



House of Commons  
Defence Committee

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# The Future of the UK's Strategic Nuclear Deterrent: the Manufacturing and Skills Base

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**Fourth Report of Session 2006–07**

*Report, together with formal minutes, oral and  
written evidence*

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Cover image of the bow section of *Ambush*, the second Astute-class submarine, reproduced with the permission of BAE Systems.

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## Summary

In its White Paper on the future of the UK's nuclear deterrent, the Government recommends the retention and renewal of the submarine-based Trident weapons system. This will require the procurement of a new generation of nuclear-powered Trident submarines to replace the existing, but ageing, fleet of Vanguard-class SSBNs.

This report does not assess the White Paper. That will be the focus of our next inquiry. In this report, we highlight the manufacturing and skills base issues which will need to be addressed if a decision is made to renew the submarine-based deterrent. The Government should respond to this report before the debate on the White Paper in March.

Building and maintaining a new generation of nuclear submarines will require a uniquely skilled and specialised workforce, and a dedicated manufacturing and support infrastructure. These already exist within the UK. But maintaining them is a key challenge. Once lost, the skills base may prove impossible or prohibitively expensive to recreate. Continuity of work on new boats is needed in order to sustain the UK's capability to design, manufacture and maintain nuclear-powered submarines.

Even if the Government's proposal to procure a replacement for the Vanguard-class submarine is rejected, the UK will need to maintain infrastructure and a skilled workforce to support the Royal Navy's conventionally-armed nuclear submarines and to carry out the decommissioning of nuclear submarines and nuclear warheads.

Affordability must be a fundamental consideration in any new submarine programme. If the UK goes ahead with procuring a successor to the Vanguard-class submarine, industry must collaborate more effectively to drive down costs. This will be important at all levels in the supply chain.

In turn, the Ministry of Defence must provide industry with clarity and consistency about operational requirements and specifications. It is vital that lessons are drawn from the problems experienced with the Astute-class programme.

Developing a Vanguard successor would be a huge undertaking. The Ministry of Defence will need the capacity to manage such a programme effectively. Any shortfalls in its preparedness must be addressed as a matter of priority.

Sustaining the skills base at the Atomic Weapons Establishment will also be important if the UK decides to retain its nuclear deterrent. The current investment in skills and infrastructure is understandable and justifiable. But the level of that investment, in advance of decisions in principle on the future of the deterrent, is a source of concern and the Government should clarify to what extent this is a result of the requirements of the regulator. Large-scale investment should follow, and not precede, policy decisions of such paramount importance to the nation.



# 1 Introduction

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1. In July 2005, we announced that we would conduct a series of inquiries into the future of the UK's strategic nuclear deterrent over the course of the current Parliament. Our intention was to encourage and inform the public debate on the future of the nuclear deterrent and to highlight the key issues and questions to be addressed in that debate.

2. Our first report, published in June 2006, focused on the strategic context and timetable for decision-making.<sup>1</sup> It considered the threats which the UK's deterrent was intended to combat, which countries could develop nuclear weapons capabilities in the 2025 to 2050 timeframe, and how this might affect the strategic context in which decisions on the UK's deterrent would be made. And it sought to clarify the timetable within which these decisions would be taken and implemented.

3. In this second-stage inquiry, we have focused on the UK manufacturing and skills base. We have considered the level of investment needed to sustain essential infrastructure and core skills in the UK submarine construction industry; the potential consequences of a gap in the submarine building programme for the long-term viability of the domestic manufacturing and skills base; the implications of the rationalisation of the UK ship-building industry for the construction, maintenance and affordability of a Vanguard-class successor; and the linkage between the Government's Defence Industrial Strategy and the decision on retention, replacement or abolition of the UK's Trident system. We have also examined the Government's investment programme at the Atomic Weapons Establishment and we have considered the possible impact of a new civil nuclear build programme for the retention of nuclear skills and expertise in the military sector.

4. As part of our inquiry, we visited the Atomic Weapons Establishment at Aldermaston, Berkshire; BAE Systems at Barrow-in-Furness, Cumbria; Devonport Management Limited at Devonport Royal Dockyard, Plymouth; Rolls-Royce at Raynesway, Derbyshire; and HM Naval Base Clyde at Faslane and Coulport. We took evidence at Westminster from BAE Systems, Devonport Management Limited, Rolls-Royce, MacTaggart Scott, Alsthom, Weir Strachan and Henshaw, the Keep Our Future Afloat Campaign, GMB, Amicus, Greenpeace, CND, and Lord Drayson and Ministry of Defence (MoD) officials. We are grateful to all those who contributed to our inquiry. And we appreciate the assistance provided by our specialist advisers, particularly Rear Admiral Richard Cheadle and Professor Michael Clarke.

5. The Government's White Paper on the future of the United Kingdom's nuclear deterrent was published on 4 December 2006.<sup>2</sup> It concluded that the UK should retain an independent, submarine-based nuclear deterrent capability.

**6. This report does not seek to assess the findings and conclusions of the Government's White Paper. That will be the focus of our next inquiry.** We intend to take oral evidence

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1 Defence Committee, Eighth Report of Session 2005–06, *The Future of the UK's Strategic Nuclear Deterrent*, HC 986

2 Ministry of Defence and Foreign and Commonwealth Office, *The Future of the United Kingdom's Nuclear Deterrent*, Cm 6994, December 2006

on the White Paper in the New Year, and to publish our conclusions before the House of Commons debates the future of the deterrent in March 2007.

7. The fact that this inquiry has focused on the submarine manufacturing and skills base should not be taken as an endorsement of the existing submarine-based nuclear deterrent, or as an indication of our collective support for, or opposition to, the renewal of that deterrent, submarine-based or otherwise. Nor should it be taken to mean that we think industrial and employment factors should be decisive in the debate on the future of the deterrent. **Any decisions on the future of the UK's deterrent should be taken on the strategic defence needs of the country. Our intention in making this report is to ensure that the House of Commons, and the public, are aware of the manufacturing and skills base issues which will need to be addressed if a decision is made to renew the submarine-based deterrent. We recommend that the Government respond to this report in good time for publication before the debate in the House of Commons on the White Paper in March 2007.**



## 2 The UK's nuclear deterrent

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### The deterrent

8. The UK's current strategic nuclear deterrent is based upon the Trident weapons system. Trident was introduced into service in the UK over a six-year period beginning in December 1994 and has a projected life span of up to 30 years. It is the UK's sole nuclear weapons system.

9. The UK's Trident system has three main components: the Vanguard-class nuclear-powered submarine, the submarine-launched Trident D5 missile and the nuclear warhead fitted to the tip of that missile. As we highlighted in our first report on the deterrent, it is the operational life of the Vanguard submarines which is the critical factor driving the timetable of decision-making on the future of the UK's strategic nuclear deterrent. During the course of our first inquiry, it became apparent that the maintenance of onshore infrastructure and the domestic UK skills base would be of paramount importance if the UK wished to keep open the option of maintaining a submarine-based deterrent.<sup>3</sup>

### The submarine fleet

10. The Royal Navy submarine fleet currently comprises 4 Swiftsure-class nuclear-powered attack submarines (SSNs), 7 Trafalgar-class SSNs, and 4 Vanguard-class nuclear-armed and nuclear-powered submarines (SSBNs). The Swiftsure-class boats are due to be retired within the next 5 years. The Trafalgar-class boats are expected to be withdrawn progressively as the new Astute-class submarines enter service.

11. The target launch for the first of the Astute-class is June 2007, with delivery to the Royal Navy scheduled for August 2008. The later boats in the class are expected to enter Service at 22-month intervals. A total of 7 Astute-class boats is expected to be ordered, though orders beyond Boat 3 are yet to be placed by the Ministry of Defence.

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3 HC (2005–06) 986, paras 126–138

Table: The Royal Navy's submarine fleet

		In-service date	Approximate out-of-service date
<b>Swiftsure Class SSNs</b>	SUPERB	1976	2008
	SCEPTRE	1978	2010
<b>Trafalgar Class SSNs</b>	TRAFALGAR	1983	2008
	TURBULENT	1984	2011
	TIRELESS	1985	2013
	TORBAY	1987	2015
	TRENCHANT	1989	2017
	TALENT	1990	2019
	TRIUMPH	1991	2022
<b>Vanguard Class SSBNs</b>	VANGUARD	1993	2022
	VICTORIOUS	1995	2024
	VIGILANT	1996	2025
	VENGEANCE	1999	2028
<b>Astute Class SSNs</b>	ASTUTE	Planned 2009	
	AMBUSH	Planned 2010	
	ARTFUL	Planned 2012	

Source: Ministry of Defence<sup>4</sup>

4 For Vanguard class out-of-service dates, see Cm 6994, paras 1–3. For Trafalgar class, see HL Deb, 14 March 2005, col WA116. For Swiftsure class, see HC Deb, 7 January 2004, col 414W. For in-service dates, see HC Deb, 26 January 2005, col 335W. For Astute class, see HC Deb, 20 April 2006, col 769W and HC Deb, 9 December 2004, col 687W.

## The onshore infrastructure

12. The submarine fleet is supported by an extensive onshore infrastructure.

### *Basing*

13. The Vanguard SSBNs and the Swiftsure SSNs are based at HM Naval Base Clyde at Faslane. The new Astute-class SSNs will also be based at Faslane. At present, the Trafalgar-class submarines have their base port at HM Naval Base Devonport, in Plymouth, Devon.

### *Maintenance*

14. Routine maintenance of the submarines is carried out at their base ports. For the Vanguard SSBNs, maintenance is carried out at the HM Naval Base Clyde at Faslane by Royal Navy and civilian personnel. Faslane is managed under a partnership arrangement involving the Royal Navy and Babcock Naval Services. HM Naval Base Clyde—which includes the Royal Naval Armaments Depot (RNAD) Coulport as well as Faslane—employs around 6,500 people.

### *Refit*

15. Refit and maintenance of nuclear-powered submarines is carried out by Devonport Management Limited (DML) at Devonport in Plymouth. DML has £1 billion worth of dedicated, and unique, facilities which are essential for submarine refuelling and refitting. It has five basins for submarine refit, with a dedicated section for the Trident SSBNs. It is currently involved in two submarine refit streams, for the Vanguard and Trafalgar classes. It is also involved in upkeep work and capability upgrades on surface ships and in providing onsite support and fleet management to the Royal Navy.

16. Devonport currently employs 5,200 staff, of which 4,700 are permanent staff. DML is owned by KBR (a subsidiary of Halliburton) which holds a 51% controlling stake, the Weir Group and Balfour Beatty.

### *Production*

17. The UK's nuclear-powered submarines are designed and built by BAE Systems Submarines at Barrow-in-Furness, in Cumbria. Barrow is the only UK nuclear-licensed site for the construction, testing and commissioning of nuclear-powered submarines. Barrow (then under the ownership of VSEL) built the Vanguard class submarines, and is currently involved in the design and build of the first batch of Astute-class SSN submarines. It also carries out design, build and conversion of surface ships for the Royal Navy (recently HMS Albion, Bulwark, Ocean) and it is planned that it will build a section of the future aircraft carriers. It employs around 3,500 people, and dominates the local economy.

### *Supply chain*

18. Fifty per cent of the prime contract value for a nuclear powered submarine is subcontracted to the supply chain. The top 10 companies, including BAE Systems, account for around 80% by value of a nuclear-powered submarine.<sup>5</sup> Key suppliers include Rolls-Royce, Alstom, L3, MacTaggart Scott, Sheffield Forgemasters, Thales, Wellman, Weir Strachan and Henshaw, and York.

### *Nuclear reactor*

19. The Nuclear Steam Raising Plants, or reactors, as well as a range of other equipment, for nuclear-powered submarines (both SSNs and SSBNs) are built by Rolls-Royce at Raynesway in Derbyshire. Rolls-Royce is currently involved in designing and manufacturing the Nuclear Steam Raising Plant (NSRP), fuel cores, propulsors, flexible couplings and turbogenerators for the Astute-class submarine. It also provides in-service support to the existing fleet, including the Vanguard-class submarine, and is responsible for design improvements, inspection, refurbishment, condition monitoring and continuous safety review of the NSRP. Rolls-Royce is involved in concept design and assessment of future submarine propulsion options. It also manages the Royal Navy's Vulcan Shore Test Facility at Thurso in northern Scotland. Rolls-Royce employs 910 staff in its submarine business.

### *Nuclear warheads*

20. The nuclear warheads for the Trident D5 missiles are manufactured by the Atomic Weapons Establishment (AWE) at Aldermaston and Burghfield, in Berkshire. The AWE also carries out scientific research, stockpile management and warhead decommissioning, and seismological research in support of the verification of the Comprehensive Test Ban Treaty. The AWE is managed under a Government-owned, contractor-operated arrangement by AWE plc. It employs around 4,000 people.

21. The nuclear warheads are fitted to the UK's Trident D5 missiles at RNAD Coulport, at the HM Naval Base Clyde. The Trident D5 missiles, which carry the UK-built warhead, are procured from the United States.

### **The Naval Base Review**

22. The Ministry of Defence is currently conducting a review of UK naval bases and this may significantly affect the submarine onshore infrastructure. The recommendations from the review, which is being undertaken by the Defence Logistics Organisation, are expected to be finalised in Spring 2007.<sup>6</sup>

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5 Ev 53

6 HC Deb, 18 September 2006, col 134WS

### 3 The submarine industrial base

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#### Sovereign capability

23. The Government's Defence Industrial Strategy (DIS), published in December 2005, sought to "provide greater transparency of our future defence requirements" and to set out, for the first time, "those industrial capabilities we need in the UK to ensure we can continue to operate our equipment in the way we choose...to maintain appropriate sovereignty and thereby protect our national security".<sup>7</sup>

24. The maritime section of the DIS stated that:

It is a high priority for the UK to retain the suite of capabilities required to design complex ships and submarines, from concept to point of build; and the complementary skills to manage the build, integration, assurance, test, acceptance, support and upgrade of maritime platforms through-life.

For the foreseeable future the UK will retain all of those capabilities unique to submarines and their Nuclear Steam Raising Plant (NSRP), to enable their design, development, build, support, operation and decommissioning.<sup>8</sup>

25. In this way, the DIS sought to ensure that "options for a successor to the Vanguard class deterrent are kept open in advance of eventual decisions, likely to be necessary in this Parliament".<sup>9</sup>

26. The DIS stated that the retention of an onshore sovereign capability in submarine design and manufacture was required because "the UK's fleet of nuclear powered submarines requires a specialist subset of skills within the maritime industry" and because the UK had "duties of nuclear ownership and commitments to the USA which can only be fulfilled by close control of an onshore submarine business". On this basis, the DIS concluded that "it is essential that the UK retains the capability safely to deliver, operate and maintain these platforms, without significance reliance on unpredictable offshore expertise".<sup>10</sup>

27. In evidence to us, Lord Drayson, the Minister for Defence Procurement, stated that:

We have a responsibility...of making sure that if we are operating nuclear submarines we have the capability to do so safely. Being able to ensure that we have that capability and that know-how is intimately tied up with an understanding of the design, the development of the system, which best comes from...having the design base and skills here in this country to do it.<sup>11</sup>

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7 Ministry of Defence, *Defence Industrial Strategy*, Cm 6697, December 2005, foreword

8 *Ibid.*, p 70

9 *Ibid.*, p 76, para B2.63

10 *Ibid.*, p 71, para B2.26

11 Q 199

28. He also told us that “it is not possible for us to procure many aspects of the submarine from other parties”.<sup>12</sup> Because of the safety issues and regulatory burdens involved, nuclear-powered submarines were in a “different league” to other military equipment, such as armoured vehicles or fighter jets, which could be purchased off-the-shelf.<sup>13</sup>

29. Lord Drayson also stated that a contributory, though “second order”, reason for retaining a sovereign capability was the issue of affordability. He argued that designing and manufacturing nuclear-powered submarines in the UK was more cost effective, and ultimately better value for money, than procuring them from abroad.<sup>14</sup> He said that American and French nuclear-powered submarines were significantly more expensive than British-built boats. Rear Admiral Andrew Mathews, Director General Nuclear at the MoD, acknowledged that this cost difference was at least in part because the US submarines were built for a longer service life.<sup>15</sup>

30. The White Paper states that:

It would be our intention to build the new SSBNs in the UK, for reasons of national sovereignty, nuclear regulation, operational effectiveness and safety, and maintenance of key skills. But this is dependent on proposals from industry that provide the right capability at the right time and offer value for money.<sup>16</sup>

It also states that the Government will “seek to bear down on the costs by sourcing some sub-system elements from overseas”.<sup>17</sup>

**31. The Ministry of Defence believes that the UK should retain onshore a sovereign capability in the design, construction, operation, maintenance and decommissioning of nuclear-powered submarines. It is important that the public understand clearly the reasons for this. We call upon the MoD to provide, in its response to this report, a fuller explanation of the need for this sovereign capability.**

## Key skills

32. As well as declaring a national security imperative for the retention of a sovereign capability in the design and manufacture of nuclear-powered submarines, the Defence Industrial Strategy also identified, in broad terms, the areas of expertise the Ministry of Defence considered essential to retain onshore in the UK. In respect of submarine design, construction and maintenance, the DIS stated:

Deep scientific and technical advice on hydrodynamics, manoeuvring and control, propulsor technology and atmosphere control are specific capabilities essential to submarine performance. Structural and acoustic engineering design is not readily available from the broader market place and has to be maintained within the

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12 Q 199

13 Q 200

14 Q 199

15 Q 239

16 Cm 6994, para 6.3

17 *Ibid.*, para 6.5

specialist submarine industry. Submarine hull and infrastructure design and construction require the use of specialist techniques, for example particular welding and fabrication processes. These specialist underpinning capabilities must be sustained in the UK.<sup>18</sup>

33. In addition, the DIS highlighted the specialist skills involved in nuclear propulsion in which the UK should retain a sovereign capability:

The ability to manage Nuclear Steam Raising Plant throughout its life-cycle, including the fuel elements, is a strategic capability that must be retained onshore. This includes design and development, manufacture, test and evaluation and decommissioning. An irreducible minimum level of associated facilities, intellectual resource and supporting technologies must be provided within the UK or under arrangements that guarantee UK control and safe ownership.<sup>19</sup>

34. In evidence to us, defence companies and trade unions told us that the design, construction and maintenance of nuclear-powered submarines, including the nuclear propulsion system, was an inherently complex enterprise. The process demanded the highest standards of manufacture and was dependent on sustaining a uniquely skilled and specialised workforce.<sup>20</sup> Nationality restrictions apply to who can work in the UK's nuclear submarine programme, which limits the pool of suitably qualified staff from which industry can draw.

35. According to BAE Systems, which owns and operates the Barrow shipyard, the broad skills sets utilised in the design and construction of a nuclear-powered submarine include naval architecture, systems engineering and marine engineering. Murray Easton, Managing Director of BAE Systems Submarines, told us that designers and engineers are required in a range of specific areas such as computer-aided design, electrical and mechanical systems, systems integration, structural hydrodynamics, noise and vibration, including acoustics, life support and safety, both of the hull and of the nuclear propulsion system.<sup>21</sup>

36. The construction process also required skilled and experienced planners, project managers, draughtsmen, safety technicians, quality control experts and test and commissioning personnel. According to Mr Easton, these were “very specialist skills” which were employed to design and construct “an exceptionally complex product”.<sup>22</sup>

37. Peter Whitehouse, Corporate Development Director at Devonport Management Limited, which conducts deep maintenance and refuelling of the UK's current fleet of nuclear-powered submarines, including the Vanguard-class, told us that the skills required in the maintenance and refit process were broadly similar to those in the construction process. However, there was less of a demand for design engineers and a greater

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18 Cm 6697, p 71, para B2.27

19 *Ibid.*, para B2.28

20 Ev 53

21 Q 2

22 *Ibid.*



requirement for personnel skilled in nuclear safety justification and environmental impact assessment.<sup>23</sup>

38. The skills required for the design and manufacture of the Nuclear Steam Raising Plant are equally specialised. Steve Ludlam, Managing Director of Rolls-Royce Submarines, the company which produces the nuclear propulsion system, said that the design of a Nuclear Steam Raising Plant required expertise in nuclear engineering and in safety case justification, which was “absolutely vital” to ensure safe operation of the NSRP. Construction of the NSRP, and of the Heavy Pressure Vessel (HPV) in which it was housed, required “very specialist manufacturing skills, not ones which are easily acquired or easily trained”. According to Mr Ludlam, these skills were “unique to what we do here in the UK”.<sup>24</sup>

**39. Witnesses to our inquiry maintain that the UK's current manufacturing and skills base is already at the minimum level necessary to sustain a viable onshore submarine industry.** Murray Easton, of BAE Systems, told us that “we are at the critical mass just now in the design, build and commissioning end of the enterprise that we actually need”. In fact, there were “already some shortages” in certain skill areas. According to Mr Easton, any further depletion of the workforce at Barrow would leave the dockyard, and the UK submarine industry as a whole, “in a very perilous state”.<sup>25</sup>

40. In evidence to us, Rolls-Royce stated that it faced a “significant skills continuity challenge over the next decade”.<sup>26</sup> This was true not only in its workforce but throughout the supply chain. Studies it had conducted for the Ministry of Defence had revealed that the supply base for the Nuclear Steam Raising Plant was “fragile” and in some specific areas supply was either currently, or soon to become, “critical”. This was a significant concern to Rolls-Royce since “sole or single source suppliers provide the majority of NSRP equipment and the supply base contains some design and manufacturing skills and capability which, in specific cases, are retained in only two or three individuals in the UK”.<sup>27</sup>

41. Skills in the supply chain varied enormously. Weir Strachan and Henshaw, which provided weapons handling and launch systems for conventional weapons on both the existing Vanguard-class submarines and the forthcoming Astute-class boats, told us that they employed a specialist workforce with design skills in systems engineering, mechanical engineering, structural design and control systems, and manufacturing skills in specialist welding, assembly, fitting and testing.<sup>28</sup> Alsthom, which provided steam turbines and power plants for the Astute-class, and MacTaggart Scott, which manufactured non-hull penetrating masts, both drew on a similarly specialist skills base.<sup>29</sup>

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23 Q 3 [Whitehouse]

24 Q 5

25 Q 2

26 Ev 59

27 Ev 60

28 Q 63 [Oatley]

29 Qq 63 [Morrison], 64 [Grant]



42. **Witnesses to our inquiry agreed that the complexity and uniqueness of a nuclear submarine, and of the environment in which it operated, called for special skills, facilities and oversight not supported by any other shipbuilding programme.** BAE Systems told us that its skills base could “only be sustained by work on real submarine projects”. Surface ship work could “provide some very important assistance to the effective utilisation of facilities and overall skills”, but it “cannot by itself sustain those skills that are specifically needed for nuclear submarine work”.<sup>30</sup> Mr Easton told us that “the skills themselves are very submarine-specific skills” and that “the standards that are required for the design and ultimate operation of the submarine are such that they do not exist anywhere else”.<sup>31</sup> This point was recognised by Lord Drayson, who told us that “the type of work involved in surface ships, both from a design and manufacture point of view, is qualitatively different from the work involved in submarines”.<sup>32</sup>

43. Mr Ludlam explained that Rolls-Royce had experienced particular difficulties in sustaining skills on other, non-nuclear, work streams. From his experience, work on heavy pressure vessels in the civil industry was not sufficient to maintain required skill levels in the nuclear sector. He stated that “if we are not using the skills in the right environment and in the right domain I think they do erode; you have got to keep practising”.<sup>33</sup>

44. The retention of key skills and experience was a key challenge not only at the level of the Prime Contractor but throughout the supply chain. In fact, supply chain companies faced particular difficulties in retaining their specialist workforce, especially in periods of inactivity in the submarine programme.

45. One difficulty industry faced was a general shortage of sufficiently skilled graduates. Rolls-Royce highlighted the reductions in the numbers of physics and mathematics graduates as a particular concern. And it stated that there had been a “severe reduction in University first-degree courses in nuclear engineering since the 1990s”.<sup>34</sup> Rolls-Royce was also concerned at the decline of UK nationals taking science PhDs at UK universities, since stringent nationality restrictions applied to whom the company could recruit. At Barrow, Aldermaston and elsewhere, we were told of a national shortage in experienced project managers. We also heard that there was a shortage of skilled technical staff. Mr Easton told us that the welders at Barrow were “absolutely world-class structural welders or pipe welders”. It was simply not the case that “a welder is a welder”.<sup>35</sup> The national pool of sufficiently skilled and experienced staff in these technical areas was small. **We share our witnesses’ concern about the shortage of science and engineering graduates, project managers and skilled and experienced technical staff, but this raises questions which go far beyond the scope of this report.**

46. **The UK submarine industry draws on a uniquely skilled and specialist workforce. Retaining that skills base will be essential if the UK decides it wants to continue to**

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30 Ev 53

31 Q 3 [Easton]

32 Q 240

33 Q 14 [Ludlam]

34 Ev 59

35 Q 6 [Easton]

design, build and maintain nuclear-powered submarines. The skills base is now at a critical level. Any further erosion of the workforce may have significant implications for the future of the submarine programme. Sustaining skills in this sector is only possible with regular and continuous submarine work.

47. Even if the decision is taken not to procure a Vanguard successor, a specialist skills base will have to be retained in order to build SSNs and maintain and finally decommission the UK's existing fleet of nuclear-powered submarines. Some indication of the order of costs would be helpful in considering arguments about affordability and we ask that the MoD provide some information about this in their response to this report.

### The gap between Vanguard and Astute

48. Witnesses to our inquiry warned that gaps in the submarine programme could lead to the departure of highly skilled and experienced personnel to other industries. The 11-year gap between the design of Vanguard and Astute submarines was cited by industry and trade unions as evidence of just how rapidly the skills base can erode without regular or sufficient specialist work, and of how difficult and expensive it is to reconstitute once lost.<sup>36</sup> Only with the assistance of the US company, Electric Boat, had the UK been able to re-establish a viable submarine construction industry after that gap. They suggested that there was a minimum frequency of production of new submarines that was essential if the UK was to retain a viable onshore submarine industry.

49. Murray Easton, of BAE Systems, told us that the Barrow shipyard had “haemorrhaged skills and experience during [the] gap” between the Vanguard and Astute programmes.<sup>37</sup> Likewise, in evidence to us, Rolls-Royce stated that the gap between Vanguard and Astute “led to discontinuity in production and a reduction of skills throughout the NSRP supply chain”.<sup>38</sup> As a direct result of that gap, the number of manufacturers of Heavy Pressure Vessels in the UK declined from five to two, and at present only one, owned by Rolls-Royce, remains.<sup>39</sup>

50. According to Rolls-Royce, the precise impact of a future gap in production was difficult to predict. It would be “dependent on the timing and length of any gap”. Even during the Astute-class programme, uncertainty over future orders meant that the company's HPV facility was “threatened with closure”. Another gap could have serious consequences. It would “signal that the principles of openness and partnering championed by the DIS are difficult to achieve”.<sup>40</sup>

51. In evidence to us, BAE Systems stated that “if [such a gap] happens again...the loss of capability and expertise is likely to be irreversible”.<sup>41</sup> Mr Easton suggested that any kind of

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36 Ev 53, Qq 12, 76 and 111

37 Q 12

38 Ev 58–59

39 Ev 61

40 *Ibid.*

41 Ev 56

delay in the submarine programme would have a “catastrophic impact” on the capability of Barrow and, therefore, of the UK as a whole, to manufacture nuclear submarines.<sup>42</sup> Even now, that capability was “very fragile”.<sup>43</sup>

52. Ron Grant, Managing Director of MacTaggart Scott, whose business was 95% defence-related, told us that the gap between Vanguard and Astute “very nearly put us out of business”. He maintained that the company had faced a particular “difficulty in actually keeping a design team together, focused”. He stated that:

we went through a three-year period of actually declaring a loss by in effect having the design team treading water involved with the research and development which was, to our small company, at a very high level and not affordable.<sup>44</sup>

53. For other, larger, supply chain companies the difficulties were unlikely to be so profound. Alstom, for example, whose naval business currently accounted for 3% of its sales, told us that a gap in the submarine programme “would not have a dramatic impact” on skill retention.<sup>45</sup> Although Jim Morrison, Unit Managing Director at Alstom, told us “we are doing everything we can...to sustain that skill base”, he conceded that his company had “tried to lessen the impact of our reliance on naval orders” and that its “future clearly lies in the [civilian] power business”.<sup>46</sup> If Alstom were to leave the submarine business, the MoD would have to find a suitable alternative supplier of advanced steam turbines and power generators. If no alternative could be found, this could have a profound impact on the entire submarine programme.

**54. The submarine construction supply chain is fragile and is particularly susceptible to gaps in the programme. Extended gaps are likely to result in an erosion of the UK's submarine manufacturing and skills base. There is also a risk that single source suppliers will abandon the supply chain in pursuit of more regular and assured work. If the UK intends to build a successor to the Vanguard-class, or maintain an SSN capability beyond the current Astute order book, the supply chain will have to be sustained. To achieve this, the MoD must give clear direction and certainty about the future submarine programme in order to encourage industry to invest. We call upon the MoD to provide, in its response to this report, an assessment of whether, how and at what cost the submarine supply chain could be maintained for the construction of future SSNs in the absence of a positive decision on a Vanguard successor.**

55. For industry, the lesson to be drawn from the gap between Vanguard and Astute was that there needed to be continuity of work in submarine design and construction. The Royal Academy of Engineering told us in evidence that “the important lesson is that continuity of both design teams and construction activity is vital if major cost and time overruns are to be avoided”.<sup>47</sup>

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42 Q 10

43 Ev 53

44 Q 65 [Grant]

45 Q 68

46 Q 72

47 Ev 106

56. The risks of a gap in the submarine programme, and the lessons to be drawn from the gap that occurred between Vanguard and Astute, were highlighted in the Defence Industrial Strategy:

Submarine design capability is at risk if long gaps emerge between first-of-class design efforts. The eleven year break between the design of Vanguard and Astute undoubtedly led to a loss of capability and impacted on the Astute programme. We now aspire to an eight year drumbeat to sustain the design capability through incremental improvements, both to drive down build costs and reduce subsequent support costs.<sup>48</sup>

57. In evidence to us, Lord Drayson said:

The central lesson we have learned [from the gap between Vanguard and Astute] is that if we are to maintain the level of skills that we need within an industry... we need to provide sufficient work to do so”.<sup>49</sup>

The UK's submarine industry was now at a “minimum critical mass” and the Ministry of Defence had “to make sure it does not get any smaller and we do not lose any of those skills”. It was simply “not realistic”, Lord Drayson argued, “to have a pause [in the submarine programme] and then look at regenerating the capability”.<sup>50</sup> According to Lord Drayson:

We could not have the option of stopping building submarines and expecting there to be a submarine building industry ten years down the track...we cannot expect, and it is not realistic to expect, that that submarine industry could be re-built again.<sup>51</sup>

As a result, he stated that:

We need to have a very clear understanding of the frequency of orders and therefore the frequency of build of submarines that is required as a minimum to maintain those skills, to make sure that we have that capability.<sup>52</sup>

58. Industry witnesses told us that the ideal frequency of build of new submarines—the “drumbeat” as they call it—is a boat every 22 months. BAE Systems argued that:

Sustaining the required capability and skills is critically dependent on establishing and maintaining a regular drumbeat of nuclear powered submarine production work—a boat every 22 months is considered the minimum necessary drumbeat.<sup>53</sup>

59. This view was supported by Lord Drayson, who told us that:

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48 Cm 6697, p 76, para B2.62

49 Q 210 [Drayson]

50 Q 210 [Drayson]

51 Q 227

52 Q 210 [Drayson]

53 Ev 53

Within the Ministry of Defence we absolutely do accept what industry is saying, that maintaining that critical mass of skills does boil down to maintaining the frequency of build at approximately this two-year cycle.<sup>54</sup>

David Gould, Deputy Chief Executive of the Defence Procurement Agency (DPA), added that:

What the industry tells us and what we actually agree with from our own analysis is that 22 months, or around that figure, is what we can economically and sensibly do with the size of workforce and the skill base that we now have put in place.<sup>55</sup>

60. These orders need not necessarily be for nuclear-armed Trident submarines. Lord Drayson told us that:

Whether or not these are submarines which will be used for the nuclear deterrent—they could be entirely attack submarines, not bomber submarines—we would still need to be maintaining a build of submarines at that frequency to maintain those skills.<sup>56</sup>

61. The skills base in submarine hull manufacture could be sustained through orders for nuclear-powered but conventionally-armed boats. The UK could order additional SSNs to fill the gap in orders created by not building new SSBNs, but it would be wrong to build additional SSNs, to sustain the skills base, without a clear military requirement for additional attack submarines. **Without a new SSBN it is possible that there would be insufficient demand for nuclear submarines to sustain the industry. It is important to recognise that there is an interrelationship between SSN and SSBN construction.**

62. According to David Gould, what was even more important than the precise number of months between the completion of each new boat was the need for some certainty in the future submarine programme. He stated that with a clearly defined rhythm of construction, industry could plan and size their workforce accordingly. The 22-month rhythm of construction was “a good figure”, according to Mr Gould, but it was not absolute. In fact, “individual submarines might actually vary a small amount without destroying or undermining that confidence”.<sup>57</sup>

63. The White Paper acknowledges the risks that:

In the event of a significant gap between the end of design work on the Astute-class conventional role nuclear submarines and the start of detailed design work on new SSBNs, some of the difficulties experienced on the Astute programme would be repeated because of the loss of key design skills.<sup>58</sup>

**64. It is clear that the gap between the Vanguard and Astute submarine programmes had a serious and debilitating impact on the UK's submarine industry and put at risk**

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54 Q 211

55 Q 217

56 Q 210 [Drayson]

57 Q 215

58 Cm 6994, para 1.6

the future of the UK's submarine fleet. If the Government wants the UK to continue to design and build nuclear-powered submarines, it will be essential to maintain a regular rhythm of submarine construction. Reducing the frequency of construction below 22 months would be risky. Without a regular build “drumbeat”, the UK skills base will erode and it may prove impossible or prohibitively expensive to recreate.

