enterprises financially is also an issue. We are now spending an awful lot of time understanding that part of the business.

Q83 **Richard Drax:** You talk about understanding it, but have you solved the supply chain issue? Have you got enough materiel coming to do all that you need to do?

Sir Kevin Leeson: You never solve a supply chain issue completely because everything moves on. You have to keep responding to it. By and large, we have done extremely well. The evidence is the fact that we have been able to ramp up civil aircraft manufacturing from the very low post-covid rate to higher rates now, but there are lots of challenges out there. Ian made the important point that it is about where your suppliers are and the fabric of the nation that they are in, particularly for things like having sufficiently qualified people to work in the business. That is a pan-Government, pan-industry issue because to have real resilience in your system, you have to have really healthy companies that are supplied by quality people. It is fair to say that that is a stressed business at the moment.

Q84 **Chair:** That is fine, but pulling in the other direction, particularly at a time of constrained budgets, is there a tendency within the Ministry of Defence, particularly in aviation, to go for the cheapest off-the-shelf option rather than making a long-term investment that is necessary to sustain sovereign UK industry and its dependent supply chain? How are you dealing with that? Do you have concerns about that?



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Sir Kevin Leeson: I think that is a huge risk. It is an incredibly tempting prospect to convince yourself that simpler, cheaper commercial systems can actually do the job when finances are short and perhaps timescales are against you. That is where it is really important that the Department properly analyses the resilience, sovereign capacity and strategic imperative and makes some extraordinarily good judgments to ensure that you focus the available funds where you can on inshore, onshore or near shore while still taking a competitive advantage.

Ian Muldowney: Building on what Sir Kevin said, that would be great. That short-termism is a risk. Anyone can take a short-term judgment. I would argue that being where we are with the combat air strategy gives us a level of surety, but the risk of buying off-the-shelf cheaper alternatives—on paper, cheaper alternatives—is still there. When you look at the through-life cost of some of these systems and at the lack of sovereign skills, that is where we need to look on a broader aperture. If you take something like Typhoon, for example, it sustains 20,000 jobs a year in the United Kingdom. It adds £1.6 billion or £1.7 billion-worth of GDP to the economy every year, as well as exports and so on. Having that investment in sovereign capability and staying through that in the medium to long term is vital for the United Kingdom—not just for industrial prosperity, but for international export prosperity and vitally important military capability.

Q85 **Chair:** One advantage for some suppliers is having much longer runs of production, so they can spread out the development cost. What is BAE doing to increase export sales to enable you to benefit from those same longer run efficiencies and benefits?

Ian Muldowney: A good example is the return on investment from the investment in Typhoon. The UK's investment was around £12 billion. That has doubled in terms of the turnover investment from export sales. We continually invest in the Typhoon platform. The MoD has invested in that, such as with the £2.3 billion investment that was announced in the summer around the radar and weapons systems. But, again, if you look to the future, the £2 billion investment that UK industry has collectively made—the four partner companies and the MoD—in the sixth generation and in the technology that underpins Tempest and the future combat air system, that allows us to start building that foundation. That will, first, make it international by design, so it is exportable and, secondly, ensure the military capability need of the Royal Air Force and our allies.

Q86 **Chair:** I understand that, but is that not the legacy possibly of when BAE was more aggressive in the export markets, rather than now when it seems to be much more dependent on the UK and US markets?

Ian Muldowney: No, from a Typhoon perspective, we are collectively aggressive, working closely with the UK Government. If you look at what we do around Typhoon—the sales into Qatar, supporting our colleagues in Italy and recently Kuwait, and the continued renewal of acquisition in Typhoon from Germany and Spain with their programmes—we are constantly moving forward. We are on the front foot, and we are

continually evolving the standard of Typhoon to go into the export market. That will lead into future upgrades and potentially more future export sales.

- Q87 **Dave Doogan:** Following on from that, the record of export sales to peer nations for Typhoon is not brilliant—in fact, it is not there. Unless you build Typhoon, you do not buy Typhoon, unless you are Saudi Arabia, Qatar, or some other middle eastern state. Given the huge scale of the investment in Tempest, what is being done to create a product that is attractive, affordable and effective for peer nations that do not have the capacity to build them themselves, or perhaps do have that capacity? Why would they select Tempest in the way that they did not select Typhoon or Tornado?

Ian Muldowney: First and foremost, the design approach of Tempest is a system; it is not just one aircraft. There is a core aircraft, but there are several systems around it, so people might buy aspects of it or they might buy the whole of it. The fundamental philosophy, right at the beginning of the design cycle—it is in the combat air strategy—is “international by design”. It is adaptable for other nations; it is built on open architecture systems and new modern engineering and manufacturing methodologies, both to drive down the affordability curve and to allow nations to have a sovereign upgradeable path, so they will be able to tailor the product for their needs.

- Q88 **Dave Doogan:** In so far as that is a departure from Typhoon, how significant a departure from Typhoon is it?

Ian Muldowney: It is not a complete departure from Typhoon, but we built in that “international by design” right up front, rather than just against four-nation requirements. That is something that is very different: we are approaching it not just as a fighter replacement, but as a whole system. That “international by design” is inbuilt into the requirements now, and the approaches we are taking. It is not only built for a 2035 to 2045 space; it evolves over decades of new requirements. You spiral the capabilities not just to meet the RAF’s need or our allies’ need, but those of future international partners as well.

- Q89 **Dave Doogan:** Sir Kevin, one of the things we have learned over Ukraine is the need for pace, and a way to generate equipment and replace equipment once used at pace. The new medium lift helicopter selection and procurement process is moving at a glacial pace. What questions should this Committee be asking the Department about the pace of delivery of that new equipment, without compromising Airbus’s position in that?

Sir Kevin Leeson: I think you are right. When we saw the integrated review published, that was a particularly surprising area. Puma, our current system that delivers very well in that area, has got quite a lot of life in it, so in terms of imperatives, that was interesting.

However, I accept that the Department has done an analysis of the longer-term equipment programme, and when things need to be replaced



and at what drumbeat. The conclusion reached looks sound on that basis, but we did understand that quite a lot of pace was needed. You are right: it does appear to have gone relatively slowly compared with the expectation that I am sure even the Department had. I really do not think that we are in a position from the industry side to judge why that has been; I think we have responded in the timescales requested of us. We are delighted that all four companies are now through PQQ. The thing feels as if it is moving again now, so, obviously, we await the ITN as the next stage.

Chair: Looking at the lessons learned from the Typhoon programme seamlessly brings us to Gavin Robinson.

- Q90 **Gavin Robinson:** Thank you, Chair, and good morning to you both. Sir Kevin, I want to look at Typhoon and Atlas. I guess from this perspective, this Committee is interested in aviation procurement and the lessons that should be learned from previous experiences. Can I ask you first—then we will turn to Ian—what major lessons can be learned about these multi-level framework procurement opportunities that we could apply for the future, both from Atlas and from Typhoon?

Sir Kevin Leeson: Anybody on the Committee who has read my CV will know that I do not come at this from a disinterested position, given that a large chunk of my life was spent on the development of the Typhoon. I am a particular fan of the Typhoon programme, and I think that the European collaboration that spawned it has been extraordinarily successful and has delivered, in its class, a really successful aeroplane. There are 660-odd aeroplanes in the buy, in a very competitive environment. It is an aeroplane that is absolutely the backbone of the home nations and a number of other export customers, in terms of the capability it delivers.

The lessons for me are the strength of a long-term close collaboration with allies. It harnesses all the engineering skills and provides real choice. I don't think, as a strong industrial nation, that we and the other host Governments of the Airbus company should ever not find ourselves in a position to be able to deliver cutting-edge technology in the aerospace sector. Our capability and heritage are so profound that we simply must continue that.

- Q91 **Gavin Robinson:** I appreciate that answer, but it is sort of glossy brochure-type stuff. I would expect you to say that. If you were selling me a paper kite, I would expect you to tell me that it was cutting edge in the hope that I might buy it. I mean no disrespect. Looking to future procurement opportunities, what are the key things—other than, as you say, galvanising a long-term future, sustained growth, investment, skills and cutting-edge technology—that we learned from the previous experiences? What should we ensure is hardwired into any future programmes?

Sir Kevin Leeson: I think it is very much what Ian touched on earlier, in terms of the range of capabilities, skills and what the aircraft should deliver. It is about having the independence of action that is afforded by



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having your own design base, which can ensure that all the technologies that make the sixth-generation aeroplanes the winning solution are as good as they can possibly be.

Q92 **Gavin Robinson:** Okay. Ian? Or did you want to come in on Airbus, Mark?

Mr Francois: No.

Ian Muldowney: To build on Sir Kevin's response, for me and BAE Systems the lessons learned are about approaching it from a through-life perspective, not just from a unit purchase price perspective, because that is where you can build a stronger foundation to understand it. Going back to my previous answer, it has to be international by design. You have to be able to do this in a way that allows other nations to acquire it, develop it and put on some of their own sovereign capability, so it is not a closed shop.

The third thing is making sure we have that medium to long-term plan agreed, collaborated on and built from a complete enterprise perspective, between not just partner nations, but partner industries. It is about ensuring that everyone has bought into the plan and that we are not just doing it in salami slices. Having that medium to long-term stability is vital for the defence enterprise. Those are my three key lessons learned.

Q93 **Gavin Robinson:** Let me flip it another way. What did we do that we should not replicate in future procurement programmes?

Ian Muldowney: I would argue that chasing after a very simple acquisition price for a platform compromises what you do through-life. From experience, I would say that you have to have a through-life approach to understanding this. If you can do that, you have a more grounded and viable programme. That builds on all the things we have talked about, such as skills and sovereign capability. That would be my key point .

Q94 **Gavin Robinson:** Sir Kevin, do you agree with that?

Sir Kevin Leeson: I do.

Q95 **Gavin Robinson:** More importantly, given that you have had a foot in both sides of defence—the public side and the private aspects—do you think that understanding or that mentality is there within the MoD? Does it recognise the pitfalls of focusing on initial purchase price solely and not looking at the longer impact and life costs of an aircraft?

Sir Kevin Leeson: I clearly can't comment on that in the Tempest context, because I am absolutely not involved in what imperatives are being pursued there. In general terms, the ultimate conundrum in procurement has always been trying to get the best of both worlds: the advantages of some degree of fixed pricing and the change management and agility advantage of some sort of floating pricing. There are a wide number of techniques to do that now. Basically, boiling it down, a programme starting and a commercial approach being decided is the good



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stage. The issue is when enforced, large-scale change of the programme is required, perhaps because of an affordability cause from the industry side, or real-world events—for example, inflation at the moment. If that causes the customer to have to significantly modify the required contract, and particularly if that represents delays, running more thinly or anything like that, that is when the problems really start.

