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TAKEN BEFORE

DEFENCE COMMITTEE

THE FUTURE OF THE UK'S DEFENCE STRATEGIC NUCLEAR DETERRENT: THE
WHITE PAPER

Tuesday 23 January 2007

PROFESSOR RICHARD L GARWIN, MR PAUL INGRAM, DR STEPHEN PULLINGER
DR JEREMY STOCKER and DR LEE WILLETT

Evidence heard in Public Questions 135 - 208

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Oral Evidence

Taken before the Defence Committee

on Tuesday 23 January 2007

Members present

Mr James Arbuthnot, in the Chair

Mr David S Borrow

Linda Gilroy

Mr David Hamilton

Mr Adam Holloway

Mr Bernard Jenkin

Robert Key

Willie Rennie

John Smith

**Memoranda submitted by the US National Academy of Sciences,
British American Security Information Council, International
Security Information Service,
International Institute for Strategic Studies and Royal United
Services Institute**

Examination of Witnesses

Witnesses: **Professor Richard L Garwin**, US National Academy of Sciences; **Mr Paul Ingram**, British American Security Information Council (BASIC); **Dr Stephen Pullinger**, International Security Information Service (ISIS) Europe; **Dr Jeremy Stocker**, International Institute for Strategic Studies (IISS); and **Dr Lee Willett**, Royal United Services Institute (RUSI), gave evidence.

Q135 Chairman: May I begin by welcoming all of you to the evidence session on the strategic nuclear deterrent and may I also welcome some Hungarian parliamentarians who are here to watch what we are doing and to make sure we do it right. To the witnesses, may I give you a particular welcome and may I ask you to introduce yourselves please, perhaps, Professor Garwin, starting with you, and to give just the very briefest background about you and then we will ask you about the White Paper and the strategic nuclear deterrent.

Professor Garwin: I am Richard Garwin, a physicist and a long-time member of the President's Science Advisory Committee and head of various military panels, including the Naval Warfare Panel in 1971, the Submarine Warfare Panel and the Aircraft Panel, and I have been working with nuclear weapons since 1950 to the present day.

Mr Ingram: I am Paul Ingram from the British American Security Information Council. I have written a few papers on the Trident replacement and was the author of the Green Paper *Decisions over*

the Future of British Nuclear Weapons, which I believe all members were sent at the beginning of December, before the White Paper came out.

Dr Willett: I am Lee Willett, Head of the Maritime Studies Programme at the Royal United Services Institute or RUSI. I am responsible for running what we are doing on the deterrent issue and I am one of the co-authors of a forthcoming paper on the White Paper and our thinking on what it means.

Dr Pullinger: I am Stephen Pullinger. I am Executive Director of the International Security Information Service (Europe) which is based in Brussels. Whilst I have been there for 18 months, I did spend 15 years in this country working on these issues and that is why I have retained my interest and that is why I am here today.

Dr Stocker: I am Jeremy Stocker. I am a consulting research fellow at the International Institute for Strategic Studies where I have been working on a paper entitled, "Nuclear Deterrence in the United Kingdom", which will be published at the end of next month.

Q136 Chairman: May I begin by asking each of you to summarise, in two or three sentences, your basic reaction to the Government's White Paper so that we have got an idea of the general approach you take to this White Paper.

Dr Stocker: I think, in the main, the White Paper gets things absolutely right. There are some unanswered questions, but, in terms of the decisions it has made about the future of the deterrent capability, I think it is the right answer, albeit probably an inevitable conclusion. What is missing from the White Paper is a broader strategy to tackle proliferation which ties in with deterrence, but also diplomatic and defensive measures into a more all-encompassing strategy to counter proliferation and that is what the White Paper does not address.

Dr Pullinger: I think, following on from that, my essential critique is really to do with the non-proliferation aspects of this question and I think the White Paper underestimates the threat that is posed currently to the non-proliferation regime. Accordingly, it does not reorder nuclear priorities to put exactly non-proliferation at the top of the list, rather that it still seems to be thinking about deterrence primarily as the threat which has to be met. There is a reordering which needs to take place which is not reflected here and the White Paper does not make the connection between denuclearisation and non-proliferation. To me, non-proliferation can only ultimately be successful if we also follow the parallel path and integrated path we need of denuclearisation. Therefore, what I would have liked to have seen was our nuclear weapons policy, our nuclear doctrine and our non-proliferation policy all in synchronicity and I do not see that in this White Paper.

Dr Willett: I think it is fair to say that the White Paper is arguably the most comprehensive, open and official review of Britain's nuclear deterrence policy and policy on capability that we have seen. It makes no significant changes to the Government's

policy, the British policy, but it does clarify some important aspects of the Government's position. It is a White Paper, not a Green Paper, so rightly it makes a policy recommendation and I support the recommendation which has been put forward, although I would admit that there are certain significant caveats and significant questions which still need to be looked at. The Cold War may be over, but arguably the nuclear age is not and one of the challenges of the White Paper is trying to explain these issues when some of the issues are so sensitive to national security that they cannot really be put forward in a public document. There are some unanswered questions on deterrence, how it works and the scenarios that we think it may or may not be relevant for, why we need a deterrent and the political implications of that and political influence, the cost and international relations with other parties. One of the big things, I think, of course is that what we have with the White Paper is a process where a series of decisions has set in motion a process towards a reunited deterrent of renewable submarines and the decision to buy into the US Life Extension Missile Programme, but it is important to point out that arguably the real decision does not come until the middle of the next decade when decisions on submarine numbers, submarine build, missiles beyond the LE and the new warhead need to be made.

Mr Ingram: Picking up on Lee's point there, that this is one of the most comprehensive statements by any government on nuclear weapons policy, I would underline that I think that is to be welcomed. The problem of course when you expose the nuclear weapons policy in this way is that it highlights a number of contradictions and discrepancies and I believe that the White Paper does that and there are contradictions within it. I would very strongly endorse Stephen Pullinger's point about non-proliferation and I would say that this White Paper underlines business as usual which I believe is over-cautious, that it demonstrates a tendency within the Ministry of Defence to over-engineer and over-equip itself for particular tasks, this one being one of them. I think essentially it demonstrates an institutional momentum that has its roots back in the Cold War and I do not believe that it demonstrates the new thinking required for the 21st Century.

Professor Garwin: The written evidence that I and my colleagues have provided deals mostly with the narrow question of maintaining the UK's strategic nuclear force in the post-Cold War world and, for that, we believe the White Paper, the decision to replace the submarines, is highly premature. The US Trident submarines operate two thirds of the time at sea and the UK submarines about one quarter of the time at sea. The lifetime of the US submarines has been extended to 45 years and, by the same token, the ratio of two thirds to one quarter is two and two thirds, so I would expect the UK submarine, from quite a few wear-outs, would last 100 years, I see no reason why they should not last 45 years and, from my experience with defence programmes in the United States, I think the Government is hastening into this decision before the facts

are really available to it or to Parliament. The question of steam generators has been raised. Steam generators are an essential component of the nuclear plant both in submarines and in the surface ships, as with stationary power plants throughout the world, but steam generators should be monitored. The US has a programme of improving the water chemistry so that the steam generators, they hope, will last the life of the ship, but it is never guaranteed. Even if one has a replacement programme with submarines coming on stream in 2024, a steam generator may fail before that time and have to be replaced. That is not difficult. One cuts a hole in the hull of the submarine, takes out the steam generator, plugs the tubes if you do not take it out, and the question really is: how much does it cost for these refurbishment programmes over the years, in comparison with a new submarine and for the same purpose, to have the same Trident D5 missiles? That is not like replacing a 20-year-old computer with a modern computer where there is absolutely no comparison about the performance, the power consumption and all those things. This is the same function and it should not necessarily be, so, if one delays the decision for another ten years or 15 years, one may well choose to build a small, single warhead in the continental-range missiles for the submarines in much smaller submarines and one could have a number of submarines at sea, two instead of one, and still save money on the programme and improve the national security while we are trying to think what these nuclear weapons are for.

Q137 Chairman: You have reminded me that I should already have thanked you for your written submissions and I am grateful because it has helped to clarify some of the questions that we will need to ask. Arising out of what you said, Mr Ingram, and a bit out of what other people have said about business as usual, do you regard this decision heralded in the White Paper as a replacement of Trident or as a running-on of the same old system, but in different submarines and, therefore, essentially renewal of the existing deterrent?

Mr Ingram: It is a bit of both. It is a running-on of the existing system, but, given the expected time that it would take to construct a new generation of submarines, I think the intention of the Ministry of Defence is to have a new generation of submarines. Otherwise, it would be very simple and quick simply to restart the production line of the Vanguard class and to construct a new Vanguard class, and that is a construction time of up to five years rather than the 17 years that the White Paper outlines. Therefore, it is a bit of both because we will be deploying, and will continue to deploy, the D5 missile with all the existing warheads, but in a new generation of submarine. One of the points I made in my evidence was that one of the choices which was not outlined in the White Paper and which could have received much more consideration is simply restarting that, of just restarting the production line of the Vanguard class which would reduce the lead-time down to maybe seven or eight years in order to account for some relatively minor modifications. After all, the Vanguard

class is not at all out of date and we are not replacing it because the technology is particularly dated; we are replacing it because there is this belief, challenged very eloquently, I believe, by Richard Garwin and myself, that the submarines are wearing out beyond repair after the mid-2020s.

Q138 Mr Hamilton: Professor Garwin, in your written statement and indeed in your opening remarks, you referred to the possibility that you cut a hole in the side if you wanted and do a bit of engineering work and this of course could extend the life beyond the 30 years. I have got an engineering background in mining for 20 years and I have worked with machinery all my life, but I have never seen any machine that can go beyond its time without major repair. Really the balance has got to be surely the balance of the repair work which is required to do a job or indeed to buy new. Could you expand on your belief that it is quite simply a matter of extending the life by ongoing maintenance?