65. In our recent report, *Defence Procurement 2006*, we drew attention to the fact that the MoD and BAE Systems had still not agreed a price for Astute boats 2 and 3. We said that letting contracts without pinning down contracts, and negotiating prices when manufacture was at such an advance stage, could not be considered “Smart Acquisition”. And we pointed out that the price negotiations on boats 2 and 3 were delaying the placing of a contract for Astute boat 4, with consequent uncertainty for the submarine industry and risks for the skills base.<sup>59</sup> **It is important that the MoD and industry agree promptly on a price for future Astute-class orders. Clarity and certainty about the future submarine programme is necessary if industry is to continue to invest in the manufacturing skills base. The MoD must also demonstrate that it has learned the lessons from the Astute programme, and implemented a much tighter contractual relationship with BAE Systems, before it commits expenditure to a new SSBN build programme.**

66. The White Paper states that the Government “envisages that the design of the next SSBNs will maximise the degree of commonality with other in-service submarines where it can be done in a cost effective manner” though it acknowledges that:

Some changes to the design of the Vanguard-class will be required to take account of equipment obsolescence, the need to continue to meet modern safety standards and to maximise the scope to make the new SSBNs capable of adapting to any changes in our requirements and to any new technological developments.<sup>60</sup>

This suggests only a modest change in submarine design, but elsewhere the White Paper speaks of more radical redesign:

We will investigate fully whether there is scope to make sufficiently radical changes to the design of the new SSBNs and their operating, manning, training and support arrangements, to enable us to maintain continuous deterrent patrols with a fleet of only three submarines.<sup>61</sup>

67. **The Government will need to consider carefully whether the potential long-term benefits of designing a completely new submarine, in which through-life affordability is built in from the start, could outweigh the cost-benefits of maximising commonality of design with existing submarines. And it will need to judge whether efforts to maximise commonality with existing submarines would be enough to sustain the specialist submarine design base in the UK.**

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59 Defence Committee, First Report of Session 2006–07, *Defence Procurement 2006*, HC 56, paras 39–48

60 Cm 6994, para 5.6

61 *Ibid.*, para 5.9



68. The same arguments apply to the Nuclear Steam Raising Plant. Rolls-Royce told us, during our visit to Raynesway, that a new generation nuclear propulsion plant would improve safety and availability, and reduce the whole life costs of the submarine. **Using a well-tried reactor in the new submarines would minimise design-related risk, but in the longer term there might be benefit in both safety and design costs in investing in a new generation of reactor technology.**

69. **We recommend that the MoD make clear in its response to this report the timetable for the procurement of the new submarines it proposes. This should indicate by when it will need to decide whether to opt for radical redesign or commonality of design for the submarine platform and for the nuclear reactor, and when it will need to decide between a three- or four-boat package.**

### Consequences of no Vanguard successor

70. We asked industry what the consequences would be if the decision were taken not to renew the submarine-based deterrent. We were told that a decision against procuring a Vanguard successor would have a devastating impact on the UK's onshore submarine industry. This would have serious consequences for the UK's ability to design and manufacture not only future nuclear-armed submarines but also nuclear-powered conventionally armed boats.

71. Murray Easton stated that:

If there is a further delay, or any delay, in the submarine ordering programme it will have a significant and, I think, catastrophic impact on our ability to design and build and, therefore, for this country to have its own nuclear submarine design and construction...If the successor programme does not go ahead then, obviously, depending on how many Astute submarines there are, our production facility at Barrow will grind to a halt.<sup>62</sup>

72. Joe Oatley, of Weir Strachan and Henshaw, told us that, in the absence of a Vanguard successor, "if there were to be a long period before there was an Astute replacement...it would have a catastrophic effect on our ability to design a new system". Although Weir Strachan and Henshaw had been able to sustain key skills during the gap between Vanguard and Astute by work in the export market on non-nuclear submarines, it had only been able to win that new business because of the prestige that came from supplying the UK's submarine fleet. Without this work, the company would find it hard to attract new business and, therefore, to retain its specialist workforce.<sup>63</sup>

73. Terry Waiting, Chairman of the Barrow-based Keep Our Future Afloat Campaign, argued that "if we do not have this nuclear deterrent based on a submarine platform...the future for Barrow-in-Furness is...bleak".<sup>64</sup> He agreed with Murray Easton that even a delay could have debilitating consequences for the viability of the UK's submarine industry. Mr Waiting told us that a delay in the deterrent decision "would be the end for Barrow in

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62 Qq 10, 26

63 Q 77 [Oatley]

64 Q 103

shipbuilding” and “would have a tremendous impact on Barrow-in-Furness...it could be the death knell for the whole town”.<sup>65</sup>

74. In evidence to our inquiry, the Campaign for Nuclear Disarmament (CND) states that it takes the issue of jobs and skills “very seriously” and that “the preservation and expansion of skilled jobs, such as those found within this sector, is an issue which carries considerable weight within some local communities and work forces”.<sup>66</sup> Dr Kate Hudson, Chair of CND, told us that “a decision to replace Trident should not and indeed need not have a detrimental impact on those workforces”. Dr Hudson argued that the UK should adopt an “arms conversion project” and told us that CND was currently working with Unison to look into the possibilities of alternative employment in this sector.<sup>67</sup> In its memorandum to us, CND maintains that “an effective alternative employment and defence diversification strategy can meet concerns about the maintenance of jobs and skills”. It states that:

Redirection of investment and subsidies into non-nuclear production and facilities can more than compensate for jobs currently located in the nuclear sector, and the same applies to potential future jobs related to any proposed new nuclear weapons system”.<sup>68</sup>

Alternative employment, Dr Hudson argues, did not mean lesser quality, or less fulfilling employment. Jobs in the nuclear sector, she maintains, “are very good jobs with very good conditions” and “those people do not want to go and work in a supermarket”. Dr Hudson told us that “CND is absolutely opposed...to anything which would suggest that, but we do not think that that is necessary” since fulfilling employment could be found elsewhere.<sup>69</sup>

**75. A decision to abandon the construction of nuclear submarines would have a profound impact upon local communities, particularly at Barrow. Nevertheless, we believe that employment factors should not be decisive in the debate on the future of the deterrent.**

## Decommissioning

**76. If there were no successor to the Vanguard-class submarine, there would be an ongoing need to retain onshore a capability to support and, ultimately, to decommission the current SSBN and SSN fleet. We call upon the MoD to state in its response to this report how much it would cost to sustain that capability.**

77. Peter Whitehouse, of Devonport Management Limited, stated that if the existing fleet continued to operate, there would be an ongoing need for in-service support and maintenance. In these circumstances, Mr Whitehouse argued that “the profile of our workforce and the infrastructure...would not be dissimilar from where we are today”. If the Government had opted for a different delivery system for the UK's strategic nuclear

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65 Q 103

66 Ev 81

67 Q 144

68 Ev 85

69 Q 149



deterrent, and decided to have a phased run-down of the existing Trident system, that infrastructure need would remain.<sup>70</sup>

78. Even if the submarine deterrent programme was stopped, Mr Whitehouse argued, the facilities at Devonport would still be needed to move the irradiated fuel out of the Nuclear Steam Raising Plant and package it ready for reprocessing at Sellafield. He stated that this would require “a markedly different workforce size and skill mix compared to where we are today”. Numerically, the workforce would be much smaller. The focus would then be on de-fuelling the submarines and disposing of the hulls. But since all nuclear site licences would have to be retained throughout the decommissioning process, “a lot of the infrastructure teams would not look markedly different from where we are today”.<sup>71</sup>

79. Mr Whitehouse told us that it was important to remember that although decommissioning “is a different type of activity, it is one that does still have very, very significant challenges in it and requires some very specialised skills”.<sup>72</sup>

80. Steve Ludlam, of Rolls-Royce, added that any decision to abandon a future submarine programme and focus exclusively on in-service support and decommissioning would impact upon military capability by putting at risk the availability of the entire nuclear-powered submarine fleet. This was because such a decision would “freeze the level of knowledge that we have and certainly freeze the level of skill we have got” as skilled workers looked for more exciting and sustainable challenges.<sup>73</sup>

## Affordability

81. The Defence Industrial Strategy stated that affordability would be a key factor in the decision-making process on whether to procure a successor to the Vanguard-class Trident submarine:

Cost effectiveness will be a key factor in any consideration of potential [deterrent] options, both submarine-based and non-submarine based. For submarine-based options it will be very important that MOD and industry are able to demonstrate an ability to drive down and control costs of nuclear submarine programmes. Industry will be fully engaged in ensuring that design efforts achieve the maximum impact in control of submarine build and support costs, so sustaining the potential for this significant future business and military capability.<sup>74</sup>

82. The MoD's memorandum to our inquiry stated that “we would expect that any commitment by the Government to a long-term submarine build programme would be matched by a commitment by industry to rationalise costs”.<sup>75</sup>

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70 Q 19

71 *Ibid.*

72 Q 21

73 Q 22 [Ludlam]

74 Cm 6697, para B2.63

75 Ev 86

83. The White Paper states that “more change is needed for industry to be able to deliver a new programme on time and at an acceptable cost. We believe that the imperative for change is well recognised”.<sup>76</sup>

84. Lord Drayson told us that the MoD's concerns with achieving greater affordability and cost effectiveness had been heeded by industry. He stated that he had seen a “recognition take root in industry, particularly over the last six months, that the Ministry of Defence means it” and that there had been “measurable improvements in performance”.<sup>77</sup>

85. David Gould told us that recent experience on the Astute programme had been encouraging. He was “optimistic” that industry and the MoD were “close to agreeing prices” on Astute boats two and three. There had been “significant overhead reductions” which had been “driven by the Barrow management to demonstrate that they can actually improve the running of the business”.<sup>78</sup> Rolls-Royce, he stated, had developed “a much better approach...on how we are going to maintain and manage the nuclear steam raising plant throughout its life” and it was investing in people and capability and had demonstrated that it was “interested in future changes [to the NSRP] to make it easier to build and easier to maintain”.<sup>79</sup> Mr Gould also said that “we have...some good cooperation starting” with Devonport Management Limited in examining “how we can build on what we are doing with Rolls-Royce in terms of reactor maintenance into submarine availability contracting”. He concluded that, as far as affordability of the Astute programme was concerned, “we have the momentum moving in the right direction”. The challenge was to keep that momentum going.<sup>80</sup>

86. We asked industry what exactly they were doing to drive down and control costs in the manner envisaged by the Defence Industrial Strategy. In evidence to our inquiry, BAE Systems stated that the issue of affordability “has rapidly become, and will continue to be for the foreseeable future, a dominant theme”.<sup>81</sup> According to Mr Easton, BAE Systems was “making a very serious and significant response” to the MoD's call to drive down costs.<sup>82</sup> On the Astute programme, this included the implementation of new working practices and techniques, such as lean design and lean manufacture, and by applying relevant lessons from other industries. This had resulted in significant reductions in overheads and projections of further reductions in the cost base over the coming years.<sup>83</sup>

87. BAE Systems had also established a Key Supplier Forum of the ten main companies in the supply chain on the Astute-class programme. According to Murray Easton, the Forum had “been hugely constructive”. It had achieved “exceptionally good results” and had

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76 Cm 6994, para 6.2

77 Q 247 [Drayson]

78 Q 247 [Gould]

79 *Ibid.*

80 *Ibid.*

81 Ev 53

82 Q 10

83 Q 38

secured further cost savings. Mr Easton told us that the Forum was “an example of the submarine industry working very well together as a team to tackle the affordability issue”.<sup>84</sup>

88. Ron Grant, of MacTaggart Scott, told us that the Key Supplier Forum “has really got us quite excited”. This was because:

For the first time...we are seeing an environment where we can actually get around the table with private contractors, have access to the Ministry...and to the Navy, and it is...starting to yield genuine benefit in both lower costs and obviously ultimately affordability.<sup>85</sup>

89. Joe Oatley, of Weir Strachan and Henshaw, said that “without doubt” the Key Supplier Forum was a helpful innovation.<sup>86</sup> He told us that his company and BAE Systems had “worked very hard” to work in “partnership” rather than a “confrontational supplier/customer sub-contract relationship”. He told us “the reason we have done that is to try and generate more value for the end customer driven by essentially trying to get a more cost-effective product and it has been very successful as a result”.<sup>87</sup>

90. However, both Mr Oatley and Mr Grant stated that, whilst there had been progress in promoting affordability in the procurement process, there was still an insufficient concentration on through-life support costs of the programme. Mr Grant told us that “there is still an obsession with acquisition costs without fully understanding the implications through life”. The Key Supplier Forum was “giving us better focus and allowing us certainly to have a better design focus” and “the efficiencies that will come from that will yield lower costs and affordability”. Yet, it was important to recognise that it was “a culture change which is not going to happen overnight”.<sup>88</sup> Mr Oatley agreed and stated that “not enough attention is being paid to the cost of through-life support” and that:

Even with the good work we are doing on the Key Supplier Forum, still the main, by order of magnitude, focus of that is unit production costs rather than through-life costs...there is still not enough attention paid to the full through-life costs of the programme.<sup>89</sup>

91. We were told that Devonport Management Limited, which conducts deep maintenance of the UK's nuclear-powered submarines, was not a member of the Key Supplier Forum. Mr Whitehouse told us that this was because DML was not technically a supplier to the Astute programme. He also told us that “DML's input into the Astute design has been limited”. However, he added that “DML has extensive knowledge of the current classes of RN submarines and their in-service support, knowledge which is relevant to the development of the Astute class support strategies”.<sup>90</sup>

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84 Q 38

85 Q 80 [Grant]

86 Q 84

87 Q 80 [Oatley]

88 *Ibid.*

89 Q 84

90 Ev 122

92. Rolls-Royce told us that it was:

working closely with the rest of the submarine community (MoD and industry) to demonstrate the potential to drive down cost, improve availability and to help sustain UK capabilities in this high value added, specialised area.<sup>91</sup>

It maintained that it already practised the partnering arrangements envisaged by the DIS and that its Vulcan Naval Reactor Test Establishment at Thurso, in Scotland, which it operated on an incentivised contract, had delivered savings to the MoD. It also told us that the forthcoming Flotilla Reactor Plant Support contract would feature a “combined Rolls-Royce/MoD team delivering reduced costs and improved plant availability based on a philosophy of shared risk and reward”. It stated that it would “hope to continue working to these principles in any future submarine programmes”.<sup>92</sup>

93. Witnesses from industry, however, maintained that the MoD had a key role to play in delivering affordability. Driving-down and controlling costs was not industry’s responsibility alone. Rolls-Royce, for example, told us that the MoD “has a leading role in a solution, which involves major rationalisation of organisations, facilities, programmes and processes”.<sup>93</sup>

94. Industry looked to the Government to provide certainty over the future of the submarine programme. With that certainty, industry could determine the optimum size of its workforce and plan for the long term, thereby helping it to control costs and delivery on affordability.<sup>94</sup> In evidence to our inquiry, Rolls-Royce stated that “a long-term view of the submarine programme in the UK is crucial for industry to determine how best to invest”. In the absence of certainty regarding the future submarine programme, controlling costs would be “challenging”. Rolls-Royce maintained that “rationalisation or greater coherence and collaboration within industry—to drive improvements and cost reductions—is harder to determine and achieve without clarity of a forward load programme”.<sup>95</sup>

95. BAE Systems suggested that the affordability of the future programme could also be improved by the early involvement of the Ministry of Defence in the design process for any new class of submarine. According to Mr Easton, it was “imperative that we actually bring operating experience into the design in order that the design is more cost effective”. He believed this would achieve cost savings not only at the procurement stage of the process but throughout the life of the platform.<sup>96</sup>

96. However, it was not only in the design and construction phase of the programme that industry believed the MoD could assist with the issue of affordability. Peter Whitehouse, of Devonport Management Limited, told us that 70% of the costs of the entire submarine programme were in-service through-life support costs. He argued that, with a submarine fleet of around 7 SSNs and 4 SSBNs, Devonport Royal Dockyard would see, in the future,

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91 Ev 60

92 *Ibid.*

93 Ev 60

94 Q 10

95 Ev 60

96 Q 13

“an enormous variability in our nuclear load: peak load to minimum load a factor of 4:1 on a three-year cycle”. Mr Whitehouse told us that it was “essential that we have access to non-nuclear workload to help cope with that extreme variability in the nuclear throughput”. Otherwise, he said, “the unit costs are extreme and the affordability problem becomes perhaps unmanageable”.<sup>97</sup> It was a fact, stated Mr Whitehouse, that:

The costs of in-service support, the deep maintenance, the long overhaul periods would escalate overall across multi-year periods if we are unable to actually deploy the industrial workforce on other work streams at Devonport during the troughs in the workload.<sup>98</sup>

97. Mr Whitehouse told us that the Naval Base Review would have a direct impact on the affordability of the submarine programme. He maintained that the co-location of nuclear submarine maintenance and surface ship fleet support work at Devonport improved the efficiency of the SSBN refit stream. Any decision to close the Naval Base at Devonport, he argued, would result in higher costs for the submarine maintenance programme.<sup>99</sup> Lord Drayson told us that “the naval base review is being carried out very clearly to address what the needs are that the Royal Navy has going forward from here in terms of the maintenance of the upkeep of the fleet”.<sup>100</sup> He maintained that “it is not about...industrial considerations”. Nevertheless, he accepted that “there is an interrelationship” between the Review and the future submarine programme. Although the Review was “a separate objective” to that of the Defence Industrial Strategy” it was important to be “smart about joined-up government”.<sup>101</sup> **It is essential that the Naval Base Review take into account the implications for the future of the submarine industry.**

**98. Affordability must be a fundamental consideration in any new submarine programme. The Government is right to emphasise that orders for a Vanguard successor will be contingent on industry driving down and reducing costs and ensuring value for money throughout the submarine programme. Industry must deliver on this requirement.**

**99. We are concerned that insufficient attention has been given to the costs of through-life support. While we understand that DML is not a supplier to the Astute programme, it seems odd and regrettable that the company responsible for through-life support on the UK's nuclear-powered submarines has had so little input into the design of the class. If the affordability of the submarine programme is to improve, it is essential that through-life costs are taken into consideration at the initial design phase. Far greater emphasis must be placed on this consideration before the design of any Vanguard successor submarine begins.**

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97 Q 16 [Whitehouse]

98 Q 25

99 Q 46

100 Q 263

101 Q 265

## Industrial collaboration

100. In its memorandum to our inquiry, the MoD stated that there was “much to be gained from cooperation and rationalisation” in the submarine programme:

Between the build entity (principally BAES at Barrow-in-Furness), the two support entities (Devonport Management Ltd and Babcock Naval Services at Faslane) and the Nuclear Steam Raising Plant (Rolls-Royce), together with the Ministry of Defence as the customer/operator.<sup>102</sup>

101. It also outlined what it regarded as the potential benefits of enhanced industrial collaboration:

Potential benefits from such cooperation and rationalisation include the removal of overcapacity and overlapping competencies, avoidance of duplication, application of common processes, spread of best practice, more efficient procurement, supply chain management and sharing of knowledge and information across the enterprise—all leading to behavioural change and the potential for significantly improved enterprise performance and availability. Transformed commercial arrangements are required to incentivise and deliver these benefits. Cooperation of this type is already being pursued to improve affordability and performance for in-service submarines and for the Astute programme.

102. Rear Admiral Andrew Mathews, Director General Nuclear at the MoD, told us that the future of the submarine programme was dependent on achieving close collaboration both within industry and between industry and the MoD. He stated that “we have downsized the industry, we have downsized MoD, we have a limited set of skills between us and the only way we are going to do this is by working together”.<sup>103</sup>

103. Progress had been made with driving down and controlling costs and “we are moving ahead here with industry”, argued Admiral Mathews. But he stated that the desired level of collaboration between industry and the MoD had not yet been realised: “what we have not achieved yet is joining those three [BAES, DML and Rolls-Royce] up to work collaboratively together with us and that is where we need to go next”.<sup>104</sup>

104. The White Paper emphasises this point and states that “progress towards industrial consolidation and a sustainable industrial base will be an important ingredient” in achieving affordability.<sup>105</sup>

**105. If the UK goes ahead with procuring a successor to the Vanguard-class submarine, it is essential that industry collaborates far more extensively than it has done to date to drive down and control costs in the manner envisaged by the Defence Industrial Strategy. Promoting greater industrial collaboration should be a key priority for the MoD. In turn, the MoD must provide industry with clarity and consistency about**

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<sup>102</sup> Ev 86

<sup>103</sup> Q 252

<sup>104</sup> *Ibid.*

<sup>105</sup> Cm 6994, para 6.3



**operational requirements and specifications. It is vital that lessons are drawn from the problems experienced with the Astute-class programme.**

106. Industrial collaboration can carry risks. Lord Drayson told us that the decision of Halliburton to float KBR, which has a controlling stake in Devonport Management Limited, was a source of concern. He stated that Devonport was a “strategic asset” which was central to the UK’s nuclear submarine programme. He maintained that Halliburton’s decision to proceed with the flotation of KBR without giving the MoD the necessary financial assurances and financial information had “significantly undermined [the MoD’s] confidence in the company”. He told us that “we need to reassure ourselves that there is the capital structure to ensure that the investment is provided to maintain this very important facility in the future”. He also told us that the MoD retained a “special share” in Devonport.<sup>106</sup> We understand that this would allow the MoD to take back control of the company and the licence if it considered the flotation to run against the UK’s national security interests.

## MoD preparedness

107. If, as the White Paper indicates, the Government does indeed decide to retain and renew the UK’s submarine-based strategic nuclear deterrent, the procurement of a new platform—a successor to the Vanguard-class submarine—may represent the biggest MoD acquisition project and the most complex to date.

108. In previous procurement programmes, for the Polaris and Trident boats, the MoD established and maintained sizable and dedicated organisations to manage the projects. These teams no longer exist, posing questions about the capacity of the MoD to deliver a project of this scale.

109. We asked Lord Drayson how the Ministry of Defence was preparing to manage the procurement of a successor to the Vanguard submarine. He told us that he was “confident” the MoD could deliver such a project. That confidence, he told us, came from the fact that “we start from the good position that we have the infrastructure and the know-how in place for the existing system and we have the recent experience...of the Astute”. It also came “from initiatives we have been putting in place within the Ministry of Defence to strengthen [its] general competence across defence procurement in terms of project management”. These initiatives, Lord Drayson argued, were “as applicable to a project such as a major submarine project as they are to other [defence procurement] projects”.<sup>107</sup>

110. Lord Drayson conceded that “what we have to do...is...recognise that we are going to need to recruit into the project team additional people with expertise”. In this respect, he believed that the MoD would be competing with the civil nuclear industry in some areas. He felt that, on the whole, “we judge that it will be possible for us to do this”.<sup>108</sup>

111. David Gould admitted that procuring a Vanguard successor would be “a massive enterprise”, but he argued that the absence of dedicated project teams of the kind used for

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<sup>106</sup> Qq 234, 236

<sup>107</sup> Q 255

<sup>108</sup> *Ibid.*

Polaris and Trident did not mean, in itself, that the MoD lacked the capacity to deliver such a programme. Instead, he told us that the Polaris and Trident teams were, in many ways:

precursors of IPTs because they were big organisations which brought all the necessary internal skills together to manage over a long period of time an extremely complex and challenging programme. That is actually what IPTs do; it is a question of scale more than anything else.<sup>109</sup>

112. Mr Gould told us that the MoD now did less “in house” than it used to and that it would be necessary to set up an Integrated Project Team (IPT) of the kind currently managing the future carrier programme “where we bring ourselves and people from outside industry together into a joint team to execute a programme of this size”. The key factor would be to “resource it properly, not just in terms of money but in terms of the internal skill”.<sup>110</sup>

113. We asked Mr Gould why, given the likely challenges of a Vanguard successor programme, there was not a project management team already up-and-running, in the event that the Government, as it indicated in the White Paper, decides to renew the UK's submarine-based nuclear deterrent. Mr Gould told us that setting up a project team would be easier once a decision on the future of the deterrent had been taken. But he added that, in any event, “because of what has been happening on investigating options and so forth...quite a few of the elements of that sort of team are really in existence”. Nevertheless, he conceded that “clearly we will have to grow very considerably to manage a programme of that size”.<sup>111</sup>

114. Industry appeared to share the MoD's confidence in its ability to manage a Vanguard successor programme. Mr Easton, of BAE Systems, stated that although the MoD had fewer people available to manage the programme “we co-operate very, very closely with them, and it is a very constructive dialogue with the Ministry of Defence, in terms of resources, demands and, therefore, programme timing”.<sup>112</sup> Steve Ludlam, of Rolls-Royce, was equally optimistic about the preparedness of the MoD to manage the enterprise. He told us that there was:

a great deal of collaboration with the MoD: the joining of teams, the co-location of teams, the secondment of MoD personnel into particular jobs within our industries, all to make sure that together...we retain the skill that is necessary to take this forward.<sup>113</sup>

**115. Developing a Vanguard successor would be a huge undertaking. It is essential the MoD has the capacity to manage such a programme effectively. Any shortfall in preparedness must be addressed as a matter of priority. The MoD's shortage of systems engineers and project managers—skills essential at the start of a programme of this kind—is a cause of serious concern. If the decision is made to renew the deterrent, it is**

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109 Q 256

110 *Ibid.*

111 Q 257

112 Q 33 [Easton]

113 *Ibid.* [Ludlam]



**essential the MoD commit sufficient resources to the programme from the beginning. It will be desirable to bring in skills from industry. We recommend that the MoD state, in its response to this report, how it intends to address its skills shortages.**

## 4 The Atomic Weapons Establishment

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116. A second element of our nuclear deterrent which is manufactured in the UK is the nuclear warhead, which is designed and built at the Atomic Weapons Establishment (AWE) in Aldermaston and Burghfield, Berkshire. As part of our inquiry, we examined the Government's investment programme at the AWE and considered the extent to which the level of that investment was consistent both with maintaining key skills and infrastructure in the design and manufacture of nuclear warheads and with the stewardship of the UK's existing nuclear warhead stockpile.

### The role and operation of AWE

117. Since the 1950s, all of the UK's nuclear warheads, including those fitted to the UK's current Trident D5 missiles, have been manufactured at the Atomic Weapons Establishment.<sup>114</sup> The AWE is responsible for supporting the entire life-cycle of the UK's nuclear warheads, from design and manufacture, to maintenance and certification of the existing warhead stockpile, and, ultimately, to decommissioning and disposal. It is also responsible for the transportation of warheads from Aldermaston to Coulport, at HM Naval Base Clyde, where the warheads are fitted to the Trident missiles and installed on the Vanguard-class submarines.

118. The AWE operates on two major sites: Aldermaston, where design research and manufacturing of the UK's nuclear warheads is undertaken; and nearby Burghfield, where final assembly, maintenance and decommissioning of the warheads is conducted. It also has a forensic seismology centre, AWE Blacknest, a few miles west of Aldermaston, where it monitors and detects underground nuclear testing prohibited under the Comprehensive Test Ban Treaty.

119. The AWE is a Government-owned, contractor-operated establishment. In 2000, the AWE plc signed a contract to operate the AWE on behalf of the Ministry of Defence for an initial period of 10 years. The contract was extended to 25 years in 2003. The company is owned by a private consortium, AWE Management Ltd, made up of three equal partners, British Nuclear Fuels Ltd, Lockheed Martin and Serco. It employs around 4,000 people. A further 1,500 people work for long-term contractors to the AWE.