These programmes are incredibly complex, and are put together in a very elaborate way to ensure that all parts of the jigsaw come together. A major timescale change to a programme or an enforced budget change is a significantly bad moment for any programme to have to deal with. The single biggest lesson—it has come through in defence studies for years—is that, once you have come up with an answer, aim to go with it, but build into it a sensible change mechanism so that you can respond to real-world events.

- Q96 **Mr Francois:** Most fair commentators would accept that Typhoon has been a great success, and that Tempest appears to be going very well. Hawk was a great success. But in the end, the company decided not really to invest in advanced Hawk. The sales have fallen off. We will come on to MFTS, which is an unmitigated shambles. One of the problems in MFTS is the very poor availability of the Hawk T2 at Valley. Why is availability so poor? As it is your aircraft, is BAE Systems taking responsibility to fix it?

Ian Muldowney: The Hawk availability at RAF Valley has improved over the last 18 months. Our Typhoon programme instilled in us some learning about how we run it as an availability service, rather than just a spares and repairs, maintenance service. We are bringing in some of that frontline experience.

Hawk availability has improved, and we are continuing with that. We signed a 10-plus year Hawk availability service contract with the MoD earlier this year. That allows us to have a long-range plan. It allows us to bring investments in, drive up affordability and increase availability. The evidence during the course of this year is starting to—

- Q97 **Mr Francois:** I am sorry. One of the problems is that we are always tight for time. It has basically gone from very poor to poor. We read in the press that the Adour engine is at the heart of the problem. That is not your engine, but it is in your aircraft. What is the ground truth on that, and what is being done to fix it? Even a layman can understand that, if the engine doesn't work, the aircraft won't fly.

Ian Muldowney: The engine is a challenge. We are working with Rolls-Royce. Rolls-Royce is working with its supply chain, and has found some challenges. It would be unfair to comment on that, but we are making sure that we understand what those challenges are, and what Rolls-Royce is doing to recover that.

- Q98 **Mr Francois:** Sorry. Please do not talk in euphemisms about “challenges”. In layman's English, what is the problem?



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Ian Muldowney: The problem is that they found some quality issues on components in the engine. That means that the engine needs to be investigated, and those engines need to start being recovered.

Q99 **Mr Francois:** Right. So that is affecting the availability of the aircraft, despite your new plan.

Ian Muldowney: Yes, it is, but we are mitigating some of that through the movement of engines around to increase the availability where we can. That plan is in line with our work with the RAF. We make sure that those aircraft are flying the soldiers that they need, to their training plan.

Q100 **Mr Francois:** Lastly, what is the percentage availability of the Hawks now?

Ian Muldowney: I would not want to make it up, but we can get that piece of information for you afterwards.

Mr Francois: Sorry, you told us what your responsibilities are. You must know the answer. What is the percentage availability of the Hawk T2 at Valley now? Is it 20% of them, 50%, or 90%? What is it?

Ian Muldowney: I would be guessing if I—

Mr Francois: Well guess, then.

Mr Jones: He could write to us with it.

Ian Muldowney: I would be happy to write to you with that information.

Mr Francois: Sorry, that is not very good, is it? Anyway.

Chair: Robert next, then Sarah.

Q101 **Robert Courts:** I would like to pick up on some of the questions that Gavin was asking. What the country is embarking on under Tempest is a multinational programme with lots of high technology. I think we would be more reassured if we could understand where lessons have been learned from Typhoon in the past. I will look at two quick issues on that. First, what lessons have been learned around the allocation of workshare and the rise in duplication, with extra cost and delay, that Typhoon was criticised for in its procurement period?

Secondly, it is inevitable, in any kind of long-lasting multinational programme, that there are changes of political governance and of capability. You would say, fairly enough, that something that makes your job harder is a change of capability requirement from the Air Force, or political changes from Government. However, both those things will very much be part of any such programme. What have you learned from Typhoon that will mean that we do not see similar problems with Tempest?

Sir Kevin Leeson: Coming from the Airbus perspective, looking back at Typhoon, interestingly, Mr Courts, I would almost see those two problems as advantages. The way the Typhoon programme was set, when four



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nations had four different currencies and completely separate political backdrops to the endeavour, was actually by taking what was called the canonical shares, so the total number of systems that each of the four Governments wanted, then partitioning the programme, in terms of design responsibility and production capacity—the workshare issue. So, the fact that workshare was a mechanism in many respects protected the programme over many years, as various Governments had ups and downs in their position, because it was buffered against exchange rate changes and swings of desire—if I can put it that way—within the various Governments.

As a mechanism, that will probably not be seen to be the way to go so early on in a programme as it was then. I think that would be a lesson that came out, in that I think both the UK Tempest programme and the Franco-German-Spanish programme have approached this in a similar way, in terms of how they have phased early capability design and development activity—even though we are not really into development yet. The approach is to actually keep your powder dry, as it were, on some of the things that start bolting down on “Which job, in terms of manufacture, is done where?”, so that you concentrate on design, using best athlete techniques and things of that sort.

Q102 **Robert Courts:** So phase it, and maybe do it later, then?

Sir Kevin Leeson: I think “Get to locking in the hardware moment a little bit later” is probably the lesson on the workshare issue. On political change—

Robert Courts: And capability.

Sir Kevin Leeson: And capability. On political change and backdrop, I think that both programmes, as they currently stand, are very much in that area. You can see, when different Administrations take over, that there are different perspectives on the importance of defence, more generally, and the types of programmes within that, so finding ways to, over time, ensure you are buffered against those, on what is a 30, 40 or 50-year endeavour, is an important part of the jigsaw for industry to—

Q103 **Robert Courts:** I am hoping not to ask an unfair question, because I am conscious that there are decisions you are responsible for and others that you are not, but one of the criticisms of Typhoon was how long it took to come into service and how much it had changed since its initial inception. There is always a capability requirement from the Air Force or from Government that may change that, but is there any way you can buffer against that, because it is bound to happen over a 20 to 30-year development programme?

Sir Kevin Leeson: I think the fundamental conclusion is: do as much of the thinking as you can up front, and do not start the manufacture until your last possible safe moment, because that is when you get locked into various things.

Chair: We need to crack on.

Robert Courts: Chair, may I ask about Atlas? We have talked about Typhoon, but we haven't talked about Atlas in terms of lessons learned.

Chair: We have questions on Atlas later, so I think we should crack on. The last question in the series is on the list. Sarah.

Q104 **Sarah Atherton:** Thanks, Chair. Ian, I would like to go back to Mark's point on the Hawk 2 engine. My understanding is that it is a crack in the compressor after 1,700 hours requiring an engine rebuild. That is obviously going to put pressure on the remaining Hawks, and there is speculation that parts are being prioritised for middle eastern countries. What is your plan for Valley? We have heard about the problems with military flight training. How do we ensure that the availability of the Hawk 2 is coterminous with the military flight training programme?

Ian Muldowney: The plan, as with all our reviews, is to make sure, first, that we understand the issue; then you have clarity around that issue. We are working closely with Rolls-Royce to mitigate that and not prioritise one customer over another, and to look at the spares pool totally. That plan is being developed with Rolls-Royce to ensure we work closely and that we engage with customers to understand what their flying requirements are. Rather than saying we are just going to focus on one, we ask what the flying requirements are and how we can manage the supply chain so as not to undermine the flying capacity and flight training, wherever they are.

We are not prioritising anyone over the United Kingdom. It is in that balance to make sure we keep everyone's flying priorities at the top of the agenda and working that through with the supply chain, driving it through Rolls-Royce into the supply chain to get that change through and get the improvements through to ensure that we inspect and understand which are the affected engines, because not all engines will be affected. There are certain elements that will not be, but make sure you do that inspection, understand the impact and then manage the supply chain without impacting the flying requirements of each of the air forces.

Chair: Okay, we now move on to combat air strategy. Robert.

Q105 **Robert Courts:** Chair, thank you very much. Rather than, as we were a moment ago, looking to the past and lessons learned, let's look to the future and risks around implementation. Could you give us an update on how that is going and what key risks you see?

Ian Muldowney: The investment that the UK MoD and UK industry made in the FCAS TI programme back in 2018 was a £2 billion investment. It was all about de-risking—de-risking key technologies, understanding where technologies are and where they are in readiness levels in terms of their maturity and what we need to develop. The announcement of the Tempest demonstrator in the summer this year at Farnborough is a key element of that. It recapitalises and tests the ability to develop a sixth-generation platform, coupled with the work that is going on in Leonardo, MBDA and Rolls-Royce to develop those key technologies to be in time to inform and provide evidence into the 2025 review point. That allows us then to commit forward to a full-scale design and development.



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The work that we are doing now, which we have been doing since 2018, is all about de-risking, using techniques such as model-based systems engineering, building what Sir Kevin said, where you make commitments to go into manufacture of equipment or manufacture of airframe at the latest possible date—that is key—but also using model-based techniques to drive down and reduce the test time and to improve a left shift of column certification evidence.

All of that is what we are testing, working in partnership across industry—not just the four Tempest partners I mentioned or the MoD, but several hundred in the supply chain and SMEs—to build that evidence to say, “We have de-risked this to go after that 2035 in-service date.”

Q106 Robert Courts: Thank you, that is very helpful in terms of looking forward and progress. I am very interested in what the risks are, as you see them, and I want to talk for a moment, if we can, about the supply chain. That is something we mentioned earlier, when Mr Doogan was asking you these questions. You talked about near-shoring and close-shoring. Have we got the supply-chain base here in order to make this a success, or are we going to find out that it has been hollowed out and that that will affect the viability of the project in the future?

Ian Muldowney: No. I would say the UK has a thriving aerospace/defence enterprise. We need to recapitalise some of that and give people some surety around the medium to long term, so that it doesn't decide to make short-term decisions. The partnerships that we are developing with the likes of Italy—a long-term partner on Typhoon and Tornado—and the emerging partnership with Japan start to give us that extended supply chain and extended confidence that we have that collective ability in there. We are—

Q107 Robert Courts: Can I just pause you there, because you were at pains earlier to talk about the need to close-shore and onshore some of the supply chain?

Ian Muldowney: For critical capabilities, yes—for critical things that give you that sovereign-capability approach. You do not have to do everything. You have to have an understanding of a whole system—a whole aircraft—but the ability to have the sovereign capability to have the key capabilities onshore, and knowledge of them, is critical for any programme.

Q108 Robert Courts: Okay. So that is the supply chain aspect of it, but what, from your perspective, is a risk?