Professor Garwin: In fact the submarines are in maintenance for a three-year major refit period and one would expect to have such continuing for the life of the submarine. Now, in principle, as one continues to extend the life, the costs go up and eventually it is cheaper to replace the submarines, but we do not know that and I do not believe the Governments know that either. Very often, the people who make the decisions are not experts and they do not even know to ask the questions and the facts are only established when they are challenged. That is the way it is in the United States and I doubt that it is different over here. Very often, as I explained in my testimony, in connection with the B52 aircraft in the 1960s, the Air Force was saying, "You cannot buy an aircraft beyond 1970". Well, we fixed the wings, we fixed the auto-pilots so that the wings were not subject to so much metal fatigue, we re-engineered the airplane and it flies even now and it is a very valuable airplane. The same thing has happened with submarines and other large capital expenditures, so the submarine has the same issue for the future as it has had for the past. One might limit the diving depth ultimately as the submarine accumulates metal fatigue, but one can fix it too. There are many things that can be done and what the Government needs to do, in my opinion, is to share the details of the analyses and the costs.

Q139 Mr Hamilton: We have four submarines, the United States has more than four submarines. Viewed on a maintenance cost basis, you get an augmentation of the amount of submarines that you have. You were talking of the B52s and, if you had a whole host of B52s, you could actually play with it. We all have to balance, as politicians, the industrial base of the United Kingdom and indeed we have contracts where you can actually develop and maintain contracts for refits or indeed new submarines coming on to base. How do you deal with the maintenance of the ships that go out to sea and indeed being able to keep other ships and doing the maintenance levels which would be required with four submarines?

Professor Garwin: That was planned and, as I say, the submarines have an easier duty than the US submarines and they have planned

major refit intervals. The question of the skills base and the manufacturing plant, that is a big problem, but, if one builds a submarine every four years instead of every two years so one has maybe a surplus of people, that does not run up the cost very much; the cost is not only the people, the cost is the equipment and the steel that is required, so we need to see those numbers. Just because BAE says that 22 months is the cadence that they should have does not mean that the Government cannot place orders at a longer interval and still maintain reasonable skills.

Q140 Chairman: Are you saying that there is a surplus of skills available at the moment?

Professor Garwin: The contractors will reduce the number of people working from 750 to 250 rather arbitrarily and the market accommodates that. We have the same problem in our aircraft industry and they argued, in the supersonic transport programme, that they needed the SSD programme in order to maintain the skills. Ten years later, Boeing thanked me for helping to kill that programme because it let them concentrate on the subsonic aircraft which was a much bigger, commercial market and the UK/French Concorde did not result in an airplane of which the United States would have to buy 500 in order to compete, but only 16 were ever manufactured. The market actually does respond. The skills do not vanish and they can be archived. There was the same problem with the Clinch River breeder reactor when Westinghouse was arguing that, if we did not build that, our nuclear plant skills would vanish. Well, they are transferred to the French and then they are transferred back when necessary and the United States and Britain can do more sharing of submarine manufacturing and technology than has been the case. If we can share nuclear weapons, technology and secrets, we can do a little bit more in the submarine area too.

Q141 Mr Hamilton: Does any panel member disagree with that?

Dr Willett: Interestingly, there are not issues or theories which are black and white in this and there can be differences of opinion. It is a simple issue really in that you can only really have a longer life for submarines if they are designed and built with a longer life in mind and perhaps I may explain some reasons for that. In principle, the US Ohio class are designed and built with a longer life in mind. Arguably, there is nothing technically impossible about doing this, but the risks and the costs do increase considerably while the availability actually declines and so delivery, so in the end you get very little return in terms of life extension. The risks and the costs in particular grow sharply towards the end of the life and through the extended life cycle in particular. First, there is the need for the increasing re-evaluation of the pressure hull, the reactor and the diving systems as the boat moves beyond the period that is covered by the safety case. Extending the life would require, for example, a new reactor because, even if you are only looking to extend the life for another five to ten years, you still need to put a reactor in which will have 25 years worth of life in it because the current

one only has 25 years of certified life. Also, the refit process for putting in new reactors is quite significant, so, if we are talking of two to three years to put in a new reactor in order to extend the service life for five to ten years, it is not really delivering you a huge amount of value in terms of time. There are also challenges for replacing combat systems on board, key components to do with the various survivability of the submarine, and again all these systems have a specified design life, so there are very significant challenges there. Secondly, there are challenges in maintaining the supply chain. Submarine components are very exposed and it is increasingly difficult to source spare parts and to order spare parts for a system that was designed 25 or even more years ago. Arguably, supply chain costs do effectively spiral as the submarine moves beyond its design life. Thirdly, in the UK one can argue that safety standard requirements actually are becoming more onerous, so the emphasis is on the Navy and the MoD to prove to an ever-increasing degree the safety of the submarine. Finally and arguably, an older boat loses capability and increases risk with important things like signature, for example, for the submarine. It is like an old car and it will become clankier and it will cost you more and more money to make it as quiet as it was before. Now, the US system is somewhat different because their system for certifying the safety of the submarine is different from ours. It is rules based and they have to show compliance with rules as opposed to meeting safety standards. They have more regular maintenance of their boats because they have more of them, so their boats are running through a more regular maintenance cycle than ours are, so the effects of the ageing are reduced and, as I said previously, the US boats are designed for a longer life. I would not obviously dare to try to disagree with someone of Professor Garwin's eminence, but that is my understanding. I think the MoD have looked very closely at all of this and their view would be that it can be done, but it is very, very expensive and very, very risky. There are others that argue that extending the life of a current boat, even only for a limited period, may cost as much as half the price of building a new boat, so it does not exactly deliver value for money. However, what is increasingly evident, as has been seen in previous classes of British submarine, is that the risks and the uncertainty in doing this increase exponentially and it is very, very hard to plan for these eventualities. Yes, I would agree with Professor Garwin that you can do more to co-operate and perhaps there are lessons to learn from both sides, but there is experience from recent cases. In the Astute class, for example, it has been well documented that the gap between building Vanguard and Astute was responsible for the draining of industrial skills and one only has to look at local newspapers in Barrow to see the submarine builders from Australia actually recruiting in Barrow to try and grab our expertise, to add weight to the argument that these skills can vanish.

Q142 Linda Gilroy: Dr Willett has to some degree answered the question I was going to ask, but I can perhaps put it a different way. It was about the cost of extending life and how that related

to the cost of renewing them, and I think I heard him say that the price of extending could be in the region of half as much as buying a new vessel so that it could in fact be cheaper to build over the long term. Also, perhaps I can ask both Professor Garwin and Dr Willett the extent to which in the new methods of procurement, procuring capability over a period of time, the point you were making, Professor Garwin, we need to know the cost, but the fact that our Government procures capability for a price with gain share built into it, why would we need to know the cost if the company could be held to that?

Professor Garwin: It is very hard to hold the company to a fixed cost when they are building a unique system which is vital to the nation. There is just no money to squeeze out of those companies, so the fact is that you will pay the actual cost of production. You will get the skills and, if they have gone to Australia, you can get them back because you will hire them on the market, so the three-year reactor replacement time, if that is required, comes with a major overhaul. A submarine is a big ship and you can replace the reactor while you are doing all kinds of other things there too. What really needs to be done is to have these component costs shown. You cannot, in my opinion, go blindly and ask for a fixed price and hold the company to it, and I think experience shows that probably with the Astute class.

Q143 Willie Rennie: We have already heard this morning that the American submarines last longer. Would there be a value in trying to rejig our programme to make sure that the next set of submarines ties in with their construction design needs to make sure we get the best value for money out of any new submarines?

Professor Garwin: I missed the question. Are you asking whether American expertise could be brought in to set a basis for the costs?

Q144 Willie Rennie: Would there be a value in us rejigging our procurement procedure to tie in with the American construction of their new submarines?

Professor Garwin: Well, it is an option and these options, in my opinion, should all be laid out with the costs so that the Government will know better what decision to make and Parliament can do its job in the bargain. I am not saying that it is absolutely sure that life extension is (a) possible and (b) cheaper, but I think it highly likely, especially since the tempo of operations has been reduced beyond the initial plan for the UK submarines. As for design life, I think there is a minimum life of 25 years, but it is not designed to fail after 25 years. It is not like an incandescent lightbulb which has a 1,000-hour life at a specified voltage because, if you make it brighter for a given wattage, it has a shorter life, so that is the optimum that people have found. Here, you are quite uncertain. You say, "I am sure that it will run for 25 years and I give my guarantee", but only in service and, as it comes to the end of that, we know what the numbers actually are. There, we need to know the cost of the retrofit, if a steam generator needs to be replaced and, as for

the signature, that is something that is the sound that the submarine puts into the water and something I know very well. It is thoroughly monitored, it can be fixed with varying currencies or whatever, it can be managed, and additional quietening(?) can be introduced into the submarines in service as well as in a new generation of submarine, but let us not forget that the job here is to put nuclear weapons at sea in a deliverable fashion. Things can be done with smaller systems, the guidance systems are much smaller, the testing programme would be cheaper and that would be an innovation well worth pricing out to see whether that is what you want to do.

Q145 Mr Holloway: Professor, there are comments made that the safety standards were somewhat different in the UK as compared to the United States. Do you have any comment on that?

Professor Garwin: No. I know a good deal about the civil reactors in the United States and I know that our nuclear Navy prides itself on the safety of its operations. We do not have a civil regulation, as I understand it, of our nuclear plants in ships or submarines, but we do have the equivalent, so before someone says that the UK submarines are safer from the point of view of nuclear accidents than US submarines, I would have to see it laid out side by side, but I do not know.

Q146 Chairman: Dr Willett, I wonder if you could expand on your point that safety regulations in this country in nuclear terms are getting more and more stringent. Extending the life of a submarine would presumably cause some degree of problems for that process, but why are safety regulations in this country becoming more and more stringent? Is that a matter of simple choice? What drives it?

Dr Willett: Well, in fact and in truth, that is an opinion that I have picked up from some interview material which we have been conducting for our research paper, so I can perhaps come back to you with clarity on that, if I may.

Q147 Chairman: Please do.

Dr Willett: With regard to the comments that Professor Garwin raised about the safety case issue and to respond to Mr Holloway's point, if I may, from my understanding, the UK has an external procedure for verifying the safety cases of the submarines, whereas the US Navy does it more internally. In the US, the US Navy has a set of rules and regulations that it needs to show compliance with, whereas here there is actually a safety standard that the Royal Navy has to meet. The US measures its safety internally, whereas the Royal Navy does not have that luxury.

Q148 Mr Hamilton: By that, you are meaning that the regulatory authorities within the UK would find it difficult to argue to support a system or for a design to continue?