120. The 1998 Strategic Defence Review (SDR) underlined the importance the Government attached to the continuing work of the AWE and to the retention of a sovereign capability in the design and manufacture of nuclear warheads:

For as long as Britain has nuclear forces, we will ensure that we have a robust capability at the Atomic Weapons Establishment to underwrite the safety and reliability of our nuclear warheads, without recourse to nuclear testing. There are no current plans for any replacement for Trident, and no decision on any possible successor system would be needed for several years. But we have concluded that it

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<sup>114</sup> Defence Committee, Memorandum submitted by the Ministry of Defence, *The UK's Strategic Nuclear Deterrent*, HC (2005–06) 835, Ev 5

would be premature to abandon the minimum capability to design and produce a successor to Trident should this prove necessary.<sup>115</sup>

## The Government's investment programme

121. In order to sustain that capability, the Ministry of Defence agreed in 2000, in its new contract with AWE Management, for the modernisation and replacement of “many of the major science, manufacturing and assembly facilities” at Aldermaston and Burghfield. The MoD's memorandum to us, of November 2005, stated that this modernisation requirement was driven by three factors: by the need to replace old and outdated infrastructure at the sites, much of which dated back to the 1950s and was “becoming increasingly difficult and expensive to sustain”; by the introduction of a moratorium on nuclear weapons testing in the Comprehensive Test Ban Treaty which “required the introduction of significant new methods to underwrite the safety and reliability of the UK's weapons stockpile”; and by demands of the nuclear regulatory regime, which “imposes stringent safety requirements” and which “are increasingly challenging to meet without additional investment in facilities built to modern safety standards”.<sup>116</sup>

122. In July 2005, the then Secretary of State for Defence, Dr John Reid, announced a major new programme of investment at the AWE. He said the Government would invest an additional £350 million per annum over the following three years to “sustain the core capabilities” of the AWE. He also stated that the “AWE is a critical national asset and this decision is a clear demonstration of the Government's commitment to the existing deterrent and to the defence and security of the UK”.<sup>117</sup> During our visit to the United States in May 2006, we visited the National Nuclear Security Administration and were told of the value the United States attached to US-UK collaboration in the nuclear sector and of the enormous respect of the US Administration for the skills and abilities of the workforce at Aldermaston.<sup>118</sup>

123. The MoD's November 2005 Memorandum states that the new investment programme would ensure the UK's stockpile of nuclear weapons remained “safe and effective”, particularly in light of “the increasing age of the Trident warhead stockpile, and of the scientists and engineers who support it”.<sup>119</sup> It further states:

This additional investment at AWE is required to sustain the existing warhead stockpile in-service irrespective of decisions on any successor warhead. This investment will sustain core skills and facilities that could also be used in the future to develop a successor but no decisions have yet been made either in principle or practice on this issue.<sup>120</sup>

124. The MoD's memorandum states that the investment programme:

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<sup>115</sup> Supporting Essay 5, *Strategic Defence Review*, July 1998, Cm 3999

<sup>116</sup> HC 835, Ev 3

<sup>117</sup> *Ibid.*

<sup>118</sup> HC (2005–06) 986, para 120

<sup>119</sup> HC (2005–06) 835, Ev 5

<sup>120</sup> *Ibid.*

falls into three broad categories: upgrading of a range of research facilities to underpin the science programme that enables the AWE to underwrite the safety and performance of the warhead; the refurbishment of some of the key infrastructure on the sites; and investment in sustaining core skills within the Establishment.<sup>121</sup>

125. Investment in science facilities at the AWE was “focussed on providing assurance of the safety and effectiveness of the UK’s stockpile of operational warheads for use on the Trident D5 missile”. The MoD maintained that since warhead safety and reliability must be guaranteed without recourse to nuclear testing, “scientists must be able to demonstrate their understanding of the physical and chemical processes that occur within the warhead” and that “age related changes must be investigated and the implications understood”. According to the MoD, this requires advanced and complex “computer simulations” to “predict the effect of future changes” and warheads were “routinely withdrawn from the operational stockpile for forensic examination, which further improves the accuracy of these simulations”. To undertake this “assurance work”, which represented the “core activity presently undertaken”, the MoD stated that the AWE required improved capabilities in high performance computer simulation, hydrodynamics and high energy density physics. To this end, part of the investment at Aldermaston was for a new high energy laser facility, Project Orion, which would replace the existing Helen laser.<sup>122</sup>

126. Investment in infrastructure at Aldermaston was focused on replacing outdated buildings and support systems, such as heating and electrical systems, which had become “increasingly inefficient and expensive to operate”. Investment was also needed to “sustain a basic capability to remanufacture key components of the Trident warhead” as faults could develop in existing in-service warheads which required replacement of certain components. In addition, the MoD told us that “a range of skills and facilities will be required safety to disassemble the warheads”. As a result, the MoD stated that there was a need to “replace or refurbish some of the basic assembly and disassembly facilities at Aldermaston and Burghfield”. These would include “new facilities for handling high explosives and highly enriched uranium...and facilities for non-nuclear components in the warhead”.<sup>123</sup>

127. Investment in skills was necessary, the MoD told us, because the average age of the workforce at the AWE was increasing as those who worked on the Chevaline and Trident programmes neared the end of their careers. In its November 2005 memorandum, the MoD stated that “there is...a requirement to recruit new members of staff to ensure that core skills within AWE are sustained” in order to “assist in the infrastructure sustainment programme” and “to operate the new facilities as they come on stream”. The intention was to increase the workforce at the AWE by around 350 staff per annum until 2007–08, 70% of whom would be “non-industrial staff” and 30% “industrial staff”.<sup>124</sup>

128. In evidence to our current inquiry, the MoD stated that “the Atomic Weapons Establishment has a strength in depth in nuclear science and engineering which is rare

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121 HC (2005–06) 835, Ev 4

122 *Ibid.*

123 *Ibid.*

124 *Ibid.*

elsewhere in the UK". But as the workforce grew older "there was a requirement to recruit new members of staff to ensure that the core skills within AWE are maintained".<sup>125</sup>

129. The White Paper states that:

We will continue the programmes of investment at the Atomic Weapons Establishment, both to ensure we can maintain the existing warhead for as long as necessary and to enable us to develop a replacement warhead if that is required. Additional investment averaging £350 million per annum over the years 2005/06 to 2007/08 was announced last year. Further investment will be necessary, and early in the next decade the costs of AWE are likely—at their peak—to be the equivalent of about 3% of the current defence budget (compared to about 2.5% today).<sup>126</sup>

**130. We recommend that in advance of any debate in the House of Commons on the future of the deterrent, the MoD clarifies what additional investment the Government intends to make at the AWE as a result of the recommendations contained in the White Paper.**

131. We visited the Atomic Weapons Establishment in September 2006. During our visit we saw, at a distance, the very large A91 building, completed in the late 1980s to house an integrated Radioactive Liquid Effluent Treatment Plant, but never used because it was declared unfit for purpose. In our report on the MoD's Annual Report and Accounts 2004–05, we expressed our amazement at the scale of the losses on the A91 building—some £147 million in total.<sup>127</sup> The Government's response accepted that this was a serious failure. It assured us that the current contracting arrangements at the AWE included specific disciplines and mechanisms governing the visibility, approval, monitoring, management and review of capital projects by stakeholders, and that Earned Value Management and Smart Acquisition principles had been adopted.<sup>128</sup> **The MoD and the AWE must apply the lessons from the A91 episode in managing the new infrastructure investment at Aldermaston.**

132. We asked the MoD whether a new civil nuclear programme would drain skills away from Aldermaston. Mr Gould said that he expected that there might be "some impact" but he stated that the AWE "is a very different operation". The civil nuclear programme, he told us, used "pretty mature technology" and "not the kind of physics which goes on at Aldermaston". Although he conceded that "there might be some overlap" and "some competition for disciplines", there was "not really a great deal of pull to the civil nuclear programme from Aldermaston".<sup>129</sup>

133. We also asked whether the closure of university physics departments was having any impact on the skills base at the AWE. Lord Drayson told us that "it is not affecting us in a

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125 Ev 86

126 Cm 6994, para 5.13

127 Defence Committee, Sixth Report of Session 2004–05, *Ministry of Defence Annual Report and Accounts 2004–05*, HC 822, paras 83–87 and Ev 27–28

128 Defence Committee, Seventh Special Report of Session 2005–06, *Ministry of Defence Annual Report and Accounts 2004–05: Government Response to the Committee's Sixth Report of Session 2005–06*, HC 1293, Appendix, paras 45–50

129 Q 282 [Gould]

dramatic sense”, but he accepted that “this country depends on having a significant and growing pool of scientists and engineers” and that “the number of physics departments which have closed in the country is a source of concern to us”.<sup>130</sup>

134. Mr Bennett told us that the key skills shortage at Aldermaston was not, in fact, physicists but project managers. He stated that “managing a significant infrastructure programme and delivering that to time...has proved something of a challenge”. Across the rest of the AWE, he told us that recruitment and retention rates were good.<sup>131</sup>

## Responses to the investment programme

135. In its submission to our inquiry, the Royal Academy of Engineering welcomed the Government’s investment programme at the AWE, which it regarded as “essential if we are to maintain the UK’s nuclear weapons design and manufacturing capability not only for future systems but also for the maintenance and stewardship of our existing weapons stockpile”.<sup>132</sup>

136. Greenpeace, however, was concerned that the Government’s investment programme would produce a “quantum leap in AWE Aldermaston’s capacity to design and build a new nuclear weapon”. Along with the recruitment of “a new generation of scientists, engineers and technicians”, Greenpeace argued that this “strongly suggest[s] that a major purpose of current investments is a nuclear weapon development programme”.<sup>133</sup>

137. This view was shared by Scientists for Global Responsibility who, in evidence to our inquiry, voiced their “serious concerns” at the Government’s investment. The new facilities at Aldermaston and Burghfield “cannot be justified on the basis of maintaining existing stockpiles” and there was a “suspicion that work is undertaken or planned which could assist is or is already part of the development of a new warhead capability or design”.<sup>134</sup>

138. Similarly, the Nuclear Information Service stated in evidence that “much of the investment programme...is not relevant to the objective of maintaining key skills and infrastructure”.<sup>135</sup> It believed current and projected investment is “at an unreasonable level”.<sup>136</sup>

139. The Aldermaston Women’s Peace Campaign stated that investment at the AWE has shown “a massive increase” that “far exceeds that required for stewardship of the extant stockpile”. It maintained that the Government “has already made a substantial investment in the development of the next generation of nuclear weapons” which had “taken place in

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130 Q 280 [Drayson]

131 Q 281

132 Ev 107

133 Ev 75

134 Ev 120

135 Ev 87

136 Ev 90

advance of a public debate...and a public decision by Government on the replacement of the current Trident system".<sup>137</sup>

140. Greenpeace also questioned the AWE's preference for a science-based stockpile stewardship programme, as opposed to an engineering-based one. This, it stated, "will, inevitably, lead to uncertainty about the performance of nuclear warheads" which would "create political pressure for a return to nuclear testing".<sup>138</sup> Any resumption in nuclear testing, Greenpeace argued, would have serious consequences for the future of the enforcement of the Comprehensive Test Ban Treaty. And, even if the UK did not resume testing, Greenpeace said that Aldermaston's experimentation with "exotic technologies to design and build a new nuclear weapon" would "lead other countries to ask: 'why should we continue to respect the CTBT...?'".<sup>139</sup>

141. Concern was also expressed about the manner in which decisions on the investment at the AWE had been taken and implemented. In evidence to our inquiry, Greenpeace said that the process by which the Government decided on the investment was "undermining deliberative democracy and the sovereignty of Parliament". It stated that:

the proper procedure should be an open and informed debate first, then a decision by Parliament on whether to go ahead with the investments necessary to make a bomb, and finally the investments.

Greenpeace maintained that, instead, "we have an 'Alice in Wonderland' situation of investments first, official decision second, and public debate and Parliamentary vote last of all".<sup>140</sup> Similarly, the Scottish Campaign for Nuclear Disarmament stated in evidence that the MoD were "trying to pre-empt crucial decisions on the future of nuclear weapons by initiating a very expensive rebuilding programme".<sup>141</sup>

142. We asked the Minister for Defence Procurement how he would respond to these arguments. Lord Drayson told us that the "Alice in Wonderland" accusation levelled by Greenpeace "reflects a misunderstanding" of the purpose of the investments at Aldermaston. This, he maintained, was to "ensure that the existing deterrent can be maintained in a safe and effective form". The moratorium on nuclear testing meant that:

the only way in which we can make sure that the deterrent is safe is to carry out very sophisticated physical and computational experiments and that requires investment in the infrastructure at Aldermaston to make sure that we continue to be able to do that properly.<sup>142</sup>

143. Nick Bennett, Director General Strategic Technologies at the MoD, told us that the investment at the AWE was "unrelated to decision on a future strategic deterrent". The investment in infrastructure at Aldermaston and Burghfield was "essential to maintain the

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137 Ev 95

138 Ev 76

139 *Ibid.*

140 *Ibid.*

141 *Ibid.*

142 Q 195



current deterrent". He maintained that, as far as the existing Trident system through to the 2020s was concerned, the investment "underpins that entirely", but "it does not underpin currently a future deterrent".<sup>143</sup>

144. Mr Bennett stated that the investment at the AWE would also ensure that the skills base at Aldermaston was sustained so that options for the future of the deterrent were kept open. The investment in skills and sophisticated equipment needed to maintain the existing Trident system, he said, would be relevant should a decision be taken in future to produce a new warhead. He told us, "in essence the capabilities at Aldermaston...will allow us, should we ever wish to, to develop a new warhead, but they are absolutely essential to the maintenance of the current one". He argued that the two capabilities were "indistinguishable".<sup>144</sup> Similarly, Lord Drayson stated that "it is absolutely true to say that those skills and that know-how does have relation to the capability within this country...to design a new nuclear warhead". But, he argued, "we have to take that decision relating to the maintenance separately".<sup>145</sup>

145. As regards the timing of the investment, Mr Bennett stated that, by around 2002, it had become clear that "we had reached the point where finally we had to do something about it otherwise we would have found ourselves in a position where we would not be able to maintain the current programme".<sup>146</sup>

146. Many observers have seen the investment programme at Aldermaston as a sign that the Government had already decided in principle to retain and renew the UK's nuclear deterrent. We accept Ministers' assurances that this was not the case. We accept too that investment in buildings and infrastructure at AWE was becoming time-critical, which might suggest that the decision on the future of the deterrent should have been taken in the last Parliament. But we are less convinced that investment in the new Orion Laser, the supercomputer and hydrodynamic facilities could not have waited for a decision in principle on the future of the UK's nuclear deterrent. If the investment was made to respond to requirements of regulators, the Government should state this in its response to this report. Large-scale investment should follow, and not precede, policy decisions of such paramount importance to the nation.

147. The widespread suspicion about the work of the AWE and the Government's investment there is partly a consequence of the secrecy which surrounds its work. We fully accept the need to maintain secrecy about some aspects of its work, but there is a case for greater openness, not least to ensure that the public is aware of the positive contribution the AWE makes to the verification of the Comprehensive Test Ban Treaty.

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143 Q 269

144 Q 270 [Bennett]

145 Q 274

146 Q 275



## Conclusions and recommendations

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1. This report does not seek to assess the findings and conclusions of the Government's White Paper. That will be the focus of our next inquiry. (Paragraph 6)
2. Any decisions on the future of the UK's deterrent should be taken on the strategic defence needs of the country. Our intention in making this report is to ensure that the House of Commons, and the public, are aware of the manufacturing and skills base issues which will need to be addressed if a decision is made to renew the submarine-based deterrent. We recommend that the Government respond to this report in good time for publication before the debate in the House of Commons on the White Paper in March 2007. (Paragraph 7)
3. The Ministry of Defence believes that the UK should retain onshore a sovereign capability in the design, construction, operation, maintenance and decommissioning of nuclear-powered submarines. It is important that the public understand clearly the reasons for this. We call upon the MoD to provide, in its response to this report, a fuller explanation of the need for this sovereign capability. (Paragraph 31)
4. Witnesses to our inquiry maintain that the UK's current manufacturing and skills base is already at the minimum level necessary to sustain a viable onshore submarine industry. (Paragraph 39)
5. Witnesses to our inquiry agreed that the complexity and uniqueness of a nuclear submarine, and of the environment in which it operated, called for special skills, facilities and oversight not supported by any other shipbuilding programme. (Paragraph 42)
6. We share our witnesses' concern about the shortage of science and engineering graduates, project managers and skilled and experienced technical staff, but this raises questions which go far beyond the scope of this report. (Paragraph 45)
7. The UK submarine industry draws on a uniquely skilled and specialist workforce. Retaining that skills base will be essential if the UK decides it wants to continue to design, build and maintain nuclear-powered submarines. The skills base is now at a critical level. Any further erosion of the workforce may have significant implications for the future of the submarine programme. Sustaining skills in this sector is only possible with regular and continuous submarine work. (Paragraph 46)
8. Even if the decision is taken not to procure a Vanguard successor, a specialist skills base will have to be retained in order to build SSNs and maintain and finally decommission the UK's existing fleet of nuclear-powered submarines. Some indication of the order of costs would be helpful in considering arguments about affordability and we ask that the MoD provide some information about this in their response to this report. (Paragraph 47)
9. The submarine construction supply chain is fragile and is particularly susceptible to gaps in the programme. Extended gaps are likely to result in an erosion of the UK's submarine manufacturing and skills base. There is also a risk that single source

suppliers will abandon the supply chain in pursuit of more regular and assured work. If the UK intends to build a successor to the Vanguard-class, or maintain an SSN capability beyond the current Astute order book, the supply chain will have to be sustained. To achieve this, the MoD must give clear direction and certainty about the future submarine programme in order to encourage industry to invest. We call upon the MoD to provide, in its response to this report, an assessment of whether, how and at what cost the submarine supply chain could be maintained for the construction of future SSNs in the absence of a positive decision on a Vanguard successor. (Paragraph 54)

10. Without a new SSBN it is possible that there would be insufficient demand for nuclear submarines to sustain the industry. It is important to recognise that there is an interrelationship between SSN and SSBN construction. (Paragraph 61)
11. It is clear that the gap between the Vanguard and Astute submarine programmes had a serious and debilitating impact on the UK's submarine industry and put at risk the future of the UK's submarine fleet. If the Government wants the UK to continue to design and build nuclear-powered submarines, it will be essential to maintain a regular rhythm of submarine construction. Reducing the frequency of construction below 22 months would be risky. Without a regular build "drumbeat", the UK skills base will erode and it may prove impossible or prohibitively expensive to recreate. (Paragraph 64)
12. It is important that the MoD and industry agree promptly on a price for future Astute-class orders. Clarity and certainty about the future submarine programme is necessary if industry is to continue to invest in the manufacturing skills base. The MoD must also demonstrate that it has learned the lessons from the Astute programme, and implemented a much tighter contractual relationship with BAE Systems, before it commits expenditure to a new SSBN build programme. (Paragraph 65)
13. The Government will need to consider carefully whether the potential long-term benefits of designing a completely new submarine, in which through-life affordability is built in from the start, could outweigh the cost-benefits of maximising commonality of design with existing submarines. And it will need to judge whether efforts to maximise commonality with existing submarines would be enough to sustain the specialist submarine design base in the UK. (Paragraph 67)
14. Using a well-tried reactor in the new submarines would minimise design-related risk, but in the longer term there might be benefit in both safety and design costs in investing in a new generation of reactor technology. (Paragraph 68)
15. We recommend that the MoD make clear in its response to this report the timetable for the procurement of the new submarines it proposes. This should indicate by when it will need to decide whether to opt for radical redesign or commonality of design for the submarine platform and for the nuclear reactor, and when it will need to decide between a three- or four-boat package. (Paragraph 69)
16. A decision to abandon the construction of nuclear submarines would have a profound impact upon local communities, particularly at Barrow. Nevertheless, we

believe that employment factors should not be decisive in the debate on the future of the deterrent. (Paragraph 75)

17. If there were no successor to the Vanguard-class submarine, there would be an ongoing need to retain onshore a capability to support and, ultimately, to decommission the current SSBN and SSN fleet. We call upon the MoD to state in its response to this report how much it would cost to sustain that capability. (Paragraph 76)
18. It is essential that the Naval Base Review take into account the implications for the future of the submarine industry. (Paragraph 97)
19. Affordability must be a fundamental consideration in any new submarine programme. The Government is right to emphasise that orders for a Vanguard successor will be contingent on industry driving down and reducing costs and ensuring value for money throughout the submarine programme. Industry must deliver on this requirement. (Paragraph 98)
20. We are concerned that insufficient attention has been given to the costs of through-life support. While we understand that DML is not a supplier to the Astute programme, it seems odd and regrettable that the company responsible for through-life support on the UK's nuclear-powered submarines has had so little input into the design of the class. If the affordability of the submarine programme is to improve, it is essential that through-life costs are taken into consideration at the initial design phase. Far greater emphasis must be placed on this consideration before the design of any Vanguard successor submarine begins. (Paragraph 99)
21. If the UK goes ahead with procuring a successor to the Vanguard-class submarine, it is essential that industry collaborates far more extensively than it has done to date to drive down and control costs in the manner envisaged by the Defence Industrial Strategy. Promoting greater industrial collaboration should be a key priority for the MoD. In turn, the MoD must provide industry with clarity and consistency about operational requirements and specifications. It is vital that lessons are drawn from the problems experienced with the Astute-class programme. (Paragraph 105)
22. Developing a Vanguard successor would be a huge undertaking. It is essential the MoD has the capacity to manage such a programme effectively. Any shortfall in preparedness must be addressed as a matter of priority. The MoD's shortage of systems engineers and project managers—skills essential at the start of a programme of this kind—is a cause of serious concern. If the decision is made to renew the deterrent, it is essential the MoD commit sufficient resources to the programme from the beginning. It will be desirable to bring in skills from industry. We recommend that the MoD state, in its response to this report, how it intends to address its skills shortages. (Paragraph 115)
23. We recommend that in advance of any debate in the House of Commons on the future of the deterrent, the MoD clarifies what additional investment the Government intends to make at the AWE as a result of the recommendations contained in the White Paper. (Paragraph 130)

24. The MoD and the AWE must apply the lessons from the A91 episode in managing the new infrastructure investment at Aldermaston. (Paragraph 131)
25. Many observers have seen the investment programme at Aldermaston as a sign that the Government had already decided in principle to retain and renew the UK's nuclear deterrent. We accept Ministers' assurances that this was not the case. We accept too that investment in buildings and infrastructure at AWE was becoming time-critical, which might suggest that the decision on the future of the deterrent should have been taken in the last Parliament. But we are less convinced that investment in the new Orion Laser, the supercomputer and hydrodynamic facilities could not have waited for a decision in principle on the future of the UK's nuclear deterrent. If the investment was made to respond to requirements of regulators, the Government should state this in its response to this report. Large-scale investment should follow, and not precede, policy decisions of such paramount importance to the nation. (Paragraph 146)
26. The widespread suspicion about the work of the AWE and the Government's investment there is partly a consequence of the secrecy which surrounds its work. We fully accept the need to maintain secrecy about some aspects of its work, but there is a case for greater openness, not least to ensure that the public is aware of the positive contribution the AWE makes to the verification of the Comprehensive Test Ban Treaty. (Paragraph 147)

## Annex: List of Abbreviations

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AWE	Atomic Weapons Establishment
BAE	formerly British Aerospace
BAES	BAE Systems
CND	Campaign for Nuclear Disarmament
CTBT	Comprehensive Test Ban Treaty
DIS	Defence Industrial Strategy
DML	Devonport Management Limited
DPA	Defence Procurement Agency
HPV	Heavy Pressure Vessel
IPT	Integrated Project Team
KBR	formerly Kellogg, Brown and Root
MIS	Maritime Industrial Strategy
MoD	Ministry of Defence
NPT	(Nuclear) Non-Proliferation Treaty
NSRP	Nuclear Steam Raising Plant
RNAD	Royal Naval Armaments Depot
SDR	Strategic Defence Review (1998)
SLBM	Submarine-Launched Ballistic Missile
SSBN	Sub-Surface Ballistic Nuclear (Nuclear-powered, nuclear-armed submarine)
SSN	Sub-Surface Nuclear (Nuclear-powered, conventionally-armed submarine)
VSEL	Vickers Shipbuilding and Engineering Limited

## Formal minutes

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**Tuesday 12 December 2006**

Members present:

Mr James Arbuthnot, in the Chair

Mr David Crausby

Linda Gilroy

Mr Dai Havard

Mr Bernard Jenkin

Mr Brian Jenkins

Mr Kevan Jones

Willie Rennie

John Smith

### **The Future of the UK's Strategic Nuclear Deterrent: the Manufacturing and Skills Base**

The Committee considered this matter.

Draft Report (The Future of the UK's Strategic Nuclear Deterrent: the Manufacturing and Skills Base), proposed by the Chairman, brought up and read.

*Ordered*, That the Chairman's draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 147 agreed to.

Annexes (Summary and List of Abbreviations) agreed to.

*Resolved*, That the Report be the Fourth Report of the Committee to the House.

Several papers were ordered to be appended to the Minutes of Evidence.

*Ordered*, That the Appendices to the Minutes of Evidence taken before the Committee be reported to the House.

Several papers were ordered to be reported to the House.

*Ordered*, That the provisions of Standing Order No. 134 (select committee (reports)) be applied to the Report.

[Adjourned till Tuesday 19 December at 10.00 am.]

## List of witnesses

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### Tuesday 7 November 2006

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**Mr Murray Easton**, Managing Director, Submarines, BAE Systems, **Mr Steve Ludlam**, President Submarines, Rolls-Royce plc, and **Mr Peter Whitehouse**, Corporate Development Director, Devonport Management Limited Ev 1

**Mr Ron Grant**, Managing Director, MacTaggart Scott & Company Ltd, **Mr Jim Morrison**, Unit Managing Director, Alstom, and **Mr Joe Oatley**, Managing Director, Weir Strachan & Henshaw Ev 12

### Tuesday 21 November 2006

**Mr Bernie Hamilton**, National Officer for Aerospace and Shipbuilding, Amicus, **Mr Keith Hazlewood**, National Secretary, Engineering Section, GMB, **Mr Bob King**, Chief Negotiating Officer, Prospect, and **Mr Terry Waiting**, Chair, Keep Our Future Afloat Campaign Ev 18

**Dr Kate Hudson**, Chair, Campaign for Nuclear Disarmament, and **Dr Dominick Jenkins**, Senior Disarmament Campaigner, Greenpeace UK Ev 28

**Lord Drayson**, A Member of the House of Lords, Minister for Defence Procurement, **Mr David Gould CB**, Deputy Chief Executive, Defence Procurement Agency, **Mr Nick Bennett**, Director General Strategic Technologies, and **Rear Admiral Andrew Mathews**, Director General Nuclear, Ministry of Defence Ev 37

## List of written evidence

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2	Rolls-Royce plc	Ev 58
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4	MacTaggart Scott & Company Limited	Ev 63
5	Amicus	Ev 64
6	Keep Our Future Afloat Campaign	Ev 65
7	Greenpeace UK	Ev 75
8	Campaign for Nuclear Disarmament	Ev 81
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10	West Midlands Campaign for Nuclear Disarmament	Ev 87
11	Nuclear Information Service	Ev 87
12	Aldermaston Women's Peace Campaign	Ev 91
13	Scottish Campaign for Nuclear Disarmament	Ev 99
14	BMT Defence Services Ltd	Ev 102
15	Nexia Solutions Ltd	Ev 104
16	Dr Dan Plesch	Ev 105
17	Royal Academy of Engineering	Ev 106
18	GMB	Ev 107
19	Scientists for Global Responsibility (SGR)	Ev 108
20	Supplementary memorandum from Devonport Management Limited	Ev 113
21	Supplementary memorandum from BAE Systems	Ev 114
22	Further memorandum from the Keep Our Future Afloat Campaign	Ev 119



## List of unprinted written evidence

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Additional papers have been received from the following and have been reported to the House but to save printing costs they have not been printed and copies have been placed in the House of Commons Library where they may be inspected by members. Copies will also be available on the Committee's web pages at [www.parliament.uk/defcom](http://www.parliament.uk/defcom). Other copies are in the Parliamentary Archives, Houses of Parliament and are available to the public for inspection. Requests for inspection should be addressed to the Parliamentary Archives, Houses of Parliament, London SW1A 0PW. (Tel 020 7219 3074) hours of inspection are from 9:30am to 5:00pm on Mondays to Fridays.

Philip Gilligan

Margot Hutchison

Gary Wiles

Miss Megan R Atton

Jane Hill

David Bargh

Paul Allard

Revd John B Wilcox

Roger Kattenhorn

Lyn Brayshaw

Mitzi Bales

Brian Boshell

Ann Hillier

Hazel Neal

Peter Ford

Gabrielle Grace

Lesley Docksey

Nigel Barnacle

Joyce McKay

John Meager

Heather Williams

Arianna Andreangeli

J G McNulty

Patricia Woodcock

Mrs Elizabeth Way

# Defence Committee Reports in this Parliament

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## Session 2005–06

First Report	Armed Forces Bill	HC 747 ( <i>HC 1021</i> )
Second Report	Future Carrier and Joint Combat Aircraft Programmes	HC 554 ( <i>HC 926</i> )
Third Report	Delivering Front Line Capability to the RAF	HC 557 ( <i>HC 1000</i> )
Fourth Report	Costs of peace-keeping in Iraq and Afghanistan: Spring Supplementary Estimate 2005–06	HC 980 ( <i>HC 1136</i> )
Fifth Report	The UK deployment to Afghanistan	HC 558 ( <i>HC 1211</i> )
Sixth Report	Ministry of Defence Annual Report and Accounts 2004–05	HC 822 ( <i>HC 1293</i> )
Seventh Report	The Defence Industrial Strategy	HC 824 ( <i>HC 1488</i> )
Eighth Report	The Future of the UK's Strategic Nuclear Deterrent: the Strategic Context	HC 986 ( <i>HC 1558</i> )
Ninth Report	Ministry of Defence Main Estimates 2006–07	HC 1366 ( <i>HC 1601</i> )
Tenth Report	The work of the Met Office	HC 823 ( <i>HC 1602</i> )
Eleventh Report	Educating Service Children	HC 1054 ( <i>HC 58</i> )
Twelfth Report	Strategic Export Controls: Annual Report for 2004, Quarterly Reports for 2005, Licensing Policy and Parliamentary Scrutiny	HC 873 ( <i>Cm 6954</i> )
Thirteenth Report	UK Operations in Iraq	HC 1241 ( <i>HC 1603</i> )
Fourteenth Report	Armed Forces Bill: proposal for a Service Complaints Commissioner	HC 1711

## Session 2006–07

First Report	Defence Procurement 2006	HC 56
Second Report	Ministry of Defence Annual Report and Accounts 2005–06	HC 57
Third Report	Costs of operations in Iraq and Afghanistan: Winter Supplementary Estimate 2006–07	HC 129

# Oral evidence

## Taken before the Defence Committee

on Tuesday 7 November 2006

Members present:

Mr James Arbuthnot, in the Chair

Mr David S Borrow  
Mr David Crausby  
Linda Gilroy  
Mr David Hamilton

Mr Brian Jenkins  
Robert Key  
Willie Rennie  
John Smith

*Witnesses:* **Mr Murray Easton**, Managing Director, Submarines, BAE Systems, **Mr Steve Ludlam**, President Nuclear Business, Rolls-Royce plc, and **Mr Peter Whitehouse**, Corporate Development Director, Devonport Management Limited, gave evidence.

**Q1 Chairman:** Good morning to everybody and welcome to our three witnesses for the first part of this morning's session. I wonder if you might like to introduce yourselves, first of all starting, Murray, with you, and then moving along the line, to tell us who you are, what you do and why you do it.

**Mr Easton:** Chairman, why I do it? Good morning, Chairman, ladies and gentlemen. My name is Murray Easton, I am the Managing Director of BAE Systems Submarines, the main part of which is based in Barrow-in-Furness. Our responsibility is the design and construction of the Astute-class submarines currently.

**Mr Ludlam:** Good morning. My name is Steve Ludlam, I am the Managing Director of the Rolls-Royce Submarines business and our responsibility is to design, manufacture and support in service all the Nuclear Steam Raising Plant.

**Mr Whitehouse:** Good morning. I am Peter Whitehouse, I am DML Devonport's Development Director, and we are the site that refuels and refits the SSBNs and SSNs.

**Q2 Chairman:** Thank you very much. I will start with a question which seems as though it covers the whole of this inquiry, which is about the skills base that is needed for the strategic nuclear deterrent, but in fact it is quite limited. I wonder if I could start with you, Murray Easton, and possibly Peter Whitehouse, to ask: what are the specialist skills that are required to maintain a minimum submarine design, construction and refitting capability in the United Kingdom, please. Specialist skills.

**Mr Easton:** First of all, Chairman, if I could talk to the design and construction end, and I will let Peter, if you do not mind, speak to the refitting and support end of life. As far as the submarine is concerned, a nuclear submarine is without doubt, as yourself and the Committee, Chairman, saw very recently when you visited Barrow, an exceptionally complex product, both in its design and construction to, really, the highest standards of manufacture. As a result, there are very specialist skills required. If you look at the design end of life, both the computer graphic skills that we need in our professional

engineers, our designers and in our draughtsmen, are key. We design to very tight tolerances and very complex systems, and in systems engineering there is the integration of, for example, structural hydrodynamics, noise and vibration, life support, safety—both boat safety and nuclear safety—and a number of other key skills. If we then move on to the construction, both in terms of the staff—which I think is often understated, that being the planners, the safety technicians, the quality control people and the supervision of a very skilled workforce in terms of manual skills, both at the structural end through electrical, mechanical and the integration of those systems—and then the commissioning of them in this very complex task means that when you look at the minimum number that we would require, I think that was your question, back in the early-90s we had some 14,000 people at Barrow-in-Furness, supplemented by some 2,000 subcontractors and we now have 3,450 plus 200 contractors. A lot more is required of our people now, such as the issues of affordability and our response to that challenge, and I feel very much that we are at the critical mass just now in the design, build and commissioning end of the enterprise that we actually need. So below this I think we would be in a very perilous state.

**Q3 Chairman:** Bear in mind it is the skills I am talking about rather than the number of people.

**Mr Easton:** Yes. The skills themselves are very submarine-specific skills. It is often said that submarine designers can design surface ships but surface ship people cannot design submarines, and that is not a reflection on either, simply to say that one is much more complex. So the skills are very specific; the standards that are required for the design and ultimate operation of the submarine are such that they do not exist anywhere else, and in order even to supplement the nuclear skills we do transfer small numbers of people between our colleagues in Rolls-Royce, in DML and Barrow. So you will find that there are already some shortages, and we cover them by that level of co-operation.

**Mr Whitehouse:** I could repeat a lot of what Murray has said in terms of the specialist skills in the nuclear area, systems integration, commissioning skills and things like that. In addition, so far as Devonport is concerned, we work on the submarine in configurations that are totally different from when it is operating. Refitting and refuelling the submarine means that we have to address things like safety case issues that are very specific to the things that we do and the configuration of the submarine when the reactor is opened up and we are refuelling, for instance. So there is a very big emphasis, in our business, on an additional area which is on the facilities, their safety justification and the safety justification of the boat as part of a system that comprises the dock and all of the support infrastructure. That is probably the biggest area that is additional to what Murray describes. We are probably slightly lighter in the front end detailed design area because we are actually working on a product that exists and is there in our facility, but I think the additional areas I would highlight are things like the environmental discharge consents, the environmental assessments—all those additional adjuncts that actually come into play because of what we do to the submarine during the refuelling operation, in particular.

**Q4 Chairman:** Would you agree with Murray Easton's suggestion that a surface ship designer would be less able to design a submarine? Would you put that into the refitting context as well?

**Mr Whitehouse:** So far as the nuclear specialisms, some of the system specialisms, are concerned, I would agree with that. When we look at the industrial labour force in Devonport, we have had to, and we are continuing to, move large numbers of people between the two types of work stream. So, so far as the industrial labour force is concerned, we do actually have quite a bit of mobility between the nuclear and non-nuclear work streams.

**Q5 Chairman:** What about the design and construction of a Nuclear Steam Raising Plant? What specialist skills are needed for that?

**Mr Ludlam:** If I take the two different sets of skills, one on the design side, the design-specific skills there are ones of nuclear engineering which is essentially a multidisciplinary engineering approach, and it is a very vital skill to bring all the disciplines of engineering together and make sure that we design and develop a very safe plant operation. I would endorse what Peter said about the safety justification skills that are absolutely vital to be sure that we are safe at all points in time with the operation of the plant. So they are the essential skills in the design side of Nuclear Steam Raising Plant. The essential skills on the manufacturing side are particular to core manufacture, which is very unique to what we do here in the UK, and are also particular to heavy pressure vessel manufacture since we now have only one pressure vessel manufacturing capability in the UK to undertake this size of pressure vessel for

nuclear submarines, and they are very specialist manufacturing skills, not ones which are easily acquired or easily trained.

**Q6 Chairman:** Of these skills that you have talked about, which are the most vulnerable to loss and which would be the hardest to replace?

**Mr Easton:** That is an exceptionally difficult question to answer because we, quite frankly, do not value one more than the other. The interaction of all the skills on the site, whichever of the three sites we were looking at, would be crucial. To have, on the one hand, world-class welders (and I mean absolutely world-class structural welders or pipe welders), I could not compare them as more or less critical to the designers, for example, or the commissioning engineers. If they move away you are vulnerable to any of those parts of your business being reduced.

**Mr Ludlam:** I would endorse what Murray is saying; it is that multidisciplinary nature that is necessary to bring the total submarine together and keeping those specific skills within that multidisciplinary area that is absolutely vital.