Ian Muldowney: There are two things for me. It is about the surety of the programme, as in we have that long-term plan and it is baked in so we do not see a complete switch somewhere else.

Robert Courts: You mean from our perspective—

Ian Muldowney: From a Government and MoD perspective. If we shift our focus and priority elsewhere, we would destabilise the programme.



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The other risk is making sure that we achieve collectively that evidence point to say we can do the programme, walking through that programme gate with confidence and making sure we do that. The underpin to that is making sure we get the supply chain of people. Going back to what Sir Kevin said, that is not a BAE Systems and Airbus thing; that is what I would call a whole-force thing. It is about, pan-Government and pan-industry, getting the right people to the right capabilities for the middle of this decade—that is critical in experience and knowledge.

Q109 Robert Courts: Now what about exports and sales? This goes back to the point that Mr Doogan asked about earlier. Is that not a risk that must be in your mind, as to which international partners you will be working with and whether you will have a product at the end of the day that you can sell to enough people?

Ian Muldowney: I think the confidence we have around the current international collaborations we have with Italy and Japan give us that confidence. That is a joint conceiving activity that will mature over time. Hopefully that will start to emerge as a more formal relationship over time. Locking that in over the next six to 12 months is a key area. Elsewhere, how do we make sure that we bring on other international partners? How are we adapting to work with others as we go and expand that? Building on the point before, how do we build that “international by design” right up front? That is part—

Robert Courts: You mentioned bringing—

Chair: Robert, we are running up against the clock on this one and Dave Doogan wants to come in.

Robert Courts: Sorry, Chair.

Q110 Dave Doogan: Very quickly, Mr Muldowney, the Typhoon partners—Spain and Germany—were hugely influential and important resources and, in fact, customers for Eurofighter, and they have gone now. Why do you think they have gone?

Ian Muldowney: It is probably not my position to comment on the decisions that were made several years ago—why they moved—but they decided to have a relationship with the French on the SCAF programme. That is where they think their near-term goals are. I think it was a case of political decisions; whether it was capability decisions as well, that is not one for me to comment on, really.

We will continue to collaborate with our Spanish and German colleagues on the Typhoon programme and there may be other opportunities in the future where we can do more. There is a lot more runway in the Typhoon programme where we enjoy that collaboration with the Spanish and Germans that we see as being still a fruitful partnership and one we enjoy.

Q111 Dave Doogan: Because of the embryonic stage of the programme, it cannot have been operational or strategic; it had to be a political decision, which is a cost to the economic scope that Tempest had to develop in. If we are not going to have Spain and Germany as customers



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for Tempest, that is a big problem. It is not insurmountable, but it is a big problem.

Ian Muldowney: Yes, but there will be other customers as well, I think, with the—

Dave Doogan: That remains to be seen.

Ian Muldowney: Well, I think the relationship that the UK MoD is building with Japan and that the industry is building with Japan gives us an opportunity. I think the long-term relationship that we have with Italy through Tornado and Typhoon again builds on that. As I said, we will continue to work with our German and Spanish colleagues through the Typhoon programme, which has got many decades to run yet.

Chair: Those decades may be needed to fill a gap.

Q112 **Sarah Atherton:** My understanding is that there are 30 tranche 1 Typhoons due to retire in 2025, leaving 107 tranche 2 and tranche 3 Typhoons spread across seven operational squadrons and adapted with new weaponry and sensors. The remaining 107 will be worked harder and will fatigue quicker, and they will probably be non-operational for longer periods as they get older, but FCAS Tempest is not due to be in service until 2040. That is probably very hopeful; the likelihood is that it will be delayed. Ian, are you concerned about the probability of air combat capability gaps? What can be done to reduce that risk?

Ian Muldowney: In terms of the risk around air combat capability, the £2.3 billion investment in radar capability announced in the summer, including the ECRS mark 2 radar capability—the E-scan radar—and the future weapons fit, will allow the Typhoon to have that kind of front-end workhorse capability for the RAF, as well as our partner nations and allies, well into the 2040s.

Aircraft numbers are probably a question for the RAF—I would not want to comment on that—but the constant evolution of Typhoon and F-35 will give us that foundation for combat air capability going forward, until Tempest comes online in 2035. They will continue going through together into the 2040s and 2050s, as part of that combat air continuum.

From the perspective of BAE Systems, the key thing is that continued investment in that capability and moving it forward, keeping Typhoon in particular at the cutting edge. Rather than a cliff edge into Tempest, that allows it to segue in nicely, so there is transfer of capability knowledge into Tempest from an operational and technology point of view, but that also ensures that we keep Typhoon right at the forefront of the combat air capability of the United Kingdom for the next 20 years, which is key.

Q113 **Sarah Atherton:** You do not foresee a capability gap, by the sound of it?

Ian Muldowney: I do not foresee a particular capability gap that is down to numbers. I see the evolution of the Typhoon and F-35 in that combat air continuum and making sure that we do not have a gap. That will be the key part of it.



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Sir Kevin Leeson: I agree with what Ian says. The key point, as I said earlier, is that Typhoon is the backbone of combat air systems in Germany and Spain, as well as in the UK and Italy, so it is crucial that they receive the attention to get them through to that 2040 timeline, in the case of the UK. In the case of Germany and Spain, of course, it is slightly longer because the German and Spanish Governments have already committed to buy an additional 38 and 20 to replace some of the earlier aeroplanes. In terms of production capability, we will see Typhoons still in manufacture out to the 2030s.

Q114 **Mr Francois:** There is one scenario in which you get a brutal capability gap: it is called war. The trend for decades, under Governments of both colours, to be fair, has been an ever-decreasing number of actual combat aircraft in the Royal Air Force. Now we are down to about seven frontline combat squadrons. Given that, and given the extreme cost of the F-35, which we will come on to in the second session, as we have so few aircraft left, why does it make sense to retire about 30 Typhoon tranche 1 aircraft? Should we not, at the very least, put them in a war reserve?

Ian Muldowney: The decision around the war reserve is a matter for the RAF.

Mr Francois: But you build the aircraft.

Ian Muldowney: From an engineering point of view, the tranche 1s have quite a wide-ranging set of obsolescence. Being able to upgrade them to be capable of operating at the same capability level as tranche 2 and tranche 3 will be a significant cost. Just the life left on those airframes, and not just the airframes but the equipment within them, would mean that would be a huge cost to the Government. Taking those out of service allows us to then have the investment to increase the capability on the tranche 2s and tranche 3s. There was always a plan to take the tranche 1s out.

Q115 **Mr Francois:** I accept that, but that plan was drawn up before Russia invaded Ukraine. The world has completely changed—it is a total game changer for defence. We have so few aircraft now anyway. Yes, there would be a cost to upgrade those aircraft, but in an emergency you would just pay what it costs. It takes several years to build a Typhoon from scratch, so surely, if you had to fight a so-called come-as-you-are war, even having those older aircraft, if you could upgrade them quickly and put them into the frontline, is a much better option than literally having nothing, is it not?

Ian Muldowney: It is an option that could be considered, yes.

Q116 **Mr Francois:** Has BAE Systems been asked to do any design studies at all about upgrading the tranche 1 in a national emergency?

Ian Muldowney: In that context, no.

Q117 **Mr Francois:** If you were asked to do such, are you capable of doing it?



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Ian Muldowney: Yes, we could look at what could be done, but whether that would be a priority would have to be a conversation with the MoD and the RAF. We would have the ability to answer the question, yes.

Q118 **Mr Francois:** You make the point that they are the service and you are the contractor, and I completely get that, but you have the technical skill to do it. If it came to it, it would be down to you.

Ian Muldowney: Us and our partners. It is not just us; it is our four nation partners across the—

Q119 **Mr Francois:** If you had to upgrade those in an emergency, how quickly could you do it?

Ian Muldowney: I would not like to guess, Sir.

Q120 **Mr Francois:** Could we have a note on that?

Ian Muldowney: We can come back with a letter if you wish, yes.

Q121 **Dave Doogan:** On the emerging apparent air capability gap, I take on board my colleague Mr Francois' point about the tranche 1s, but an alternative to that would be to build in increased UK demand to manufacturing new. That would obviously come at a significant cost, but if the MoD was to knock on your door and have that conversation, and say they wanted to order another 30 aircraft of the latest tranche, how long a horizon are we talking about for that sort of delivery?

Ian Muldowney: Good question. In terms of where we are today, we have an ongoing production line with the orders that have come up. We still have Qatari jets to deliver, and major units are being delivered to our German and Spanish colleagues for their production lines, so the supply chain is warmed up—we are not going from a standing start. If the theoretical question is, "If the UK was to order some more aircraft, how long will that take?", roughly a typhoon production line from placing the order to the first aircraft coming off the line is about four years, because we have that warmed-up production line to go and do that. We are not starting from a standing start.

Mr Francois: Don't worry, the Russians will give us four years' warning, won't they? So it will be all right.

Dave Doogan: That is best endeavours—that is what I asked.

Chair: Right, we did say we would get back to Atlas.

Q122 **Mr Jones:** In terms of the A400M, it has been a troubled programme. Problems with the propeller gearbox, the combustion chamber and sensors has meant they have to retrofit engines, and obviously there were the very tragic deaths in Spain in 2015. There are reports that, for example, the German air force are concerned about availability. With the C-130Js going out of service in the next six months, or starting to, how confident are you about the reliability of the A400M?



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Sir Kevin Leeson: It is true that the programme has, over a long period of time, had some difficulties it has had to recover from. I'm afraid large aircraft programmes tend to be a little bit like that in world history. I am pleased to say that we are substantially through all that development ground, so we are now into the two issues of capability for the change in the UK Government plan with the retirement of the C-130. We are working closely with the MoD against their priority order to advance a number of the capabilities that would have been coming along over the next two to three years, to ensure that they meet the MoD's priorities for the early retirement of the C-130. That is very close working, and it is going very well, so I am confident that we will meet the MoD's priorities on delivering the capabilities necessary to make that change and minimise the risk of it.

In terms of availability, I sit here with the Committee at this point in time having had a very good eight weeks in which I am pleased to say we have been delivering over the agreed target availability in respect of aircraft on the line to do the job from A400. It is true that in the earlier part of the summer there was a regrettable collection of what we would call discoveries—forgive me for using the engineering expression; “discoveries” probably sounds strange to the Committee—of things that quite simply should not have gone wrong, but I'm afraid aircraft programmes do tend to throw up odd moments along the way and you have to deal with them. You have to make sure that safe operation is possible and that the customer output is protected. We had a little difficulty with that in the summer, but I am now pleased to say we are completely through that. We have borne the burden of that, as Airbus, to ensure the customer is not prejudiced. I am confident that in terms of both availability and capability we can deliver to the MoD's changed priorities.