Dr Willett: The submarines are designed, and built, with a 25-year life and all those who appear to be involved in the game at the moment appear to find it very, very difficult to find a justification for extending the life any further than that. I am not saying that the British submarines are safer than American

submarines or the other way round, it is just that the procedures for verifying that process are very, very different and not necessarily comparable.

Q149 Chairman: Mr Ingram, on this issue of skill, in your paper which I found very helpful, the basic paper, you said, "Exaggerated warnings of catastrophe from any delays should not frighten the Government into a hasty decision". Are you saying that the warnings of catastrophe about losing skills, which certainly we have been given, we have been told that these skills are at a critical level, are you saying that these warnings are exaggerated and, if so, on what evidence do you base that assertion?

Mr Ingram: Essentially what I am saying is that, whilst it is costly to restart a nuclear submarine programme, we have already seen with Astute that it leads to delay and overcost. It is not impossible, for many of the reasons that Richard Garwin has already outlined to the Committee, that some of the more unique skills are transferable globally, that it is possible to retool, particularly when you are creating a new submarine from scratch and that it is not as black and white as has been hinted at by witnesses to this Committee before Christmas. I would also just reflect back to the Committee its own report as a result of the previous inquiry which stated quite clearly that industrial reasons should not be leading this particular decision because this decision is more important than the industrial reasons for replacing a submarine.

Q150 Chairman: Yes, of course that is right. The industrial question of whether, if we delayed, we would then be capable of meeting our strategic defence needs is something that we would have to take into account.

Mr Ingram: You certainly need to take it into account, but also the Committee need to consider the longer term, not simply the transfer from Astute to the Trident replacement. The Rand Report, which I refer to in my more recent evidence, suggests that it would actually be advantageous from an industrial perspective to delay the start of construction of the Trident replacement in order that there is not this enormous gap that has been the concern of the Committee in the previous inquiry between Astute and the Trident replacement construction. There would be an enormous gap between the replacement programme and the NUFC, the next generation of submarines to replace Astute, so, if we are not careful, if we rush into this decision now, we could well be facing exactly the same, or perhaps an even worse, industrial problem when it comes to that gap with the next replacement submarines.

Q151 Chairman: Yes, as I understood it, because I read that report following your reference, the worry about that was the gap between the end of the strategic ballistic submarines and the NUFC programme.

Mr Ingram: Yes.

Q152 Chairman: That is, I think, not an issue that we should concern ourselves with at the moment. At the moment, we are worried about whether it is possible for British industry to create these submarines at all. I do not think that you have actually given me evidence to suggest that industry is wrong in saying that these skills, once they have left, would leave for good. When they tell us that, if they left, they would leave for good, can you give us any evidence to suggest they are wrong about that?

Mr Ingram: I would say that, as with so much of the evidence that you are hearing today, there is actually a great deal of speculation involved. We have speculation that the cost of extending the life of the Trident submarines may be as much as half the cost of replacement. That is entire speculation. There is no reference in the White Paper to those costs. Similarly, if there were a delay in the replacement of Trident, there is the speculation that the submarine base would be impossible to restart. I would say that the burden of evidence is on industry to demonstrate that because we have already seen quite a significant gap between the completion of the Trident construction programme and the start of the Astute programme and, as I say, that came at a cost and at certain delay, but it was not impossible. With a similar gap, one could quite genuinely assume that it would be costly and it would take longer, but it would be far from impossible to reconstruct the submarine base with a relatively short gap of five or ten years because many of the unique skills could be brought in from outside and there could be retooling at a cost.

Q153 Linda Gilroy: From where do you get the skills that build a ballistic submarine? There are only three countries in the world that do that at the moment. Are we going to go to the Russians or are we going to allow our skills base to go to the Russians? We have talked about the Americans, but I think there is also the debate to be had about our independent deterrent.

Mr Ingram: Well, our deterrent is not independent when it comes to procurement and we already entirely rely upon the Americans for the delivery of the missiles. There is no reason at all why we should not co-operate more with the Americans when it comes to the construction of the submarines, as Professor Garwin has already hinted. There are also the French with whom we are collaborating over the construction of the carriers. These are concerns that could easily have been more widely considered in the White Paper, but, because of the rush into publication and the rush that this Committee and Parliament are having to comply with in order to make the decision very quickly, we are not having that sort of information and consideration over the options, which is why there is a very major advantage to delaying this decision beyond March.

Dr Willett: Arguably, the crunch of the decision only really comes, as I said previously, within the next decade when we have to start cutting metals, so there is plenty of time to talk about this between now and then. The Astute case proves that there are

skill losses and cost overruns if you delay these kinds of decisions. Now, as Paul rightly said, yes, there are cost issues, but cost is one of the major things. Yes, we can delay the decision, but it will cost more. Now, are you prepared to delay this decision and pay for the implications of doing that? In terms of the independence of procurement, yes, of course we have to buy our system from somewhere. What we do have, through our co-operation with the Americans, is the best system that money can buy for affordable cost. There are options for closer co-operation on submarine design, reactor design, submarine build and reactor build, but there will be some political obstacles to that and tensions with the US about what they can and cannot share, in terms of the technology, with us. The options for increasing co-operation, I would argue, yes, would help the potential to reduce costs, but, in terms of tying ourselves into the American time-lines, the time-line gap actually is not as bad as people think it is. The number that people refer to from the American point of view is 2042 when the last American boat comes out of service, but in fact their first new boat will be ready to go into the water in about 2029 and ours we will be looking to go into the water in the mid-2020s, so the time-line is not that different and perhaps, therefore, there is some scope for looking to bring the time-lines more into line.

Dr Stocker: I was just going to comment on our lessons from the Astute programme. The lesson to be drawn surely is not that it is possible to recover from a mistake, but it is better not to make the mistake in the first place and why repeat it.

Q154 Mr Holloway: It seems to me that Professor Garwin and Mr Ingram are suggesting that industry is being rather self-serving in this. Is that fair?

Professor Garwin: Yes, though that is the purpose of industry, to make money for the stockholders. In fact there is an incompatibility with a 45-year life and building a ship every 22 months. Under those circumstances, you would have to have about 25 submarines in service and the UK does not have the need for 25 submarines and cannot afford to operate 25 submarines. Therefore, the life is set at 25 years. That is the industry decision to make a new ship every 22 months and the Government goes along with it. The White Paper discusses the operational independence, it does not claim that the submarine strategic nuclear policy is totally independent obviously because these are Trident D5 missiles and the maintenance of the missiles is done in the United States, and it takes more maintenance on a missile than on a submarine, but I think it would be perfectly reasonable for the UK and the United States to pool their manufacture of submarines. Once you buy a submarine, then it is yours for 30 or 40 years and you can do the major refits and add the reactors. After all, the United States aircraft, many of them use Rolls-Royce engines and there is no reason why the Admiralty cannot operate US-built submarines. Now, they have to fit the missiles of course, so there are a lot of interface questions and in this case fortunately the D5 is used by both. I would like to see small, single warheads,

intercontinental-range, modern missiles developed perhaps jointly with a much smaller submarine. We have the same problem that you do; we have these submarines at sea with enormous excess capacity. Eventually, we should have a smaller submarine for the same number of warheads that we decide to have.

Q155 Mr Holloway: Does Mr Ingram think that British industry with international shareholders today are bouncing the Government into an early decision?

Mr Ingram: Well, at the very least, as was hinted by Lee Willett just now, there is the possibility of us simply making a decision in March, not to go the whole decision, but simply to investigate the options further and to make a final decision at maingate in 2010/11. That is an option that has not been put before us in the White Paper, but would be more consistent with the procurement of other military systems. That, at the very least, would give us much more time for Parliament and for the public to engage in the discussion and the debate over where our future lies and we will be that much closer to the point of deployment of a new system. Now, there are all sorts of advantages, which we have not gone into in this Committee, which indeed the White Paper has not gone into, of deferring this decision even for four or five years, not least the possibility of us actually putting a serious proposal into the international community for greater disarmament in the lead-up to 2010. Therefore, to answer your question specifically on industry, I do believe industry are bouncing this Government into making a decision now and committing on this in order that they can have the security of production far, far earlier than they would need to necessarily.

Q156 Mr Holloway: Chairman, Dr Stocker is frowning at some of this.

Dr Stocker: Yes, I specifically wanted to comment on the idea that the UK and the US could pool the production of submarines. The practical effect of that would be that we would buy them from the Americans because the Americans are not going to be buying nuclear submarines from us. That argument is going the other way, I think.

Q157 Chairman: And you would find that objectionable?

Dr Stocker: Not necessarily. If we decided, as part of the industrial strategy, that we no longer wanted to build nuclear-powered submarines in the UK and that we wanted to buy not just the missiles, but also the submarines from the United States, that might be a decision we could take, but I do not see the UK at this stage being prepared to surrender that amount of its defence industrial base to another country, no matter how friendly it was.

Q158 Willie Rennie: You would not necessarily have to get the Americans to do the construction and at least, if you co-operated on the design, there should be other benefits there.

Dr Stocker: That is another issue and indeed, although it is not in the White Paper, it is in the exchange of letters between the President and the Prime Minister, the intention to collaborate further on future submarine platforms, which would indicate that

the Government are intending to do just that and there would be clear mutual advantage in doing so.

Q159 Mr Jenkin: Professor Garwin and Mr Ingram, what perverse and misplaced motive does the Government apparently have to avoid even considering these options in the White Paper? What do you ascribe that to?

Professor Garwin: I am a physicist, not a psychiatrist!

Mr Ingram: There is pressure from industry, as has already been stated, so that is one. There are potential political legacies of particular individuals which I would not want to go into because that is more the political thing which you might have more to say about than I would.

Q160 Mr Jenkin: Are you talking military or political?

Mr Ingram: Political. Thirdly, it could demonstrate a certain amount of caution on the part of many in the Ministry of Defence to ensure that, at all costs, we have a boat out at sea at any one time, at all costs, and I would say that this is a belt-and-braces approach illustrated within the White Paper, I might add, by the statement, which I believe is quite courageous, that we absolutely require four submarines in order to have one submarine out at any one time when in actual fact the average patrol length of a submarine is over three months. What that is saying essentially is that it takes at least three months to resupply a submarine once it has come back to port which, as I say, I think is a complete belt-and-braces approach. Finally, I think it is institutional momentum which I highlighted at the beginning.