**Mr Easton:** If I may, Chairman, often in the public domain there is a view that a welder is a welder, as an electrician, but it is so specialist in this particular product that it is not just a matter of their training it is a matter of their experience as well, and it is vast, quite frankly, in any of the three facets of the business that you are interviewing today.

**Q7 Mr Jenkins:** If I could ask questions on the Nuclear Steam Raising Plant, what is the difference between the commercial nuclear power station and their steam raising plant with all their engineering skills to the submarine environment? Why are they not interchangeable and why are you still going back through the record of how much skill and experience we need? We need that across the commercial world as well as in the military world. What is so different? What is this specialist skill? What is unique about building a Nuclear Steam Raising Plant for a submarine?

**Mr Ludlam:** At a basic level the skills are the same; the uniqueness of a Nuclear Steam Raising Plant for a submarine is its size—its compactness. That is the first point I would make. We need to fit a very powerful reactor into a very small space, which is quite different to the civil world, and the materials therefore are likely to be different on a submarine reactor; the size and shape of things are quite different and the tolerances we are working to as a consequence are quite different, in that respect. If we look more specifically at some of the more detailed parts of the reactor—let us take the reactor core—that is quite different, out of necessity, for the way that we operate a submarine plant compared to the way that we would operate a civil nuclear plant. A submarine plant is moving up and down in speed all the time and the reactor, essentially, follows that movement up and down in speed and therefore has to be controlled in a particular way. A civil reactor sits at power, at a constant power, and the control

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**7 November 2006 Mr Murray Easton, Mr Steve Ludlam and Mr Peter Whitehouse**

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systems are quite different as a consequence of that. I think there are some quite marked differences, but at the basic level there are some similarities too.

**Q8 Mr Crausby:** I would like to ask some questions specifically on the submarine design base, and these questions are aimed at all three witnesses. I have heard a great deal over the years, really, particularly about the loss of the design base for the production of submarines at Barrow. The question I would like to ask is: what do we do about it, then? We go on and on and talk at great length about what a great problem it is, so how could a minimum design base be sustained and what kind of work would it need to be involved in?

**Mr Easton:** May I start? If you look over time, over certainly the last 20, 25 years, it is quite apparent, although I am relatively new to Barrow-in-Furness—only three-and-a-half years there—that the design and build of nuclear submarines has been supplemented by the design and build of very large first-of-class surface warships, and some of them very complex surface warships. That rather builds on the response I made earlier about the capability of designers but it has also assisted in smoothing the peaks and troughs, if you like, of the design demand, resource demand, over time. So what can we do to retain them? We routinely recruit significant numbers of apprentices. We are now up over, at the last count, 114 apprentices this year, and that is excluding 12 accelerated and four adult apprentices with a further 28 graduates. So we are trying to bring new blood in, and they love coming to us because it is a very challenging work environment; it is on the leading edge of technology. So we are supplementing and we have a lot of people who stay with us a long time because they are skilled. How do we retain them? I have to say by ensuring that there is continuity of work in a place, clearly.

**Q9 Mr Crausby:** Lots of people would say that there is no future in this business. I was brought up in Lancashire and that is what people said about cotton when I was very young, and they were right, were they not? Is that an issue—where people say: “There is no long-term future in submarine design, so I ought to do something else”?

**Mr Easton:** If I were to make the analogy you just have, there are other places in the world to get cotton but as far as nuclear submarines are concerned, first of all there are very few places that build them and build them to the cost that we do. I think we have a very favourable comparison to at least two other builders, being France and America, so whilst they are expensive products, they appear comparatively to be good value for money. What else can we do? Where can we get them? The policy is that we cannot export our nuclear submarines currently, and for understandable and obvious reasons, so we have the home market and that we must satisfy.

**Mr Ludlam:** If I can just add to Murray’s point, I think all of us find when we bring either youngsters in or somebody in their first or second change of career they are very excited by the work that they are given. It is a challenge for engineers, they thoroughly

enjoy it and I think they would then welcome the future of a long-term programme and the future of a long-term programme actually would then spur on that innovation that they bring. Engineers do enjoy the challenge, and submarines certainly give that challenge.

**Mr Whitehouse:** One of the key issues going forward is that to actually be able to attract young people into this particular industrial segment it is going to be very important that, as the civil programme potentially starts up again, they can see and believe that there is a vibrant and relatively sustainable and stable programme going forward, whatever its size, rather than one that, if you like, is turned on and off depending on the exact circumstances of the day. I think this tension that will probably start to arise with the NDA (Nuclear Decommissioning Authority) work with the civil programme and the military nuclear sector is actually going to make that aspect of being able to look forward and see a forward submarine programme much more important perhaps than heretofore.

**Q10 Mr Crausby:** Murray’s point that you can still get cotton in other parts of the world is the core of it, really, is it not? We cannot leave this to market forces. We can still get cotton but if we let this go then we will not be able to buy nuclear submarines. So does the Government have a role in ensuring that this is in some way supported, to ensure that we maintain a minimum base? The question I would like to ask is about what that cost would be and the size of that. In personnel terms, for instance, how large would a minimum design base need to be and to what extent should the Government prop that up and pay for it?

**Mr Easton:** I never believe that the Government alone has the responsibility; industry also has and we have our part to play. Affordability is a huge issue that is very prominent just now, and I like to think that within industry we are making a very serious and significant response to that. If you look at what should the Government do, as has been mentioned by Peter Whitehouse, continuity of work is all for not only us as the designers and builders but, also, for the entire supply chain who depend on us. If we do have fluctuations people will leave us for very challenging work elsewhere. They want to work in the submarine business and we have to ensure that even if there is a further delay, or any delay, in the submarine ordering programme it will have a significant and, I think, very catastrophic impact on our ability to design and build and, therefore, for this country to have its own nuclear submarine design and construction.

**Q11 Mr Crausby:** I know it is a difficult question but I am asking the question how many and how much, really, as to what the size of the design base should be; what are the minimum numbers of people and how much would that cost the industry without the support of orders?

**Mr Ludlam:** I do not think it is easy to give a size but some of the points that we each consider as we look to invest in each of our businesses—and I will

separate manufacturing again from design—on the design side, to preserve the level of skill that we need we think a eight-year design refresh is quite important; so every eight years it would be quite interesting to retain the skills to do a new design. Certainly when we have looked forward in Rolls-Royce, we have anticipated that a two-year, 22-month, or something of that order, manufacturing drumbeat would be the sort of size that we could work to. So if the Government were to help, a long-term programme based around those sorts of parameters would be quite useful to us, to allow us then to take our part in industry and say: “With that as a horizon we can now size (?) the businesses accordingly”, and at that point I think we could give a much more reliable estimate of what would be necessary to keep the skill base and actually keep quality manufacture, because quality manufacture is the important thing,

**Q12 Mr Crausby:** We went 16 years between Vanguard and Astute. Are you saying that is too long? Is that really what caused the problems of Astute?

**Mr Easton:** We have undoubtedly haemorrhaged skills and experience during that gap that you are talking about. We currently stand at 150 designers or professional engineers, the design end, and some 300 draughtsmen in support of them taking that three-dimensional information and making two-dimensional information for production. They are absolutely critical to us, and that is the core that certainly in Barrow we must maintain. We can supplement that; we can with computer graphics out-source, but it has to be very selective because of the skills and the understanding of the people that you require. So I completely agree with you, it is fundamental that we sustain it. We have fluctuations in the programme and these fluctuations naturally, were there any delay, will be very significant to us.

**Q13 John Smith:** You referred to retaining these skills and the role of Government almost exclusively in terms of continuity of work and making sure the work is there. Do you believe the Government could go any further? Currently, we have the Defence Training Review; there is going to be a major announcement shortly and if it goes according to plan there is going to be the creation of a huge Tri-Service military school of engineering. Could you envisage a role that Government, or the MoD, could play in supplementing or assisting you in retaining skills or providing skills for the future?

**Mr Easton:** I think you make an exceptionally good point, and in fact we have been in dialogue recently with the customer, the Ministry of Defence, because it is imperative that we actually bring operating experience into the design in order that the design is most cost effective, it suits what the operator needs and, also, for through-life maintenance because they maintain it through life at sea before it goes to a place like DML for maintenance. We need that experience to be integrated. For any future boat I consider it very, very important that there is integration, and yes, they could supplement some of

the resources. The core resources that we have with the understanding on what build techniques there are and what design capabilities are needed is fundamental. However, you are quite right; it can be supplemented.

**Q14 Mr Borrow:** Mr Murray, you mentioned the use of surface ship work to help with the peaks and troughs of submarine work. I got the impression that you are working on the basis that the surface ship work would supplement existing submarine work. Would it be possible to retain and maintain the skill base if there was a clear gap in submarine work and substitute for that surface ship work, or would that not be possible?

**Mr Easton:** If I gave the impression that surface ship work would supplement our current requirement for submarines then that was erroneous, and I apologise. What I meant to say was, effectively, where there are also gaps in the programme. For example, the design of Astute is not complete but, as your Committee saw when you visited, it patently exists and we are in the final stages of commissioning a complex first-of-class. Therefore, we have designers that will increasingly throughout 2007 finally become available. What do we do with them? If we are to retain them there must be work. There is the possibility naturally of surface ship work satisfying that what will be a surplus at that time—it is not yet but it will be at that time. Yes, it very definitely can compensate in those areas. The only problem I foresee is that although that satisfies the demand in engineering and the design and drawing end (if you, for example, talk about the aircraft carrier that would satisfy that and we have plans to become actively involved in that), in fact, though, in production we are out of sync and the carrier does not fill the hole that any delay in any of the submarine orders would generate. In fact, it makes it worse because it supplements our demand for submarines—the point you made—and then the trough is even deeper. So we really cannot, as an integrated business, cope with a delay to the submarine programme.

**Mr Ludlam:** If I can make a slightly separate point against the question (I think it probably applies to each of us, but I will be very specific), let me take the pressure vessel area. In Rolls-Royce we make pressure vessels; we made them in the commercial business, then we made them in the nuclear business for the civil plants and then we went back to the commercial business. As the commercial business was getting more and more competitive and we came back into the nuclear side, what we found was that we had lost some of the skill necessary to build nuclear plants, and we went through a fairly tough period of producing lower quality than one would expect to see on Royal Navy submarines, and it took us a long while before we got that right and then could send things out of the factory. If we are not using the skills in the right environment and in the right domain I think they do erode; you have got to keep practising. It is a slightly separate view, and we have probably all got specific areas like that in each of our businesses that would see that same effect.

**Q15 Mr Borrow:** So the existence of a short gap may not have a significant effect on skill levels, but the longer the gap the greater the loss of skill—

**Mr Ludlam:** The level of skill begins to reduce.

**Q16 Mr Borrow:** Also, the greater the likelihood that people with those skills would go elsewhere because they wanted to build submarines rather than do something else.

**Mr Easton:** Or they wanted a high technology challenge. Good engineers go for good engineering challenges. Job progression.

**Mr Whitehouse:** It is also a very important part of the affordability equation. Our business is integrated, we have a nuclear and a non-nuclear maintenance workload and an industrial workforce of 2,200–2,300 that we move between the two. If we look at the submarine population going forward, we are talking about 7 SSNs and 4 SSBNs. Statistically, that is a very small number. So we will see going forward, on a three-year rolling basis, an enormous variability in our nuclear load: peak load to minimum load a factor of 4:1 on a three-year cycle. It is essential to help with the affordability equation in the support area; at the end of the day, 70% of the cost of one of these things is in service and when it is being supported, not in build. It is essential that we will have access to non-nuclear workload to help cope with that extreme variability in the nuclear throughput, otherwise the unit costs are extreme and the affordability problem becomes perhaps unmanageable.

**Q17 Mr Borrow:** Can I pursue the issue around the numbers involved in each of the specialist skill areas. I think, Mr Murray, you mentioned that your existing staffing level is about as low as you could see as being sustainable, but you were not in a position to identify one particular area of skill as more important than another. Would it be possible to give details of the minimum numbers in each specialist area that would be needed to sustain that skill base? Even if you have not got it now, would it be possible to make those figures available?

**Mr Easton:** Indeed, I am perfectly happy to support that and I commit to do that after the hearing.<sup>1</sup> We can be talking about single numbers of people with the skills: four radiation physicists or half-a-dozen people with the structural design capability—it is down at those levels, it is not big numbers at all. We co-operate, obviously, and make proposals to the Ministry of Defence, our customer, to try to modify what can be a disadvantageous situation to them or to us. As an example, we were talking about is there a delay, is there a gap? The gap between the first and second, second and third Astute submarines was 18 months each, thereafter 24 months. That is the way they were originally contracted. We have modified that in a proposal to the Ministry to 22 months and 22 months, as Steve Ludlam mentioned. The reason for doing that was to optimise the resource profile so that we did not create big demands and then we had surpluses. So we have proactively looked at this

ourselves and made a proposal. It actually reduces the number of people slightly that are employed in Barrow but it was better for the whole programme.

**Q18 Chairman:** Peter Whitehouse, could you provide the same sort of information in relation to Devonport, please?

**Mr Whitehouse:** Yes.<sup>2</sup>

**Chairman:** Moving on to decommissioning, David Hamilton.

**Q19 Mr Hamilton:** You will be aware that in July the Prime Minister agreed that a decision will be taken at some point whether we continue with the nuclear deterrent or not. I do not know whether that will be a free vote or whether there will be a whip—I am not too sure but I can have a good guess! Everybody will be watching to see how that goes. My question is really about decommissioning and the maintenance skills required, because it is not something you just close off, you would have a long-term feed-out if that were to be the case—it is important to understand that. If a decision was taken to abandon the construction of nuclear submarines what skills and infrastructure would have to be kept for the maintenance work? Peter, I think you are probably the best person for that.

**Mr Whitehouse:** If the submarines continue to operate until a date when they begin to phase out, essentially, the profile of our workforce and the infrastructure—the physical facilities that we need—would be not too dissimilar from where we are today if there were to be further refits during a phased run-out, perhaps during a transition to perhaps even a different type of delivery system. Thereafter, if a programme were stopped then the key thing is that our facility at the moment has the unique capability to actually move the irradiated fuel out of the NSRP and package it ready for transportation to Sellafield. That would be, obviously, a markedly different workforce size and skill mix compared to where we are today because we are refitting at the moment. We would need to keep the site licensed with the NII and, therefore, a lot of the infrastructure teams would not look markedly different from what they do today. So infrastructure, probably, very similar in terms of maintaining the site licence and keeping the facilities capable of doing the work they do. In terms of workforce, it would move progressively towards focusing on all of the things that are needed to actually safety-justify the de-fuelling operation, keep all the environmental consents and other authorisations in place to allow the de-fuelling operations to happen, and thereafter to actually then begin to address the issue of disposal of the actual hulks.

**Q20 Mr Hamilton:** Could you give us an estimate of how many people that would require? If you cannot, could that information be passed across: present workforce to what would be required if that was to come about.

<sup>1</sup> See Ev 114

<sup>2</sup> See Ev 113



**Mr Whitehouse:** Indeed.<sup>3</sup>

**Q21 Willie Rennie:** I get a sense that the excitement in this area is all around building new vessels and that decommissioning would not be that attractive for those that you require to do the job. How much is that the case and what would be required in order to attract those individuals?

**Mr Whitehouse:** It is not particularly about excitement, it is about the scale of the operation that would be carried out. The numbers of people would be markedly reduced from where we are today as a maintenance and refit site. I think the key issue would be the tension, perhaps, that we would see with the ramp-up of the NDA work within the civil sector. In fact, as a business ourselves we are looking at NDA activity to actually help mitigate the variability of workload that we see from the submarine programme; we are looking at the NDA sector to deploy some of our skills and keep people that we need in the long term effectively and productively employed during lulls in their military workload streams. At the end of the day, things would have to be done; we would be in there in a common pool looking for common skills with the NDA programme, and that is something we would have to address at the time.

**Q22 Willie Rennie:** Is there the kind of kudos, though, attached to that in the same way as the kudos to building new vessels? Are people attracted to that? Where do the best people go?

**Mr Whitehouse:** As it stands at the moment, we have very little difficulty in attracting young men and women, graduates and apprentices, as Murray has described, into our business to carry out the maintenance work. In many respects it is every bit as complex as the build programme but with the complexity focused in different areas. There is a lot of challenge for both our non-industrial and our industrial workforces in what we do as the refit site. If the submarine programme were to wind down at some point in the future then the skill mix, the numbers of people, would change markedly, and that is something we would have to address at the time. It is a different type of activity; it is one that does still have very, very significant challenges in it and requires some very specialised skills.

**Mr Ludlam:** I could perhaps take a slightly different view? If a decision were to be taken not to build any more submarines and we were into an in-service support and decommissioning phase, I think inevitably a decision would also be taken to freeze the level of knowledge that we have and certainly freeze the level of skill that we have got with that knowledge. That then probably affects engineers because if they are not growing in their knowledge it is less exciting for them. It also probably affects the military capability, too, because we may face, in service support, some issue that we have not developed the knowledge to address immediately, and therefore the availability of the submarine could be affected. It is a slightly different view, I think.

**Robert Key:** Can I ask Mr Whitehouse this: as you know, there is a Royal Naval base review going on. If the Government decided to close the Devonport Royal Naval base, could your operation at DML move to any of the other bases which might be kept open?

**Q23 Chairman:** Could you see if you could answer that on the very narrow basis that Robert Key has asked it, because we will come on to the base review later.

**Mr Whitehouse:** In terms of the physical infrastructure that we have at Devonport it is highly specialised, it is just being extensively modernised and extended and I think the key issue would be the affordability of the re-creation of that infrastructure. That would, in practical terms, preclude moving the irradiated fuel-handling capability, the refuelling capability anywhere else. Those docks, the fuel-handling infrastructure, the cross-site services are just so extensive I find it inconceivable that it could be affordable to move it anywhere else.

**Q24 Robert Key:** Could DML continue to operate if the Naval base was closed?

**Mr Whitehouse:** There is the issue that I outlined to your colleague of the very significant peaks and troughs in our load going forward, as we drop to a single SSBN refit stream. I said a ratio of about 4:1, peak to trough, in terms of industrial throughput. The key to actually keeping submarine maintenance affordable, in my view, hinges on a decision to actually sustain the current programme and move to a successor SSBN. If that is the decision, then I believe that decision to maintain the programme, to build a successor system, should be a pivot point around which decisions on the Naval Bases, base porting, should actually revolve. If that is not the case and if decisions on where surface ships are baseported and, hence, their in-service maintenance are taken out-with that submarine context then both the affordability of the submarines and the affordability of the surface ships will suffer because of the integrated nature of our site.

**Q25 Chairman:** You are talking about the decision to build a successor SSBN as though it were a decision that had been taken, which of course it has not. Can we consider for a moment the consequences of there being no Vanguard successor? What would happen to the skills base then?

**Mr Whitehouse:** So far as our site is concerned, if the existing system were run on for its projected full service life, which in parallel throws up the requirement for a number of SSNs to operate with the SSBNs, then irrespective of a successor decision being positive the affordability of the submarine flotilla in that run-out phase would suffer just as badly as I have just described. The costs of in-service support, the deep maintenance, the long overhaul periods would escalate overall across multi-year periods if we are unable to actually deploy the industrial workforce on other work streams at Devonport during the troughs in the workload.

<sup>3</sup> See Ev 113

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**Mr Jenkins:** The point there—I am going off a little bit—is the assumption that we are going to maintain the existing fleet. If we are not going to have a replacement the next question is: why have we got the fleet? So how much will it cost to decommission them in the shortest time possible and wrap it all up? I thought you were going down that road, but you probably were not.

**Q26 Chairman:** I was going to ask if we were not to have a Vanguard replacement would we be able to build nuclear powered submarines—SSNs rather than SSBNs? Murray Easton, would you like to answer that?

**Mr Easton:** Absolutely we would be able to build them, yes. Our designers, as I mentioned earlier, Chairman, will be available in number increasingly throughout next year, 2007, and 2008. Clearly they are available then and very experienced at what they do; they can apply themselves to any other nuclear submarine demand. I am not aware that there is one, with the possible exception of the potential successor programme. If the successor programme does not go ahead then, obviously, depending on how many Astute submarines there are, our production facility at Barrow will grind to a halt.

**Chairman:** Thank you. Moving on to the Astute and the potential successor, as it still is, Willie Rennie.

**Q27 Willie Rennie:** One of the reasons, I understand, for the early problems with the Astute programme was the extended gap between the Vanguard and the Astute programmes and, therefore, the loss of construction and design skills. What happened to those skills after completion of Vanguard, and which skills were hardest to reconstitute back at Barrow?

**Mr Easton:** What happened to the skills? If we look to some 14,000 people and how did we get to 3,500 and where did they go, effectively they dissipated into the rest of the manufacturing community in Britain. I faced a similar problem, actually, when I was in your constituency when we looked to British shipbuilders who employed 110,000 people and thought: “They don’t now so where must they be and can we attract them?” They literally dissolved into the manufacturing and industrial community. However, they also lose their skills; so they are not match fit, they do not keep up that skill capability. That is the crucial thing for us. Where have people gone? I really could not tell you. A lot of the manual employees, the skilled dexterous people that we have, go offshore; they go offshore and then, depending on the fluctuations of demand in that industry, could come back. They would not have practised what they need to for our business but they may come back. The problem is much more acute in terms of the white collar; when they move away they do not tend to come back. So, whether it is designers, whether it is draughtsmen, whether it is supervisors, planners—all those key skills—nuclear safety experts, they go away, and we do not attract them.

**Q28 Willie Rennie:** Why is that then? Surely, if they can easily transfer somewhere else they can easily transfer back again. What is stopping them?

**Mr Easton:** Stability of employment, I think, generally. Most of us like to know the mortgage is going to keep getting paid, and they go for that stability. They try and avoid fluctuating demand, as naturally we do in business as well.

**Q29 Willie Rennie:** Have you learnt any special lessons during that period then, about how to handle that change and those gaps?

**Mr Easton:** The lesson learned—and I think one of my colleagues mentioned this already in the hearing—is that we try and employ as much flexibility as we can, but recognising the demand for quality is such that you need people often to be practising their particular skill—white collar or blue. There is a lot of flexibility and there is a lot of co-operation—I mentioned earlier even between the companies. I think, arguably, when you have got 14,000 people there is a lot more opportunity for people to move around, but when you are down to 3,500 then, frankly, it is very difficult often to identify those opportunities. Stimulating work for people and making it attractive, Barrow-in-Furness, for example, has a particular geography about it—naturally it is in a 33-mile cul-de-sac—we have to make it, you said, exciting earlier. It is exciting; it is very enjoyable and the employees that we have enjoy working there—the majority of them; I dare say not all—but it has got to be challenging work, and that more than anything—people want to be valued.

**Q30 Mr Jenkins:** Going on from that constant nature and how you would like to have a constant nature of work—we all would—as an industry have you come together and developed a timeline as to what is now proposed or planned, whether carriers, submarines, 45s, etc, and what would be the optimum arrangements, for those orders to give you some constant work across industry, therefore lowering the price and not returning to the old boom and bust scenario? Have you done that?

**Mr Easton:** We are motivated by the customer, certainly, to come together often, and we do, and we share resource plans with them as to how we can, with the Ministry of Defence, obviate the, as you say, “boom and bust”. The fact of the matter is that some of those projects, like the carrier, are so high in their resource demand and often with dissimilar skills, as we have talked about earlier, that that can create difficulty. If I look to Steve Ludlam and Rolls-Royce, unfortunately they do not want nuclear reactors in the carriers, so that is not going to be too helpful. We have, in the rest of the industry, certainly, got an opportunity to be flexible in terms of what work goes where, and we try to co-operate just on the grounds of affordability or the projects will never happen.

**Q31 Mr Jenkins:** So the answer is no, you have not got a timeline with the industry?

**Mr Easton:** We have a timeline for ourselves, and I can furnish the Committee with what our resource plots are.<sup>4</sup>

**Q32 Mr Jenkins:** Yes, please.

**Mr Ludlam:** If we look at what we have discussed in the submarines business overall, as a collaborative issue, we have looked at, really, some simple points: a 22-month manufacturing drumbeat, an eight-year design cycle, a new class of two years, seven years, seven years and two years—the first two years being the concept, seven years of design, seven years of manufacturing and two years of commissioning. Those are the sort of lines of time we have put down to start to think about how the size of our businesses should look and what investments we can make to keep that size to meet that demand. It is not something that we have been given it is something we have discussed as, probably, an optimum position.

**Q33 Chairman:** Do you believe that the Ministry of Defence has the capacity and the skills base within it to manage that, and do they understand the sorts of things that they ought to be talking to you about? Do they have that skills base themselves?

**Mr Easton:** In a word, yes. They have fewer people who understand it than they used to have—they have reduced the number—but I have to say we co-operate very, very closely with them, and it is a very constructive dialogue with the Ministry of Defence, in terms of resources, demands and, therefore, programme timing.

**Mr Ludlam:** A number of the new contracts that each of us are looking at involve a great deal of collaboration with the MoD: the joining together of teams, the collocation of teams, the secondment of MoD personnel into particular jobs within our industries, all to make sure that together, as an industry, including the MoD, we retain the skill that is necessary to take this forward.

**Q34 Chairman:** When people are seconded from the Ministry of Defence into your industries, do they ever return to the Ministry of Defence?

**Mr Ludlam:** Yes, they do.

**Q35 Chairman:** Just checking. Let us assume, for the purposes of this question, we are going down the line of a new SSBN. Would it need a new design of nuclear reactor, and if so why?

**Mr Ludlam:** The current design of nuclear reactor was designed in the late-70s/early-80s and whilst it is very safe and it has the power that is necessary for the current military capability that we are looking for it is likely that the safety regime as we go forward will get tighter and tighter. Without going into some of the more secure areas of conversation, a new design of reactor would be quite important to make it what we might call a “passive” plant. So the biggest issue with a nuclear reactor is when you are not using the power to move around or for electricity it is still generating heat and you need to take that heat away. Largely speaking, you would do that

using a pumped flow system and electricity is required for that. If you lost the electricity the pump flow is not there and it is much harder to take the heat away. So a new design of reactor would aim to avoid pumped flow systems and a more natural process of taking the heat away and, hence, it would be much safer. Also, the amount of fuel, so to speak, we have got in the tank is becoming more and more important for the military operations that are going on. So we probably might choose to look at the reactor core and see just how many more miles per gallon we could get from that reactor core. I think a new reactor is possible; it is possible on safety grounds. In doing all that, the affordability changes, too, so when we have looked at a new reactor design compared to the old reactor design, we are looking at something like, perhaps, 10 or 20% improvements in affordability through a new reactor design too, because of the way that we would remove some of the components on the plant that we could basically design out and, again, make the plant better to operate and safer to operate.

**Q36 Chairman:** So a new design would be not only safer but it would be cheaper?

**Mr Ludlam:** We would be aiming to make it safer and cheaper, and within that new design sustaining the industry as well.

**Q37 Mr Borrow:** It is an eccentric question. In the early-90s the United States Government commissioned an inquiry into the possibility of closing down the Electric Boat company to see was it possible, if you did not need to manufacture any nuclear submarines for a while, to shut the whole facility down and then several years later start it all up again and what the implications would be. The result of their study was that it was not a good idea and they did not pursue it. Has any thought been given to that as an option in the UK by the industry?

**Mr Easton:** I am aware that many people contemplate a wide range of scenarios, some of them practical and some of them not. Most people depend on that (as I understand it, the study you refer to is a Rand Corporation study) as one indicating the catastrophic effect that would be inevitable. Looking even at the delay, they did actually cancel one Seawolf boat—one of the class—and then terminated that class. The class was expensive, but it was made a lot more expensive by cancelling a boat, because obviously the overheads just went exponential. It could be one reason why the American boats are significantly more expensive than the ones that we produce in this country. So, no, I do not think it is a good idea either.

**Q38 Linda Gilroy:** The Defence Industrial Strategy identified affordability as a key consideration in the decision over the potential Vanguard and Trident successor. In earlier answers to various questions you have given us some insight into what industry is doing to reduce costs, including the through-life costs. Are there any things that we have not touched

<sup>4</sup> See Ev 114

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on in those earlier questions that you would like to set before us as to what industry is doing in that respect?

**Mr Easton:** Indeed. Affordability, I mentioned earlier, is a massive issue which we recognise fully and proactively, certainly, in BAE Systems Submarines. In 2005 we took 31% out of our overheads; in 2006, this year, we set ourselves a target of taking 10% out of the cost base—so overheads, materials, labour, right across the base—and we will achieve that. That has been generated by a number of lean design studies, lean manufacture, even a lean office study. So we have involved people from outside industry—for example, car manufacturers, technologies that would not normally be seen as associated with our business but from whom we can learn. We also worked very closely with the Ministry of Defence, but I think most importantly I would highlight that affordability has been assisted when you look at the materials component of the price of a submarine. Up until very recently, certainly in both one to three of the Astute class, materials would comprise about 50% of the value. It has, in fact, now gone up to about 60% simply because our overheads and our productivity have gone in the opposite direction. What do we do? We proposed change to the whole supply base by our initiative of getting together (I believe you are going to take evidence today from several of our colleagues in Strachan & Henshaw, Alstom and MacTaggart Scott) with a group of 10 companies in a key supplier forum who have looked at what we actually need rather than what we ask for. Often, the Navy or even ourselves, as designers, say we want something but to ask the supplier what you need, often, you get a different answer. That has been a hugely constructive forum, it has met five times already—the sixth occasion is imminent—but we have invited the DPA, the DLO and the DTI, so we are trying to get government bodies to co-operatively work with us, and of course they are. We have had exceptionally good results from that, and I think it is an example of the submarine enterprise working very well together as a team to tackle the affordability issue.

**Q39 Linda Gilroy:** As far as through-life costs are concerned, I appreciate one of the things from the Devonport point of view is that, like cars, submarines are requiring a lot less attention in the mid-life. Have you been building in further potential savings for through-life costs? I must admit I was a little worried when I saw some of the amazing things you were doing, as far as the modular vertical ways that you brought over from Electric Boat and some of the very long pipe runs that were being done, as to how accessible these were going to be when it comes to through-life support. I suppose my general question is: to what extent have you been co-operating to make sure that these things do not build in difficulties but actually make additional savings of through-life cost support?

**Mr Easton:** You make an extremely good point but we do actually have a very active engagement between the three companies here, to be honest. The

supply chain is a fairly small family but, in particular, the three companies giving evidence work exceptionally closely together, very co-operatively. In particular, if you look at through-life maintenance, to take the example that you used yourself, long pipe runs, you can tend to look at that and say: “Well, that is maybe not the best for getting each section of pipe out in the future”, but quite clearly what it does is reduce our UPC because we are reducing the number of joints; it is simplifying the operation because the number of leaked parts are reduced significantly and if come the day they need to get a section out then, of course, they can cut the pipe and put in couplings. That is how we would have designed it in the past, with far, far too many couplings. So as a repair procedure (I am sure Peter will better explain than myself) they are very resourceful at taking out sections of a system that we may have put in in a larger piece.

**Q40 Linda Gilroy:** Would you like to comment?

**Mr Whitehouse:** It is fair to say that one of the biggest issues I have seen in 20 years there is this tension between initial production costs, procurement costs, and what that might mean for the in-service cost as and when we start to carry out these major overhauls at the ten-year period. I think it is a fact of life that there is always going to be that tension between the two areas, but, as Murray says, there has always been, and increasingly so, very intensive dialogue between the two facilities, and indeed with Rolls-Royce, over the impact of those decisions that are taken at the design and build stage on the in-service support regime.

**Q41 Chairman:** We raised that with the Chief of Defence Staff (Procurement) one month ago, so I hope you are involving him in this issue as well.

**Mr Easton:** The three IPT leaders for both new build, nuclear and submarines when in operation are involved in dialogue with us and, I believe, co-operate.

**Q42 Mr Hamilton:** On something that Murray indicated earlier on, and it is Linda's point about reducing costs, I worked for the National Coal Board, a massive organisation, and one way they reduced the costs was by pushing them down to the sub-contractors by saying, “If you want to come forward with the designs and so on”, and the costs are passed on to them rather than doing the costs themselves, and we will be taking this up with the small companies next. What type of dialogue do you have with the small companies and is it the case, and I know big companies tend to do it, that they do, as a way of reducing their costs, push it on to others to do that? Do you do that?

**Mr Easton:** The best example I can give you is actually from one of the next gentlemen to give you evidence, Joe Oatley of Strachan & Henshaw, part of the Weir Group. We have an example there where the submarine is nothing without a system for discharging its weapons and they provide that and it is absolutely crucial to the design and operation of the submarine. We started a series of lead design

projects where we were looking, quite intrusively in process analysis terms, at what it is that we actually do to the design. That was fine for us looking introspectively, but the second project that we picked actually was the weapons-handling system and I am sure he will endorse my view that we worked exceptionally closely with them and it was not a matter of pushing the costs, but what ideas did they have which could affect the costs. Sometimes we impose design requirements on them that they, the manufacturer, or the supplier in that case, do not believe are necessary and getting into a more healthy dialogue rather than, "This is what I want. Make it. Give it to me". It is hugely more collaborative and co-operative now than it has been ever before, I believe.