Q123 **Mr Jones:** So there is still a risk. There are outstanding issues, for example, on certification issues.

Sir Kevin Leeson: As I said, we are working on the priorities that the MoD has set for the various capabilities that they require. Within each of those revised priorities I am pretty confident we can do what is necessary.

Q124 **Mr Jones:** That doesn't fill me with a great deal of confidence, Sir Kevin. One of the areas, for example, is special forces, which has been very controversial. Are you capable of delivering the targets that they have set you, for example, for availability?

Sir Kevin Leeson: That was the area that I was talking about. On availability, yes, because that sort of capacity is within the task line daily requirement plan. In terms of capability, we have an accelerated capability delivery plan to make sure that the key moments in that special forces capability—we probably should not in this context go into the details of some of those.

The thing to remember with A400, Mr Jones, is that the departure of a thoroughly capable platform, as C-130 was over its 60 years, is always an interesting moment for an air force. You must remember that the



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capability coming in to replace it is substantially more capable as an aeroplane in its own right—same load, twice the distance; double the load over the single distance.

Q125 **Mr Jones:** It is, if it works, but there is a risk there, especially with special forces. Some people in the community think it's a turkey. Let's be honest: you have not convinced them yet that this is going to be as capable as the C-130 and that they can face up to the more difficult environments that they have to operate in, compared to the normal delivery of freight, for example.

Sir Kevin Leeson: You are absolutely right. Creating familiarity and confidence in a new system with specialist communities in defence is always a challenge. We are now at the cusp of doing that activity. We have already done a variety of para work, where the confidence is now boosted as that wider, larger capability is seen to exist.

Q126 **Mr Jones:** Does that include delivering airborne troops? **Sir Kevin Leeson:** Yes

Q127 **Mr Jones:** Has that been agreed or certified?

Sir Kevin Leeson: To various levels.

Q128 **Mr Jones:** I have to say I am not filled with a great deal of confidence from what you are saying. There are a lot of ifs and buts here. If it is, for example, an aircraft that is delivering freight and suchlike, you can understand if things get delivered late, and that is a problem. But I worry that if we are going down this route with our special forces, some of these things have not yet been finalised. It is a huge risk because we actually need our special forces to use this aircraft operationally.

Sir Kevin Leeson: I would take issue with the "huge risk" moment.

Q129 **Mr Jones:** You just said that parachute training, which has been raised with me by members of the special forces, has been done within certain parameters. Well, it either has or it hasn't. If there are still outstanding issues there, the one thing our special forces do on quite a few occasions is parachute out of C-130s, so it is a pretty basic requirement. I would not suggest it is a "nice to have".

Sir Kevin Leeson: Without wishing to take the Committee into the finer details of various types of parachuting and the capabilities, the aeroplane has those capabilities for parachuting already.

Q130 **Mr Francois:** But is it cleared?

Sir Kevin Leeson: Clearance is a part of what Airbus does, and clearance is part of what Governments do on behalf of their own people. Our clearances are in place.

Q131 **Mr Jones:** Your clearances are, but has the customer—the MoD—accepted that? Let us just take parachutes—

Sir Kevin Leeson: That is the acceleration of the capability delivery plan jointly agreed with the customer that I talked about.



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Mr Francois: So no.

Q132 **Mr Jones:** This is a huge risk, isn't it, Sir Kevin? I accept that it is not your fault that the Government have decided to accelerate this programme—and let me say on the record that I think the A400 is a capable aircraft; there is no doubt about that—but in terms of the risk that is there, from what you are saying, it seems like there are still things that have not been signed off. If you are talking about getting the confidence of your customer, certainly in terms of the special forces community, it does not sound as though we are there yet, are we?

Sir Kevin Leeson: What I was trying to point out is that you earlier remarked that there was huge risk, and what I am saying is that there is not huge risk. A large number of the capabilities required for the special forces activity are already in place. Some within the capability plan are delivered over the next few months. Some are within the Government sort of area and release mechanism, rather than ours. We are confident that in terms of the priorities we have been set for the MoD's perception of the risk that it is prepared to take on the handover of the duties between the two aircraft types, we can meet the requirements set on us.

Q133 **Mr Jones:** You can, but then it depends on the special forces community accepting those things, doesn't it?

Sir Kevin Leeson: That is probably an area for my colleagues on the Government side.

Mr Jones: I accept that, but I have to say that what you have said has not filled me with a great deal of confidence.

Q134 **Richard Drax:** Sir Kevin, I do not think I am going to give away any secrets about how our men and women jump out of aeroplanes—they have been doing it for a long time. What I have heard is that, as far as the Parachute Regiment are concerned, it is not ready for static line jumping, quite apart from other forms of parachuting, and you certainly can't bang this big aircraft down on a short runway in very rough terrain as you could do with the old Herc, which has been used on many occasions, including in Afghanistan.

Sir Kevin Leeson: That is not true. We have done beach and field landings; we can deliver twice the load that a C-130 can, both by volume and by weight, into pretty well the same strip—slightly longer for take-off.

Q135 **Richard Drax:** What about the parachuting?

Sir Kevin Leeson: Parachuting off the ramp: cleared. On static line, we do not have a clearance yet for symmetric, both doors, but we can certainly do single door, large stick.

Q136 **Richard Drax:** That has passed, has it?

Sir Kevin Leeson: Yes.

Q137 **Mr Francois:** Some people are sceptical about the value of Committee visits, so to try to silence that, we went to Filton about a year ago, and



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we talked to the people who worked on the engines for the A400M. We said, "What's the ground truth about the unreliability of the engines?" and we were basically told by a very experienced engineer—I am not trying to get anyone into trouble, so I will not name him—that, "When they did the gearbox on the computer, it worked. When they built it, it didn't. So we're forever having to have engines and gearboxes brought back here to be repaired, because they keep burning out. There is a long-term plan in place to redesign the gearbox, which will improve the availability, but that is some way off." That was the ground truth from an experienced engineer at Rolls-Royce at Filton. Where are we on that reliability plan, and has the problem been fixed?

Sir Kevin Leeson: We are essentially through the problem of the gear deterioration in design terms. Mod pack 2 is already in delivery, and we have accommodations—ameliorations—for those aeroplanes that are still pre-mod, where essentially the gearboxes do not have the life that they should. In terms of first-line impact, we do not have any aeroplanes in the first-line fleet that are short of engines or gearboxes.

Q138 **Mr Francois:** Okay, so of the 22 or 24 that we are buying—

Sir Kevin Leeson: It is 22.

Mr Francois: How many of those have had the improvement carried out? How many have been "fixed", in layman's English?

Sir Kevin Leeson: I would have to give you a note on the current status of mod pack 2.

Mr Francois: We are going to be getting a lot of notes at the end of this hearing, aren't we?

Sir Kevin Leeson: Only one from me so far. I am sorry: I do not carry around the mods list of the A400 in my head.

Q139 **Mr Francois:** With respect, sir, this has been a fundamental problem with the aircraft for years. Much of the criticism of the A400M is centred on this.

Sir Kevin Leeson: And as I have explained, Mr Francois, the gearbox issue predominantly—actually, completely—does not now apply at first line. The aeroplanes have the gearboxes they need to a standard that allows them to do normal operations.

Q140 **Mr Francois:** I will reverse the question: how many first-line aircraft have had the mod?

Sir Kevin Leeson: We will include that in the note.

Mr Francois: All right.

Sir Kevin Leeson: It is not an issue for current availability.

Mr Francois: Yes, okay, fair enough.



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Q141 **Sarah Atherton:** I have just come back from the Falklands, where the A400M is working very well. The RAF like it very much. It is supporting the British Antarctic expedition down there, so they are very happy with it. For my own curiosity, because I have not got a straight answer, going back to SF capability, has the Atlas got a shorter STOL than the Hercules?

Sir Kevin Leeson: Has the Atlas—

Sarah Atherton: Short take-off and landing. Is it a shorter take-off and landing performance than the Hercules? Which one is it? Which is the best for a shorter runway?

Sir Kevin Leeson: In what load configuration?

Sarah Atherton: Packed with SF—full kit SF.

Sir Kevin Leeson: There are certain configurations where, carrying the same load as a C-130, it's better, or it can carry more load but actually requires slightly longer.

Q142 **Sarah Atherton:** So if it is packed with SF full kit, what is the length of the runway it requires to land?

Sir Kevin Leeson: I would need to run the numbers on what that SF fit would be, I'm afraid. As you will understand, if it is a particular SF configuration of just a small number of people, that is such a small load that the aeroplane, having vast amounts of extra power, would actually outperform.

Sarah Atherton: The rumour is that it requires a longer runway than the Hercules.

Q143 **Dave Doogan:** Are you saying that, with exactly the same load, it has a shorter runway length requirement? Can it also land and take off on just as rough terrain?

Sir Kevin Leeson: It actually has a lower load-bearing requirement, so it can actually land on softer terrain than a C-130.

Q144 **Dave Doogan:** And with exactly the same load, can it take off over a shorter length or a slightly longer length?

Sir Kevin Leeson: I think I would need to come back to the Committee with some example numbers.

Chair: Thank you very much for a session that has, I am afraid, run on slightly, but that is because of the interest in the subject. We thank you both very much for your contribution.

Examination of witnesses

Witnesses: Anna Keeling and Paul Livingston.

Q145 **Chair:** We now move on to the second panel today for our inquiry into aviation procurement. We have Paul Livingston, vice president and chief executive UK for Lockheed Martin, and Anna Keeling, vice president and managing director at Boeing Defence UK. Do you want to say a couple of words to start off the session?

Anna Keeling: Good morning. My name is Anna Keeling, managing director for Boeing Defence UK. I am a proud British citizen, living and working here in the United Kingdom, responsible for all of Boeing's major defence programmes in support of our Armed Forces.

Paul Livingston: Good morning. I am Paul Livingston, chief executive for Lockheed Martin. I have been with the company just over 21 years and in this role about 18 months. I am also, like Ian in the earlier session, an ex-apprentice.

Dave Doogan: Hear, hear.

Chair: One of our members declares an interest. We will kick straight off with Mark Francois.

Q146 **Mr Francois:** Mr Livingston, we will come on to MFTS in a moment, but first on Crowsnest: you have had over seven years to integrate an airborne early warning radar on to an air vehicle—a helicopter, in layman's English. Why is this programme still in such desperate trouble after all that time?

Paul Livingston: We had a significant delay from one of our subcontractors, who at one point said they needed to stop work for three months to replan to even give us the date to which they could complete things.

Q147 **Mr Francois:** Who was that?