Q161 Mr Jenkin: We move on to the role of deterrence. The White Paper states that "the fundamental principles relevant to nuclear deterrence have not changed since the end of the Cold War, and are unlikely to change in future", yet arguments to support that thesis are singularly lacking from the White Paper. Is that not rather a shortcoming and would the panel like to comment on whether that is a valid statement?

Professor Garwin: I think there is very little logic in carrying the so-called deterrent force from the Cold War era into the present. One has to ask: will there be a definable enemy with missile defences, for instance? That would require a lot of nuclear weapons to keep them from what? Well, we do not know and the Prime Minister says it is not knowable, but, as has been indicated, there are many requirements here which are all compounded. One assumes that the Americans and the British will have a falling-out so that the UK has to operate at least one boat at sea all the time because the Americans will never ever provide the nuclear support. That is very unlikely. It may be that there will be a falling-out and, under those circumstances, then, in order to provide for its own deterrent, the UK will have to operate one boat at sea at all times, but I should say, as for buying in US submarines or Russian submarines, I proposed very seriously when I received the Enrico Fermi Award in 1996 that the US buy tritium from Russia. That was absolutely necessary for our

nuclear weapons, but it has a lifetime of 12 years, so you buy it long enough in advance that the stockpile is always topped up and you have then five or eight years to start your own production in case the rations do not come through with the sales in advance. The same thing is true here, except that the lifetime of a submarine is at least 30 and may be 45 years, so you have a time to start your own production if your supply source raises the price or does not propose to sell you any more.

Q162 Mr Jenkin: Sorry, but I want to talk about the role of deterrence.

Dr Pullinger: I think it is a very good question because the public perception of deterrence and our general assumption about the nuclear deterrence has always been in the context of the Cold War where we had nuclear weapons in order to deter the Soviet Union, an ideological and potentially hostile power, from attacking us. In that sense, the deterrence scenario is essentially defensive, it is responsive and I would say that it has the greatest capacity for credibility in that sense because, if the survival of the United Kingdom is at stake, then deterrence is increasing its credibility, but that scenario does not exist any more, so we are trying to apply the deterrence theory to the new sorts of scenarios we are likely to be facing in the future. It is not for the Government to speculate about this because I am sure they do all this thinking in Whitehall of particular scenarios which they cannot publish in a White Paper, so I suppose it is the duty of academics and think-tanks to try and think through some of those issues in public.

Q163 Mr Jenkin: Do you honestly believe that North Korea or China or Russia would behave in the same way as they do now if the United States and the United Kingdom and France no longer possessed nuclear weapons? Are you seriously saying that it has no effect on their behaviour at all?

Dr Pullinger: No, I was not saying that, no. I certainly would not want it to be a situation in which North Korea and Iran had nuclear weapons and we did not or the United States.

Q164 Mr Jenkin: Well, then the doctrine of deterrence still applies, does it not?

Dr Pullinger: What are we deterring them from doing? That is the question. We can contain North Korea and deterrence will play a role in that and we can deter Tehran from taking certain actions in the Middle East, but what I am saying we should try and investigate is a scenario such as that of the Iraq situation. When we were going into Iraq to challenge their weapons of mass destruction programme, if they had actually been armed with nuclear weapons, to what extent would we have been self-deterred from taking serious action against them?

Q165 Mr Jenkin: Well, we did not rule out a first strike on the Soviet Union when we considered the Soviet Union a threat and they had nuclear weapons.

Dr Pullinger: But we never directly confronted the Soviet Union

because ----

Q166 Mr Jenkin: Thank God!

Dr Pullinger: ---- we knew the ramifications of what might happen.

Q167 Mr Jenkin: Yes, so the doctrine of deterrence is, therefore, quite useful in preventing large-scale wars.

Dr Pullinger: In terms of Iran, which is the one I am trying to think about, yes, but I am saying that it is going to be a strategy of containment rather than we are going to be prevented from taking physical action for disarming Iran once it has nuclear weapons which can deter us. That is the point.

Q168 Chairman: You said in your opening comments that there was a gap in the White Paper in relation to the theory of deterrence. What did you mean?

Dr Willett: Well, I endorse to an extent what Dr Pullinger says in that, as we have been seeing just now, something like the issue of the deterrence theory is a very open-ended question subject to much interpretation and, arguably, it is effectively an academic exercise and it can be very murky in its background and its conclusions.

Q169 Chairman: Is that different from the past?

Dr Willett: It has always been the case and, if you look at the White Paper compared to the SDR, for example, there is a far greater discussion of deterrence and its principles than there was in 1998, but it is very difficult for the Government, I think, to delve into it in the White Paper for two reasons. First of all, it may convey any thinking to a potential adversary and, secondly, as I say, it is an academic exercise generally, so the Government may leave its thinking open to intellectual criticism and perhaps a White Paper, being a policy paper, is not the right forum to raise such murky and ill-defined questions. I think on the key point about whether the deterrence does, or does not, work, there are two points worth bearing in mind here. First of all, since the end of the Second World War, we have had the existence of nuclear weapons, but no major state-on-state wars. Yes, there have been major and minor wars by proxy, but there have been no major state-on-state wars. One of the questions to ask here is: does the existence of nuclear weapons mean that we are effectively living with nuclear weapons, but with no major state-on-state war, or, if we get rid of them, are we looking at an increased risk of major state-on-state war? The second point to make is that of course what is new, however, is that we have to have a better understanding of how deterrence works in these new scenarios with new actors in mind and with new future actors in mind. I would disagree that there is no direct threat to the UK at the moment, and the whole point of that is that we just cannot see what threats there will be in 50 years' time. The Third Reich, for example, rose and fell in just 30 years.

Mr Ingram: Firstly, I disagree. I think the White Paper did put its big toe into the idea of the potential for deterrence and I

think that is one of its problems. For example, it raises the possibility of using nuclear weapons to deter state-sponsored terrorism and the very major weakness of that possibility is actually thinking through the genuine scenarios. Let us say, a state supplies a terrorist with nuclear weapons, those terrorists then independently go off and blow up a nuclear weapon in London, Aldermaston comes in, looks at the traces and finds out that this material originated from Tehran or wherever. Are we seriously talking about several weeks, perhaps even months, after this explosion dropping a nuclear weapon on Tehran? It does not bear credibility and this is one of the major weaknesses of trying to extend deterrence into the terrorist situation. Secondly, we all agree, I believe, that we do not actually face today, tomorrow is another issue, but today we do not face that threat, so why do we today have a submarine out at any one time?

Q170 Mr Jenkin: Can I challenge you on that very point? The reason we do not face that threat today is precisely because we have a submarine on patrol every day. If you took that submarine away and took away the deterrent, then the global politics would change and we would be facing those threats again. Okay, the Americans are in this as well, but that is why the world is like it is.

Mr Ingram: We could have a debate about that, but what I would focus on particularly is about the submarine being out. If we were to maintain the submarine deterrent, but not have a continuous sub-sea deterrence, which was an option raised by the Committee back in June in its report ----

Mr Jenkin: Are you seriously suggesting ----

Chairman: Just let Mr Ingram answer the question.

Q171 Mr Hamilton: Chairman, the Committee is not here for a debate.

Mr Ingram: Exactly, which is why I am trying to avoid the bigger debate. The focus particularly on the continuous at-sea deterrence, if we were to withdraw the boat, I believe, and you can believe differently, I believe that this would have no impact on Britain's security today. It may do in the future, but today it would mean that we could extend the life of the existing system dramatically. Thirdly, in terms of deterrence into the future, this whole idea of the insurance, I think we have to treat our responsibilities as one of the five formally recognised nuclear weapon states in the NPT more seriously. If we go back to our commitments in the year 2000 at the NPT review conference, we see very, very significant and major progress in the agreement of 13 steps.

Chairman: Mr Ingram, we will be coming on to the NPT in a few minutes' time. We are trying at the moment to explore the role of deterrence.

Q172 Mr Jenkin: Is there a case, as you suggest, for a comprehensive review of deterrence?

Dr Stocker: I think there is. To answer your original question

about whether there is a gap in the White Paper in terms of it saying that the deterrence had changed or the fundamentals had changed, I think there is a gap there because deterrence and particularly its nuclear dimension is as relevant as it was in the Cold War, but the nature of that deterrence has changed fundamentally. It has changed fundamentally for the UK probably more than anybody else, with the possible exception of France. The context within which we might have to conduct deterrence in the future, other than in the scenario of a resurgence of a hostile Russia, has changed completely and all of the kind of assumptions and policies that we worked out during the Cold War and learned quite painfully and over a protracted period of time, most of those assumptions no longer apply. Deterrence is as salient as it ever was, but it is a very, very different kind of deterrence. I would focus in on one in particular from the UK's point of view, which was that, during the Cold War, we had to deter a much larger, much more powerful and overtly hostile power with relatively slender resources and that meant that we had to threaten to maximise the damage to Soviet society with the resources available. In today's so-called 'second nuclear age' where national survival is probably not at stake, threatening to devastate another society in total or in large part is neither appropriate nor credible, so actually deterrence credibility may now be based on our ability to threaten the least amount of damage to another society, but in a scenario in which nuclear weapons are relevant because somebody else is threatening to use nuclear weapons or other WMD.

Q173 Mr Jenkin: And it would be okay to have this review in public?

Dr Stocker: I think elements of it, yes. Clearly the MoD is not going to talk about how many missiles or what kilotonnage are aimed at which city and would be used under which scenario, but the White Paper says very little about deterrence. The little bits that it does say, like the independent centre of decision-making which is the Cold War second centre of decision-making reinvented, the studied ambiguity which it makes passing reference to is also a hangover from the Cold War. The White Paper really says very little about deterrence and in order to argue the Government's case and in order to present the policy that would make deterrence more credible to the people we want to deter, I think the Government probably does need to do considerably more in spelling out a deterrence policy as well as a policy for the deterrent, which is actually what the White Paper is all about.

Q174 Chairman: Dr Stocker, when the White Paper says, "We deliberately maintain ambiguity about precisely when, how and on what scale we would contemplate use of our nuclear deterrent", you would say that was wrong, would you?