**Q43 Linda Gilroy:** Again you have all, I think, touched on the close work that you are doing with the MoD to try and get efficiencies and drive out costs, but are there further things which, in your view, could be done in that respect? In particular, if I can address the question to Mr Whitehouse, is there sufficient joined-up thinking between what we have been discussing this morning and the Naval Base Review? I do not know if Mr Easton wants to touch on the MoD question first.

**Mr Easton:** We talk about lead design and how can we change things. Clearly we require the Ministry of Defence's acquiescence to what changes we would make. It may affect the specification or there may be compromises because in some instances their specification may be considered to be out of date or there is a different way of looking at it, so they have to be part of that team. We need them, as indeed they do, to very actively consider some of the smarter, brighter ideas that come up. It is a relatively conservative business, both the designing, building and operating of a nuclear submarine for the best of reasons because it is so safety-critical and demands such high performance, but that does not mean that we cannot engage a lot of progressive thought and clearly the Ministry have to be a part of that, but they are engaged and I believe it is—

**Q44 Linda Gilroy:** And you would absolutely agree that you would want them to be?

**Mr Easton:** I absolutely want them to be. It is fundamental and we cannot do it without them. If I look to where next, how much more can we do with the Ministry and, coincidentally, with the three companies represented in front of you, we are in very active dialogue currently and have been for the past three months, at actually our initiative, to see how better we can collaborate with the customer as a team of four to make these vessels more affordable.

**Chairman:** I am sure that is not entirely coincidental.

**Q45 Linda Gilroy:** There may have been some dialogue on that. Mr Ludlam?

**Mr Ludlam:** If I can give two other dimensions of working with the customer, first of all, there is the dimension of the joined-upness with the research and development, so it might not necessarily be a bad thing, a long pipe run. As long as it has been

designed with research and development sat behind it that justifies the life of that pipe run, it may not necessarily be a bad thing for in-service support, so I think joined-up with R&D, it is getting far better now between ourselves, the MoD and the connections that are necessary to drive that forward. The second thing, I think, is the commercial arrangements we are now entering into with the MoD. The commercial types of contract that we are able to take, each of us, are more innovative, they are challenging, they are very output-driven and require a huge amount of innovation on the part of both the MoD and on the part of the companies to actually make the profits that the businesses want to make, so I think that is a great thing the MoD have brought in working with them. It really forces that innovation and, as I said earlier, the engineers love that and that brings out some of the best ideas.

**Q46 Chairman:** The Naval Base Review, Mr Whitehouse?

**Mr Whitehouse:** I think the question was whether there was sufficient joined-up thinking in that. I think it is early days at the moment. It is a fact, I believe, that we own the dockyard, it is integrated and co-located with both a nuclear and a non-nuclear operational naval base and we have, as DML, a very clear understanding, we believe, of the way that the cost structure and the economies of scale can be affected by decisions that are not directly associated with the dockyard business. There is an interaction between the Naval Base, how many ships are operated from there, how many submarines are operated and what that does for the in-service support budget in both nuclear and non-nuclear domains. I think in the spirit of joined-upness, now that that picture is becoming clear, and obviously there is an interaction with the issue that is being discussed today, the future of the submarine programme, it is incumbent on us to actually ensure that we communicate clearly with the MoD as to how we believe decisions about Naval Bases could affect in-service support costs, and we will be doing that, you can be assured of that.

**Chairman:** Are you content with that, Linda?

**Q47 Linda Gilroy:** Yes, and, as that develops, perhaps you can let the Committee have a note of the scale of what is involved in that. I believe the work on that is ongoing and I do not know whether you can do that at the moment or whether it will be available in the foreseeable future.

**Mr Whitehouse:** Probably within the next few weeks.

**Linda Gilroy:** Perhaps the Committee could have a note on that then.

**Chairman:** If you could give us a note on that, we would be most grateful because we will be keeping a close eye on it.<sup>5</sup>

**Q48 Robert Key:** Earlier you told us that the nuclear submarines operated by both the United States and France are considerably more expensive than our British nuclear submarines, but, Mr Easton, you

<sup>5</sup> See Ev 113

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said that, for understandable and obvious reasons, we cannot export our submarines. Now, at least two of the companies here today have extensive historic links with the United States. Could you say if there is any realistic prospect of greater design collaboration with the United States on submarine design?

**Mr Easton:** Yes, there is. There has been some dialogue, and it continues, between the two countries certainly at industrial level, though I cannot speak for government level between the two ministries of defence. I perceive there is a lot of co-operation, but I cannot give you any specifics; that would be for them to say. Certainly with colleagues in Electric Boat, as a result of them supplementing some of the resource that we required in the early stages of the Astute programme, we have developed very good relationships with them and there is a testing comparison often on prices and techniques between the two companies. Is there more that could be done? There is already a very healthy dialogue.

**Q49 Robert Key:** Is there anything anyone would like to add to that?

**Mr Ludlam:** I could add by talking about the Defence Industrial Strategy which declares the need for a sovereign capability, so whilst collaboration could occur, I think we would here in the UK need to maintain a level of skill, a level of knowledge, to be able to stand alone in order to through-life-support a nuclear submarine.

**Q50 Robert Key:** Lord Drayson indicated to the All-Party Shipbuilding Group quite recently that there might be export possibilities for our aircraft carrier, the new aircraft carrier. If you can do it with aircraft carriers, why can you not do it with submarines?

**Mr Easton:** You can do it with submarines, you just cannot do it with nuclear submarines.

**Q51 Robert Key:** Because of the nuclear technology question?

**Mr Easton:** Yes.

**Q52 Robert Key:** So has there been any discussion with France, moving on to France because you mentioned the United States and you said yes, they have at an industrial level, so has there been any industrial-level contact or discussion between BAE, Rolls-Royce or DML and France?

**Mr Easton:** We have, over the past six months, had direct links with DCN, the state-owned sector in France, and that is particularly in relation to the supply chain within the bounds of security and classification in dialogue with the French because there is some restriction on us in that respect when we are talking about nuclear technology. However, with much of the supply chain where it is not nuclear, and where we certainly have the difficulties with a very fragile supply base in this country, we should see whether or not we can make it slightly more secure and affordable, the submarine, by identifying with the French whether there is any common equipment, whether they make the same components that we do and, if so, what their costs are. That dialogue is under way.

**Q53 Robert Key:** How about Rolls-Royce?

**Mr Ludlam:** For Rolls-Royce, specifically on the nuclear side we are subject to the 1958 Agreement and the 1958 Agreement process requires companies like Rolls-Royce to seek government permission if we want to talk to a nation other than the UK about nuclear matters. Therefore, on the nuclear side we have not sought that permission, so there have been no specific discussions on the nuclear side with the French.

**Q54 Robert Key:** DML?

**Mr Whitehouse:** I think exactly the same constraints apply to us. We have had discussions with the French over both the approach that they are taking to the procurement of their new class of SSN and the sorts of commercial models and related matters that they are developing to try and actually produce better affordability, but it has really been in that sort of domain that we have been talking to them.

**Q55 Robert Key:** You mentioned a little earlier the understanding, the informal arrangements between your three companies over design and that you work pretty closely together and were comfortable working together. Is there any way that you could make that more formal in terms of pooling design resources?

**Mr Easton:** I mentioned that we have an initiative which has been running for some months now in terms of identifying the principles of collaboration between the three companies in order, frankly, that we can pool resources and that we can optimise, for the purposes of affordability for the submarine enterprise, the skills and capabilities in all of the three yards and, yes, that is the purpose of the dialogue, so that is what we are pursuing now.

**Q56 Robert Key:** Is the Ministry of Defence doing enough to assist you in that?

**Mr Easton:** They are a participant. They are the other part or corner of the square, the three of us and the Ministry. It is a team of four.

**Q57 Robert Key:** Is there any evidence of partnering arrangements, which the Ministry of Defence are very keen on, in this area?

**Mr Easton:** At this point in time, I think it would be premature to say what form the collaboration will take, except that it is highly co-operative just now and we are focused on concluding agreed principles of collaboration. Obviously all three companies here are very enthusiastic at the prospect of working very closely together. We perceive a shrinking market, we want it to be sustained, and, at our initiative, we are doing as much as we can to secure that.

**Q58 Robert Key:** Anything to add?

**Mr Ludlam:** Certainly. I think the affordability challenge that we face and the availability challenge that we face is the very driving force to give that innovation that is necessary and it makes the whole collaborative venture much more interesting to take forward.

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**Chairman:** That is the end of the questions we will be asking you, but could I finish your bit of it by saying to all three of you, thank you for your hospitality in hosting the Committee and showing us what you do,

BAE and DML in the past and Rolls-Royce, I think, perhaps in the next fortnight or so. We are extremely grateful to you and it has been extremely helpful for this inquiry as for others, so thank you very much indeed.

*Witnesses:* **Mr Ron Grant**, Managing Director, MacTaggart Scott & Company Limited, **Mr Jim Morrison**, Unit Managing Director, Alstom, and **Mr Joe Oatley**, Managing Director, Weir Strachan & Henshaw, gave evidence.

**Q59 Chairman:** May I start again by welcoming you to the Committee and saying thank you very much indeed. We will try not to give you a particularly devastatingly hard time, but you are very welcome in front of the Committee. Would you like to, as before, introduce yourselves, say who you are, what you do and why you do it.

**Mr Oatley:** My name is Joe Oatley. I am the Managing Director of Weir Strachan & Henshaw. We are a systems engineering business operating in both the defence and the civil nuclear sectors, based in Bristol, with about 500 employees, the majority of whom are engineers. About two thirds of our business is defence and the vast majority of that is submarines. Our role within the submarine world is to provide the weapons-handling and launch system for all the conventional weapons on a submarine. We have been doing that for the last 34 years within the UK. We provide design, manufacture and in-service support, so we cover the whole breadth of that. We also provide that system to the Australian submarines and most recently to the Spanish submarines also. We also have, I know you have not talked about it, but I guess it is relevant to any successor, a piece of work at AWE where we are supporting the refurbishment of those facilities.

**Q60 Chairman:** So you do the weapons and the launch system on the Astute programme, amongst others.

**Mr Oatley:** Yes, Astute amongst others, Trafalgar, Vanguard, Upholder.

**Mr Morrison:** My name is Jim Morrison. I am the Unit Managing Director at Alstom Power Steam Turbine Retrofits UK. We design, manufacture and supply steam turbines for the nuclear submarine programme. Steam turbines for submarines is not our core business. We have been pursuing a strategy lately of being able to continue support for the manufacture of the forthcoming steam turbines for the forthcoming submarines, pursuing a strategy of being able to hold on to, what I call, our “know-why”, that we are a position where we are not actively trying to replace the essential skills or know-why within our organisation.

**Q61 Chairman:** Did you say you were not actively?

**Mr Morrison:** Not at the moment. Our strategy at the moment is to be able to simply hold on to, and retain, the key skills and the processes and the methodologies to be able to continue the support of the existing Astute programme.

**Mr Grant:** I am Ron Grant. I am Managing Director of MacTaggart Scott & Company Limited. We are a privately owned, limited engineering company on the outskirts of Edinburgh. We employ around 250–260 people and whilst we have been in existence for quite a long time, we are very much conscious of the need to stay abreast of the changing market. The volume of our business which is associated with defence is probably around 95%, but since around the mid-1980s we actively set out to grow our export side of the business and we currently export something like 60% of our output, so defence is a major component of our business, albeit one, I would say, wholly dependent on having the domestic market. In fact we have found in our travels around the world, seeking to sell our wares which are essentially bespoke equipment, that we very much need the visibility of a domestic shop window in order to be allowed to be part of the export market and it could be said that one can be part of a domestic market without necessarily being part of the export business, but you certainly cannot be part of the export business without having a visibility in a domestic market. The nature of our equipment covers both surface ship and submarine equipment. On submarine equipment, which we have been involved with since our inception at the turn of the century, it is non-hull-penetrating masts, which are high-strength, low-weight, non-pressure-hull-penetrating, capable of carrying a variety of payloads from the optronics to communications heads, through infrared, radar, snort induction and diesel exhaust, and in fact we manufacture the complete suite of non-hull-penetrating masts which are currently on Astute and we have also trialled those into other submarines. We have an early derivative of that presently in the Australian submarines and there has been interest in that design of mast in the USA as well which we are actively trying, subject obviously to the usual controls of export IPR and intelligence, so masts is the key element of our business. Quiet, stealthy hydraulic motors and pumps and power packs, these are also very much a key component of our business which we have supplied around the world.

**Q62 Chairman:** When you said “the turn of the century”, you meant the previous century?

**Mr Grant:** Sorry, 1898 we were in fact established.

**Q63 Mr Borrow:** The Committee would be interested to try and get a handle on what specialist skills your companies have got, whether you did



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work on the Vanguard programme as well as the Astute programme and what stresses and strains of the gap between those programmes there were for your companies. The large companies we have heard about this morning, but in terms of your companies with specialist skills, to what extent were you involved with the Vanguard programme, to what extent are you involved now with the Astute and how did you manage the gap between those two programmes? I think we would be interested in trying to get a grip on the mechanics of that.

**Mr Oatley:** Our involvement on Vanguard was the same as it is on Astute, to provide the weapons-handling and launch system for all the conventional weapons on that submarine. The key skills that we have break down into what I would broadly call “design, manufacture and in-service support” because we operate in all three areas. Within design, our engineering skills are systems engineering, structural design, shock and stress, mechanical engineering, control systems, quite similar in a way to a lot of BAE’s skillset, within construction it is specialist welding, specialist assembly and fitting, testing and within the support arena we have some very experienced fitters, people who can remove, refurbish and reinstall the equipment, so those are the kind of specialist skills that we have and we need. Obviously there was a very large gap between Vanguard and Astute. We were probably more fortunate, whether by design or hard work, I am not sure, because we won a contract from Australia to provide a system on the Collins-class submarine which filled some of the gap between Vanguard and Astute and there were also a number of key upgrade programmes within the support element through that period, a key one of which was the fitting of the Tomahawk missile, and that kept a number of our key design resources engaged through that period. Therefore, whilst we undoubtedly had a dip, we were able to keep all of the design team together through that period with those programmes.

**Mr Morrison:** We had the same scope of supply for Astute as we did for the Vanguard. With respect to our skills, essentially the skills that you require are the same as the skills for building steam turbines for power plants. However, the specifications are substantially different for submarines than they are for normal power plants, these being the materials because of the safety concerns, the long life, the inaccessibility to the plant, the different configurations, different operating speeds where normal power plants run at an operating frequency, whereas submarines cruise and they change speeds, the noise, the vibration characteristics, the methodologies that we employ and the justification of safety cases to the MoD. These are substantially different from what we do on normal steam turbines, so essentially it is the same set of skills, but the specifications are very, very different. With respect to how our numbers have evolved, when I took up my position in Rugby three years ago, we had a dedicated naval department of essentially 27 to 30 people. We currently do not have a naval department anymore. We have integrated those people into our core activities essentially because the

department was not sustainable through the order intake. The reason for integrating them into other departments is that we are acutely aware of how important our product is for the future of submarine build and this was essentially to try to keep the essential skills that we require to produce the future boats, so we have retained the skills, but we have essentially dispersed them into our mainstream activities, and what we do is we cluster them to be able to produce future boat sets. That maybe gives you an idea of the way that our business has evolved through the submarine programme.

**Q64 Linda Gilroy:** Can you try and describe to me, because I am not quite clear about this, the extent to which those skills, as you were describing, needed for safety justification, very high skills, are used in the sort of broader work that you have just described for us? Is the full skill range used in the presumably civil work that you are doing in that department or are there aspects of what they would do on nuclear—

**Mr Morrison:** No, outwith the naval arena, they are only using a subset of the knowledge that they have for the production of steam turbines for power plants.

**Q65 Linda Gilroy:** So how do you prevent the degrading of their skills that would be used for naval nuclear steam-raising plants?

**Mr Morrison:** We are essentially going down a path to try to outsource certain components. The package that we produce is a steam turbine and condenser generating set. The steam turbines is really the core business for my wider operation and those we are retaining in-house. The condenser sets, we no longer produce those for the commercial world and we have effectively sub-contracted that to other areas of business in the UK. Effectively we are looking at what we can produce and then coming up with a strategy to be able to put our package together.

**Mr Grant:** The key skill sets which MacTaggart Scott has to retain are its familiarity of design for the environment and the interaction of materials operating in that environment. Whilst we supplied equipment in much the same suite as I mentioned earlier on into the Vanguard class, I have to say that Astute very nearly put us out of business simply by virtue of the delay between Vanguard and Astute and the difficulty in actually keeping a design team together, focused, affording the R&D which we were keen obviously to bring to bear in order to be a player in the Astute programme. The mast technology which I mentioned just now was a complete departure for us in terms of materials and technology because it is essentially GRP as opposed to a metal mast and it has now gone through subsequent evolutions of research and development looking at use of carbon fibres to further enhance strength, reduce weight and obviously give the submarine designer the flexibility to put the fin where he wants to in the submarine as opposed to the obligatory location at the centre of gravity, so retention of those skill sets was vital to us. We went through a three-year period of actually declaring a loss by in effect having a design team treading water

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involved with the research and development which was, to our small company, at a very high level and not affordable. We subsequently learned that we needed to grow our export defence activity in order to afford our investment into research and development and that is another key factor in the inter-dependence of participation in the two markets.

**Q66 Mr Crausby:** In the event that Her Majesty's Government decided not to procure a replacement for the Vanguard submarine, what effect would that have on your business and to what extent would you be able to maintain the core skills that would enable you to participate in any future nuclear submarine programme?

**Mr Grant:** We would have great difficulty in retaining those skills and, to a large extent, that is down to who we are and where we are. We are actually in an area where the manufacturing industry has declined quite substantially. Our investment in graduate sponsorship and in training is quite considerable. In order to bring the new blood into the industry and obviously to give us the young ideas for tomorrow, I think if we found a major dislocation in UK submarine procurement, then that gap would have a significant effect on retention of our more skilled personnel and our ability to maintain current levels of training and R&D.

**Q67 Mr Crausby:** To what extent would you be able to transfer those skills to, say, other work, to surface ships, for instance, and retain them in that way?

**Mr Grant:** We are involved in surface ship work, yes, but that still requires some special skill sets of its own. We do not necessarily have designers who are multi-skilled in both surface ship activity and in submarine because the skill sets are different.

**Q68 Chairman:** Mr Morrison, what are your answers to these questions?

**Mr Morrison:** What effect would it have on my business? Naval business represents approximately 3% of our sales, so in the bigger scheme forward for my company, it would not have a dramatic impact. With respect to us being able to hold on to our skills that we would require to continue the future Astute boats, that is obviously dependent on when future orders come through and also, to a large extent, how our core business continues to be successful.

**Q69 Chairman:** I have the impression that you have rather written off defence as a real money-maker for your company because other things seem to be going better. Would that be unfair?

**Mr Morrison:** No. What I would not like you to come to the conclusion of is that we are not committed to supplying future boat sets for the future.

**Q70 Chairman:** No, that was not the conclusion.

**Mr Morrison:** I would like to make that perfectly clear, that we are doing everything we can to be able to sustain that skill base.

**Q71 Chairman:** But you sound as if you are doing it out of public duty rather than in order to make money.

**Mr Morrison:** That would be an accurate assessment.

**Q72 Chairman:** That is a funny way for a business to behave, is it not?

**Mr Morrison:** Well, as I say, it is not a loss-making business for us. We have restructured the naval organisation and we have in fact removed it as an independent department and we have integrated it into our core activities, so we have tried to lessen the impact of our reliance on naval orders while still retaining the capability, but our future clearly lies in the power business.

**Q73 Mr Hamilton:** If I have interpreted it correctly, essentially you have a responsibility to the workforce and the company—

**Mr Morrison:** Yes.

**Q74 Mr Hamilton:**—and, therefore, what you are doing is diversifying because you do not get the contracts as often. There is not a process on which they can depend in the future. That sounds exactly what we should be talking about in relation to all companies, not only in engineering, about diversifying in a way and looking at the export market because they cannot depend on the market in the UK. That seems quite logical to me.

**Mr Morrison:** Prior to us receiving an order this year for boat four, the last order that we received was in late 1998.

**Q75 Chairman:** David Hamilton has, I think, correctly rebuked me. Mr Oatley?

**Mr Oatley:** In terms of if there were to be no Vanguard replacement, the effect on us, I guess, would depend on what happened in terms of Astute replacement and the timing of that. We currently have a large design team working on a new system for an export boat in Spain, so we have continuity through that. If there were to be a long period before there was an Astute replacement, I think it would have a catastrophic effect on our ability to design a new system. That could be mitigated by ongoing design work in support of the existing fleet for upgrades and the like, but, as I say, it would depend largely upon the timing of the next design cycle.

**Q76 Mr Crausby:** Do you have a view on the eight-year gap that Mr Ludlam mentioned in comparison to the 16 years between Vanguard and Astute? How did that affect you, the 16-year gap between Vanguard and Astute?

**Mr Oatley:** I think the eight-year gap is about right and if you look back prior to the large gap between Vanguard and Astute, eight/nine years is about what occurred. As I said in an earlier response to, I think, David's question, we were fortunate in that long gap between Vanguard and Astute in that we secured an export contract out of Australia to provide a system to the Australian Collins-class submarine. We also had a significant upgrade programme to install

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Tomahawk missiles into the existing fleets and those two contracts kept our design resource, at least at a minimal level, busy through that period, so if it had not been for the export order, I think we would have been seriously damaged by that gap.

**Q77 Willie Rennie:** As you have evolved such stress of diversification into other markets and exports as well, what is the kind of anchor that keeps you in this country if that depends on MoD work which becomes less significant?

**Mr Oatley:** I think from my point of view the UK is still our core business. There is no doubt that providing the weapons-handling and launch system to the UK fleet is our core business and the reason we have been able to win export orders is because that is our core business, and because we have developed a leading product for the UK Navy, we have been able to sell that overseas, so it is still our core and it will remain so. The other key thing that keeps us here is the in-service support element of that, and I would think this applies across most of the supply chain, and it is very important that we have both the design and supply element and the in-service support and it would be very difficult for us to continue if we did not have all of those elements as a business. It is our core still in the UK, but it needs to be across the whole realm of supply and support. Without that, I think it would not be economic.

**Mr Grant:** We are a private limited company and, without wishing to sound too melodramatic about it, we are very proud to be a British company, arguably even prouder to be a Scottish company at times, but perhaps I am not best equipped to be commenting on that particular aspect of it! We are a major employer in the area and the reason why we can be successful is because we have a workforce which basically does not have walls between departments and there is good interaction between design, manufacturing and support staff, and there has to be in an organisation such as that which we are trying to do. Frankly, the concept of moving our business off British soil just does not—

**Q78 Mr Crausby:** It is not on the agenda?

**Mr Grant:** It is not on the agenda, never has been.

**Mr Morrison:** We are part of the global organisation. However, the specific product that we produce in Rugby is steam turbine retrofits and in fact it was ourselves that essentially created a world market for steam turbine retrofits, so we are at the very, very hub of Alstom activities and we have the key skills and competencies for this market and we are very strongly placed within the Alstom network to retain our position in Rugby.

**Q79 Mr Crausby:** What kind of industries are really in competition for the skill base that you have got? Where do workers go when they leave your company?

**Mr Oatley:** For us, the biggest competition is the aerospace market and if you look at our design engineers and the questions earlier about how exciting and attractive the submarine market is for engineers, and it is, it is very much seen as a high-end

engineering, exciting, interesting place to be. The other high-end, interesting, exciting place to be as an engineer is typically the aerospace market and, particularly with us being located in Bristol, we have strong competition particularly from Airbus for our design resource, so that is where we predominantly lose people to.

**Mr Morrison:** We have actually got a very, very high retention rate, so it is not a real issue for us and, if we do lose people, it is generally to other players in the industry.

**Mr Grant:** On the manufacturing side, we do have a problem retaining staff in whom maybe we have invested in training up to the latest numerical control technology in machine tools, the latest concepts of ERP, and generally on the manufacturing side they will move into a sub-contract machining activity which is essentially a make-to-print, as opposed to a bespoke design, activity. Oddly enough, and perhaps it is a feature of young people seeing the grass as being greener, we do actually get a fair proportion of them back. On the design side, the majority of our design staff tend to move south into aerospace or into offshore oil and gas. That is the major problem for us.

**Q80 Mr Hamilton:** My question is the one that I asked the people at the beginning and they were the major companies and we are now talking to SMEs. In the time that I have been on this Committee, I have visited a number of places throughout Scotland and one common complaint that came from all the smaller companies was the way in which they were being treated by some of the major companies where they are sub-contracted out to. Naturally that is a very delicate issue, but, coming from a large industry, I realise that is exactly what the National Coal Board did to small companies. Do you have direct access to the Ministry in relation to any contracts that are being done or are you moving towards a position where you are becoming dependent on the sub-contract with major companies because the Ministry is actually having direct negotiations with the major companies rather than taking the bother to talk to some of the smaller companies? Do you have direct access?

**Mr Oatley:** On Astute, we contract with BAE, but we have a large amount of direct contact still with the Ministry people at all levels and we find them very supportive. I would say that historically the relationship with BAE would at times be the way you have described and I think in the last, and Murray Easton referred to this earlier on, 18 months to two years both they and we have worked very hard to try and change that and to work much more in a partnership arrangement rather than a confrontational supplier/customer sub-contract relationship. The reason we have done that is to try and generate more value for the end customer driven by essentially trying to get a more cost-effective product and it has been very successful as a result.

**Mr Morrison:** I have not noted any great differences between the way that we have contracted for boat four as compared to boats one to three and, therefore, I would not have thought that our

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relationship with our sub-contractors would have changed significantly, if at all. I would reiterate what Joe has just said about the relationship with BAE and through the Key Supplier Forum and that we are beginning to try to work together. With these boats we only negotiate with BAE and BAE negotiate in turn with the MoD, so we do not have a great many interfaces through the Astute programme directly with the MoD.

**Mr Grant:** We still contract directly with the Ministry of Defence and indeed we are in a partnering agreement with the Ministry of Defence for the through-life support and post-design services for most of the equipment which we are presently involved with. What I would say is that I would like to endorse the comments of Joe Oatley. The Key Supplier Forum, which Murray Easton made mention of earlier on, really has got us quite excited because for the first time I think we are seeing an environment where we can actually get around the table with private contractors, have access to the Ministry at the same time and to the Navy, and it is, I believe, starting to yield genuine benefit in both lower costs and obviously ultimate affordability. I picked up one of the questions from the earlier presentation with regard to what through-life costs really mean and whether people were recognising it for what it was, and I think there is still an issue of an obsession with acquisition costs without fully understanding the implications through life. I think the Key Supplier Forum, in giving us better focus and allowing us certainly to have a better design focus, the efficiencies that come from that will yield lower costs and affordability, and we are very excited and pleased to be part of the programme.

**Q81 Robert Key:** Mr Grant, do you think the Ministry of Defence understood how close your company came to closing down?

**Mr Grant:** I think it understood it, but I am not sure whether it was necessarily the highest feature on its agenda at that particular time, bearing in mind at that time the Ministry of Defence was substantially downsizing itself and looking at new methods of contracting and engaging with industry.

**Q82 Robert Key:** The Defence Industrial Strategy identifies affordability as a key element in the decision over any potential Vanguard and Trident successor. Do you think that the Defence Industrial Strategy has taken on board the significance of through-life costs in the way you were just describing?

**Mr Grant:** Yes, I do, but I think that it is a culture change which is not going to happen overnight.

**Q83 Robert Key:** And that is being addressed in the Key Supplier Forum, is it?

**Mr Grant:** Yes, it is.

**Q84 Robert Key:** Do you, Mr Oatley, agree that the Key Supplier Forum is a helpful innovation?

**Mr Oatley:** Yes, without doubt it is. I think I would echo what Ron Grant says about the need for more emphasis on through-life support and I still think

that not enough attention is paid to the cost of through-life support. Even with the good work we are doing on the Key Supplier Forum, still the main, by an order of magnitude, focus of that is unit production costs rather than through-life costs, so I still believe that there is not enough attention paid to the full through-life costs of the programme.

**Q85 Robert Key:** Mr Morrison, do you agree with that?

**Mr Morrison:** We have had an approach from the Key Supplier Forum for all the reasons that I have spoken about. What we have tried to do with boat four and for future boats is really to get a design freeze. We have had the drawings, we have had the design and it is really a question of us being able to handle our supply chain, so what we have tried to do is tried to shy away from design changes and that really precludes us from beginning to look at changes in the design for through-life costs.

**Q86 Robert Key:** Do you think the Ministry of Defence, for all that it requires, understands the distinction between the very large main contractors and the small sub-contractors in the industry on which the main contractors depend?

**Mr Grant:** I think it is starting to understand because of its participation in this Key Supplier Forum as well. It is possibly having a vision of interaction between prime contractors and the second tier of sub-contractors which perhaps it had not paid too much attention to before and I think there is an awareness coming from the Key Supplier Forum particularly that it is a team approach which very much needs coherence in all sectors of the chain.

**Q87 Robert Key:** Mr Morrison, you were shaking your head in disagreement.

**Mr Morrison:** No, sorry, a personal twitch, I think!

**Q88 Chairman:** Is DML on the Key Supplier Forum?

**Mr Morrison:** No.

**Mr Oatley:** Well, the Key Supplier Forum is an instigation of BAE's, not the Ministry's and it is focused upon the key suppliers to the Astute programme and DML are not a key supplier to the Astute programme, so its instigation was very much upon looking at the supply chain for the Astute programme and trying to work more closely with that supply chain to get, as I said, actually a better unit production cost. That was the main focus when we set off with the Key Supplier Forum.

**Q89 Chairman:** Here you are talking about the need to look at the through-life maintenance and, thus, the costs of support and yet the people who are actually doing the support are not on the Forum that discusses this.

**Mr Oatley:** There are a number of DLO representatives who do come to the Forum.

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**Q90 Chairman:** DLO representatives?

**Mr Oatley:** So there are Ministry of Defence people who are involved in the support costs and obviously many of the suppliers, ourselves included, are providing the in-service support of their own products, but yes, the main focus of that group is production costs, not through-life costs.

**Q91 Chairman:** Is this an issue we should take up with BAE Systems?

**Mr Oatley:** I guess I would question whether it is an issue for BAE Systems or an issue for the Ministry.

**Q92 Chairman:** But you said it was a BAE Systems' initiative.

**Mr Oatley:** It is indeed and the intent of it or my understanding of the intent of the Key Supplier Forum when we set it up was to really focus hard on making the Astute programme affordable because the key issue we had a year ago was that the programme was looking like it was unaffordable and may not be able to continue at its projected cost, so we had a very urgent need to all sit down and try and understand how we could work together to make the Astute programme, in terms of its unit production costs, more affordable, so that was its pure objective when we started, so I guess yes is the short answer to your question.

**Chairman:** We shall pursue this further.

**Q93 Linda Gilroy:** Education and training, you have touched on a number of issues which probably give us some insight into the industrial skill areas in which there are significant shortages. Is there anything from the experience of your companies that you want to add to what you have already said about what areas that affect your companies there are skill shortages in?

**Mr Oatley:** I think this is common across many industries in the UK at the moment, that there is a definite engineering skills shortage. We have a significant graduate training programme and we brought in nine graduates this year and we continue with that every year, so we do not have too much difficulty in attracting new engineering talent into the company. Our key issue is retaining it once we have trained it up. I think Ron Grant mentioned this earlier, that one of the other key aspects is the experience and knowledge of the application in which that engineering is used and the submarine application is particularly challenging. We have a

rule of thumb that it takes about 10 years to become truly proficient in the submarine environment, so there is a very long lead-time between injecting new talent at the bottom and their becoming really very proficient in that environment and that is the big problem, that if you lose a lot of people who are experienced, it takes a long time to replace them.

**Mr Grant:** We have a very active apprenticeship scheme, we also sponsor graduates and we also have graduates not of our direct sponsorship coming in for work experience from time to time. We also do a lot of work in local schools, the purpose here being to raise the profile of engineering in the manufacturing industry because there is still a perception among young people coming through school that engineering is not necessarily a particularly attractive route to be going down and the manufacturing industry perhaps means getting dirty, so we do work hard to try and bring youngsters in from local schools which I think is an important feature of our training. We also train Navy personnel. We have various specialist test facilities on our site. For example, on our handling equipment, we have industrial reference equipment which enables the Navy to replicate obviously in-service experiences and carry out testing on-site, so not only training on our own personnel, but investment in training of Navy personnel is also a key element of our activity.

**Mr Morrison:** We have only begun to embark on recruiting young graduate engineers after many years of restructuring, so I think it is a bit early for me to be able to respond to you.

**Q94 Linda Gilroy:** So from what has been said, I take it that it is sort of general engineering skills, getting people started in your industries, rather than specific areas that we have been talking about earlier on?

**Mr Oatley:** It is the specific areas where I would have a concern. We can, and do, recruit young general engineers and then train them in those specific areas, but, as I said earlier, the time to do that is quite considerable and we can lose those people with specific skills to different industries because they are still very employable within a different industry as a senior engineer, so it is those specialist skill areas where I focus my attention in terms of retaining key skill sets.