Paul Livingston: That was Thales. We have looked at how well we were managing them as a subcontractor—whether we were looking at enough metrics, whether we were deep enough into their programme to understand the depth of the problems they were facing. Clearly, we were not, so we have taken significant remedial action on that.

I am pleased to say that, today, out on Carrier Strike Group 22, the latest version of the software—12.2—is performing well and is much more stable. In fact, it is stable. We were having a lot of instability problems last year, as I am sure you are aware, but that capability is now coming together. It has taken too long, and we regret that immensely, but, like all programmes that Lockheed Martin undertakes, we are determined to see it through and complete its development.

Q148 **Mr Francois:** This year is the 40th anniversary of the Falklands war. You have taken what is an upgraded version of Racal Searchwater radar and



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integrated on to a Merlin. Forty years ago, we basically did the same thing with an earlier version of Searchwater and a Sea King. We did that in 13 weeks because there was a war on. Why, on your watch, with all the technological advances that we have four decades on, has it taken us seven years to do what we managed to do in 13 weeks 40 years ago?

Paul Livingston: The actual system itself, in the back end, is entirely different, as I am sure you are aware. It is a new processing system because the tasks the radar is being asked to perform are much more complex than they were in the original Searchwater specification.

Part of it has been the porting of old Ada code on to new systems with a lack of Ada-experienced engineers in the marketplace in general; that was definitely a function in the delay. Following on from that, you are then trying to embed that new functionality.

One thing that has changed immensely is the certification regime. If I were to give you an example, the original Merlin Mk1, when it was created, built and delivered, had 4,000 flight test points to get certification by the military. For the Crowsnest system, which does not even touch the primary flight controls—it is an entirely independent system—over 10,000 test points have to be attained to achieve MAA certification. That certification is also a driving factor in the time, particularly when you talk about new software and checking that that code meets the standards.

Q149 **Mr Francois:** We are tight for time. Without going into classified areas, we know that on CSG21 a year ago, it didn't quite work as everyone would have liked it to. Let's just leave it like that.

Paul Livingston: That's a fair statement.

Q150 **Mr Francois:** Given you have had seven years, given all of your tensions with Thales—there were rumours at one point of legal action—when is this thing going to work as advertised? There is not a lot of point spending upwards of £10 billion on two carriers and all the support ships and all the F-35s if we haven't got sufficient airborne early warning to protect the fleet. When is this thing going to do what it says on the tin?

Paul Livingston: We are looking very hard at what reports come back from CSG22, because, as I said, we are seeing significantly improved performance. I spoke with the Navy just last week in order to understand their views of it, which are ever improving. Since we went on contract, and even in the last year or so—and they have started using it—the Navy have actually changed some of what they may want the system to do in the future. Right now, there is a live discussion between the Ministry of Defence, the Royal Navy, Lockheed Martin and our subcontractors: are there additional things that they want embedded in that were not even in the specification that was signed up to? Are there things they are not quite so bothered about any more? What is really important to them given their current context? We are going through those discussions now.

Q151 **Mr Francois:** Right. So you can't give us a date.



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Paul Livingston: Because we are changing the specification based on what the Ministry of Defence has asked us to re-look at.

Q152 **Mr Francois:** So, very simply, we have had seven years, it still doesn't work, and now we are arguing about whether to change the specification or not. I think most of us would regard that as basically deplorable.

Let's move on to MFTS. You are in a joint venture called Ascent with Babcock. When Ben Wallace became Secretary of State, he gave each of the three heads of service one key mission, and the key mission he gave the Chief of the Air Staff was to sort out the problems with the military flight training system. Two years on, it is still a disaster. Why is this still going wrong?

Paul Livingston: I'm afraid I have to fundamentally disagree with the fact—it depends how you define MFTS. To be clear, the military flying training system is split into three phases. Phase 1 is before they ever get near an aircraft; it is your basic military training at Sandhurst or somewhere else. Phase 2 is the bit Ascent delivers in partnership with the UK Royal Air Force and the other services. Phase 3 is at the operational conversion units, which are owned by the frontline commands.

The situation as of today—I confirmed this with the Deputy Chief of the Air Force last week, to make sure that he and I were aligned—is that MFTS phase 2, the bit Ascent delivers, is currently delivering 78% of its contracted capacity, because that is what the current demand is.

The biggest pressure on the system right now is at the operational conversion unit, which came about because of four key factors. One is covid: less people left, so therefore pilots who we were assuming were going to be leaving and needed to be replaced didn't leave. Covid also brought back some departures. Several people who had retired from the Royal Air Force or other forces, and had gone to the airlines or somewhere else, found the jobs weren't there any more, asked to come back and, I think quite rightly, the Ministry of Defence said, "These are highly skilled air crew. Why would we want to lose that experience?", so they brought them back.

Thirdly, the integrated review reduced the multi-engine and the helicopter fleets, meaning that there was less demand at the operational conversion units for those. Finally, international defence training at the operational conversion unit has also impacted their ability to draw people from the system.

Right now, if MFTS phase 2 trained everybody as quickly as it could, they would finish phase 2 and have up to a three-year hold before they actually started at the operational conversion unit.

Q153 **Mr Francois:** Are you basically saying it is not your problem—it is the Royal Air Force's problem? At the heart of this—and I notice what you say about multi-engine—are fast jet pilots. It is taking seven years to train someone from when they go to Cranwell to when they are in the cockpit of a fighting Typhoon—seven years. Many of them get bored with waiting.



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They leave. We barely have as many pilots to fly the F-35 as we have F-35s, and we do not have many of those. Are you saying, "Nothing to do with us, gov. We're just the contractor. It's the Royal Air Force's fault"?

Paul Livingston: Right now, I think we need to look, as a partnership and an enterprise, at the end-to-end governance of phase 1 to phase 3, which currently does not happen. It is split into three distinct phases. Ascent and industry will be happy to engage in that debate. Historically, we have clearly had areas where we have not delivered well. I will take the Texan as an example. At one point, the Texan was not performing. We were not getting the contracted capacity from Affinity. The 10 aircraft were not enough. Despite some efforts from Affinity, we at Ascent were not seeing the output that we needed, so we elevated it to a shareholder-to-shareholder meeting—Lockheed and Babcock, bringing in Elbit and KBR.

Mr Francois: I only have a couple more questions. In a sense, you are giving the game away, because the fundamental problem with this is that it has all been so complicated that everyone in the history of this programme has pointed at everybody else and said, "Not me, gov."

Chair: Mark, get to a short question.

Q154 **Mr Francois:** When is this going to be fixed so that we can have fast jet combat pilots in the cockpit within three years rather than seven?

Paul Livingston: The MFTS phase 2 curriculum that Ascent delivers for a fast jet pilot is 25 months' course time. What breaks that up are holds, and refreshers if they have been held too long, because you then use up some of the system's capacity to do that refresher training. Right now, even with the Hawk problem that was discussed earlier, we are being asked to turn the wick down on our capacity. That is why we are currently delivering only 78% of our contracted capacity. We have that capacity available. It could be used. At the moment, the demand from the—

Q155 **Mr Francois:** When we have all these shortages of pilots, you would think that we would want to turn the wick up, so who is asking you to turn the wick down?

Paul Livingston: The discussion with the Ministry of Defence and the Royal Air Force has been to hold back because the operational conversion units could not take those extra people if we trained them. They would simply be held for longer and need to be refreshed for longer.

Q156 **Mr Francois:** So you are saying that the bottleneck is in the OCUs.

Paul Livingston: Today, the bottleneck is the OCUs. I spoke with the deputy chief of the Air Force last week. He concurred, and shared his confidence with me that Ascent is delivering what is asked of it for this year's flying training programme, and for the next two years flying training programmes as we look at it.

Mr Francois: It is still seven years.

Q157 **Dave Doogan:** There is an evolution with primes in defence contracting in



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the United Kingdom where primes manage the MoD customer in a more responsible way and help the MoD to understand better what it is that it actually wants, rather than quite often what the MoD thinks that it wants, which changes 15 times between asking for and actually getting it, all at huge additional cost and delay to the services and the taxpayer respectively.

As with Crowsnest, didn't the prime contractor have a responsibility to tell the MoD that smashing a mechanically scanned array radar that operated in an analogue way, which is a geriatric system, into a digital battlespace management scenario was a profoundly bad idea, and that what they actually wanted was electronically scanned array radar? That would have provided that airborne early warning. It would have done it much quicker and would probably have been cheaper in the long run.

Paul Livingston: You may be aware that the original competition for what became Crowsnest was run by Lockheed Martin as a prime contractor on behalf of the MoD based on the performance, risk and cost parameters that the Ministry of Defence set. Two options were offered. One was the reused Thales radar, with Thales putting a new digital backend on to it. The other was Lockheed Martin's internal bid, which was an electronically scanned array radar, which was basically four panels in pods to give you that coverage. Based on the parameters of the competition that the MoD asked us to run, the Thales bid was clearly the one that was successful. All of us could look back now and say that that potentially was not the right answer, but I would say to you that Lockheed Martin's internal bid was an AESA radar.

Dave Doogan: Right, okay—I think that was a yes.

Chair: Anna has been a bit left out in this early exchange, but we now come on to questions for both companies from Gavin Robinson.

Q158 **Gavin Robinson:** Thank you, Chair. I will come to you first, Anna, so that you can contribute productively to this session. You both work for American companies. I think it would be useful for us, when we are considering future aviation procurement opportunities, to understand how much of a corporate risk you consider the current economic situation and the fluctuation in the rate of the dollar versus the pound to be.

Anna Keeling: Boeing is a responsible procurement partner to the Ministry of Defence of the United Kingdom, and some of the advantages of contracting with an organisation such as ours is that we are a large-scale global organisation. We are used to dealing with the types of market fluctuations that we are seeing today, so we have that experience. In the United Kingdom we have a presence of over 80 years.

When it comes to contracting with primes such as Boeing, we offer the Ministry of Defence the type of contract that it wishes to contract with us on. With Boeing Defence UK, the majority of our contracts—in fact, all of our contracts—here are direct commercial sales, direct into Boeing Defence UK. These are long-term, fixed-price contracts. We offer the Ministry of Defence the ability to contract either in pound sterling or in US



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dollars or in a mixture. Predominantly, the contracts with Boeing Defence UK are denominated in pound sterling today. Because we take this very long-term view of those contracts in collaborating with the Ministry of Defence, we obviously do our very best to provide the capability that the Ministry of Defence needs within the budgets that it has available.

Q159 Gavin Robinson: Do you fear that there will be a reduction in prospective orders, given the economic situation?