Dr Stocker: As far as it goes, I think that statement is perhaps not right or wrong, it is inevitable. Given the uncertain nature of deterrent requirements, there is a certain inevitability to that. I read that as referring to who we might deter under what

circumstances and what we might do to them. That is not the same as discussing deterrence policies and mechanisms and how deterrents might work in the new environment. You do not then have to say, "That means we will drop X number of kilotonnes on city Y under circumstances Z".

Dr Willett: To clarify that, again one theory probably does not fit all because in the Cold War days when there was one obvious adversary working out the calculations were easier than working out how a more diverse set of adversaries that we face now, how they may figure that the deterrence works. In any new discussion of the deterrence theory, one model will not fit all. We will need an understanding of how individual states and individual actors work. There are those that argue that nobody is not deterrable in some way, shape or form, but understanding how that works on an individual case-by-case basis is very important. The interesting point you make about the ambiguity issue, of course, is in the Cold War our strategy was based on the certainty that we would respond but now the premise is that because of the numerous and more diverse potential threats, the ambiguity that we might have is arguably worth underpinning the deterrence concept. One of the key things that the White Paper raises, and will be important in discussing the deterrents theories, is the whole issue of strategic and sub-strategic deterrence and how that works. Sub-strategic was a post-Cold War reaction to changing circumstances in the late 1990s and there has not been a mention of it in great detail in the White Paper and how that still applies, if at all, whether it is part of our NATO commitment or in other circumstances, for example against WMD threats, will be something that needs to be gone into. There are some questions still and that is a good thing, but it merits discussion in other forums.

Q175 Chairman: There are lots of questions so, Dr Pullinger, very briefly.

Dr Pullinger: I was going to talk about the sub-strategic element of the deterrent which is missing from the White Paper but there has subsequently been a Parliamentary answer in response to the question about why the sub-strategic elements of the deterrent are missing and the explanation now is that any use of British nuclear weapons would almost be by definition strategic and I, to be honest, agree with that revision because I think the sub-strategic elements in terms of the signalling to an adversary that you are on the point of going strategic does make a lot of sense in the sorts of scenarios that we are in.

Mr Jenkin: That is why you cannot keep a submarine in port.

Q176 Robert Key: Could we turn to the question of the deterrent as an insurance policy and could I invite Dr Willett to answer my first question. In the Prime Minister's foreword to the White Paper, he says: "We believe that an independent British nuclear deterrent is an essential part of our insurance against the uncertainties and risks of the future". Do you agree?

Dr Willett: Absolutely. The insurance policy sound bite, if you like, has been much used and there are those who argue that the whole point of an insurance policy is that you do not cash it in and it is something that helps you after the event, and worrying about what happens after the event is not really what this debate is all about. Certainly I think it is very important that we have this insurance policy in our back pocket when we are talking about the Trident debate because what it does provide is a hedge against a wider variety of threats and perhaps "insurance" is the wrong word but it provides the ability to protect ourselves against, first, nuclear blackmail, secondly, against direct nuclear threats and, thirdly, as I said, as something in our back pocket for this uncertain future. The Government does have a dual-track policy on this deterrent issue of maintaining minimum deterrence whilst also pursuing a multi-lateral approach to arms control and arguably having that insurance policy with a deterrent in your back pocket gives you the credibility to be able to pursue both tracks of that policy.

Q177 Robert Key: Could I ask Dr Pullinger, do you accept that the public finds the insurance policy argument a persuasive one?

Dr Pullinger: Yes, I think they do. I have never argued that we should abandon our nuclear weapons while other people's potential threat to us have done, but I think it is only part of the argument of this insurance policy because I think that we do have to prepare to meet the eventuality that we are confronted by another threatening nuclear weapon state, but I do not think that is the primordial nuclear threat that we are going to be facing in the future. I think we are potentially heading towards a world of 12, 15 or 20 nuclear weapon states and that is not just me saying that, the *Wall Street Journal* in the first week of January, Henry Kissinger, amongst others, said: "We are on the precipice of a new and dangerous nuclear era". I think we should be investing much more political energy in ensuring that we do not fall over the edge. I think our non-proliferation priorities should be much higher. I am not saying abandoning deterrents by any means, but arguably it is no longer the most important part of that. In a world of 15 or 20 nuclear weapon states, you are going to have them deployed in many volatile regions of the world, lots of people, lots of scientists working on the technology, the skills of how to make nuclear weapons that will be producing vast quantities of new weapons grade material which will have to be controlled. In that situation you are not going to be able to create lots of stable deterrence relationships around the world. Although Britain will be in a fairly benign situation one hopes with nuclear weapons, we will still be affected by the proliferation of nuclear weapons, whether or not we are a target of those nuclear weapons and, of course, all the time we will have these non-state actors, terrorist groups on the fringes trying to get hold on the black market of all this vast quantity of weapons grade material that is being used. The repercussions for us will be very damaging in terms of our long-term security, so it is a re-ordering of those nuclear priorities that I would like to

emphasise.

Dr Willett: I think part of the question that we have not answered yet and the White Paper does not answer, and this relates to the insurance policy, is what position the UK sees itself playing in the world. People argue that there are many other nations and they reel off dozens and dozens that do not see themselves as requiring a deterrent and that is because they do not have, or think they have, the kind of profile that we have and try and play the kind of role that we think we try to play. If we are happy to be lower ranking, assuming that we see ourselves as a global power, if we were happy to step away from that as a Government, as a country and as people and have a lower rank in the world then, yes, we would not need 60,000 tonne aircraft carriers, we would not need the major Armed Forces that we have, we would not need nuclear power deterrents. At the moment we have a policy decision, and if you like, a decision within the country as a whole to try and be that player. There is an insurance premium that goes with that and we have to ask the key questions here about insurance premiums, there is a value that having deterrents and securities that it offers, there is a price to that and are we prepared to pay that price and how much value does it deliver to the UK as a whole?

Q178 Robert Key: Do you think that the British public understands that we are not the fifth or fourth biggest economic power in the world by accident, it is precisely because of the projection of power in the 19th and 20th centuries that has put us there and because we are predominantly a trading nation facing globalisation, if we wish to maintain that we need to be able to defend our interest in free trade, shipping and air power.

Dr Willett: We have a global, if you like, economic foreign defence and security policy and a deterrent is one of the pillars that underpins that. One can argue that in the post-Second World War phase when we were having the financial problems that we had at the end of the war, the problems with the empire, our arrival as a nuclear power was one of the things that kept us having that high global profile at a time when other elements of that power were falling away. Today, arguably, when we have conventional Armed Forces that are reducing in size, quality and affordability challenges for the defence budget, perhaps a deterrent is one of the things that still continues to give us that global profile.

Q179 Robert Key: In the BASIC submission to the Committee you say on page eight: "Delay would allow an informed and proper and public parliamentary debate to take place. Discussion over this decision has until now been stifled by an information blackout within Whitehall". What do you mean by that?

Mr Ingram: I mean that until the White Paper was published on 4 December, any questions that were directed at the Ministry of Defence essentially were, "Wait until the White Paper, the information will be there". Clearly the information is not in the White Paper. We have got many questions here today based largely on speculation and the answers that we have been given have been based largely on speculation because the information that is

required to make a truly informed decision is not there in the public. What I mean is that if we were to defer the decision, if the Ministry of Defence were to engage with some real information, information that would not prejudice the national security of this country but would give us a proper debate in this area, then I think we would be in a much better position to analyse exactly the sorts of issues such as the insurance policy and the technical ability to delay this decision much more effectively.

Q180 Robert Key: I suspect Professor Garwin would agree with that broadly. Could I ask you, Professor Garwin, do you think this whole process is far more open in the United States of America or, to put it the other way, do you think in this country we are obsessed with secrecy over decision-making in this area of public policy?

Professor Garwin: Secrecy is always more comfortable for those who have the secrets. The United States does have a more open policy and procedure and the people in charge often contrive to close it; the current administration is one of those. I would say on this question that one should not confuse fire insurance with fire extinguishers; an insurance policy does not keep the disaster from happening, it tries to make you whole afterwards, the fire extinguisher may keep the disaster from happening. What we have been discussing here, the essentiality of deterrence for a first-grade power, what does that say about Germany and Japan? They are trading nations; if it is essential for the UK why is it not essential for Germany and Japan? They may not be serious but they would have to have nuclear weapons in order to hold up their heads among the nations.

Q181 Mr Hamilton: Chairman, I would like to follow that up because I do not follow the logic of the argument from Mr Pullinger or indeed the comments from Mr Willett. Mr Willett makes the assertion that if we do not have the nuclear deterrent and we want to be a lesser nation in armed forces, surely one of the big arguments is that we utilise the money that we would spend on a nuclear deterrent and put that to our conventional armed forces which actually assist us in the naval outlets that we have and indeed assist us in places like Iraq and Afghanistan if we want to utilise them. I do agree that we need to decide as a nation where we want to be as a world force for the future, but the question that Robert asked Mr Pullinger is do you accept the public assurance policy argument is a persuasive one to the general public? On what basis do you think the general public are persuaded by that argument, because that is not the public I have got. The public I have got are extremely sceptical about a Trident expansion and therefore I would like to hear clarified not the academic argument but how do you perceive the public to be on side in this issue? I do not see it.

Dr Pullinger: The public see there are other nuclear weapon states in the world. They know that North Korea is to test a weapon and the Iranian regime, which in many respects is a reprehensible one, is not complying with the IAEA and is possibly pursuing a

clandestine nuclear weapons programme. They know that Russia, China and others still have those weapons, and there is no prospect of getting rid of them, so in the near term, certainly, they do not see why we should get rid of it at the moment.

Mr Hamilton: I understand the point you are making; these are arguments that are all well-tryed, but I am asking a straightforward question: on what basis do you believe that the public side with your opinion and that the public are not of the opinion that we should be looking away and walking away from nuclear deterrence. I am asking, what evidence do you have?

Chairman: He has given an answer.

Mr Hamilton: He has given an opinion, but I am looking for evidence which tells us that there has been some survey done somewhere that says the public want us to be doing that.

Chairman: To be fair, the question he was asked was what was his opinion. Robert Key.

Robert Key: Chairman, the only evidence I have is that I, through my website, did a survey of opinion and it came in two to one that people thought that there was indeed value in the insurance value, but it is very, very small indeed.