**Chairman:** I think that is it, unless anybody wants to ask any other questions. Thank you very much indeed to all three of you. It has been most helpful and most interesting.

## Tuesday 21 November 2006

Members present:

Mr James Arbuthnot, in the Chair

Mr David S Borrow  
Mr David Crausby  
Linda Gilroy  
Mr David Hamilton  
Mr Mike Hancock

Mr Dai Havard  
Mr Adam Holloway  
Mr Kevan Jones  
Willie Rennie  
John Smith

*Witnesses:* **Mr Bernie Hamilton**, National Officer for Aerospace and Shipbuilding, Amicus, **Mr Keith Hazlewood**, National Secretary, Engineering Section, GMB, **Mr Bob King**, Chief Negotiating Officer, Prospect, and **Mr Terry Waiting**, Chair, Keep Our Future Afloat Campaign, gave evidence.

**Q95 Chairman:** Good morning and welcome to this evidence session about the future of the UK's strategic nuclear deterrent. This is the second of a series of inquiries we are doing into the strategic nuclear deterrent. The first was into the global context and the timetable required for decision-making. This one is into the manufacturing and skills base. There will be further inquiries during the course of this Parliament and we are all now waiting for the Government's White Paper. Until that is published, we have to assume that all the options on the future of the deterrent remain open, and so the purpose of this morning's evidence session is to focus on the possibility—and it is only at the moment a possibility—that the United Kingdom might go for a renewal of a submarine-based deterrent. To witnesses and to everybody else I would say please do not take this as a sign that we favour the option of a submarine-based deterrent—we might or we might not—we are simply exploring the implications of various options at the moment, so that is the basis on which we are conducting this evidence session today. Welcome to the witnesses and thank you very much indeed for coming to give evidence. I wonder if you could begin—and we have met some of you before—by introducing yourselves and saying what you do, what your organisations do, where you are based, and what sort of work your members do. Mr Waiting?

**Mr Waiting:** Thank you, Chairman. My name is Terry Waiting and I am the Chairman of KOFAC, that is the Keep Our Future Afloat Campaign, in Barrow-in-Furness. It was established in 2004 after the announcement of 700 redundancies in the shipbuilding industry in Barrow. We were set up to lobby for shipbuilding jobs and to make sure that the people that mattered were aware of our concerns, were aware of what was happening in the shipyard and of the changes that were being made. I am Branch Secretary of Amicus, the union. I am also the leader of the local Labour Group on Barrow Borough Council. KOFAC is a community campaign that is led by the trade union movement and that involves the community and people throughout the North West. I think that is all I need to say.

**Q96 Chairman:** Thank you. Could you say how many people in Barrow work in the submarine industry?

**Mr Waiting:** Directly employed in the submarine industry in Barrow-in-Furness there are now 3,600. That includes 200 contract workers and 3,450 direct workers in the shipyard.

**Q97 Chairman:** Thank you very much. Mr Hazlewood?

**Mr Hazlewood:** Good morning, Chairman and ladies and gentlemen of the Select Committee. My name is Keith Hazlewood. I am GMB National Secretary for Engineering and Manufacturing. Our head office is in Wimbledon. I have a responsibility for national negotiations in shipbuilding, aerospace, steel, engineering, construction, thermal insulation and the offshore industry. In the submarine programme the GMB members predominantly are steelworkers. These are the people that actually build the ships, the welders, the platers, etc.

**Q98 Chairman:** And can you say how many of your members work in the submarine industry?

**Mr Hazlewood:** In the two yards that I have association with in Barrow-in-Furness and DML, we have 2,000 members.

**Q99 Chairman:** Thank you. Mr Hamilton?

**Mr Hamilton:** Good morning, Chairman, ladies and gentlemen. My name is Bernie Hamilton and I am lead industrial officer for Amicus for the aerospace and shipbuilding sector. I have responsibility for negotiations and conditions of employment within those two industrial sectors. We have membership across the whole spectrum of the industry covering design, research, fabrication and manufacturing skills, and in every establishment that is involved in this sector of industry at Devonport, Faslane, Barrow, Rolls-Royce and Aldermaston.

**Q100 Chairman:** Thank you. And Mr King?

**Mr King:** Good morning. My name is Bob King. For the purposes of this meeting I am the lead negotiator for Prospect, the trade union. We have around about 1,500 members, mainly professional and scientific grades in AWE at Aldermaston and in Burfield so, unlike my colleagues, my main lead role is in relation to those two areas, although Prospect as a union does have scientific and professional members at the submarine bases as well.

**Q101 Chairman:** Can you break down those figures and say how many work at Aldermaston?

**Mr King:** Staff?

**Q102 Chairman:** The 1,500, your members?

**Mr King:** We have 1,500 members at Aldermaston and Burfield, the two sites in Berkshire out of around 4,000 staff. There are other trade unions there as well.

**Chairman:** Can I begin by saying thank you very much for your written memoranda which have been most helpful. Let us move on to the first issue, the Government's White Paper and David Crausby.

**Q103 Mr Crausby:** As you know, the Government have promised to publish a White Paper on the future of the UK's future nuclear deterrent by the end of the calendar year, something I think we all look forward to. What do each of you hope that its conclusions will be?

**Mr Waiting:** As far as KOFAC is concerned, in Barrow-in-Furness we are pleased that the White Paper is, hopefully, going to come before the end of this session of Parliament. We would welcome this. We recognise the arguments that are going backward and forwards about where the deterrent should be based, if we are to have a nuclear deterrent. I think the argument has been won that it should be a submarine-based deterrent, and that the numbers of people that it would employ in Barrow-in-Furness, should it be a submarine-based deterrent, would certainly sustain the workforce that we have at the moment for some years to come. If we do not have this nuclear deterrent based on a submarine platform, well, I am afraid the future for Barrow-in-Furness is indeed bleak. I think at the session on 2 November, Mr Crausby, you mentioned that you came from a cotton town where the industry had folded and people lost their jobs but they moved on and they got other work. In Barrow-in-Furness, as you are aware, we are 33 miles down a cul-de-sac. There is nowhere to go. Before we can get any meaningful employment we have to travel at least 100 miles to the south, and Preston and beyond are the only places for us. We believe that we have the skills in Barrow-in-Furness to build the submarine and to make sure that it is delivered on time and on cost. The amount of work that has been done on current orders on Astute on making the submarine cheaper and more affordable to the MoD is tremendous. The work that is on-going in the plans that the managing director and his team have for the yard has taken the cost out of shipbuilding. The delivery needs to be examined, I know that, and I am quite confident that Mr Easton and his team can do that, but we really do need that platform to be built in Barrow-in-Furness. There is no other yard in the country that can do it. If you even think about saying that we will defer the decision for two years, it would be the end for Barrow in shipbuilding, I promise you that. It is not just the 4,000 people around in the shipyard. It means that in Barrow-in-Furness 70-odd thousand people will suffer. We suffered tremendously in the early 1990s when we lost 9,000 jobs nearly overnight. We are still paying

the price of that actually with the skills gap in Barrow-in-Furness. We are overcoming that now, we are getting our way out of that, but it is something that we could not sustain again. Any delay in this order would have a tremendous impact on Barrow-in-Furness and, as I say, it could be the death knell for the whole town.

**Q104 Chairman:** We will come to a lot of those issues in some of the questions we ask you.

**Mr Hazlewood:** From the trade union point of view, we are actually looking at the continuity of employment to cut out the peaks and troughs from the industry because it has been devastating to the whole of the shipbuilding, aerospace and the submarine-building industries. You get peaks and you get troughs and in the troughs you lose your capability and in a lot of cases these people never come back and when you are peaking you are struggling for jobs. If we can get some continuity all away across the piece that would be very helpful from the trade union point of view. There needs to be a recognition of the skills involved in the industries that we are representing here today. Also we cannot emphasise enough the importance of the work for the local community and this particular yard that we are on about, Barrow-in-Furness, as my colleague Mr Waiting has emphasised, is on a 33-mile cul-de-sac. There is no other employment for that particular area. We also have problems with UK manufacturing at this moment in time, as we are all aware, and we are hoping that the White Paper will address that and lead to UK prosperity and the upsurge in the economy which is a very much needed boost.

**Q105 Mr Crausby:** Thank you. Mr Hamilton?

**Mr Hamilton:** From an Amicus point of view we welcome the publication of the Government's White Paper. We hope and we believe it will be consistent with the Defence Industrial Strategy principles. We believe that this has to maintain and retain the strategic capability to build these submarines and to replace this deterrent. We believe that that consistency in strategic approach will give the commitment the industry seeks to put the investment in place to maintain those skills that are required. We have heard from our colleagues about the devastating effect of the gap between Vanguard and Astute which had caused that effect and I think that the Defence Industrial Strategy sets out a different way forward on that and gives us a long-term vision. We hope the Government and Parliament comes to a decision soon and, as you have heard, it is important that it does come to that decision soon for the future of the industry and to retain that strategic capability within this sovereignty, within these shores. That will allow the investment to take place that is required to maintain and to further progress the skills, education and investment in retraining programmes within the different respective sites, whether it be in the build, the front-line primes, whether it be in the supply chain or whether it be in the support and infrastructure that is required for that decision to be



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taken. And we hope that the pre-Budget report and the Comprehensive Spending Review do not impact in any way in terms of delaying a decision or that Parliament decides to delay that decision because, as we have heard recently from the industry captains themselves, there is a specific need for a specific drumbeat of these orders taking place to retain that capability and skills within the industry, and I hope that the White Paper contains that view and that vision and that Parliament then takes its decision.

**Mr King:** To echo the points colleagues have made, but I think to emphasise another one—as far as Prospect in relation to AWE is concerned, it is the speed of the decision that is more important than anything else. I believe it is highlighted in one of this Committee's reports about the age profile of our staff and the members at AWE, and if is a decision is not made relatively quickly there will not be the ability to succession plan, eg to pass those skills on. We have got concerns in relation to the newer people coming through and the training that they are getting. It was only announced yesterday, I understand, that Reading University, which is the closest university to Aldermaston, has closed its physics department, which is a big concern. AWE needs intake now to train those people up. It is not sufficient to have the qualifications, it needs the experience to do the work, so whatever the decision is, whether it is going to be new build and upgrade or simply to maintain the current or even decommission, there are different skills and different people that need to be involved, so the quicker that decision the quicker we can do the succession planning and get the new skills in.

**Mr Waiting:** I would just like to clarify something. We are not talking about the missile systems. We are talking about the platform and there has been a lot in the press and I do know that people are talking about the actual missiles are going to be replaced. All we are replacing is the submarine. I know that it has been spoken of that you could perhaps refurbish the current fleet of Vanguard class submarines and upgrade them and prolong their life slightly, but I do not think that is a viable solution in the long run and I think it is more costly. I am sorry, I should have said that earlier.

**Chairman:** To the witnesses can I say that you will perhaps agree with a lot of the points that your colleagues make, in which case there is no need to repeat them—and thank you very much for not doing so in that last answer session. David Borrow?

**Q106 Mr Borrow:** If I can look at the issue of replacing submarines. If we ignore completely the jobs and the skills base and everything around that, what in your view is the reason that the UK needs the capacity to design, build and maintain the nuclear-powered submarines? Why can we not simply buy them from somebody else that builds them without having all these worries about drumbeats and capacity and skill bases, and simply get out of the business and go and buy it somewhere else?

**Mr Waiting:** For instance, if you were going to buy them from America, I think the cost of the American submarine is \$2.5 billion, which far outweighs

anything that you are going to be buying from the UK. The French would be another option, I understand and you could buy from France, but I do not think that they have got the capability to be up to the sort of standard that we require. The other thing is that if you want a strategic defence do you really want it to be built in another country? Are we going to lose all of the skills so that if ever in the future you needed to build a submarine, you would not have the capability, you would lose all the design skills and all the tradesmen who are so highly skilled. Many of the members of this Committee visited the yard in Barrow and saw the people there. You saw the people in the shipyard. They are not ordinary people. They were walking round in overalls and everything else but really they have got extraordinary skills, and to waste those you have got to be very careful in what you are doing and understand what you are doing because you will never ever be able to assemble that workforce again once it goes.

**Mr Hazlewood:** I agree with what my colleague says. This is one of the biggest concerns that we have regarding the United States. We believe that the Americans' way of sharing work and its intellectual property is based on protectionism. For example, the British model is of free trade but the manufacturing strategy in America is that in defence and the supply chain 70% of the work has got to be fabricated in America. This applies to ships, planes and other defence equipment, therefore enhancing the American manufacturing strategy and it would be detrimental to the UK losing jobs and skills, as my colleague has already said, without repeating what he is saying, as the Chairman mentioned, I agree with my colleague's comments.

**Mr Hamilton:** I think it is vitally important that we retain that sovereign capability and strategic capability. I also think that you have to look at the cost of taking the decision that says you buy off the shelf because the infrastructure and not just the front-line jobs would be affected by that and the communities would be affected by that. As my colleague from Barrow said, it is a remote community and if you look at cities across the UK where the sites are, whether it be the repair or the base or the actual build sites these are in naturally remote communities. That decision would be a devastating decision and therefore the public expenditure to replace that against what it would cost to maintain and continue with that sovereign capability would have to be balanced. Therefore there are two arguments. One is the public expenditure argument but the second is the sovereign capability that has to be retained, in our view.

**Q107 Mr Borrow:** The next question I have got is really for Mr King and it is a similar question looking at the warheads. Given that we buy the missiles from the US, why can we not buy the warheads as well? Why do we need to have the capacity to produce warheads here? Why not simply buy the whole shooting match from the US?

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**Mr King:** Not that I am not saying that it is easy to close down a submarine base, but you cannot close a nuclear facility very quickly so everything—the technology, the science and the experience—is already there. To reinforce some of the comments about the submarine bases, to buy that experience in (which to be fair, thankfully, is not widespread across the world) it is going to take an awful long time and a lot of expenditure to do it. The other thing to reiterate on that point—and I believe the MoD said this in evidence as well—is the critical thing on this is to maintain independence. The other element, particularly in relation to the production of the warheads, is the fact that whatever decision the Government makes there will be a necessity to maintain that facility for some time to go. Without wishing to be trivial about it, you cannot just go and put them in the dustbin and they will go away. There is a need to maintain a facility and, if you are going to maintain a facility, it seems sensible to maintain it in this country to do any of the possible three outcomes that the Government may decide because it is going to have to be there anyway.

**Q108 John Smith:** Mr King, you mentioned the future of Reading University earlier. Is there a direct link between Aldermaston and Reading in terms of training and recruitment?

**Mr King:** I would have to refer to my colleagues to know if there is a direct link but it seems fairly clear that that is the nearest physics department to Aldermaston and Burfield which are the two sites in Berkshire, so it would seem fairly clear that that would be one that we would want to maintain to maintain the science. I am not actually from the specific area myself.

**Q109 John Smith:** But you could come back to us?

**Mr King:** Yes, certainly.

**Q110 Chairman:** Perhaps it was a generic point that you were making that you were concerned about the closure of physics departments at universities.

**Mr King:** I am told by a post-it note that there is not actually a direct link but there is a lot of recruitment that comes directly from Reading University into AWE.

**Q111 Mr Hancock:** In the Defence Industrial Strategy they have made it quite clear that there were key capabilities in submarine design and construction and indeed in the operation and refit and how you could retain an onshore facility. What do you consider would be the real risk because it cannot be just a reason to go on with a nuclear deterrent because of the future of Barrow. That cannot be a reason, can it, in realistic terms, but there is an issue, is there not, about the time gap that you talked about between when you stop building the existing run of submarines and when the new contracts will be? What specialist skills would actually be lost? People talk about it but nobody ever emphasises what they are.

**Mr Waiting:** For instance, when we stopped building Vanguard and there was a gap between Astute and there were the layoffs in the early 1990s, then we got Astute and that started coming on track, first of all we did not have the basic skills in the numbers required for the outfitting and the welding and all those peculiar skills that are peculiar to nuclear submarine construction because they are extra special skills. Before we got there we did not have the design team. If you have a gap now you will start to lose your design team for the naval capability because submarine designers can design surface ships but people who design surface ships cannot necessarily do the concept design of nuclear submarines, or of ordinary submarines for that matter. Even as we speak now the Australian yards have got the scent that there could be gaps in Barrow-in-Furness and in the shipbuilding industry in the UK as a whole, and they are advertising in the local press now to take these special skills of the design people who do the concept design. Then you have got the drafting people who put that together and then you have got the workforce who carry it out and work to those drawings. They disappear very, very quickly and they are not, as I said earlier, ordinary skills, they are extraordinary skills of that workforce. It is dead easy to think that a welder is a welder. I am telling you in Barrow-in-Furness a welder is not just a welder. Welders for the reactor have got extra special skills and people who design have got the extra special skills which, as I say, once they are gone they are gone for good. They are not lost to Barrow-in-Furness because, as you quite rightly say, I suppose you could replicate what we do in another yard (it would take you a few years but you could do it) but you would not have those skills because they would go forever, and if you are not training people in those skills, as my colleague has said from Aldermaston, you lose those skills forever and they are gone for good.

**Q112 Mr Hancock:** In that case is there evidence that that training is on-going now?

**Mr Waiting:** Yes.

**Q113 Mr Hancock:** What are retention rates like in a plant like Barrow?

**Mr Waiting:** Actually they are very good because the design engineers, especially for what they are do because what we build is unique to Barrow-in-Furness, cannot get that sort of experience and work anywhere else. The designers like doing that sort of work, that is what they do. They are not necessarily all based in Barrow-in-Furness. BAE Systems have other sites in the United Kingdom where some of these men and women are based. Retention is very good because of the type of work. There are obviously offers from other places that poach, for want of a better term, our workers if they can, and they are offered some quite extraordinary sums of money I understand to go and do that. I also understand that some of them do like the challenges that are put to them from the design and build of a nuclear submarine.

**Q114 Mr Hancock:** Do the others feel much the same?

**Mr Hazlewood:** Just to be a bit more specific Mr Hancock, yes, very much the same, but regarding the specific skills you asked the question on, you look at the skilled technicians or the draughtsman that are designing these submarines, and also the skilled and semi-skilled trades such as welders, platers, scaffolders, electricians and electronic engineers, and while ever you have got work you will have a workforce in such an area because there is nothing else, quite honestly, for them in that area.

**Q115 Mr Hancock:** What about the situation at Aldermaston and Burfield?

**Mr King:** In relation to training?

**Q116 Mr Hancock:** And holding on to people.

**Mr King:** The retention is good although there have been specialist skills lost at AWE, which is one of the main concerns. The difficulty with it, and one of the issues that our members always bring to our attention, is the fact that they gain a qualification, a degree or whatever, they then come to Aldermaston, they learn the nature of the business they are involved in, and then you are pretty much limited to where else you can go and work because of the fact that it is so specialist. I have an example with me which is a job advert which is for a fairly middle grade for a joining development scientist/engineer. If you compare the qualifications and experience required for that to an outside role in standard engineering, because of the types of material that you are dealing with, the level of qualification and experience, understandably, is considerably higher. The difficulty that we have noticed from looking at the equivalent of our members in scientific roles in the commercial sector is the average time that they are staying with an employer is around three to four years before they move on and try and develop somewhere else. One of the key things we have got at AWE is the ability for a scientist to have a long career progression without the need, dare I say it, to succumb to swapping into a management role, so the longevity is there and certainly from the scientific environment people can come there and have a job for a long period of time, which is how the job is developed.

**Q117 Mr Hancock:** If I could then come to you first, when you said if we do not replace the deterrent there will be an on-going need to maintain the existing capability and to make sure it was safe, what sort of period of time would you estimate? If there were no replacement for Trident, how quickly would the situation at Aldermaston and Burfield go down? Would it be a fairly gradual decline over the full length of the life cycle of the existing boats or would it accelerate quite considerably?

**Mr King:** It is not so much the life cycle of the supply; it is the life cycle of the material that has got to be maintained, and it leads off the question I believe was asked earlier about why can we not buy in. If we buy in we do not know the life cycle. If we are supplied with a warhead from the US, we do not

know the properties of that. One of the key roles that Aldermaston is maintaining is the stability of the current warhead stockpile so it is going to be effectively over the life cycle of the existing warheads obviously into decommissioning.

**Q118 Mr Hancock:** But you are employing 4,000 people there on the two sites. Are they all employed now on just that task?

**Mr King:** No, there is maintenance.

**Q119 Mr Hancock:** Of the plant?

**Mr King:** There is maintenance of the plant and there is maintenance of the materials and maintenance obviously of the stability of the current stockpile, which is the majority of the work that is done, and obviously decommissioning work that comes back in from warheads that have come back from use on the submarines. That is the majority of the work now and obviously they are then refurbished and replaced and sent back out. So it is basically keeping the current stockpile flowing, which is why we were saying earlier there would be a change. If it was the case that there was no longer a need for the deterrent, then obviously the work would be solely on the decommissioning and maintaining the stability of materials now. If it was to either upgrade or continue with the current, then the work would remain very much as it is now (although AWE is expanding just to keep up with the work that it has got now). If it was a new build obviously there is a new set of skills that we would need to look at and probably those are the ones that are more worrying because the place has been there some time and the skills to originally develop this are getting older and older.

**Q120 Linda Gilroy:** A question specifically to Mr Hazlewood—because I can get my head around how design teams and design drafts people take quite a long time and you need to keep them together—can you just explain in a bit more detail as far as electricians, fabricators and trades people are concerned, those that work on the submarine, and we have talked about the high level of skills, in terms of the time taken to acquire those skills and experience, how would that compare with probably pretty skilled people who work on ships and so on? What is the extra? Is it years?

**Mr Hazlewood:** To be proficient in the submarine industry you are looking in terms of years at nine years whereas within a normal shipbuilding yard you are looking at three, four, five years, a normal apprenticeship.

**Q121 Linda Gilroy:** So if a gap develops that is—

**Mr Hazlewood:** That is right, yes.

**Q122 Willie Rennie:** I am a bit confused by some of the comments. You say retention is good at Barrow but then you say there are adverts from Australia seeking staff there. Then you say if Barrow were to go you would not get the skills back, but obviously

it is a good enough place to work so why would they not come back? I was a bit confused about all that kind of thing.

**Mr Waiting:** I think there have been surveys done and I think the most recent perhaps was for the Rover plant when people left that industry, and 70% of them would not return to it. That was a similar experience as we had in Barrow-in-Furness with the redundancies in the 1990s. Once we had lost the workforce they would not come back into the yard, voluntarily or otherwise. If they could find any sort of job they went into different jobs and they would not come back again. A lot of the younger people left the area for good and did not return, so we lost those skills. Quite a number of other people went on long-term incapacity benefit. I think if you look at the North West Development Agency's documents they say Barrow is perhaps one of the largest pockets of worklessness in the North West because the men and women did have industrial injuries and once they were out of work they capitalised on them, for want of a better word, but that is what happens, that is really what happens in a working town. It happened in the coal-mining communities as well. The whole community goes down. It is not easy to get back into work and it is easy to get back into ordinary jobs. It is the same when you live in places that are remote like a coal-mining area or like Barrow-in-Furness, it is not easy to get into other work. If you lose the skills of drafts people and the designers, they go away and they do not return because they have got well paid jobs out of the place. The people who are coming from Australia and other places and advertising in the local paper in Barrow want people who are already in work. They are not looking at the ones who are unemployed really. They want the people who are in work.

**Q123 Willie Rennie:** But you did reconstitute them for Astute. How did you manage to do that?

**Mr Waiting:** First of all, we sought assistance from Electric Boat. One of the things the managing director did was to seek the assistance of Electric Boat, the American company, and they did assist us greatly. I have got to say it was a two-way street because we helped them in some techniques on welding as well, so it was not a one-way street. That was one of the things that we had to do. Then we trained our own people to the standard required. We have going through the Barrow yard now a number of graduates and we have a very successful graduate training programme. We make sure that we do; it is an active thing, it is not an accident. We go to the universities and attract people to our industry. Through the graduate training programme in Barrow-in-Furness we are getting the right sort of people and training them through. If there is a gap now in the submarine build or a gap now where we do not order the future Tridents, there will be an excess of design engineers and everything else in Barrow, as I think was said at the meeting on 7 November, in the middle of next year. Those people will go and they will not come back to Barrow, they will go somewhere else.

**Q124 Willie Rennie:** You did reconstitute it for Astute so why can it not be done again?

**Mr Hamilton:** That is where the strategic capability and the Defence Industrial Strategy has to make the change. You have seen the evidence from Murray Easton. A lot of the cost overruns were because of that. The delay in terms of getting Astute out was because of the learning curve that had to be relearned. Murray Easton in his evidence gave you the fit-for-purpose workforce and it is the same across the whole spectrum, whether it is design, build or maintenance of that capability and that workforce. As other colleagues have said, people who work in the shipbuilding industry and refit ships, on the face of it the skills set may look the same but it is completely different when it is applied to submarines because the standards that are required to work on board nuclear submarines and the capability of the nuclear submarines requires that learning curve to be relearned and yes, it was reconstituted fortunately in the Barrow area to build the Astute, but if another delay were to take place as was done between Vanguard and Astute then that capability will be lost in the UK forever. You need only look in your own backyard, Willie, in terms of the effect that that has. Yes, thousands of skilled people left Rosyth Naval Base but when Babcock went back at certain peaks and troughs within the refit cycle to bring skills back in again, they were not there and, equally, they were not fit for purpose because they had left that continuity of training and education which is done on the job, and therefore there is a cost and there will be a very high cost to the public purse if that delay takes place.

**Mr Hazlewood:** If I could just come back to what we mentioned earlier, you mentioned retention and peaks and troughs within the industry, and hopefully this will be addressed by the Government's White Paper, but while you have got peaks and troughs you are going to lose people and in a lot of cases you are not going to get these people back, the reason being they are going to find continuity of work elsewhere and you will never get them back. That is the biggest fear that we have within the industry. That is why we need this continuity across the piece.

**Mr Holloway:** I do think that people sometimes think in these procurement programmes there is a confusion and a gigantic grey area between jobs and having the right equipment—helicopters and fast jets come to mind here—but leaving aside the important issue of keeping jobs and communities like Barrow alive, do you guys not think that there is a global market for skills as well as equipment and therefore that the situation might not be as critical as you paint it?

**Q125 Chairman:** Who would like to start on that? Mr Waiting?

**Mr Waiting:** In what respect? If you want to build atomic submarines and if there is a requirement for atomic submarines and for a nuclear defence of the realm, then you want atomic submarines and the capability is in Barrow-in-Furness. If you are talking about aeroplanes you can build aeroplanes almost

anywhere—America, France, wherever. You do not need any extra special facility. If you are going to build an atomic submarine you need an extra special facility. If you are going to maintain an atomic submarine you are going to need an extra special facility. DML is one of those facilities. Faslane is another one of those facilities. You could not say, for instance, we will do it in Liverpool because they have not got the expertise and the licences and everything else, and all of the work that went on for many years before that; you cannot do that. It is not something where you can just say, “We will not do it this week, we will do it over here, we will do it there”; you cannot do it. It is not exactly the same as fast jets and helicopters. As I have said, the capability for the defence of the realm, if it is going to be submarine-based Trident missiles, has got to be done in places like Barrow-in-Furness and serviced in places like DML and Faslane.

**Q126 Mr Jones:** If a decision were taken to abandon Trident, which is obviously an option which certain people are arguing for, that is clearly going to have a massive impact on places like Barrow. What would it mean in terms of jobs? You have already touched on skills but also the argument—and this is not one I am putting forward I hasten to add—that it would be easy to find alternative employment there. Can you just talk us through first what the effect of it would be and then what the alternatives would be?

**Mr Waiting:** If we are not going to continue with the Trident replacement, then the future for Barrow is non-existent really. In 1991–92 when we lost the major part of our workforce (9,500 jobs) overnight we set up an organisation called Furness Enterprise and its remit was to build a local economy so we would no longer be dependent on a single employer so that we could diversify our economy. In that regard Furness Enterprise has failed. In lots and lots of other ways it has been tremendously successful but Barrow-in-Furness is still dependent on BAE Systems and our shipyard for the major part of its employment. Barrow-in-Furness takes £73 million in wages from BAE Systems every year. That cannot be replaced. There is nobody going to relocate to Barrow-in-Furness to give us jobs, believe me.

**Q127 Mr Jones:** I am a very sad individual and on Saturday night I was reading the RAND report on the future of shipbuilding. I am very sad! One of the recommendations in the RAND report is that shipbuilding should be considered for Barrow, particularly in the next few years when you have got this bow wave of procurement, MARS and the carriers and everything else. What is your response to that? Playing devil’s advocate, we could say there is enough procurement coming from surface ships to put capacity into Barrow.

**Mr Waiting:** In fact, it could create more problems than it will ever solve. For the carrier for instance we are down, I understand, if it ever is built, to build one block of that. The MARS programme I guess is what the RAND report is talking about—I know it is—but that is some years away yet. What are we going to do? There is going to be a big

trough in the meantime because you are not going to build a future Trident so what happens then, how do we maintain that workforce, because it is unsustainable? I know that BAE Systems are not going to have 3,500 people walking round with their hands in their pockets, they are not going to do it. I understand their profit was two per cent but they are allowed up to six or eight per cent to take the profit from any MoD order. If you were a shareholder right now with the way that the interest rates are going, if that is all of the return you could get for your money I think you might be interested in putting your money into a building society rather than in BAE Systems. I do not say that lightly because that was put to me by a former managing director of the yard.

**Q128 Mr Jones:** The point being the point you are making about the continuation of employment but are you actually then saying that what the conclusion of RAND comes to in terms of return of surface shipbuilding to Barrow is a non-starter?

**Mr Hamilton:** It is not a non-starter but the point that is being made is that submarine capability is unique and it cannot be sustained with a surface ship. Surface ship design is different from submarine design. Surface ship capability to build and maintain is completely different.

**Q129 Mr Hancock:** There is going to be a gap.

**Mr Hamilton:** If there is a gap then you are going to lose the sovereign capability. The practical point of all this, in my own backyard and Willie Rennie’s constituency, when you took the maintenance of the submarine fleet away from Rosyth, it destroyed the infrastructure, the community and the educational processes to be able to have that highly skilled workforce in place. There is no requirement to maintain the level of employment in a yard that does not have submarine capability because the infrastructure and the overheads that are required because of the very nature of the work that is undertaken is not replicated and not replaced by surface ship work, and therefore the argument which says that these people can go and do other jobs in the community is a non-starter and a nonsense argument.

**Q130 Mr Hamilton:** I will not ask the question I was going to ask. I am going to follow the theme that you moved on to. The real answer to Bernie’s point is what are the unemployment levels in Dunfermline at the present time? They are pretty low. Can I ask the question to Terry because Terry is the one who indicated 3,500 jobs from a 70,000 population. Can I give you my background: 20 years in the pits, 80,000 of a population, 4,000 jobs, 2.5% unemployment now. That is the difference. The question I am putting is if Vanguard does not go ahead at all, forget the peaks and troughs, if a decision is taken not to proceed, how many jobs would be retained in there for decommissioning and what would be the position—and it has to come off and the question that Kevan asked has to come up—and are there alternatives? Rather than talking down

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the area, are there alternatives that you can move on to? The bleak position that you paint I painted 20 years ago as a Labour Group Secretary and junior official in my area.

**Mr Hamilton:** As you would expect from a trade union, the answer that we would give on this is that these jobs are highly skilled and well-paid. Replacement jobs that have taken place within the UK economy—and this is the Amicus point in terms of retaining manufacturing within the UK—are not like-for-like jobs. They are replaced with poorer paid service economy jobs and yes, there will be regeneration, as there is taking place within Dunfermline High Street and within the West Fife area but it has taken ten years for that process to take place and the investment and money that is going to be required to put that back in place to take place. Yes, there is relatively low unemployment but it is not the same substantive jobs that are being replaced and they were never replaced in the mining communities either.

**Q131 Chairman:** We are falling behind a bit but, Mr Waiting, do you want to add to that?

**Mr Waiting:** I have fully taken on board what you have said but right now in Barrow-in-Furness there are 5,700 people on incapacity benefit. We have quite high unemployment for the area considering what we had throughout the 1980s when we were building the Trident, when it was actually going against the national trend and we had nearly full employment and the national trend was high employment. I do not know exactly where your coal mining community is—

**Q132 Mr Hamilton:** Mid-Lothian.

**Mr Waiting:** We have nowhere to go. As I said earlier, the nearest we can go for a job in manufacturing is about 100 miles away, and that is a 200-mile round trip for your maths. There really is nothing else to do. You mention decommissioning. We do not do de-commissioning in Barrow-in-Furness, we do not do scrapyard technology, we are not into that either, so there is nothing. I am not saying this to tug at your heart strings. It would be virtually the end of the road for Barrow-in-Furness.

**Chairman:** Mr Waiting, you are now in deep difficulty because I think Linda Gilroy wants to ask a question about scrapyard technology.

**Q133 Linda Gilroy:** We do not do scrapyard technology in Devonport! The Defence Industrial Strategy identified affordability as a key consideration in the decision on any future potential Vanguard and Trident successor. Can you tell us how your unions and members are helping to reduce cost and assisting in improving the productivity of the workforce? I think if I start with Mr Hamilton and we will go the other way round.