Anna Keeling: That is not for me to say. We are here in order to demonstrate value for money. Our direct commercial sales are governed by single-source regulation, so there is full transparency to both the Government and the Ministry of Defence on the costs of those contracts, and within those we are also creating sovereign capability. If you take the example of the P-8 programme, the platform was a foreign military sale—Government to Government—but all of the training, sustainment and support is contracted here in the United Kingdom with Boeing Defence UK and our local suppliers, so that is sovereign capability.

We source 5% of every single P-8 aircraft from the United Kingdom—these are parts that are then exported to the United States—and because this is a global programme that provides economies of scale, the suppliers that supply into that production line actually supply for over 150 of the aircraft that are flying, not just the nine procured by the United Kingdom.

Q160 Gavin Robinson: Were P-8s purchased in dollars or pounds?

Anna Keeling: As an FMS contract, that is a conversation for Government to Government. I can only assume that they were purchased in dollars.

Q161 Mr Francois: But you just said most of the contracts were in pounds.

Anna Keeling: For Boeing Defence UK—the direct commercial sales contracts placed here in the United Kingdom. In terms of foreign military sales, Government to Government, it is a question for the Ministry of Defence as to how it contracts those.

Q162 Chair: What is the ratio between FMS contracts and your sales in Ministry of Defence terms?

Anna Keeling: It is a very good question, and I am aware that the Ministry of Defence does publish figures. In fact, it is very difficult to obtain that information, and it is not information that we have to hand.

Q163 Mr Jones: I am sorry, but that is nonsense. You sell it. You know how those contracts are done. I will give you a few examples. Wedgetail is a Government-to-Government contract. P-8 is. You have two there that are in dollars.

Mr Francois: Apache?

Mr Jones: Apache is Government-to-Government, so you have three major Government-to-Government programmes that are in dollars. You are trying to give the impression to the Committee that there was an option for the Government, but that is not true for those three major



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contracts, because they are not with this fictitious Boeing UK company, so they are all in dollars.

Anna Keeling: We employ over 3,000 local people here in the United Kingdom. It is a British workforce.

Q164 **Mr Jones:** I don't want to know that. Listen, we will come on to the work share in a minute. I have a question about the work share, and I shall give you my opinions about that then. You must know as a company how much of the contracts with the MoD—whether it is Boeing UK or Boeing US—is in dollars or pounds.

Anna Keeling: Let me clarify that. The E-7 contract is a direct commercial sale to Boeing Defence UK; it is not an FMS contract. Apache—

Q165 **Mr Jones:** Hang on, let's deal with that one. Is that in dollars or pounds?

Anna Keeling: That is a combination of currencies—both dollars and pounds.

Q166 **Mr Jones:** Percentages?

Anna Keeling: I don't have those to hand.

Q167 **Mr Jones:** Could you let us know, please?

Anna Keeling: If that is not commercially sensitive information, yes.

Q168 **Mr Jones:** If you are going to write to us on that, could you also say which bits of it are which? Is it the ongoing through-life maintenance of the contract, or is it the actual purchase of the airframes and the thing itself?

Anna Keeling: I can clarify the split. Certainly, we split those currencies where it makes sense to do so.

Q169 **Mr Jones:** From your point of view or the MoD's?

Anna Keeling: That is a conversation in collaboration with the Ministry of Defence. We do that together.

Mr Jones: This is not very convincing, I have to say.

Anna Keeling: Where the aircraft comes from the United States—let's take the E-7 programme or the P-8 programme, which have come from the United States—

Mr Jones: Or China in one case.

Anna Keeling: Yes, it makes sense that those contracts are in US dollars. For our contracts here in the United Kingdom, for services and goods procured here, of course it makes sense to denominate those in British pounds, so as I said, that is how we operate—

Mr Jones: It is a long way around, but you have answered the question. The bulk of the actual contracts are in US dollars.

Mr Francois: Yes.

Q170 **Gavin Robinson:** I will come back in here if you don't mind. A lot of your answers would suggest benevolence on the part of Boeing when you work with UK MoD. That's not my experience. I'm sure you were briefed on that before. We don't need to labour over our most recent history. My question was: what risk have you identified with the fluctuation in currencies and the economic situation? You have answered an awful lot since that question was asked, but we haven't really discerned the associated risk. You will see that my colleagues are now very excitable in probing the answers that you have given.

Mr Francois: Interested, I would say.

Gavin Robinson: Interested—and rightly so. But we haven't really discerned the risks, so can I bring you back to that first question? There is perhaps greater risk now in answering the question, given the interest of others. Genuinely, what risk is associated with future procurement opportunities, given the fluctuating currency, the myriad arrangements that you appear to have and the economic situation?

Anna Keeling: Given that we are here for the long term and we have experience in these global programmes, we manage that risk very transparently—

Gavin Robinson: Unless it is commercially sensitive.

Q171 **Mr Jones:** With respect, that is just PR spin, frankly. That means nothing.

Anna Keeling: I will use the E-7 programme as an example, since it has been cited. The larger cost generally is seen through life. Through that procurement, we are committing that over half the contract value through its life will be spent here in the United Kingdom. Other than the purchase of the aircraft, we are looking to source as much as possible here in the United Kingdom.

Q172 **Mr Jones:** The bulk of it is actually from the United States—the purchase of the aircraft, plus half the maintenance. Some of the maintenance can only be done in the United States, can't it?

Anna Keeling: No, the maintenance of the aircraft will be performed here in the United Kingdom.

Q173 **Mr Jones:** No. I have asked questions about the intellectual property and source code, for example. There are things that cannot be done here and have to be done in Florida

Anna Keeling: We are currently working to create a mission system capability here in the United Kingdom as part of that commitment. As I said, over half the total programme cost will be spent here in the United Kingdom with Boeing Defence UK and our suppliers.

Q174 **Mr Jones:** Can I just play devil's advocate? If I were a Congressman or a Senator and you said to me that half of the programme was only being spent in the United States, you would get an absolute grilling. You know



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that that is not how US defence procurement works in terms of your company in the United States or, for example, Airbus or any other UK company that wants to procure things in the United States. They must ensure that the bulk of that work is done in the United States—those are the facts of life. What we have basically done with these three contracts is give Boeing and US taxpayers the benefit of our taxpayers' pounds when they could be spent here, rather than in the United States.

Anna Keeling: I would disagree.

Q175 **Mr Jones:** Half of it is. I will tell you something: if I were a Congressman, you would not get away with that answer in the United States Congress, would you?

Anna Keeling: It is really important to note that the Ministry of Defence has bought into the E-7 capability, which exists today and is flown by the Royal Australian Air Force, South Korea and Turkey. There is no active production line for the E-7 other than here in the United Kingdom.

Mr Jones: There is an alternative. You could have not bought the E-7 and done something else.

Q176 **Gavin Robinson:** Paul, do you foresee or have you identified any corporate risks given the economic situation and the fluctuation in currencies?

Paul Livingston: Absolutely. We also have to look at it through both lenses, because we spend an enormous—

Q177 **Gavin Robinson:** So you do see risk, yes?

Paul Livingston: Of course. We have an enterprise risk management system at Lockheed Martin. This year we have surveyed all of our senior leaders around the world and looked at what we think are the highest enterprise risks to manage, and you will be unsurprised to hear that two of the subjects right near the top of our top 10 are global currency fluctuations and inflation.

We do have to balance it. We have the luxury, in some ways, of balancing it both ways. For example, on a programme such as the F-35, which is a US Government contract so we get paid in dollars, an awful lot of that—15% of every aircraft—is spent with UK companies. For a lot of them, their contracts with us are in pounds sterling. We have the ability to balance currency risk a little bit like that, particularly when you think that one quarter of UK defence exports are to Lockheed Martin—we represent 25% of the defence export market of the UK.

We manage things such as currency risk. Also, through the pandemic, as an example, we spent over £750 million in advance payments to UK suppliers to ensure that they kept healthy. There are those kinds of enterprise risks and the cost of inflation. Obviously, we signed up to things such as the prompt payment scheme for small and medium-sized enterprises, but we accelerated payments during covid even beyond that. When you have a complex supply chain and there is a really small, 30-



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person company in the north-east that is building the critical component that you need for the whole supply chain, you do not want to end up not delivering an aircraft because one piece is missing because you did not look after that supply chain.

Q178 **Gavin Robinson:** You mentioned £750 million. I assume that was over two years?

Paul Livingston: Just about two years. We have stopped counting now, but we were making accelerated payments all the way through the period of Government furlough and beyond.

Q179 **Gavin Robinson:** Did you sustain your supply chain throughout that time, or was there any aspect of it that failed despite your support?

Paul Livingston: We sustained our supply chain, nor did we in the UK, with our 1,600 employees, furlough a single member of staff.

Chair: We will move on to work share issues, including on the F-35, although we have already touched on the E-7.

Q180 **Mr Jones:** This is to both of you. In terms of manufacturing in the UK, what is your workforce or the number of jobs that you support in the UK?

Paul Livingston: At Lockheed Martin, there are just over 1,600 employees spread around the UK.

Q181 **Mr Jones:** Direct employees?

Paul Livingston: Direct employees, yes. There are then just over 400 in joint ventures and, through our investments that I alluded to—the 25% of defence exports for the UK—we sustain another 28,000 jobs in the UK supply chain.

Q182 **Mr Jones:** Is that because of the work share you get from the F-35?

Paul Livingston: The F-35 is by far the largest single component of that, but there are other programmes where we contract with UK suppliers to benefit our UK supply chain. What we are looking to do in our next big growth phase, if I can touch on it, is realise our aspiration to build on the investments we have already made this year in the north-east of England to build a satellite manufacturing facility up there, assuming that the competitive conditions are right for us to make those investments.

Mr Jones: You are very welcome in the north-east, Paul. Anna?

Anna Keeling: We have a highly skilled workforce of over 3,000 UK employees.

Q183 **Mr Jones:** Are they direct employees of Boeing?

Anna Keeling: Yes, they are. There are currently 300 vacancies, and we are hiring. Since 2015, we have spent over £12 billion in the UK supply chain. We work with a network of over 300 UK-based suppliers. We have invested in our first European manufacturing facility in Sheffield. That produces actuators, which are exported to the 737 production line.



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Q184 **Mr Jones:** Can I stop you there? I have had this from Boeing before. Can we separate Boeing commercial from Boeing UK military? When you are claiming jobs, I know there is a tendency to pick and choose which one you want to get the higher number. Those 3,000 jobs—are we talking about Boeing UK in terms of military?

Anna Keeling: That is Boeing UK. The larger proportion are Boeing Defence UK, but I would have to get the precise split.

Mr Jones: That would be helpful.

Anna Keeling: I would assume that at least 1,600 to 1,800 of those are Boeing Defence UK. We have some shared resources across the entire Boeing entities in the United Kingdom.