Chairman: Then next week we can take evidence from you, Robert.

Q182 Robert Key: If you wish to, Chairman, it might be very long. Could I just continue this theme for a moment; it is very important. In their submission to us the Church of England memorandum says that, "To assess the validity of the deterrence argument, therefore, there must be some indication of the circumstances in which the weapons *might* be used." We know the Government has said that they wish to deliberately maintain ambiguity, but the Church of England's submission says that, "All it would require is for the Government to indicate what is its overall strategy, including the parameters for the weapons' use and any limits within which any targeting policy would be set. That would enable the Government to explain how their use would be consistent with [their] obligations in international law." Do you think the Church of England is right in posing that position?

Dr Pullinger: Obviously there is some ambiguity about when we would use nuclear weapons but we are actually constrained by certain limits. We have provided a negative security assurance to non-nuclear weapon states that we would not use nuclear weapons against them unless they were attacking us in alliance with a nuclear weapons state; we have said we would only use nuclear weapons in compliance with international law which involves questions of discrimination, not deliberately targeting civilians, proportionality and the rest of it. There are limits, therefore, there are constraints on the circumstances in which we could use nuclear weapons, but personally I think there is too much ambiguity about the circumstances. We are saying self-defence; we would use them in self defence in extreme circumstances. The Israelis could use that argument possibly to pre-emptively attack the Iranian nuclear weapons programme; they could say they are

developing nuclear weapons which are a reasonable threat to us, we are acting in self-defence under Article 51, pre-emption is allowed, we can go in and take this out. It is self-defence, it is extreme circumstances, no-one else is going to do it. The language we are using, therefore, is giving an awful lot of leeway to the circumstances in which we could use nuclear weapons and I personally would prefer it if we really tried to constrain it to when the national survival of the United Kingdom is at stake. We can talk about the precise terms, but I would really like to hone it down to that.

Dr Stocker: I was just going to add two brief comments to that. Firstly, in relation to advance declaration - things like no first use or not using weapons against non-nuclear weapon states - it is simply a health warning that in the extreme and severe circumstances under which the use of nuclear weapons might be contemplated, the value of those kind of advance declarations is likely to be minimal; it is, frankly, not going to matter what you said you will and will not do in the past, your actions will be governed by the extreme circumstances that you find yourself in at the time.

Dr Pullinger: Can I come back on that immediately? I agree, these things are not going to stop states doing things in extreme circumstances, but nevertheless they should not be planning to do them, they should not be planning to use nuclear weapons in those particular scenarios when the survival of the United Kingdom is not at stake - and it is these sorts of scenarios that we were talking about earlier on that matter. It is not the piece of paper, it is not the international law, but it is planning for what you are going to do in practical situations that we should take into account.

Dr Willett: Very quickly, any potential state or party that will threaten us with a nuclear weapon or other weapon of mass destruction potentially is putting our national survival at risk, and therefore saying this, like we did with refusing to rule out first use and substituting it with declarations of preparedness to go first et cetera are part of the credibility of deterrence. Deterrence is all about communicating a credible and capable threat and showing you have the intent to use it and you have to talk up your ability to ever do it to make your opponent think that you actually are serious.

Robert Key: Chairman, may I move on to tactical roles and first use of Trident?

Chairman: Could you make them very brief, please?

Q183 Robert Key: Certainly. Dr Stocker, you indicate in your written evidence that the White Paper makes only a passing reference to missile defence; what should it have said?

Dr Stocker: It could have said more, to say what current Government and MOD thinking is in this area because it is directly relevant to the debate about the nuclear deterrent. Noting that, our deterrence posture to date, as a legacy of the Cold War, has

been based purely on the punishment element of deterrence and we have always eschewed deterrence by denial, which is another way of saying defence - in other words persuading somebody not to attack you because you can ward off the blow rather than because you will hit back in retaliation. Because of the decision announced yesterday by the Czech Government about a radar site for missile defence, that issue is going to well up in the political arena again, particular when it looks like Poland might become the site for missile interceptors in a European context. Missile defence, which has been quiet for three or four years, is going to be back on the political agenda and it is, strategically as well as politically, relevant to the current debate about nuclear deterrence.

Q184 Mr Jenkin: What impact does the recent Chinese missile strike on a satellite have in this debate and is it something we should consider?

Dr Stocker: Directly I am not sure it does have a major impact, other than in terms of demonstrating (a) a higher level of technical capability than many people may have assumed the Chinese have and (b) it demonstrates some of the dynamics of their deterrence relationship with the United States. Clearly, the Chinese are putting a lot of resources into having a multi-faceted deterrent against the United States in order to increase their freedom of action in their particular region and the ability to counter American, Soviet-based military systems would clearly be an important component of that deterrent capability.

Q185 Mr Jenkin: Making the world safer or less safe?

Dr Stocker: Undoubtedly, less safe.

Q186 Robert Key: Should the UK be developing tactical nuclear weapons, Dr Willett?

Dr Willett: No, the UK's strategic deterrent is there as an ultimate capability to protect the nation under grave threat to its national survivability. Tactical nuclear weapons are not part of our inventory, they are not part of our thinking and they are not part of our reason for having a deterrent. We should also make sure that we see that there is a distinction between tactical and sub-strategic, they are not the same thing. Tactical effectively relates to battlefield nuclear weapons and sub-strategic is more of a policy designed to enhance the flexibility of the UK's Trident system in a post-Cold War world, of course noting the points that have been made previously that any use of weapons, of course, can be seen as strategic. Tactical and sub-strategic are in my mind not the same thing, and it is important to note of course that our view on all this is very, very different from that of the US. The US has a different policy, different strategy, different capabilities and we should not be viewed as having the same views and developments as them.

Q187 Mr Holloway: Common sense would be both tactical and strategic; I mean tactical in the sense that you would be able to remove the item that is a threat to you; strategic in the sense

that it sends an extremely clear message and it did so before, so it can be both.

Mr Ingram: It absolutely can be both. The use of a service revolver can be strategic in the circumstances, but to use military terminology, tactical nuclear weapons are essentially the definition of battlefield nuclear weapons designed, in Cold War days, for example, to explode in Central Europe over a conventional conflict. A strategic nuclear weapon is what the UK has and that is not tactical in purpose.

Q188 Mr Holloway: But that does not mean that you cannot and perhaps should not have 0.7 kilos, much smaller weapons. They still have a strategic effect, do they not?

Dr Willett: This is where we start to get into the area of theory and why the UK has certain kinds of capabilities and why it does not. Yes, you could argue that to deter a threat to national survival you may need a smaller yield weapon that can take out a particular target without doing too much collateral damage et cetera, but the bottom line from the defence point of view though is that we have a capability that is designated to be a strategic capability, it is there as a policy tool and not as a battlefield/war-fighting weapon which is what tactical weapons are generally regarded as.

Chairman: I would like to move on to non-proliferation.

Q189 Robert Key: One very quick one, could I ask if any of our witnesses today think the White Paper should have had anything to say about first use?

Dr Stocker: Only to reiterate the earlier point that, as Sir Michael Quinlan pointed out, there are two dangers with that kind of policy. First of all, in extreme circumstances those declarations will count for nothing. Secondly, by ruling out certain options, in other words drawing lines in the sand, you potentially invite other people to step right up to the line in a way that if there was greater ambiguity, they might not step quite so far forward. Therefore, no first use is pretty unhelpful.

Q190 Robert Key: Professor Garwin, would you agree generally with that?

Professor Garwin: No, I would not.

Q191 Robert Key: I know you are a physicist, but you have come a long way and we want to get your wisdom.

Professor Garwin: That is fine. I have studied first use, I have some papers with the National Academy of Science's Committee on International Security and Arms Control which deal with this, the future of nuclear weapons in view of US nuclear weapon policy, and in fact there we recommend adopting a no first use policy and no first use stature - not necessarily no first use treaties because, as has been said, those do not mean anything and a no first use policy does not mean that if somebody threatens the United States, has destroyed all of us with biological weapons, that we would not respond; of course, it is a democratic society and it can change

its mind at any time, so the point of extreme circumstances I really take. But I do believe that a no first use stature would be very helpful, though I do not say that the White Paper should have discussed that. On the point of missile defence though I would say that promising missile defence is a lot easier than delivering missile defence, and the programme on which the United States is spending some \$10 billion a year will not deliver protection because it is a mid-course programme - that is the one which the Czech Republic and Poland have been in the news about, presumably for countering missiles from Iran, but if you have missiles from Iran from the very beginning they will have effective counter-measures - balloon decoys and anti-simulation - and if you go to my website you will see many, many articles about this. That is why the UK has not considered missile defence because it does not know how to do it.

Mr Ingram: Just on this point of no first use specifically and the ambiguity that is used, I think it is just very important to recognise that exactly that sort of policy is seen as a threat by other countries and drives proliferation, which is where we are going to now. It is very important to see that decisions that we take that may appear in our interests actually drive threat perceptions elsewhere. We have already identified the Chinese development last week as appearing to be against the interests of global security on the basis of increased capability by China - not intentions specifically but capability - so too our policy of ambiguity and not ruling out no first use can be seen by other countries as a direct threat and will drive their decisions over military procurement and particularly nuclear weapons procurement.

Q192 Mr Borrow: Can I perhaps move on to the non-proliferation and disarmament which we have touched on, on and off, so far during this session. Can I go initially perhaps to Dr Pullinger and Dr Stocker; we need to have your views on what should have been in the White Paper to do with non-proliferation. You both mentioned that it was not covered in the White Paper; therefore, what are your views on what should have been and how the UK policy would have been improved had there been something firm in the White Paper?