**Mr Hamilton:** There is the evidence that Murray Easton gave which showed you the efforts that have been made since he was made the managing director at Barrow in terms of reducing the costs, of more efficiency, of greater capability and better use of public expenditure. That is where we have jointly

worked together with that employer to do that and I think there is recognition in terms of the shipbuilding and ship repair industry—and I include submarines in that term—since that industry has gone through 25 years of severe pain, that we have to work together with the employer to make the yards as efficient and productive as we possibly can because that is the only way that these key capability skills are retained. Efforts have been made generally across the whole of the industry and I would want to point to the fact that as unions we advocated support, where there are peaks and troughs of work, and we went down and argued with our members that they should transfer to other yards to take those key skills. Therefore the learning curve that is required for a brand new worker or an electrician who has worked on houses and is put into a shipyard is taken away in terms of expenditure on shipyard electricians moving through from Rosyth through to Govan or through to Scotstoun. We recognise as trade unions that we have a role to play in that. However, the captains of industry have a bigger and greater role to play in terms of their interaction with yourself and driving down those costs. I think the Astute programme has showed that where they have continually put in place a programme to have year-on-year, end-on-end, project-after-project cost reductions. There will come a point in time when that will plateau and it will not be able to be sustained beyond that. After the first of class, as everybody knows, there is a huge learning curve up to first of class and then after that there are the efficiency and productivity gains, and I think the Defence Industrial Strategy drives you towards that.

**Mr Hazlewood:** On the issue of affordability, the GMB believes that maintaining and improving the skills and qualifications of the workforce will improve productivity and also investment in new technology and new methods of working to help improve productivity will be an asset, so will incentive reward schemes. The GMB through the CSEU and a company called SEMTA has worked to establish a skills data base within the shipbuilding industry. They have done a trawl regarding the demands and the capabilities for the forthcoming CVF programme. The GMB also believe more co-operation between the shipyards, as my colleague has already mentioned, would help, and we are watching with interest the formulation of the new co-alliance and the sub co-alliance. That is to say the way forward and the way things pan out there.

**Chairman:** I think I would like to move on to John Smith to talk about collaboration.

**Q134 John Smith:** Part of this has already been covered, Chairman, but another thrust of the Defence Industrial Strategic is strategic collaboration—and you referred to it. How do you feel about that—companies working more closely together, the possibility of mergers? What is the unions' position on that?

**Mr Hazlewood:** From a GMB point of view obviously we would welcome more co-operation between the shipyards on design and production methods. Once again I am referring back to the new

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co and the sub-co and we will see what comes out of that. We think that is going to be a way forward and it could only benefit the industry.

**Mr Hamilton:** We are in favour of it. These projects are massive in terms of skills, investment, research and development, design, and therefore you have to have a substantive company. I think the Government was right in terms of their concerns about the flotation of KBR and the financial capability of that company in terms of support for the Devonport dockyard and the maintenance of a deterrent/the whole nuclear submarine fleet. There has to be a substantive size of industry to be able to support that kind of capital expenditure and to get the best value for the taxpayer on that capital expenditure. So we are fairly relaxed in terms of the Maritime Strategy, the Defence Industrial Strategy (which started that) and also the infrastructure review because there is a requirement for that to take place. Obviously we would have concerns in terms of impacts and in terms of areas and jobs, but at this point in time the lack of skills within the industry and the need for people to be employed outweighs that.

**Q135 John Smith:** What about international co-operation? You referred to the Electric Boat role on the Astute. Could you see greater international co-operation between the UK and the US in submarines?

**Mr Waiting:** We still continue to work with Electric Boat on various issues for Astute and, again, it is a two-way street. There is an exchange of ideas with the Americans. When the Committee was visiting the yard, I am sure that you were told that we are working very closely with our supply chain to make sure that affordability is there as well. Obviously there has got to be great care taken there because you can put people out of business if you put the squeeze on them too much. So the management team within the shipyard in Barrow-in-Furness is working with other suppliers to make sure that we are all singing off the same hymn sheet, so to speak, so we can get the price right so that everybody has got the employment that is required and we have got the capability for future ships and submarines in the industry. So there is a lot of time invested in this by senior management within BAE Systems and by other people.

**Q136 Linda Gilroy:** The Minister for Defence Procurement has written to MPs with an interest in these matters in recent days expressing his concerns about how slow the consolidation is to come about. Mr Hamilton mentioned the KBR flotation. I just wondered if you would like to say a bit more from the unions' point of view about how that looks. I was going to ask a question about whether the companies and the shareholders are doing enough to make this happen.

**Mr Hamilton:** Obviously we have meetings with government ministers as well and we understand the Minister for Procurement's strategy. Both myself and Keith have attended meetings with the Minister and we understand the vision that he has. On the

view that says that we should not be using public procurement contracts to allow people to exit an industry and therefore for them to walk away with a bag of gold, I agree fundamentally with the Minister on that in terms of the proposed purchase by BAE Systems and BG of Fabric International. I think he was absolutely right that that was not the correct way. I think hopefully in the discussions that are taking place between BAE and BG, the Minister was painting a picture—and if I have got this wrong I have got it wrong—I think the picture he was trying to paint was of a substantive company in its own right being brought together in a joint venture if possible and, if not, working in collaboration, then this would be the next step in terms of having a joint venture. I think the concerns that were being expressed about the flotation of KPR were about the financial capability of that stand-alone company to continue to fund the infrastructure, the investment and the requirements that are needed to maintain that capability within the Devonport area. I think that is a concern and indeed I did not have the assurances from Halliburton in terms of KPR that that was going to take place. I have to say in our own practical experience there are a number of contracts out in the system just now that if that company had stepped up to the plate with financial assurances on, then Appledore shipyard would still be open, but that company has failed to step up to the plate and so therefore I think the Government do have a concern that if that is what has happened would that be replicated within Devonport.

**Q137 Linda Gilroy:** Appledore is still open at the moment.

**Mr Hamilton:** I understand that.

**Linda Gilroy:** I just wanted to set that straight.

**Chairman:** I am sorry, Mr King, we have let you off too lightly, David Crausby is just about to start on Aldermaston.

**Q138 Mr Crausby:** I have some questions about Aldermaston. I guess Aldermaston is in a different situation in some respects from Barrow in that it is in a different part of the country and no doubt the alternative job prospects are better in that part of the world. What I am concerned about is specialist skills from the point of view of not just the employees but from the point of view of their retention in the interests of the whole of the country and in the interests of our deterrent. So what kind of work do Prospect members at AWE need to be involved in to sustain those specialist skills at the required level? To what extent could the skills of scientists and engineers at Aldermaston be utilised in the civil nuclear sector? Does the possibility of the new civil nuclear programme create any difficulties for us in the transfer and opportunities for skills?

**Mr King:** I did say to Dr Stephen Jones when I was going to give evidence that I am not a scientist by any stretch of the imagination but I will do my best. Part of my role is I deal with the UKAEA, AEAT, and some of the regional authorities as well and also the JET project, which has got some publicity this morning. I think the skills are different because they

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are honed at AWE with a specific purpose. I noticed the question earlier about a global market for these skills—and I sincerely hope there is not a global market for nuclear warhead construction, and I would like to think that we do everything we can to make sure there is not! As I say, I am not a scientist but they are particular in the way that these issues are constructed and I was allowed to give evidence today because I do not know any secrets so I cannot give any away and it was the safest way of doing it! Apparently the difference in technology is very much to do with the delivery vehicle, which is obviously launched from the submarines and how it is designed to fit within the Trident missile itself is the clever bit, apparently, which is about as far as my science goes, so it is a particular skill. There are also elements about the life cycle of the products which are being used which are different. I will not go into detail about that because I do not know. They are very, very different skills from the skills of the majority of the members we have got who work, for instance, within nuclear power generation or in relation to the Fusion project because they are developing new technology, whereas the job within AWE is very much maintaining the current technology, it is very much a maintenance element. You mentioned about the area, the direct difficulty we have with the area is the fact that the scientific skills required and the salaries paid—and you probably knew that I was going to bring this in somewhere along the line—are not relative to the market rate. However, the majority of people do not come to work at AWE because they want to work in the commercial sector; they want to work in the public sector and maintain those terms and conditions, so the salaries are not at a high level. What is a high level, which reflects two things, is the wish of the scientists and engineers to develop a long term career and also to have security in employment, which is obviously something that is rare these days. The current problem that we face is that when we deal with the employer—with whom we do have a very good relationship and I know my colleagues' toes will curl when I say that—is that we are dealing fourth hand. We are dealing with the management group that is designated by AWEML, which then reports to the IPT which then reports to the MoD. For instance, with regard to the current problem that we have with the possibilities of an increase in contributions to the pension scheme, we have got no direct route in and that is definitely causing us a problem. On the longevity maintenance, the apprenticeship scheme that is AWE's is extremely good and, as I mentioned earlier about Reading University, does attract a lot of students across from physics and chemistry and other related sciences, so as far as maintaining it within the company is concerned we are doing very well but I do not think the skills are directly related, although I suppose the only one that would be is the safety element.

**Q139 Mr Crausby:** Can I just ask you to say something about the impact of the Government's investment programme at Aldermaston? What impact has that had? Have you got any concerns about it? Has it had any effect on the skills base?

**Mr King:** As far as I am aware from what I have seen, and I do not actually work there although I do visit a great deal, the majority of the investment programme has been on refurbishing the buildings which basically were constructed in the 1950s. I always make the joke that there are 4,000 people that work at AWE. Two of them design things and the other 3,998 are involved in safety, which I think is very good, but the site obviously has to be secure, it has to be safe, and that is the one key element. I think a lot of the investment has gone into refurbishing buildings. I do not mean putting nice chairs in. I mean ensuring that they are safe to contain the elements they have to contain, so I think the investment programme has been working well. We have had some development in relation to terms and conditions but obviously the latest issue around the pensions is of grave concern to us. If you look on the AWE website under the elements that they attract people to the company with, there are two things on the page and the first one is pensions, so it is a key element that we are currently having issues with.

**Q140 Mr Havard:** I would like to ask you about the argument with regard to the virtual arsenal (do not panic) and whether there is any debate about this. This is the argument that says, given the skills and the information we have through the nuclear cycle civil generation, etc., and if we are to keep the capability, the role and function of Aldermaston could switch to be more like Porton Down. In other words, it would become something that could be involved in terms of verification and so on, so you could keep the skills. In other words you keep the capability to reconstitute a nuclear programme should you wish to have it. The example that is often given is Japan that has both the capability and the civil fissile material potentially and all of that sort of stuff and could constitute a programme within six months to two years. It is a compromise argument and Aldermaston would be absolutely central should you wish to go down that road. I wondered whether or not there was any discussion going on about what would happen in terms of the focus in Aldermaston shifting as opposed to Aldermaston going and what the skills would be and how they could be reconverted.

**Mr King:** To give you a very short answer—purely because you said “virtual arsenal”, and as a member of Mr Hancock's constituency I think we are still one above them in the League—it is not something that has been discussed. The only discussion we have been having at the moment is what shape the Government's decision is going to take and we will adapt to that. It sounds like a bit of a strange line, but the position of the majority of staff, including scientific and engineering at Aldermaston, is, whatever decision the Government makes, that is the decision that—

**Q141 Mr Havard:** That is what I was really fishing for. In a sense the truth of it is that the capability at Aldermaston is able to do a number of things on this continuum, is it not, to replace what there is, or to develop something different even, and also to



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maintain safety for what is and potentially to do the problem of dealing with disarmament, if you like. It is capable of doing all these things.

**Mr King:** Yes.

**Q142 Chairman:** Maybe he is not the right person to ask. Maybe the Minister is.

**Mr King:** I would think on the science basis I most certainly am not qualified.

**Chairman:** Mr King, you suggested that your colleagues' toes would curl. I had the impression that they had a good relationship with their employers and so I am sure they did not. Can I say thank you very much indeed to all of you for giving evidence so helpfully and so clearly, and also briefly, which is not easy when you have four of you answering several different questions coming from all angles.

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*Witnesses:* **Dr Kate Hudson**, Chair, Campaign for Nuclear Disarmament, and **Dr Dominick Jenkins**, Senior Disarmament Campaigner, Greenpeace, gave evidence.

**Q143 Chairman:** May I welcome you both to this second inquiry that we are doing in our string of inquiries. Thank you for giving evidence to our first. As you know, we will have several inquiries during the course of this Parliament. We know who you are but nevertheless could you tell us who you are and what you represent?

**Dr Jenkins:** I am Senior Disarmament Campaigner for Greenpeace. I also have some expertise in the sociology and history of science and technology which may be relevant, but I am not a scientist or an engineer.

**Dr Hudson:** I am Kate Hudson. I am Chair of the Campaign for Nuclear Disarmament.

**Q144 Mr Jones:** We have just had the trade unions who represent people who work not only in the civil nuclear industry but also in the construction of Trident submarines and also at Aldermaston. If we abandon Trident and do not replace it that is clearly going to have a major impact on jobs in those local communities. First of all, what would you say to those local communities and, secondly, is there any realistic alternative for those communities other than what they do at the moment in terms of supporting the independent nuclear deterrent?

**Dr Hudson:** First of all I would like to say that this aspect of the issue is something that CND takes extremely seriously. We have very good relations with a number of trade unions. We have trade union affiliates and, of course, we are aware that at the recent Trade Union Congress there were a couple of trade unions who were not in support of the resolution not to replace Trident because of their concerns about the jobs question in particular. Amicus and GMB had concerns about the jobs question. It is certainly CND's position that a decision to replace Trident should not and indeed need not have a detrimental impact on those workforces. We have been working for some years to encourage the Government to adopt a viable arms conversion project. There was much work done around this in the 1980s and indeed the 1990s as well. We have just commissioned, supported by Unison, a substantial piece of new work looking at that very question. It is our understanding first of all that there are not extensive or very significant numbers of jobs still related specifically to the nuclear weapons industry, not on the kind of scale

that has been seen in the past, but also in particular that, as there is a large number of physical scientists and engineers working in that area, and those skills areas are well known to be in short supply now with the changes in universities and shortage of graduates, and in particular we know that there is a shortage of relevant PhDs and so on, it is perfectly possible for those skilled workforces to be re-employed in other sectors. In particular we are aware that with the Government's support for the development of sustainable energy forms and so on many of the scientists and engineers working in that sector could find work in alternative sectors.

**Q145 Mr Jones:** Yes, but both organisations are also against civil nuclear power, so what would you say, for example, to the county of Cumbria which relies not only on civil nuclear power but also, in terms of Barrow, on nuclear submarines? It is a bit of a double whammy and it is all right saying that there are alternative jobs, and I have to say that over the years I have read many of these ploughshares types of documents, but it does not actually mean a great deal if your organisation, certainly in Cumbria, for example, is going to close down two of the main employers in that county.

**Dr Hudson:** It is certainly the case that in the past when work has been commissioned by those workforces themselves on alternative forms of employment they have generally been orientated to the Government investing and the companies investing in non-defence sectors and alternative forms of manufacturing production. I do not know to what extent it would be possible to convert into those areas, but as far as I am aware it is possible for some of those workforces specifically to be maintained through non-submarine production, for example.

**Q146 Mr Jones:** If you have been to Cumbria and looked at the geography are you seriously suggesting that you are going to get employers to move to Barrow or, for example, to Sellafield, the Workington area, in large numbers in terms of the jobs there are now both in the civil and the defence nuclear industries? It is just pie in the sky, is it not?

**Dr Hudson:** I am not so sure that it is pie in the sky. It is certainly the case, as far as I understand it, that with the non-continuation of the work at Dounreay it was possible for all the employees

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there to have continual employment or to be re-employed in similar sectors, particularly with regard to things like decommissioning, dealing with waste and so on.

**Q147 Chairman:** Dr Jenkins, I think you should have the opportunity to answer those questions.

**Dr Jenkins:** The first thing is that Greenpeace has historically been involved in developing precisely these kinds of studies and it has had a long history of that, but the overall perspective would be as follows. It is a national issue whether we continue with the Trident nuclear missile system with world ramifications. In such a case it is incumbent upon the Government to put serious effort, serious money and serious planning into taking care of workforces who have shown their commitment to the nation over many years and it is in that context that this should be addressed. My feeling is, and here I have to go back to historic knowledge when I worked on issues for Friends of the Earth about Sellafield and so forth, that there has been a real failure of the Government and agencies and the MoD to really think creatively and put real effort into defence conversion.

**Chairman:** I did not begin by saying, as I should have done, thank you very much for your memorandum, but Kevan Jones would like to come back to you on that.

**Q148 Mr Jones:** Just in terms of studies, obviously, we cannot replace the jobs by just getting people to produce studies, of which I have read many over the years. None has actually ever been implemented and obviously they have employed a lot of people in your organisations or certain university bods to write them, but in practical terms, in terms of replacement jobs, you say it is a job for Government, but surely, as an organisation which is advocating wholesale unemployment for large parts of west Cumbria and the southern Lakes, you have a responsibility to come up with a better argument than that it is Government's responsibility to do this. Secondly, in terms of a response to the point about alternative jobs, do you not also recognise that there is an issue around the types of jobs? What you are talking about here are very highly skilled jobs and replacing them with a baked bean factory, for example, in west Cumbria would not replace the skill set or the types of jobs which you would be taking away by closing down our civil nuclear programme or the defence side.

**Dr Jenkins:** Just to be clear, here I have to refer to my historic knowledge because today I come to focus on Aldermaston, where there is not a similar job problem. I have been located in the centre of a very prosperous part of England. The studies that were done in the past were not trivial at all. I remember a study done in the 1980s which looked at how jobs in Barrow, nuclear submarines, could have been diversified into the area of equipment for North Sea oil, so in terms of my organisation we have never simply said, "This is a problem for somebody else". We have been involved in such studies, but I think this is a serious issue and

demands response in detail and today I have not come with that focus and I am not prepared to give it that kind of consideration.

**Chairman:** We can ask Dr Hudson questions about that.

**Q149 Linda Gilroy:** This is on the same issue so it may be that you can deal with this in the course of answering the question I have got. We have heard this morning, and I think you were probably observing the trade union contributions this morning, that the scientists, engineers, the design people but also the skilled trades people, are very proud of what they do. They do it very specifically because they believe in it, and we have certainly had a sense of that on the various visits that we have paid, particularly to Barrow, where they were, I think, not unrealistically comparing what they do with the work on the space shuttle and the complexity of what they do, the safety case justification work that is done there. Is it not therefore probable that a proportion of those people—and we have heard from the trade unionists that some of them would not—would go elsewhere, probably abroad? They would obviously have restrictions placed on them as to where they could take their specialist knowledge in some cases. Is that something which CND have given consideration to? Would you be comfortable with that idea, that they would be taking their skills elsewhere rather than retaining them within the United Kingdom?

**Dr Hudson:** First of all, in the discussions that we have had with trade unions in the recent past I remember a particular discussion we had with PCS, and the point they were making was precisely the one you are making about comparing like job with like. Jobs in that sector are very good jobs with very good conditions, and those people do not want to go and work in a supermarket. CND is absolutely opposed—and as a trade unionist myself I would be absolutely opposed—to anything which would suggest that, but we do not think that that is necessary. Just to refer back to my point about the Dounreay nuclear power plant, this point is made in our paper, but according to the UKAEA which is responsible for clearing up this site, the decline in employment at the end of the Dounreay research programme has been reversed, with 1,200 people now employed in engineering, radiological protection planning, environmental and waste management. We made a similar point about the new role of Porton Down, given the biological and chemical weapons conventions, so we believe that it is absolutely possible for like employment to be found. I wonder: is it the case, and it seems unlikely to me, that it would be possible to sustain the works at Barrow solely on the commissioning of four new submarines?

**Q150 Mr Jones:** It would be a better alternative to what you are proposing.

**Dr Hudson:** It would be a big help but how sustainable is that? There is also the Astute class, of course. There is also presumably the production of surface ships and commissioning of other forms of production.

**Q151 Mr Jones:** You are against all these things anyway most of the time.

**Dr Hudson:** No, no. I am only talking about nuclear weapons.

**Chairman:** Was that the answer to your question, Linda?

**Q152 Linda Gilroy:** It was an answer but it was not exactly an answer that I think the people that I represent would understand because the comparison I made was with the space shuttle. It takes 18 months to two years just to do the long overhaul of these submarines, let alone build them. We heard that it takes nine years to train up to the level of skill that is required. These really are unique jobs and I am a bit disappointed with the reply.

**Dr Hudson:** As far as I understand it, part of the work at Devonport is the refitting of the existing Vanguard class submarines and that is a kind of periodic but regular thing where the ships come in and are refitted and so on. That work will continue. There are other nuclear powered submarines, for example, and there is a whole range of jobs there and commissions and contracts and so on.

**Q153 Mr Jones:** Which you are against.

**Dr Hudson:** No, we are not. I am here specifically to make the case as to why a decision not to replace Trident need not destroy Britain's skills and manufacturing base. I am not here to make any comment about having the Astute class submarines or refitting the existing ones or having decommissioning of all those types of things that are necessary and could occupy skills and provide employment.

**Q154 Chairman:** Dr Hudson, could you tell us: do you oppose the position by the United Kingdom on nuclear powered submarines?

**Dr Hudson:** We are not in favour, under conference policy, of new build nuclear power stations for a number of reasons, particularly because we think that it will not provide a solution to the problems of climate change. Constitutionally as an organisation we are only for the abolition of nuclear weapons. That is overwhelmingly our concern and I am not particularly interested here in making any kind of case against nuclear powered submarines. I see that as a separate issue.

**Q155 Chairman:** But as a separate issue is it the policy of CND to oppose the existence of nuclear powered submarines?

**Dr Hudson:** I do not actually know if we have got a conference policy on that specific issue. It is certainly not something that we campaign against.

**Q156 Linda Gilroy:** I just want to clarify something. You suggested that the refits on the current Vanguards would go on. Is it the position of CND therefore that the Vanguard submarines should continue until the end of their lives?

**Dr Hudson:** Our current campaigning priority is to prevent the replacement of Trident. That is our absolute focus at the moment. Obviously, we have campaigned for scrapping Trident and so on for many years. We are for the abolition of Britain's nuclear weapons, but I would say personally that there is very little likelihood of the Trident nuclear system as it currently exists being scrapped prior to a decision on a replacement being taken and prior to the end of its natural life. As these things take very long times to achieve and to bring about we nevertheless believe that there will be sufficient skilled work provided for those communities for very many years, whether it is decommissioning the submarines or dealing with problems of waste and so on around nuclear reactors in submarines, all those things. We believe very strongly that there will not be a detrimental impact on those workforces.

**Q157 Chairman:** But, Dr Hudson, in your evidence to our first inquiry did you not suggest that if there were a decision not to replace Trident it would be based on the principle that nuclear deterrent no longer worked and was not a good thing, and therefore that it should follow that we should immediately abolish the existing deterrent? Did you not suggest that?

**Dr Hudson:** I think this is a bit of a red herring really because obviously CND is an abolitionist organisation. We want British nuclear abolition and we also work for global abolition. We have a kind of unilateralist plus multilateralist position. That is what we are very strongly committed to on moral, legal and security grounds. That is absolutely the case. Much as I might like it to be otherwise, I do not think there is any immediate chance that those things are going to happen. What is possible, however, is that there is again a very serious national discussion about whether or not we need to renew the Trident system, and that is what we are engaged in talking about.

**Mr Hancock:** I think that is a very fair point. I think some members here are trying to twist the issue, Chairman.

**Mr Jones:** I just want straight answers.

**Q158 Mr Hancock:** No, no. The debate we are having today is about the replacement of the Trident missile system, whether or not we should continue with it. We are not debating whether we are going to stop the current programme tomorrow. I think the answers they have given are about the brief we have in front of us today. I am interested to know, particularly regarding jobs, about the suggestion that the Government have a responsibility to look at that in Barrow, for example. The answer we got from the people from Barrow was that in a total population of 70,000, and I do not know exactly what the working

population is, 5,600 are on some form of disability benefit. I was interested when you said that Government have a responsibility to look to diversify. Why would they want to do that when they are still committed to building nuclear submarines? You would not set up a diversification programme at the same time that you wanted this very skilled, uniquely placed workforce in this very difficult location to continue to build at least another three submarines for you in the Astute programme and possibly two replacement Trident boats, would you, so when does this kick in?

**Dr Jenkins:** The first thing is that if I indicated that one agency solely had this responsibility that is not what I am saying. When I worked for Friends of the Earth I was deeply involved in talks with British Nuclear Fuels, which, of course, has the Sellafield plant in the area, and right from the Chairman down they were interested in a major, indeed visionary, re-orientation of British Nuclear Fuels that would take it from being a reprocessing company into being a global nuclear clean-up company which would, for example, have contracts in the United States to clean up giant plants there and would be involved in dealing with the horrendous problems of the nuclear waste of the former Soviet fleet and so forth. The approach there was a dialogue between British Nuclear Fuels, organisations like Friends of the Earth and Government. In the larger picture that is what one wants. On this issue of jobs in the Barrow-in-Furness area I can only indicate my broad frame that that is the approach that should be taken and certainly this issue of jobs would not immediately arise because of the Astute programme.

**Q159 Mr Holloway:** It strikes me that all your comments are around mitigation of the central point for both of you, your sincerely held view that unemployment in these places is completely preferable to having a nuclear armed UK.

**Dr Jenkins:** No, because I think that is a false alternative. It is completely possible, and it is indeed the business of Government, to take care of its citizens without—

**Q160 Mr Holloway:** Sure, but from your perspective the main thing is us not having a nuclear arsenal. Therefore, from your point of view this is kind of semantics, talking about jobs, because ultimately you prefer us not to have nuclear weapons regardless of the consequences on those communities.

**Dr Jenkins:** Not regardless, because we believe that it can be done without such terrible consequences.

**Mr Holloway:** Okay. That is just semantics, I think.

**Q161 Chairman:** Dr Hudson?

**Dr Hudson:** I do not think it is a semantic issue. There is the question of what is in the scales. On the one side there is international law. There are moral questions, there are our treaty obligations, there is the question of whether or not we think that the course we might follow in replacing Trident might contribute to the development of

nuclear proliferation rather than helping to secure us. Those are things which any government has to take extremely seriously when it is looking at the future security of the nation and its own people, not to mention the impact on the wider community. There are, let us say, 3,500 jobs at Barrow. It seems to me that if the Government is very serious about these issues and serious about the employment and the skills base in this country, as well as ensuring the security of the nation, then the Government can, if it wants to, put significant thought into thinking about how these skills can be redeployed, and we know there is a skills shortage nationally in these areas, so it does not seem to me impossible that if a government wanted to take all these issues seriously it could find ways of redeploying these skills or indeed investing in Barrow for production in surface ships and other forms of submarines.

**Q162 Mr Holloway:** But for you the main thing is nuclear disarmament and not jobs.

**Dr Hudson:** Clearly it is, but there is no reason in my view why the Government cannot find ways of investing in Barrow to sustain its long term future or redeploying the workforce in like-for-like skilled work.

**Q163 Mr Jones:** You mentioned Barrow and, Dr Hudson, I do respect your position, but it is a purist position, is it not, in the sense that, as Dr Jenkins just said, it is the Government's responsibility to plug this gap? Do you not think though, as a campaigning organisation which has an abolitionist stance and certainly not just on civil nuclear power, there is an onus on you to come up and say to people in Barrow and parts of west Cumbria and others, Devonport as well, what the alternatives are going to be and that the actions you take by abolishing the independent nuclear deterrent and also civil nuclear power are going to have consequences, not just in terms of numbers of jobs; it is also the types of jobs? We heard earlier on in terms of Aldermaston that it is about also future skills and investment in nuclear technology and other things like that, so do you not think that you—both organisations—do need to give a little bit of thought to what these people would do in the future rather than just say, "We are an abolitionist organisation"?

**Dr Hudson:** Yes, I think it is incumbent upon us to take the issue very seriously and, as I tried to suggest earlier, CND does take it very seriously. That is why, in addition to doing some preliminary work, we have also commissioned an expert in this area. Thanks to Unison we have commissioned a major piece of research. I have been down to Devonport on a number of occasions and spoken at public meetings there. We have tried to engage in local campaigns and have particularly tried to engage with the workforce in discussion down there with the local trade unions as well. I myself was invited to speak at a fringe meeting at the Amicus trade union conference two or three years ago on

this very issue and I would be more than delighted, if I were invited, to speak at a meeting of the workforce in Barrow.

**Q164 Chairman:** Dr Jenkins, is there anything you would like to add?

**Dr Jenkins:** No. I share the statements made by Dr Hudson.

**Mr Hamilton:** Kevan has already asked the question but I would like to follow it on Dr Hudson's point, and that is that skills redeployment is one thing, but that does not help the town, because what will happen is that the best of the skills will move out of town, will move elsewhere within the UK. I have to say to Dr Jenkins that you do your case no good to argue that it is a government responsibility, and I accept the point you make that you have to look at alternatives and not go down the cul-de-sac that some people are trying to put you down. You are entitled to have a principled position and that position should and will be accepted by a great many Members in the House of Commons. There is a secondary issue and that is about jobs. It is not just about government. I am sorry; I find that comment quite offensive. It is not just about jobs and it is not about the Government having to do that. It is the collective responsibility of us all.

**Q165 Chairman:** Mr Hamilton, it is about a lot more than jobs, as you say.

**Dr Jenkins:** I made very clear my clarification. As part of the analogous issue of Sellafield I should say, because I was not employed by Greenpeace at that point, that Greenpeace was also part of that process. It involved a process of, as I said, trade unions, British Nuclear Fuels itself, NGOs; the Government was mainly missing from the process, I have to say, so that is the approach that should be taken. That is the approach that Greenpeace has historically been involved in, but I would emphasise that Government must take a lead because none of those actors can deal with the problems of taking care of the town without the strong, involved and continuous engagement of Government.

**Q166 Chairman:** If I can echo something that David Hamilton has been implying, what your organisations are fighting for you are fighting for on the basis of your belief that it is the future of the world that is at stake and that strikes you as really rather an important issue?

**Dr Jenkins:** Yes.

**Dr Hudson:** Yes.

**Mr Hancock:** I agree entirely with the line you have taken and I think that we have missed the point considerably as the Committee today on why you were here offering us your advice.

**Chairman:** That is not part of their contract.

**Mr Hancock:** No; I want to ask it now because others have deviated. I would like Dr Hudson to tell us where CND feel the Government would be

breaking treaty obligations if they were to replace Trident because I think that is really important to us as an example to the rest of the world.

**Chairman:** Hold on. We had that evidence in the first inquiry.

**Mr Hancock:** I would like to ask it in the context of the question. We are very close to a decision.

**Q167 Chairman:** No; this is an inquiry into the preservation of the skills base.

**Dr Hudson:** Can I just say something there?

**Q168 Chairman:** Could you be very brief, doctor?

**Dr Hudson:** I will be very brief. When we gave evidence to the first Select Committee meeting, which was on the strategic context, you told me then that that was not the appropriate place to raise the question of treaty obligations. In fact, you said that that was the responsibility of the Foreign Affairs Committee, not the responsibility of the Defence Committee.

**Q169 Chairman:** I do apologise.

**Dr Hudson:** Then I wrote to Mrs Beckett and subsequently went to have a meeting at the FCO to see if it was possible to have a discussion about that angle of it and they said no, so I am sorry to say that so far we have not actually had any opportunity to put our case about the legal implications, our responsibilities under the NPT. If you read my memorandum and publications that we have produced and are currently producing, including our alternative White Paper which we have produced today, it specifies very clearly in there the obligations of our Government under Article 6 of the NPT in good faith to begin and indeed effectively conclude discussions on disarmament. That was strengthened not only by the verdict of the World Court in 1996 but also at the 2000 NPT review conference where we made an unequivocal undertaking to disarm our nuclear weapons, so I very much hope that Parliament and the Government will provide an opportunity for all those issues to be raised and thoroughly discussed in the national interest.

**Q170 Chairman:** Dr Hudson, can I give a commitment that this Committee will give you the opportunity to talk about the treaty matters in our next inquiry?

**Dr Hudson:** Oh, good.

**Q171 Chairman:** If that is okay.

**Dr Hudson:** When is that?

**Q172 Chairman:** We have not decided yet.

**Dr Hudson:** After the decision.

**Q173 Chairman:** No. It will, I hope, be before a decision by Parliament anyway.

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**Dr Hudson:** Right; thank you very much.

**Q174 Chairman:** Dr Jenkins?

**Dr Jenkins:** I want to address this from a different perspective, which is that the major treaties, the Nuclear Non-Proliferation Treaty and the Comprehensive Test Ban Treaty, are technical treaties. To take the Comprehensive Test Ban Treaty, at its heart is the idea that by blocking the development of a technology you effectively can arrest the nuclear arms race, prevent the spread of nuclear weapons, so it is all about the skills base, that treaty, and it is impossible to separate the issue of skills base from the issue of treaty obligations in the case of what is now happening at Aldermaston.