Q185 **Chair:** When you are talking about that 1,600 to 1,800, what percentage of them would be at existing facilities that you have acquired—for example, helicopter maintenance and so on? In other words, how much new investment, particularly in manufacturing and production, have you brought into the UK on the back of all these contracts?

Anna Keeling: Again, we do look at our prosperity agreement holistically, and there has been over £300 million of capital investment since 2015. Of course, we have the joint investment of £100 million into RAF Lossiemouth, which is specific to the defence portfolio.

Q186 **Mr Jones:** It is, but even if another company got that, they would have acted on it, so that is not a commitment for yourself, is it? You would have had to do that if, for example, Saab or any other company had got the contract.

Anna Keeling: Could you please clarify that? I am not sure I understand your comment.

Q187 **Mr Jones:** Frankly, I get sick and tired of the MoD claiming these huge jobs at Lossiemouth. Whoever got the contract would have had to put that investment in. When was Boeing UK started as a company in the UK?

Anna Keeling: It was incorporated on the back of the Chinook programme. From memory, it was around 2011.

Q188 **Mr Jones:** I will tell you why I ask that. I remember a meeting with quite a number of Members of Parliament, including members of this Committee, and Boeing UK at that time. What you committed to then was to grow the workforce in the UK, and you were going to invest in R&D. I always remember the company saying, "Boeing is no longer going to be just an exporter of technology from the United States; we are going to grow it here," and there was huge commitment. It is now 11 years later, and you somehow have just over 600 direct employees of Boeing Defence. In that period, it has been Christmas for you in terms of the contracts you have got, and I have to say that I have not seen the same commitment in terms of what was given then. That is why I keep asking the questions of Boeing. I am not opposed to international sales and



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international collaboration, but I do question your company's commitment to delivering on what was said at the meeting we had about the days of Boeing just exporting things from the United States being finished. They clearly are not, because you are still doing it.

Anna Keeling: We are extremely proud of our prosperity agreement, I have to say, and we are very passionate about it. It is reviewed by the Minister for Defence Procurement and the Aerospace Minister every year.

Q189 **Mr Jones:** I agree. Listen, my criticism is not necessarily of you. You have been given presents and you have taken them—I don't blame you. I criticise the MoD for not insisting that you actually stick to what you promised back in 2011, and you have not.

Anna Keeling: And we have invested deeply in the United Kingdom—

Q190 **Mr Jones:** I am not an isolationist, but I will come back to my point: if I were a Congressman sat here, and you said that in 11 years, on these multi-billion-pound contracts, you would have created basically 600 jobs in the UK—

Anna Keeling: Over 1,600—3,000 in total—

Q191 **Mr Jones:** Yes—in 10 years! If I were a US Congressman, I would want to ensure that, if you had huge contracts from this country, manufacturing and other things would be in the UK. You know that from your experience with Boeing in the United States—they insist on that. I do not blame you—you were given a prize and took it—I blame Ministers for not insisting that bigger work share and investment should go into the UK.

Anna Keeling: Investment continues to come into the UK—

Mr Jones: It does, but not enough.

Anna Keeling: And we present good value for money.

Q192 **Mr Jones:** I do not accept that from a UK taxpayer's point of view, because I am interested in ensuring that we have long-term viability of UK skills and investment—

Anna Keeling: We are investing in those deeply. We have an active pipeline, an early careers pipeline, and we utilise our apprenticeship levy fully, annually, for all the sustainment, support and training that Boeing provides in-country—a sovereign capability delivered by UK people. We are investing in R&D, which we are looking to lead to export opportunities. Today, for example, we are investing in UK-unique autonomous systems behaviours; we have invested in Lossiemouth; and we are now talking about a potential centre of excellence with the rotary wing enterprise, looking at driving greater economies of scale across our vertical-lift portfolio. Our prosperity activity here is deep, and we are deeply committed to that.

Chair: I think we have exhausted that particular aspect, although the Committee remains deeply unconvinced, I am afraid. Mark Francois for the next question.



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Q193 **Mr Francois:** Turning to the F-35, Mr Livingston, last year the Secretary of State told us that he would not place a further F-35 order until the issues of spiralling costs and UK weapons integration had been addressed. We have now ordered, I think, 74 or 76 in toto—

Paul Livingston: We only have a contract for 48 to date.

Q194 **Mr Francois:** But we have announced our intention to order further. We have not placed the contracts yet. What are you doing, first, to control costs? Without being unkind, the F-35 was nicknamed the “jet that ate the Pentagon”. Secondly, what are you doing to speed up the integration of non-American weapon systems, like Meteor, for example?

Paul Livingston: Okay, those are two excellent questions. First, the unit recurring flyaway cost, which is if you like the windscreen-sticker price per aircraft, has come down—I am talking about the F-35Bs, because I assume the Bs are what the Committee would like to focus on—by 51% since the start of the programme and 39% since the first UK delivery. The programme cost is not spiralling; it is reducing. We have signed the F-35 handshake agreement—it is called UCA, a weird acronym I wish I could remember the phrase for—for the next three lots, lots 15 to 17 of the aircraft. Again, cost has come down and cost growth is less than inflation, which in these times is quite the achievement.

Q195 **Mr Francois:** When we get into individual lot costs, as you well know, it all gets very complicated. As notes appear to be the order of the day, perhaps you can give the Committee a detailed note on the actual lot-by-lot costings, rather than trying to go into the weeds of it now, because in all seriousness it would take a long while.

Paul Livingston: Happy to do that.

Q196 **Mr Francois:** Right. If our numbers go up to the mid-70s from 48, are you basically telling the Committee—in layman’s English—that those aircraft will be cheaper to buy than the 48 we have already bought?

Paul Livingston: They should be, with the one caveat that it depends on the delivery profile.

Mr Francois: Right.

Paul Livingston: Cost is a factor on volume. As you build more jets or buy more jets together, that improves the cost per unit. At the moment, the UK has taken the decision to take its near-term purchases and spread them out further; this is part of the 48 that are already on contract. So those delivery dates have gone. We were expecting—I think it was eight, eight and nine in the next three lots; it’s nowhere near that. As those lots get negotiated, with less Bs per lot, that may alter the price of the B. I can’t say yet to what extent it alters it, because that will depend on the volume and depend on the volume of other B customers.

Q197 **Mr Francois:** I think you’re trying to be straightforward with us, so, as this gets very complicated, perhaps you could give us a note. I think the Committee is concerned to hear that, within the 48 that we think we have



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already ordered, even those deliveries are slipping to the right, let alone the follow-on aircraft.

Paul Livingston: Just to be clear, it's not our deliveries that are slipping; it's when the MoD are choosing to take their options in those lots that has been changed.

Q198 **Mr Francois:** Yes, but at the end of the day, it's when the aircraft could fight—that is what it's ultimately about.

Paul Livingston: There is a defined price, with the Government, per lot of aircraft; lots 15, 16 and 17 are the ones that we have just done the handshake agreement on. It depends on what lots the UK decides to pull its Bs from, and that is a discussion between the MoD and the Joint Program Office.

Mr Francois: So that's ongoing? Weapons integration, please.

Paul Livingston: I know, sir, that you asked the Ministry for Meteor integration dates in a very recent parliamentary question, and I believe they declined to answer date-wise, on grounds of national security. So I don't really feel I can get out in front of the Minister for Defence Procurement and talk about dates. What I will say is that Lockheed Martin works hard to inform the integration forecast for weapons integration. There is a live discussion going on between the JPO and the nations—there are now 16 partner nations in the programme—to determine the priorities. Also, some nations have specific certification requirements that are different from others, and some weapons manufacturers have different certification requirements. We take all that data in and we offer a forecast to the JPO of what things can be done when. Ultimately, it is a decision between the customer community and the Joint Program Office, which then flows down to us in what is called the air systems playbook, which is what we then have to deliver to.

Q199 **Mr Francois:** Yes, but again—in layman's English—because it's an American aircraft and it's an American-led JPO, the American stuff always seems to get priority and so non-American weapons, like Meteor, have to fight like crazy to actually get into the programme. We know that. ITAR requirements are a factor in this, too. Are ITAR requirements still a barrier to UK-US co-operation on defence programmes generally and on F-35 specifically?

Paul Livingston: Thank you for that. Obviously, ITAR is there, along with all other countries' export regulations around defence products, to safeguard technology and maintain operational advantage for the allies. I know that ITAR has a reputation for being onerous and has become somewhat of a pejorative term.

Mr Francois: Slightly, yes!

Paul Livingston: When the Secretary of State for Defence appeared in front of this Committee on 2 November, he talked about the Americans moving towards an OGL, open global licence, for the UK, Canada and Australia, which would, we think, speed the discussions around or smooth



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the process around other programmes. What I would say on the F-35 specifically is that of course it has its own MOU, which governs all the data transfer, so it doesn't actually fall under ITAR in terms of between the US and the UK; it falls under the negotiated F-35 memorandums.

Q200 Mr Francois: Lastly—then I'll hand back—what is the cost per flying hour of an F-35B?

Paul Livingston: The cost per flying hour is something that—you're going to hate me saying this, so I will put the warning out there now: I cannot give you the cost per flying hour, because I do not own all the elements of it and I don't have visibility of all the elements of it. There are five elements to the cost per flying hour, two of which it is entirely outwith our ability to understand, which are manpower cost and operations cost for the Royal Air Force and the Fleet Air Arm, which would include fuels and things like that. There are then the bits that we do influence, which are the maintenance, the sustainment, and the training. Some of those we have a very good understanding of, and some of those we have a partial understanding of, because, for example, the propulsion system is contracted separately, so Lockheed doesn't have visibility of those costs. What I can tell you is that from 2015 to 2021 we had a 50% reduction in Lockheed Martin sustainment costs, and from 2022 to 2027 we are forecasting to come down another 35%. We are continuing to burn down the elements that we control by a significant amount.

Q201 Mr Francois: For the elements that you are responsible for, what is the cost per flying hour? What is the cost of "your share" of it?

Paul Livingston: I would have to write to you on that, I am afraid. I don't have a number in front of me.

Q202 Mr Francois: Okay, if you are saying that quite a few of those elements are in your control, but not all of them, that is a fair answer. Will you come back to the Committee with a note on the cost per flying hour of an F-35B in UK service for those elements? You can do that, right?

Paul Livingston: For what Lockheed Martin charge, yes, of course we can.

Q203 Mr Francois: Thank you. As you well know, one of the criticisms is that this is an extremely expensive aircraft to operate.