Dr Pullinger: As I said in my opening remarks, there should have been a more serious assessment of the potential dangers of a proliferated world and the threat that the non-proliferation regime is under. It is a question of degree and an appreciation of the problem that is not there. The United Kingdom has an excellent record on non-proliferation and arms control and the diplomatic effort that it puts into trying to stop other countries getting these things, putting controls onto the materials and in terms of its own force posture it has done more than any of the other nuclear weapons states in terms of reducing the number of warheads and platforms and its fissile material - it does not make any more fissile material for weapons purposes. It has an extremely good record, therefore, and what I would like to see from the United Kingdom - ideally it should come from the United States and that is a possibility, that is something that Henry Kissinger and

others called for a couple of weeks ago, that the United States takes leadership, it realises that we are on the edge of this nuclear precipice in a proliferated world but it is not in the strategic interests of the United States or any of us to reach that stage and therefore we have to do a lot more in terms of preventing it ever becoming reality. This has been written by MOD/FCO and in terms of the arms control and disarmament aspect there is not a lot you can criticise about it, but it is too complacent, it is going through the motions. Arms control is stuck and the only way we are going to get beyond that is if we have political leadership - and by that I mean at prime ministerial and presidential level - to say we have got to tackle this problem, and the only way we can do that is to get the other nuclear weapon states around the table and thrash out what I would call a new nuclear settlement and say where are we actually going with this? We are drifting towards a world in which we are all going to be far less secure so maybe we can try and go back to first principles and decide where we are going with nuclear weapon proliferation and how we are going to avoid getting there in a staged process of de-nuclearisation. We may not be able to get to global elimination of nuclear weapons, I have no idea, but we can go a lot further down that road and we can also rebuild an international consensus that that is where we are trying to get to, so we are pulling nuclear weapons back from the front line, we are putting them back in the cupboard, and eventually we may be able to get rid of them. Perhaps we will not be able to, perhaps we will have to have a hedge against a break-out to make sure that no state ever has the incentive to start developing nuclear weapons. I do not know what that scenario will look like, but we have to avoid that nightmare scenario of 20 or 30 nuclear weapon states in, say, 20 years time, which is a possibility and people are now recognising that.

Q193 Mr Borrow: Mr Stocker, do you agree with that and do you think that the UK could actually do something to get talks under way?

Dr Stocker: Broadly, I would agree with what Stephen said, but my main criticism about the White Paper and what it says about non-proliferation is largely presentation in that the White Paper talks about the options for the deterrent and then seems to tack on a series of perfectly valid statements about non-proliferation, almost as though the Government felt it necessary to demonstrate its non-proliferation virtue in order to sweeten the bitter pill of nuclear renewal. Actually, I think that was a missed opportunity because the Government could quite validly have spelled out that actually, done sensibly, deterrence and non-proliferation are not mutually exclusive, they are two tools designed to address exactly the same problem, namely proliferation. Whilst there is a certain tension inherent in having your own weapons while seeking to deny them to others, actually that tension is understood by most countries, they fully understand that it is normally in any country's interest to have its own weapons and other people not to have them, and there is

nothing unique about nuclear weapons in that sense. I am rather more optimistic on the non-proliferation front than many commentators have been. It looks like the number of nuclear powers is about to hit double figures with Iran, and of course North Korea's recent partial test, but we have known about North Korea and Iran going nuclear for some years, we have been widely expecting it. Beyond Iran there are predictions of 15 or 20 nuclear powers, but we have had those predictions since the 1960s; beyond Iran, who is going to be the next one? There are no obvious candidates stacking up. There were two, Libya and Iraq, and in different ways they have been dealt with. There is a next list of proliferators waiting to happen; that is not to say that further proliferation is not going to happen, and the crucial thing that the White Paper could have usefully said was one of the ways in which we prevent other countries going nuclear is through the extended deterrence that is provided to them by existing nuclear weapons states, principally the United States but also the UK. The UK in NATO doctrine - although it is not spelled out in the White Paper - the UK nuclear deterrent is a contribution to the deterrence posture of the alliance as a whole, and that of course provides a framework that allows countries like Germany, like Turkey, not to go nuclear because they are subject to an extended deterrence provided by others, and it is not only the United States. The White Paper, therefore, could have done more to actually spell out how deterrence and non-proliferation do actually work together towards the common end.

Chairman: Dr Willett, we heard pretty much your view about this in our first inquiry, so do you mind if we move on - in the interests of time?

Q194 Mr Jenkin: Dr Stocker, your analysis almost suggests that a world in which the present, broadly responsible nuclear states, forego their nuclear weapons is actually perhaps a less desirable world than the one we have where there are a few responsible states with nuclear weapons.

Dr Stocker: I would agree with that. The argument about a nuclear-free world is an entirely abstract one because I do not know anybody who has the faintest idea of how you could bring about a nuclear-free world or even whether it would be desirable, if you could somehow bring it about, simply because we could bring about a nuclear, disarmed world and the country that cheated and had just two weapons and nobody else had them would be in a very, very unique strategic circumstance, as the United States found out in 1954.

Mr Jenkin: That is very interesting, thank you.

Q195 Mr Borrow: Can I ask Mr Ingram how effective he thinks the non-proliferation treaty is and does he feel that the White Paper has a positive or negative impact?

Mr Ingram: To answer that directly, clearly I believe the White Paper has a negative impact because it will basically send a very clear message that supports the statement that has just been made,

that while the Government in the White Paper itself and many times previously in its policy claims to have the objective of a nuclear weapon-free world, as is required under the non-proliferation treaty, to have that objective, whatever the time line, they do not believe in it. I too think that they do not believe in it; in fact, the White Paper itself says that "there would need to be compelling evidence that a nuclear threat to the UK's vital interests would not re-emerge in future before we responsibly could contemplate disarmament." It says that in black and white. That, of course, is never, ever going to happen; there will never be 100 per cent possibility that there will be proof that there will never be an emerging threat, so we do enter into the realm of the Government believing the scenario that Dr Stocker has just outlined. I am one of those analysts that believes that that is an unstable situation. Even if we only take Iran as an example, if Iran were to acquire nuclear weapons there would be tremendous pressure on Saudi Arabia, Egypt and a number of other regional powers to respond likewise and the pressures would grow. I do not believe personally that it is a stable situation if North Korea were to develop their nuclear arsenal and actually be able to deliver them into South Korea and beyond into Japan, and Japan to sit idly by and think well that is all fine, thank you very much. I do not believe that we exist today in a stable situation, and if the nuclear weapons states believe that they can continue along the route indefinitely that we have now, they will be sorely disappointed and we will enter into a very unstable world of nuclear proliferation. While it is very difficult to perceive the steps towards a nuclear weapon-free world - and I would agree it is difficult - I would challenge that it is impossible and I would say it is equally difficult if not even more implausible to believe that the current status quo will be maintained indefinitely into the future.

Mr Borrow: Can I just come back to you on that scenario?

Chairman: Can I interrupt and say we need to get the questions and the answers as short as possible now.

Q196 Mr Borrow: The statement was made earlier that of the five original nuclear powers the UK had been the best in terms of reducing the number of nuclear weapons and being pro-active in non-proliferation. The White Paper envisages a further reduction in the number of warheads, but there has been criticism of the UK for not being proactive in terms of getting further discussions. Do you accept that?

Mr Ingram: I accept that with the changes announced in the strategic defence review of 1998 and indeed the changes that were announced by the previous Government in the early Nineties, this nuclear weapons state is the best of a bad bunch. The trouble is, of course, that there have not been any changes since then and this announcement of a reduction from just under 200 to just under 160 warheads is almost irrelevant because we will still have 48 warheads out on patrol at any time, and we will continue to have this deployment until perhaps the 2050s. While we have a positive

record up until this date, therefore, we are now planning to have pretty much a status quo into the indefinite future, which does not send the right signal, either to the other nuclear weapons states or indeed to any potential proliferators who may indeed interpret the statements we had earlier about status, about economic development and all the others and think yes, we would like some of that too and we do not feel it just to continue along the line. Just to finally finish, the argument that is put in the White Paper against that point is only legal on the NPT, which itself - I do not want to go into it - is contested. There is no political and there is no non-proliferation argument, I believe, against the idea that this is dangerous and sends a very bad signal to non-proliferators.

Mr Borrow: If I can put a question back to you that I asked at the meeting that we had last week, are you saying that the only way for the UK to go is to make a decision which effectively gets rid of nuclear weapons altogether, and if we were going to be one of the good guys in terms of reducing nuclear weapons and getting rid of proliferation, the only step we have got is to unilaterally get rid of nuclear weapons. I know you have said we do not need to make a decision ---

Q197 Chairman: Let us have an answer to that. Mr Ingram.

Mr Ingram: My answer is simply that we need to defer the decision and ---

Q198 Mr Borrow: Can I come in there? I have heard your argument that we can afford to defer a decision. In the scenario which is what the Government believes, that if we defer a decision as a country now then we are in effect unilaterally not replacing our existing nuclear weapons, and when the boats run out we will no longer have a platform and will no longer have a system, so effectively the decision would be made in the next few years - that is the belief of the Government and that is what the White Paper says. You may not accept that, but what I am saying is if what the Government is saying is correct, that we have to make a decision shortly one way or the other, your decision would be not to renew the boats that are used to fire nuclear weapons.

Mr Ingram: My recommendation to you is to make a decision based on facts of the situation as far as we know them. The White Paper is riddled with inconsistencies on exactly that point, around the need to make a decision urgently and now. My recommendation is that this Government puts at the very heart of its nuclear policy the objective of achieving further nuclear disarmament, and that entails the idea of Britain becoming a non-nuclear weapons state at some point in the future, ideally on a multilateral basis.

Chairman: I want to move on to deterrent options. Linda, moving on to deterrent options we have explored that in recent discussions.

Q199 Linda Gilroy: I wonder if I can ask what your reaction is to the assessment of the various deterrent options in the White Paper. Was it comprehensive, Dr Stocker?

Dr Stocker: Yes, it was and I do not think the answer that it came

up with surprised many people; it is what the Americans would call a no-brainer". What was interesting was that amongst the four generic options the only really credible alternative to Trident was not examined, which would have been a submarine-launched cruise missile, but the White Paper elsewhere did compare cruise missiles with ballistic so it did cover that option, albeit in an indirect way. It is very difficult to fault the logic of the White Paper and I know that the MOD did look at a wider range of options before settling on those four main ones featured in the White Paper, so I am convinced that a pretty comprehensive study has been done, based on realistic assumptions and the conclusions are correct.

Q200 Linda Gilroy: When in your paper you said to us that the most credible alternative would be the submarine-launched cruise missile, you are satisfied with the comparison that is made in the annex that really says that on cost, effectiveness and on capability it really is not a comparison?

Dr Stocker: Indeed. In fact, as part of the original Trident procurement decisions, there was a study done by Chatham House in the late Seventies which did some quite detailed open sourcing work, and it demonstrated then as an alternative to four or five Trident submarines, if you wanted cruise missiles fired from submarines you would need eleven submarines and 800 missiles. The figures probably do not exactly equate today but it indicates the order of magnitude of difference of capability as between cruise and ballistic.

Q201 Linda Gilroy: Professor Garwin, if I could turn to you, invulnerability and the ability to survive a first strike were key considerations in opting for a submarine-based deterrent during the Cold War. Do you attach any importance to that argument now? How would you view that?

Professor Garwin: It keeps me awake at night to think that the submarine base will be destroyed by a nuclear weapon, all the submarines that are in port, so a submarine at sea with survivability is a very good thing to have. But they are to survive, not to fire, and this question of 800 cruise missiles versus 50 D5s is not a matter of a deterrent, that is a matter of prompt strike. A submarine at sea could, within days or weeks, move to the shore where it wants to fire its cruise missile so if you are satisfied with the eventual response you do not need more cruise missiles than you need ballistic missiles. In that regard the White Paper is incorrect in saying any programme to develop and manufacture new cruise missiles will cost far more than retaining the Trident D5 missile. The UK could manufacture the Tomahawk, a perfectly good cruise missile; it would not have to do any development but it might have to get licences from the US manufacturer. But it did not want to do that, it wanted to rebuild the Trident submarines without thinking, it did not mention the small inter-continental range ballistic missiles, which is a good thing to do. The development costs are far less than for one of these multiple warhead missiles and would be reflected throughout

the entire system.

Dr Willett: As Dr Stocker pointed out, we have gone round this board twice before with Polaris and with Trident first time round, and the issue with the cruise missile is discussed in detail in the White Paper, but the key issue of course is that not only can it be shot down, as the White Paper mentions, but then your warhead falls into the hands of whoever's territory it happens to land on, and you cannot have that risk. The important point about the Tomahawk is that you cannot just take the current warhead and stick it into a Tomahawk, you would need a new warhead and a new missile because the airframe was designed only for conventional purposes and not as a deterrent weapon, and the problem is that it is just not fast enough. The interesting thing about the current decision though and going down the road in years to come is whether there is any possibility that the Government will look at options for multi-roling the submarine in terms of giving it a broader range of capabilities - D5 missiles, yes, perhaps with some intermediate range missiles, whether they are modified Trident or others, perhaps with some cruise missiles that have either nuclear or conventional warheads on them. The US has conventional Tomahawks in its Ohio class submarines so it can be done; the question of course is, is the strategic requirement and rationale there to do that, but that would potentially give the submarines a greater range of options.

Professor Garwin: I am sorry, that is not true. If you do not want your nuclear warhead unexploded to fall into other people's hands then there is a well-established technology with insensitive high explosives or other explosives to explode the warhead - of course you disseminate the plutonium, but that does not matter, we did that at Palmaris, and you clean up afterwards.

Q202 Linda Gilroy: Is not a more important issue in weighing up the pros and cons of this how it stands in relation to missile defence systems?

Professor Garwin: Oh yes, that is a different point, but one should not adduce all of the arguments, some of them correct and some incorrect, so, yes. Tomahawk is not very vulnerable to missile defence but it could be countered by certain defences. When I inveighed against missile defence, it was only mid-course, terminal defence is entirely possible, it is possible when you are defending individual silos, it is not easy to do when you are defending cities.

Q203 Chairman: I do not want to go into the various options, I just want to be sure that you believe that they have been sufficiently covered by the White Paper. Dr Pullinger, do you want to comment on that?

Dr Pullinger: Yes, specifically on the choice of this platform which, looking from a non-proliferation perspective, helps to make us the most stable nuclear posture deployment. I would prefer to have designated platforms, which this system is, I do not want to have dual use platforms with nuclear and conventional that might

get mixed up.

Chairman: That is Dr Willett's point.

Q204 Linda Gilroy: One of the issues that is raised about the submarine platform is the possible future developments in terms of transparency of the oceans. Do any of you have any observations to make on that area?

Dr Willett: Very simply, people have been trying to do it for a long time and it has not happened yet.

Mr Ingram: However, if we were to be in a position to delay this decision then that would be another advantage, we would be that much closer to the point at which we were deploying to be able to make exactly this decision in greater confidence that it would be still possible to hide a submarine and perhaps also to be able to deploy other missiles than the D5, for reasons already suggested.

Q205 Willie Rennie: Professor Garwin, could you just summarise quickly what the United States are doing in terms of their deterrent and what the significance of the reliable replacement warhead programme is in that deterrent?

Professor Garwin: The United States continues to operate the three components of the deterrent: the aircraft, which has been downplayed in importance, the land-based missiles, mostly single-warhead missiles now, deployed in the vast spaces of the United States in silos and the Trident submarines, so they will continue to upgrade those. There is an initiative for conventional strike so that some of the Trident missiles and perhaps some of the land-based missiles will be loaded with conventional warheads with an accuracy of a few metres so that they could attack big targets, but it is very difficult to get the effects of nuclear weapons in destroying large targets. You can destroy a concrete silo with a conventional warhead, a shaped charge, delivered by one of these missiles, but it would be easy enough, as I said, to defend that silo by passive and active means. So this conventional strike has not yet been realised and there are problems that people will understand as they think more deeply about it. The United States Navy is confident that a prudently operated strategic submarine is invisible and essentially undetectable in any strategically important sense, so they are not worried about that, they spend a lot of effort to make sure that it is true and the US also spends a lot of effort to see whether they can compromise other people's submarines. The reliable replacement warhead is a programme which was generated a few years ago; it may or may not go forward. Its purpose is to be able to build new design warheads under a comprehensive test ban treaty without testing them, and not for new military munitions but to replace the current warheads if they deteriorate. It has just recently been announced in November by the National Nuclear Security Agency that the metallic component of our two-stage warheads - the so-called pip, containing plutonium, surrounded by metal - has a life of at least 85 years, probably more than 100 years. The previous official estimate was 45 years - I mention this in my testimony - and this has a great

influence on whether you need a so-called reliable replacement warhead or not because all of the other parts of a nuclear weapon are testable and replaceable apart from the pip and you just reuse the pip while you substitute new electronics, new neutron generators and new other things in the nuclear weapon of existing design. So reliable replacement warhead is a programme for maintaining skills, nuclear designer skills, in case the comprehensive test ban treaty vanishes or in case we do need to make new design nuclear weapons, but it is not essential for the preservation of the deterrent and the National Nuclear Security Agency has also said that.

Chairman: That is helpful, thank you. I would like to move on, very briefly, to the costs question.

Willie Rennie: In the White Paper it says that the cost would be in the region of £15-£20 billion and that would be a price worth paying. First of all, do you agree that that is an accurate estimate and, second of all, when would it not be a price worth paying?

Q206 Chairman: Can we leave that second question because I think we have got a general impression from each of the witnesses as to what their view is about the worth of it, but I would like to know whether they accept that money estimates, please.

Dr Willett: There is a very interesting point made in the White Paper. The £15-£20 billion of course looks at the upfront acquisition costs and what we need to try and understand here is not only how much it costs to buy it but how much it costs to run it through life as well for the 50 years. The very interesting point that the White Paper raises is that it makes reference to the running costs being between five and six per cent of the defence budget, and that figure is a very important one because it requires some considerable clarification as to what it means, because it contrasts previous statements which detailed the running costs as being between two and four per cent. If you use the two and four per cent example as your baseline, then based on the calculations that we did at the previous Trident programme the whole programme costs come in at around £25 billion over the whole life, which is in keeping with previous statements, and one could argue that on that basis, if you are looking to reduce the number of submarines, reduce the numbers of missiles, the numbers of warheads and that you have a blueprint for doing everything as you have done before, you actually could do it for less than last time, but the issue of the five to six per cent of the defence budget is a very interesting one because it is somewhat new, so I would be looking for the MOD to explain in coming weeks what that five or six per cent actually consists of and what that therefore means to what the likely overall costs would be, because that is somewhat different from what has been said in the past in my understanding.

Q207 Willie Rennie: Do you think the five to six per cent is in addition to the £15-£20 billion?

Dr Willett: It is, yes. In my understanding it would be £15-£20 billion although of course that is based on four submarines and probably a worst case scenario because politically it would be unacceptable to get this one wrong. Of course, in the past it is very important to note that both Polaris and Trident the first time round came in on time and on cost so there perhaps may be some fat in the estimate to ensure that the MOD does come in under budget - understandably, given the flak that it may generate. One could argue that that £15-£20 billion could be reduced, but the issue of the running costs through life is one that requires further clarification.

Q208 Chairman: Dr Stocker, do you have anything to add?

Dr Stocker: I was just going to clarify that the surprising thing about the costs is the big price ticket put on the four submarines, which is approximately double the cost of the Vanguards at 2005 prices. Allowing for some cost escalation, that is surprising. The four Vanguards came in a little under £6 billion and the Government is reckoning on double that. That may to some extent reflect the bitter experience with the Astute programme and the fact that as we have a much smaller submarine force each individual boat is going to cost more, but even so that doubling of costs of the platforms is surprising and it might be helpful to get clarification from the MOD on why the submarines are projected to cost as much as they are budgeted.

Mr Ingram: It is not quite double but it is almost, and that actually reflects previous experience where the Trident cost double Polaris and the Trident costs in today's prices were £15 billion. I think it could well be a reasonable estimate today, but as with so many things - Olympics, Domes and things like this - things do go up in price, so it could easily be more than £20 billion for the acquisition, and as has already been said you have also got the running costs, so this is where you are getting estimates of £76 billion or whatever, which is not a particularly helpful figure because money depends on when you spend it, how you spend it, if we do not have £76 billion that we could spend elsewhere if we did not spend it on Trident today. It is very difficult, but I would say that £15-£20 billion - you can probably go under, you can have arguments in favour of going over. If you were simply to purchase four Vanguard class submarines as I was hinting at earlier today it would be considerably less than £15 billion, but that is not the option that we are being given today. There are choices that we could make to reduce that cost, but we are not going to for some reason.

Chairman: That is it for this morning. Can I say thank you very much indeed to all the witnesses, particularly, if I may say so, to Professor Garwin for coming such a long way to help another country with decisions that are very important to us; we are most grateful. We are most grateful to all of you, however.