Paul Livingston: If I could answer that, you also have to look—as the Mitchell Institute for Aerospace Studies did recently—at cost per effect versus cost per aircraft. When my predecessor last appeared in front of the Committee, there were only 260 aircraft on a handful of bases. We now have over 865 delivered to 36 bases and 16 nations on contract. The programme has come a long way and there are a lot of aircraft out there, but the F-35 is only a quarter of the way into its programme of record. I suspect that if you went back to when comparable aircraft such as Typhoons were 25% down their production run, they probably had a significantly higher sustainment cost than they do today.



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The reality is that the F-35 can achieve effects that would otherwise take multiple aircraft types in formation. The actual cost per mission is what we should really look at as a value-for-money metric, as opposed to cost per flying hour. That said, I also point out that we have won every competition that has been fought this year, including the Swiss competition where it was published that we were the highest performance for the lowest cost. Countries continue to select the F-35.

Q204 Robert Courts: Ms Keeling, may I go back to E-7? The IOC was meant to be in 2023, but it has now slipped to 2024. Can you tell us why?

Anna Keeling: As we have heard, all of industry, not just defence, has been tackling the pandemic and working through that. It has exacerbated supply chain issues. Wherever we sit in the industry, we have all experienced workforce challenges. We have spoken about inflation. All those elements have impacted the delivery of the programme, and we are working as diligently as we can through all of that to ensure that we deliver it as quickly as possible.

Q205 Robert Courts: What in particular and why? Can we have some more specifics on this? You mentioned inflation, which on the face of it should impact cost rather than the initial operating capability date. What thing has actually caused that to slip to the right from 2023 to 2024?

Anna Keeling: Supply chain is one of the largest challenges. It is important to note that when we first contracted the E-7 back in 2019, together with the Ministry of Defence we made the best assessments on schedule that we could at that time. No one within industry predicted a global pandemic; no one predicted the impact that would have on supply chain resilience. That has been the biggest driver. We are currently working through a very detailed schedule assessment. You may be aware that the Ministry of Defence is preparing itself for the submission of its full business case in early 2023. This might be an important point for me to clarify: the IOC is a matter for the Ministry of Defence; Boeing is responsible for the delivery of the first aircraft. Our current assessment is that that will be in 2024.

Q206 Robert Courts: So it is 2024 for delivery? Could you talk us through that a bit more? The IOC is the moment when you have it in service with its initial capabilities, not up to full spec. But that applies to the MoD?

Anna Keeling: That is correct; the in-service date is what Boeing is responsible for.

Q207 Robert Courts: So your point is that supply chain pressures have meant that has had to slip to the right?

Anna Keeling: Predominantly, yes.

Q208 Robert Courts: How has that manifested itself? Have you not been able to get hold of parts, or have people not been able to make them?

Anna Keeling: Yes. As an example, on parts provision to the E-7 build here in-country, we are currently seeing an average increase in lead times of 244 days.

Q209 **Mr Jones:** The original contract was for \$1.9 billion for five aircraft. It is now down to three aircraft. The full business case has not been made yet—I have asked questions around that. Where does the responsibility for delays lie? If the business case has not been made by the MoD, it seems very strange to start manufacturing these aircraft. What will we be paying for three as opposed to five?

Anna Keeling: I do not have full visibility of all those costs, so obviously I am not able to share that. Yes, I understand that the full business case is currently being put together. The original requirement was certainly for five. We are responsible for delivering what our customer asks us to deliver. We were, of course, approached by the Ministry of Defence to still deliver this programme, and this remarkable capability, to the United Kingdom despite the reduction in fleet size. We worked through that diligently and are now supporting the Ministry of Defence in its full business case submission.

Q210 **Mr Jones:** Where does the legal responsibility for delays lie? Is it with you or the MoD?

Anna Keeling: We have been working at this from the very beginning. We are certainly responsible for the management of our supply chain. We are responsible for the delivery of the aircraft itself. We are responsible for ensuring that we have a workforce. Again, it is important to note that we delivered this contract at pace. It was contracted within a matter of nine months—not the typical two to three years that we might see in a defence programme. The pandemic came about rather quickly. We established a production line here in the United Kingdom, in Birmingham, during the start of the pandemic, and started the modification of those aircraft.

Q211 **Mr Jones:** Can I ask about STS Aviation? It has never converted this type of aircraft before, as I understand, and it has no legacy capability. Do you believe that it is wise to commence the contract without an actual business case? Does STS have the capability to deliver this aircraft?

Anna Keeling: I will answer those points in order, if I may. An initial business case was submitted by the Ministry of Defence.

Mr Jones: For five.

Anna Keeling: Absolutely. We commenced the programme on that basis. The request to reduce fleet size happened, if my memory serves me correctly, in 2020—over a year into that programme—and we responded to that because it was the right thing to do.

Q212 **Mr Jones:** I accept that, but if you buy more, it is usually cheaper than buying less.

Anna Keeling: And there will be cost savings.



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Q213 **Mr Jones:** Well, no, not necessarily. If I buy five of something, I can get a better deal than if I buy two or three. Is the cost going to go up? I am concerned about STS, because it has never done this work before. There is a risk there.

Anna Keeling: We carried out due diligence in terms of securing a production partner on the E-7 programme. We have full confidence in STS. What we have on the ground is a highly skilled workforce, which is a combination of Boeing Defence UK people and skilled STS people. Of course, we reach into the broader Boeing organisation for the expertise required.

Q214 **Mr Jones:** Of the STS workforce, how many are UK personnel as opposed to Australian or US personnel? If you do not know the number, you can write to me.

Anna Keeling: The STS workforce is a British workforce. It is Boeing—

Mr Jones: With great respect, it's not, is it? Some of the personnel are either Australian or US.

Anna Keeling: That is the skilled workforce that Boeing has brought to bear. We have brought in the subject matter experts who have built these aircraft before, relayed that expertise, and upskilled our local workforce so that we have a sovereign capability.

Q215 **Mr Jones:** It would be interesting to have a breakdown of the actual UK workforce, and what percentage of it is from Australia or the US.

Anna Keeling: I would have to write to the Committee. It is a smaller number.

Mr Jones: No problem.

Anna Keeling: What I can share, and this is obviously not specific to the E-7 production line, is that at any one time, of course, Boeing here in the United Kingdom will leverage the expertise of its global workforce. Today, we have no more than 1% of individuals who are providing that technology transfer—knowledge and skills transfer—to our workforce here in the UK so, predominantly, we are a United Kingdom workforce.

Chair: Can we move on to the final point, which is about availability?

Q216 **Mr Francois:** Ms Keeling, do you accept one of the early lessons from the war in Ukraine is that the Russians are prepared to use large numbers of cruise missiles to hit fixed targets?

Anna Keeling: They are the reports, yes.

Q217 **Mr Francois:** Right. We have a limited number of radar stations along the east coast. If NATO were to go to war with Russia, it is not unreasonable to assume that they would be priority targets for our opponents, is it?

Anna Keeling: Not unreasonable.

Q218 **Mr Francois:** If they cruise-missile all our fixed radar sites on the east



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coast, we cannot use the E-3D AWACS because we have withdrawn them. The replacement is the E-7; we cannot use Crowsnest, because even the Navy cannot make it work at the moment. That is a mess. We have not got any airborne early-warning aircraft at all. We would be blind, wouldn't we?

Anna Keeling: I am not sure what other capabilities exist within the Ministry of Defence.

Q219 **Mr Francois:** We just don't. I know what you are referring to, but in terms of something that can go up there with a radar and see other aircraft coming in to attack the United Kingdom, we would have nothing, so the delays to these programmes are extremely worrying in terms of our national security after the Russian invasion of Ukraine. Would you agree?

Anna Keeling: Yes.

Q220 **Mr Francois:** That being the case, the fact that the programme has slipped a further year, so the capability gap has got wider and longer, is very concerning, is it not?

Anna Keeling: It is, and our responsibility is to continue focusing on delivering that capability as soon as possible.

Q221 **Mr Francois:** And yet you have told the Committee—candidly, to be fair—that the MoD has not even finished the full business case. How can that be? If we were now in wartime, we would effectively be blinded.

Anna Keeling: I cannot respond for the Ministry of Defence but, again, I stress the circumstances under which this capability is being delivered—a proven capability, I might add, that has had great success in missions of the Royal Australian Air Force.

Q222 **Mr Francois:** With respect, that is why we are keen to get our hands on it, for all the reasons we have just explained to you. We are not saying that it does not work; we are saying we want it more quickly. We are very concerned that, after the Russian invasion of Ukraine, we are potentially highly vulnerable. The number was cut from five to three. If it was going to cost approximately £1.9 billion for five aircraft, what is it going to cost for three?

Anna Keeling: I am not able to discuss those matters.

Mr Francois: Why not?

Anna Keeling: The full business case has not yet been submitted. We were certainly set some targets around cost savings to keep the programme, and that is what we have committed to delivering. It is really important to note this. As I said, we are living in really uncertain and turbulent times. We are doing everything we can to deliver this programme as soon as possible. We will not compromise quality or safety.

Q223 **Mr Francois:** But in essence, you are telling the Committee that our E-3s are gone, the programme has already slipped by a year, you can't tell us



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as we sit here today how much these aircraft are even going to cost—

Mr Jones: It's not her fault.

Mr Francois: I understand that. None the less, you can't absolutely guarantee to us when the aircraft will enter service—correct?

Anna Keeling: What I can tell the Committee is that we are doing everything possible to deliver the capability. Our current assessment is that the first aircraft will be delivered in 2024. What I can say is that we are utilising our full resources, deploying people into the supply chain—

Q224 **Mr Francois:** Lastly, IOC is normally defined in quarters. IOC in layman's English is when the thing turns up and works. In which quarter of 2024 will the E-7 achieve initial operating capability with the Royal Air Force?

Anna Keeling: Regrettably, that is a question for the Ministry of Defence. What I can share—what is our responsibility, as I say—is the delivery of that first aircraft, and that will be, as per current assessment, later in 2024. We would be very happy to share full information once that business case is submitted. That is the time when that deep assessment of the schedule will be completed.

Chair: And that should make our session with the Royal Air Force extremely interesting, when they come to see us. Thank you very—

Mr Francois: Sorry, no, no.

Chair: Mark.

Mr Francois: No, Chair. Surely, no. This is about national security.

Chair: No, it isn't, Mark.

Mr Francois: It is. Surely the Ministry of Defence—not you, but the Ministry of Defence—should have worked all this out before it took the Sentries out of service. Surely that would have made more military sense in defence terms, wouldn't it? Before it took the thing out of service—

Chair: Mark, they can't answer that question. It's a question for the Ministry of Defence and the Minister, and a question for the Royal Air Force, which we will deal with at our next session. Thank you very much for an interesting session.