**Chairman:** That is very interesting.

**Mr Hancock:** Hear, hear.

**Chairman:** Thank you. Do you want to carry on?

**Mr Hancock:** No. I am perfectly happy with those answers.

**Chairman:** What about decommissioning? Do you want to ask questions about decommissioning?

**Mr Hancock:** No. I assumed that they had already answered that and they had recognised that from both perspectives, Dr Jenkins on behalf of Aldermaston, Burghfield, that there would be an ongoing issue while the decommissioning, or indeed the existing programme, continued, and likewise I think Kate Hudson made it quite clear that she recognised there would be the ongoing issue of servicing the existing boats and the warheads that were contained within them, so I accepted that they had answered that question in some detail.

**Q175 Mr Borrow:** I would like to move on to Aldermaston. The written submission has cast doubt upon the rationale explained by the Government for the investment of £350 million over each of the next few years, so I would be interested in what your principal concerns are in respect of that and how you would respond to the argument that the key nature of such an investment was to ensure that the skills were not lost because there was a risk that they could be lost and that would put at risk the existing nuclear deterrent from a safety point of view, irrespective of any decision that is made in terms of a future replacement deterrent.

**Dr Jenkins:** I think it is important to address this issue in the last context. The concept of science-based stockpile stewardship was developed in the United States and is a completely discredited and ideological concept. Effectively what happened in the United States was that in the mid nineties the giant US nuclear weapons laboratories, of which Aldermaston is in many ways merely an offshoot today, were faced with the prospect that they no longer had a reason to be in business. Moreover, they were also faced with real concerns about environmental contamination of sites and so on. Furthermore, they were faced with the prospect of the Comprehensive Test Ban Treaty. It is in that context that they struck a deal with the Clinton administration. In return for their technical support, saying that the treaty could be verified,

they would receive from the US Government close to or greater than Cold War levels of funding to continue the development of exotic technologies with the ostensible purpose of maintaining the existing deterrent. Those nuclear weapon laboratories received that funding and then reneged on that deal in a most despicable and—words fail me at this point. In the US Senate they gave testimony, contradicted by their own studies, that it would not be possible to continue with the treaty for verification issues. They have since been rewarded by the Bush administration with levels of funding equal to those at the highest point of the Cold War. What we now see today with this concept being deployed in Britain is a horrendous undermining of British foreign policy. Prime Minister Blair took the unprecedented step before the Senate vote, with the German Chancellor and the French President, of appealing directly to the Senate to ratify the Comprehensive Test Ban Treaty, making very clear his commitment of British foreign policy to the Comprehensive Test Ban Treaty as a priority matter. What we are now seeing with the development of Aldermaston bomb-making capacity is a subtle but insidious undermining of that British foreign policy goal. If you would like me to answer in more detail about Aldermaston I can be specific.

**Q176 Mr Borrow:** It would be helpful to the Committee if, having spoken at length about US Government policy, you were to deal specifically with how the investment of £1,000 million over three years in developing and sustaining Aldermaston is not what the Government says it is for.

**Dr Jenkins:** The situation we find ourselves in is one of a blanket of secrecy in which it is not possible to have absolute certainty, and this is a situation this Committee has commented on as being unsatisfactory in the past. It is more a question from my point of view that there is evidence that real questions need to be asked. Here I refer to the statements made by leading US nuclear weapons scientists from the heart of their nuclear weapon programme where they challenge this very idea that these exotic technologies were needed to maintain the safety and reliability of the deterrent is crucial. Men such as Ray Kidder, Norris Bradbury, Carson Marks, Richard Garwin, Sidney Drell, Bob Purefoy and Simon Seymour Sachs have all raised the issue that if your actual objective was to maintain the safety and reliability of the existing nuclear deterrent the best way to do it would be engineering based inspection and re-manufacture.

**Q177 Chairman:** Can we come on to that? It is a slightly different question. The issue is whether the preservation of skills allows the UK to keep its options open to allow the possible replacement of Trident if we decide to go down that route, and you are saying that that is not what is happening?

**Dr Jenkins:** What I am saying is that it would be good if this Committee called expert witnesses, both of these senior US scientists but also

Aldermaston scientists and engineers themselves, and asked them precisely the question, could we not maintain the deterrent, and in doing so we would be maintaining the skills necessary to maintain it, by a much cheaper programme of engineering based inspection and re-manufacture?

**Dr Hudson:** I have a slightly different angle on what I think you were asking about the Government's stated intention for the investment at Aldermaston. It is certainly our view, and this is obviously taken from information available in the public domain, that what is taking place there is far more than that required for stockpile stewardship, and of course our great concern, with other campaigners over the last two or three years, is that what is taking place at Aldermaston is actually the preparation or indeed the beginnings of development of new nuclear warheads. Just to refer you to what it said in AWE's in-house magazine, they talked about the scale of development taking place there as comparable with that of Heathrow's Terminal 5. This is from their own statements on it, a budgetary increase of some 36%. We understand that has brought a project 1,050 additional staff and an anticipated 1,200 contractors. We follow very closely with other colleagues from campaigning organisations the planning application process in West Berkshire and we know, for example, that in spite of considerable local protest permission was given for the building of an Orion laser facility which, as far as we understand, is a thousand times more powerful than the existing laser, and that laser is able to simulate the effects of weapons testing, so obviously that leads one possibly to conclude that developments are taking place with the purpose of developing a new nuclear weapons system. We understand the scale of the new computers that are being developed there, with other types of facilities, the core punch hydrodynamics facility, for example, and the new uranium facility; all the evidence would suggest to us that the developments and the investment there are not merely for stockpile stewardship but for the development of a new system, and we believe that the works are so far in development that one could conclude that the Government might have already commissioned that work to begin.

**Q178 Mr Borrow:** Given that this inquiry is looking at skill bases, and the evidence that the Committee has received is that the skill base at Aldermaston is an ageing workforce and therefore the argument that has been put is that they need to start a programme of recruiting young skilled scientists who can be trained to take over from those older scientists who will be leaving service, the argument is that that needs to be done irrespective of the decision on replacing the nuclear deterrent; otherwise that skill will have been lost and we will not be in a position to replace the nuclear deterrent. Do you think that argument is totally fallacious?

**Dr Hudson:** I would not say it was necessarily totally fallacious. Certainly, looking at some of the age profiles, reading the other submissions and so on, if a third of the skilled workforce is in the higher age

profile then obviously one can see that there is some concern about that, but the scale of the recruitment, taken together with the nature of the jobs that have been advertised, some quite leading senior engineering teams and those types of things, does not suggest to me developing talented young scientists in the field. It suggests more importing quite advanced expertise in the range of sectors that could lead to the development of new nuclear weapons. Also, of course, this is one of these areas linking to the wider skills issue in Britain, and a sucking into this of quite a large proportion of skilled graduates, PhDs and so on, is going to deprive other areas of those skills.

**Q179 Mr Havard:** I read the memoranda you both sent around this. One of the things you say to me is that the capability at Aldermaston is too great, it is more than sufficient to do the safety and in fact it is greater than that and it has the capability of producing a new bomb, of doing all sorts of things it should not be doing. It has got in it these exotic technologies that allow this development to take place, and you say it to me as though this is a surprise, but it is no surprise. There is nothing new in this argument. When the investment for Aldermaston was set out it was made very clear that it would do more than just provide safety for the existing warheads. It said it would keep a design successor for the existing warhead, should one be required, and keep the options open, so all these skills are there. This is nothing new to me, that these skills are there. It is capable of doing all of the things on the continuum, which is why I asked the question I asked earlier of the trade unions who represent people in Aldermaston, so the skills that are there are the skills required to do any one of these things. The decisions about which ones are done are political decisions. The other part of your evidence is that you suggested that in some way or other that is contrary to particular technologies, treaties and all the rest of it, which we are not going to go into today, but in terms of skill retention and skill necessity to either provide safety or development, then all you say to me is, "Yes, both are there but one should not be".

**Dr Hudson:** Obviously, for us the concern, as you say rightly, is the overarching concern. We do not feel that these developments enable Britain to be in compliance with its treaty obligations. While the Government currently has a policy of having nuclear weapons it is not surprising that they wish to invest in the facilities which enable those to be continued. I think the point that we were raising in particular about this is that the scale of the investment and the activities and the building that is taking place there currently would suggest that in some way the decision to go ahead with a new generation of nuclear weapons has already been taken, which would seem to be the wrong way round.

**Q180 Mr Jones:** What do you base that on?

**Dr Hudson:** What I was just saying about the scale of development there which AWE itself has likened to Terminal 5, the new laser and so on.

**Dr Jenkins:** I have to enter into an area which is of great obscurity but at the same time of real importance, which is that the evidence, it seems to me, is not that Aldermaston has just been sitting around developing capacity. Actually, there is already track record. A nice remark was made by John Brown, the former Director of the Los Alamos Laboratory, where he said, "You cannot just have this conversation about warheads. It has to be about delivery systems and even military command and control. These things are part of an inter-related system. That is what people forget". The importance of that is that since the end of the Cold War we have seen an upgrading of the Trident nuclear missile system, the technical characteristics of which make it more conceivable that it could be used, so that involves single missile warheads, it involves re-targeting systems and a dual yield. The point here is that suddenly in 2000 Aldermaston says, "Yes, we have done it". "With high accuracy, targeting and an option of two warhead yields [Trident] can now operate in both strategic and sub-strategic roles". The point is that it is not simply an issue of what Aldermaston may be about to do, but also that Aldermaston has already been in a way—and it is a semantic question—producing a new weapon; hence that suggests that we have also got to be concerned, for example, when we discover from an advertisement in PhysicsWeb that the new scientists that are being hired will be making prototypes. At what point does making a prototype turn into making a new weapon?

**Mr Havard:** That is the point I wanted to get to. You say that taking a multi-warhead and producing just one single warhead on it and improving its target capacity so that it can be dropped with much more accuracy is a new weapon. That is what you have just said. The truth of the issue is that for a period of time the UK has effectively been reducing the capacity of its nuclear weaponry. We used to have tactical nuclear weapons. We do not have them any more. There are various ways in which we have said we will have fewer warheads on them. Whether you make them any safer by having fewer warheads is a different debate, but what you are saying now is that they have produced this capacity so you can drop a less lethal nuclear weapon with more accuracy than you could before in the form of a Trident missile, so they have improved it to that extent. That is what you are saying.

**Q181 Chairman:** Is that what you are saying?

**Dr Jenkins:** What I am saying, and here I stand on what the Director of Los Alamos says, is that what matters is the whole system, and in terms of what we have done, we have made a weapon which states across the world will see as more usable against them and that is deeply distasteful.

**Mr Havard:** That is a debate. What is clear is that the Government has not hidden any of this. As you say in your own memorandum, in the history section of the report in 2000 it made very clear that this potential that you have just described had now meant that Trident could be used in a sub-strategic way rather than in a strategic way, and I think this

whole question of their ability to provide those options to the Government is hardly a secret because the Government has admitted it is doing it, has told the public it is doing it, so nothing that you are telling me is particularly a secret or new, and it is consistent with the Government's position—

**Chairman:** Dai—

**Q182 Mr Havard:** Hang on a minute; I am going to finish this sentence. The potential for Aldermaston was always to be to keep that potential there, to have that ability to do that. Whether you think it is right or wrong is a different debate, but do not try and pretend to me that in some way it is some sort of X-file that has come out of somewhere and it is a conspiracy. It is not. It might well be wrong but it is not a conspiracy.

**Dr Jenkins:** The Government has said different things at different times, and it said to this Committee that this investment was required "irrespective", and then John Reid talked about the purpose, so it would appear that the Government's clear intention was to say, "This is simply for maintaining the existing warhead", and we are raising doubts about this.

**Chairman:** I think it was for maintaining the existing skills.

**Q183 Mr Jones:** It is an important point because I accept that you are trying, as Dai said, to portray a great conspiracy theory when there is not, because actually what it says in the memorandum, and I will read it again to you—there is a film at Aldermaston—"It will also ensure that we retain a minimum capability to design a successor for the existing warhead, should one be required, and keep our options open". Would not the Government, can I put it to you, be failing if it did not put this investment in? I accept you do not want any investment at all, but if we did not put investment in now the argument we are going to have on whether or not we replace the nuclear deterrent would be academic because we would not have the skills and the expertise to do it.

**Dr Jenkins:** What I think would be appropriate, because, as I say, this is an area of obscurity and secrecy, would be for the Committee—

**Mr Jones:** No, it is not secrecy. I do not accept that.

**Q184 Chairman:** Hold on. Let Dr Jenkins continue.

**Dr Jenkins:** The parliamentary question put down by Norman Baker MP asks, "What is the lower yield of the Trident nuclear warhead now? Has it been developed into a mini nuke?", and the reply is, "This is a matter of national security".

**Q185 Mr Jones:** Well, of course it is.

**Dr Jenkins:** At a time when the Government has itself said that there is no direct military threat to the UK, then we need to know the facts.

**Mr Jones:** No, but what you are trying to portray—

**Q186 Chairman:** Dr Hudson, you have an answer you were trying to give.



**Dr Hudson:** I just wanted to make an additional point. It is quite clear that our organisations are opposed to the replacement of Trident for a very wide number of reasons. Our specific concern about the situation at Aldermaston is that irrespective of normal functionings and stockpile stewardship and so on, which obviously the Government under its current policies is required to do, and quite sensibly so given the safety considerations and so on, nevertheless we have been promised by the Government a full public and parliamentary discussion and debate about the future of the nuclear weapons system and whether it is appropriate or not for Britain to maintain such a system for its future security and so on. This parliamentary Committee I understand is part of that discussion and process and looking at the issues. If the Government has already taken a decision and therefore what is happening at Aldermaston is the enactment of that decision then it seems the wrong way round and we have concerns that that is what is taking place at Aldermaston. Nothing anyone has said has yet convinced me that that is not the case.

**Mr Jones:** I accept that nothing I am going to say or anyone is going to say is going to convince you, but what would be wrong would be any government saying they were going to go into an open public debate about the replacement Trident when they realised that if they had not put the investment in (which everyone has been quite clear about because it has not been secret in any way, shape or form in terms of policy), in other words that if they took a decision without this investment in skills etc. or in Aldermaston to replace Trident, they could not do it because they would not have the capacity to do it. I think you are going to enter into a debate which is open and transparent, which I think this is, and I think the MoD have been quite clear. What you are trying to do, which I accept you are entitled to do, is whip up the conspiracy theory *et al* to try and damage the debate, which I do not think is very helpful in terms of your case, to be honest, which I do respect.

**Q187 Chairman:** I do not think that is what you have been saying.

**Dr Hudson:** I am not suggesting there is a conspiracy theory. I just hope that there is no intention to pre-empt the decision, which I hope will be taken by Parliament.

**Chairman:** I think you have stimulated the Committee so much that we will go on, if we do not stop pretty much now, until about teatime, and we cannot because the Minister for Defence Procurement is coming before us. Do you want to ask a nice, emollient question to round it off, David?

**Q188 Mr Hamilton:** Do you seriously think, if there were an ulterior motive by the Government, that during the debate—and it was myself who asked the Prime Minister about a vote in the House of Commons and now all we need to find out is whether it will be a free vote, but that is a separate issue—if there were conspiracy theories going about that would not come out during the debate that we are going to be having in the House of Commons, and do you think that that is going to make a difference to MPs? I am just to trying to think of a scenario. If the Government say, “We have proceeded with this investment so much that that is why we should make a decision to accept a new nuclear deterrent”, do you honestly think that MPs will vote according to the amount of money they will spend potentially? It just does not work out.

**Dr Jenkins:** I would like to put this in a historic context. It has been said by people like Lord Solly Zuckerman or Dr David Owen, speaking about his time as minister, that Aldermaston scientists have manipulated political decisions, have gone ahead with the development of systems without proper oversight. All this has been said by people of that calibre. We have the historic Chevaline decision. The issue may not simply be one for Downing Street and that is why I would very much hope that this Committee will first question senior scientists and engineers at Aldermaston, secondly, seek independent technical advice because this is a technical issue, and thirdly, go to where the best expertise can be found for opposing points of view, which is the United States, and call on the people of the very highest calibre from inside the nuclear weapons establishment to advise it in this issue.

**Q189 Chairman:** Thank you both very much indeed. I have said that you will have the opportunity to come and talk to us about treaty obligations. If after this morning you want to come back you would be most welcome.

**Dr Hudson:** I would love to.

**Chairman:** Thank you very much indeed for your evidence this morning. As I say, you have stimulated us enormously and we have enjoyed it.

*Witnesses:* **Lord Drayson**, a Member of the House of Lords, Under Secretary of State and Minister for Defence Procurement, Ministry of Defence, **Mr David Gould CB**, Deputy Chief Executive, Defence Procurement Agency, **Mr Nick Bennett**, Director General Strategic Technologies, Ministry of Defence and **Rear Admiral Andrew Mathews**, Director General Nuclear, Ministry of Defence, gave evidence.

**Q190 Chairman:** Welcome, Minister and gentlemen, to the second of our inquiries into the strategic nuclear deterrent, which as you know is into the skills base. I must open by saying how welcome it is to have you, Minister, and the Ministry of Defence taking part in this inquiry, so thank you for coming. We are waiting at the moment for the White Paper, but I wonder whether I could begin by asking you to introduce your team, some of whom have given evidence before us already. If you could you tell us about your team that would be most helpful to start with.

**Lord Drayson:** Perhaps if we could start on the left-hand side: Nick Bennett, who is the Director General of Strategic Technologies, David Gould who is the Deputy Chief Executive of the DPA and Rear Admiral Andrew Mathews who is Director General Nuclear.

**Q191 Chairman:** The White Paper. We were told in June by the Prime Minister that the Government were likely to be publishing a White Paper by the end of the year. Is that still the expected timing?

**Lord Drayson:** Yes it is, Chairman.

**Q192 Chairman:** Are you able to give us any better indication of when?

**Lord Drayson:** No further than that, except to say that we have indicated that the White Paper will be published once decisions have been taken on the future of the nuclear deterrent. No decisions have been taken as yet, but the expectation is that the White Paper will be published by the end of this year.

**Q193 Chairman:** What sort of form will it take? Will it set out what decisions have been taken and ask for comments or will it set out the options that the Government could follow?

**Lord Drayson:** It will set out the assessment that has been made of the options that there are for the replacement of the deterrent. That assessment will include the risks, the threats, the options, the costs that are involved in the different ways forward. It will set out the results of the preparatory work which has been undertaken to give Parliament an opportunity then to assess that once ministers have had an opportunity to review those issues.

**Q194 Chairman:** The way you put it just now, it will set out the decisions that have been taken for the replacement of the deterrent. That contains just the slightest tinge of an implication that a decision has been taken to replace the deterrent.

**Lord Drayson:** Absolutely not, Chairman. No decision has yet been taken. We are at the stage where the options are being reviewed, but no decision has been taken as yet.

**Q195 Chairman:** May I put to you one point which was put to us this morning by Greenpeace? They said that the programme of investment in Aldermaston raises some concerns, that the proper procedure

should be an open and informed debate first, then a decision by Parliament on whether to go ahead with the investments necessary to make a bomb and finally, the investments. Instead, the evidence strongly suggests that we have an *Alice in Wonderland* situation of investments first, official decisions second and public debate and parliamentary vote last of all. What do you say about that?

**Lord Drayson:** That reflects a misunderstanding of what the investments that have been made in Aldermaston have been for. They are to ensure that the existing deterrent can be maintained in a safe and effective form given that under the nuclear test ban treaty the only way in which we can make sure that the deterrent is safe is to carry out very sophisticated physical and computational experiments and that requires investment in the infrastructure at Aldermaston to make sure that we continue to be able to do that properly.

**Q196 Chairman:** But in any event the public debate will follow the Government's decision.

**Lord Drayson:** The public debate will follow the publication of the White Paper. The White Paper will follow the position taken when ministers have reviewed the options which have been presented in the White Paper.

**Q197 Willie Rennie:** Many have criticised the necessity of having this debate at this exact time. Could the reasons as to why we are having the debate now rather than in four, five or six years' time not be set out?

**Lord Drayson:** The central issue that we have to focus on, which is why the debate is important now, is that we have the existing deterrent system. That system has a life and if we decide that we wish to replace that system when it comes to the end of its life, we have to take decisions now relating to the way in which we are going to do that because of the length of time it takes to develop and build and bring into service a successor system. That is the central reason why a decision is made now.

**Q198 Willie Rennie:** What do you say to those who say that it is far too early in the process to do that and you should actually allow more time for events to develop and perhaps to chime in with the developments in America for the replacement of their system, which might be more economic for the UK in the long run?

**Lord Drayson:** I would say that we do not have the option to do that if we wish to retain the option to be able to replace the deterrent because of the very long lead times which are involved in the design and development and the bringing into service of any successor deterrent system. Rear Admiral, would you like to give a bit more detail in terms of the timing?

**Rear Admiral Mathews:** This is a compromise between the time it takes to design, build and then commission a nuclear submarine and how long we can economically and reliably run on the existing system. This really comes down to the fact that it is the platform that is driving this decision and the two questions then are: what is the time to develop a new submarine and what is the time that we can run on the existing system? If I just answer those two questions. We estimate it takes around 17 years to design and build a new platform, which is exactly in line with the American model. It is about two years to get through the concept stage, there are big decisions about the number of missile tubes, the type of propulsion, the type of submarine you want before getting into detailed design. At the end of detailed design, we have to have got it right because we do not build a prototype: the first-of-class is the first-of-class and we expect it to go to sea on time. It is a bit like building an onion in reverse once we start building this thing because we work from the outside in. So if we come to a late change, it is extremely costly because this is a highly integrated platform, it is highly complex and change means that we often have to make change throughout the submarine, which is difficult to do once we have started construction. We also have a complex safety case which, again, we have to mature before we get into serious construction. If we do not have our safety case right it causes rework. Bear in mind what we are doing with this platform: it is a complex piece of kit, it operates in a complex environment, nuclear propulsion, nuclear weapons, it has a complex safety case. It is important you get those principles right at the end of that design stage, so the design can be long, but it is a vital piece. Then we go through along the construction critical path, starting with propulsion, and we test this before we put it into the submarine. And then we build it in sections, join the sections together and integrate them. This is a complex process and then we need about two years for trials, commissioning and testing at sea and training the ship's company to operate it. A thirty-year life is about as long as we can get out of these platforms. We design them for 25 years; we estimate that we can extend Vanguard for about five years and still get reasonable reliability from it. To go beyond that, we start to get into the law of diminishing returns; we need to invest significant amounts of money. Our experience of operating old submarines is not good: they are unreliable; they cost a lot of money. We see around 30 years as the maximum life of a submarine. That drives us to making a decision about now.

**Q199 Willie Rennie:** The defence industrial strategy says that the UK must retain onshore key skills in design, construction, maintenance and decommissioning of nuclear submarines. Why exactly does the UK need to have that onshore sovereign capability?

**Lord Drayson:** It relates to a number of factors, but the most important is that we have a responsibility in terms of making sure that if we are operating nuclear submarines we have the capability to do so safely, to

meet all our regulatory commitments and being able to do so properly. Being able to ensure that we have that capability and that know-how is intimately tied up with an understanding of the design, the development of the system, which best comes from an intimate knowledge which is generated from having the design base and the skills here in this country to do it. The second thing stems from security aspects: it is not possible for us to procure many aspects of the submarine from other parties. Therefore, for those two key reasons, we are put in a position where, if we take the decision to replace the nuclear deterrent and if we decide that the best way to do that is to continue it being submarine-based, then we do need to maintain that capability here in the United Kingdom to do so. There is a second order issue which relates to affordability and value for money for taxpayers. Our analysis shows that having the capability to do so here in the United Kingdom does also give us the best value for money in terms of the affordability of the system through doing it in this way. That is the experience which we have had from the existing class of submarines and the class of submarines which we are building at present, the Astute class.

**Q200 Willie Rennie:** Why is that different from armoured vehicles, fighter jets, even Trident missiles? Why is the submarine any different?

**Lord Drayson:** The nuclear issues provide a greatly enhanced burden on us in terms of the regulatory burden which we have to meet in terms of the safety case and so forth. That is what puts it in a different league to everything else in terms of military equipment as opposed to armoured fighting vehicles which you mentioned.

**Q201 Willie Rennie:** The DIS is silent on alternative options for the deterrent, on whether it is air based or submarine or land based; it is silent on the alternative options for the deterrent. Do we have the capability in the UK to develop those capabilities for air and land if it was decided that that was the route we were going to go down?

**Lord Drayson:** We would have the capability in those alternative areas and the alternative possibilities are being looked at in terms of the basis of the system. Those are being looked at in the various options as to whether it should be a preferred solution which continues to be submarine based or another system such as air based. Those options are being looked at. We have to recognise though that we have an existing level of significant knowledge and expertise and experience in operating a nuclear deterrent on the basis of a submarine and therefore, should we look at an alternative in terms of it being air based or land based there would be a significantly greater technological risk because it has been some time since the United Kingdom has deployed an air-based system and the United Kingdom has never deployed a land-based system. We would need to recognise the difference in technological risk in those two areas and the difference in capability here in the United Kingdom.

**Q202 Willie Rennie:** Does that rule out the other two options then?

**Lord Drayson:** This is an example of the issues which are being looked at as part of the preparation for the White Paper. As I have said, no decision has been taken.

**Q203 Mr Hancock:** Forgive me if I misheard you. I was under the impression that when the White Paper was going to be published there was going to be a government-preferred option that would be the starting point for the debate on this issue. However, when you were giving your answer to the Chairman, you alluded to a ministerial view but it did not appear that the view was going to be expressed in the White Paper. How is it going to be presented to the country?

**Lord Drayson:** Yes, it will be expressed. I apologise if I was not clear on that point to the Committee. The White Paper will express that view as to the preferred option.

**Q204 Mr Hancock:** What? A ministerial view or a government view?

**Lord Drayson:** A government view.

**Q205 Mr Hancock:** So there will be a decision of Government on the preferred solution, whether we have a deterrent or not or what version we have?

**Lord Drayson:** Ministers will review it and then the White Paper will be published.

**Q206 Mr Hancock:** I wait to see what that decision will be. May I just ask a question? When the existing Trident boats were being planned, they were planned originally for a 30-year life, were they not?

**Rear Admiral Mathews:** A 25-year life.

**Q207 Mr Hancock:** Not originally 30 years downgraded to 25?

**Rear Admiral Mathews:** I do not know the answer to that. My belief is that we designed them for 25 years.

**Mr Hancock:** It would be interesting to know for sure, because my recollection is that the original spec was that the boats would be for a 30-year service life which was then downgraded to 25 years.

**Chairman:** Could you possibly write to us? Mike Hancock is probably older than you are so he may remember it.

**Q208 Mr Borrow:** Would I be right in assuming then that when the White Paper is published, there will be analysis of the options of a land-based and an air-based system and in that analysis it would include the timescales involved in developing a land-based or an air-based system and obviously if those timeframes were less, significantly less than a submarine-based system, that would obviate the need, were that the one to be chosen, for us to do anything significant straightaway?

**Lord Drayson:** What we expect to see coming out in the White Paper—and, as I have said, this is a work in progress—is that the options will be reviewed and they will be set out in the White Paper as I have described. We do need to recognise that we know

today, and as we have expressed to the Committee today and in the submission from the Ministry of Defence, our views on the timescales that exist predicated by the length of time it takes on the basis of a submarine system. Alternatives to that are being looked at within the White Paper and, as I have expressed today, the challenges that that would present, beyond the submarine base comes from the fact that the United Kingdom has not for some time had an air-based system and has never had a land-based system and that needs to be reflected in the assessment of the technical challenge, the technical risks that would be present.

**Q209 Mr Havard:** I am not going to talk about the skills at the moment, but as you are on the White Paper and this is the first opportunity we have had, it will obviously mention platforms but will it mention other things? For example, I want to ask you later something about the virtual arsenal concept; the idea of saying “We are not going to have one” but still retaining the capability to revitalise one should we wish to have it. To what extent is the White Paper actually going to look at the options? Is it just simply going to be narrow? How wide is going to be and does the end of the year mean when Parliament is sitting?

**Lord Drayson:** My understanding of the end of the year is a calendar end of the year.

**Chairman:** Your focus in relation to the defence industrial strategy was exemplary and you got it in four days before time, so we expect and hope for great things.

**Q210 Mr Crausby:** It is generally argued that one of the major reasons for the cost overruns for Astute was the extended gap between the Astute and the Vanguard programmes. What lessons have you learned about the problems of skill retention caused by that gap and what are you doing to ensure that similar problems do not occur between the Astute programme and a potential Vanguard successor?

**Lord Drayson:** The central lesson that we have learnt is that if we are to maintain the level of skills that we need within an industry, this is not just applying to the submarine industry but is a general fact of the defence industry, then if we need to maintain those skills, we need to provide sufficient work to do so, but the way skills can be maintained is only by putting them into practice. It is not realistic—the United States looked at the possibility with its submarine programme—to have a pause and then look at regenerating the capability. It was deemed that it was just not practical to do so. What we have learned from the gap, which as you rightly say, occurred between Astute and Vanguard, is that we need to have a very clear understanding of the frequency of orders and therefore the frequency of build of submarines that is required as a minimum to maintain those skills, to make sure that we do have that capability. That requires quite a detailed look at the various trade-offs, taking into account that we have considerably reduced the submarine industry in this country; it is now at a minimum critical mass,

therefore we need to make sure it does not get any smaller and we do not lose any of those skills. The analysis which we have done, which has been vindicated by external analysis, is that a frequency of orders, the drumbeat that is talked about in the industry, of approximately 22 months is what is needed to require the maintenance of that level of skills. Whether or not these are submarines which will be used for the nuclear deterrent—they could be entirely attack submarines, not bomber submarines—we should still need to be maintaining a build of submarines at that frequency to maintain those skills.

**Mr Gould:** It is a whole raft of skills that goes from high level design, detailed design, actually practising those skills. One of the things we learned on Astute was that you could not, for example, take specialised submarine designers, give them work on surface ships, which we did, and then expect them to reconvert back from surface warships to submarines at the level of skills with which they left the submarine business. The skills inevitably fade if you do not practise them. It goes beyond that. This is not just about building a submarine; it is also about building the reactor plant and the supply chain for the reactor plant and the steam-raising plant and the systems inside the submarine. To keep those skills alive and to benefit from changes that you can make to make the submarines easier to operate, easier to build, you need to do the 22-month/24-month delivery of a new submarine, but progressively, you need to change and adapt the design to reflect changes in the supply chain, changes in the way in which you maintain the submarines and that actually also keeps the skills going. We have now got that sort of rhythm built. We have been working very closely with the companies—BAE Systems, Rolls-Royce, Strachan & Henshaw, DML at Devonport and they are increasingly coming together to do this as a single submarine enterprise and work together. Clearly, if you stop that, if you slow it down, then you might save some material costs as you slow down the number of submarines you build, but you carry the overhead of keeping the skills there and inevitably you get skill fade, so that when you try to build up again it takes you longer to do it and if you let it go too far then it becomes a very, very difficult problem to solve. That is borne out by US experience as well.

**Q211 Mr Crausby:** So you do accept that the slowing down of that rhythm—BAE seem to be fond of this word “drumbeat”—would affect the retention of those skills. We have heard as well from SMEs that it particularly affects them; probably more than it affects BAE. If you accept that there has to be a rhythm of about two years, does then the production of the Astute submarines in some respects dictate when we will want to produce a replacement for the Vanguard submarine?

**Lord Drayson:** The two issues are absolutely connected. It is firstly about having a critical mass of know-how and skills within the industry which are submarine design and build skills, which are, in many aspects but not entirely, common to both

attack and bomber submarines. However, we also need to recognise that the length of time it takes to design a new class of submarines, should it be decided a new class of submarines is needed to replace the Vanguard, is considerable, which in itself is what is determining the timing. It is a combination of two issues which we need to manage, but within the Ministry of Defence we absolutely do accept what industry is saying, that maintaining that critical mass of skills does boil down to maintaining the frequency of build at approximately this two-year cycle.

**Q212 Mr Crausby:** I suppose if we accept that there is going to be a regular drumbeat of two years for submarines and the number of Astute submarines is going to be six, then we almost do not need the White Paper do we? We pretty well know when you will be making the decision to produce the Vanguard successor because these things are absolutely linked. Rather than us working it out that way, when is the ideal date for a potential Vanguard successor from the point of view of skills, not from the point of view of the decision or the White Paper but from the point of view of skills retention? What is the ideal year for a potential Vanguard successor?

**Rear Admiral Mathews:** If I just take you back to my 2024 date for the successor, if there were one, to go on patrol, then that ties in nicely with our plans for Astute which currently sit at seven boats, that is our target, if that is deemed affordable when we get there, then that sets a nice drumbeat to get to that date. So that is an integrated programme. If the decision is not to build a successor nuclear submarine, then we are in a different business.

**Q213 Mr Crausby:** So that is taking it out 30 years then from the 2024 date?

**Rear Admiral Mathews:** Yes. I am sure that the design life was 25 years when the original staff requirement was set.

**Q214 Mr Hancock:** I have a quote here which says that the Government assume the lifecycle for the whole system is 30 years.

**Rear Admiral Mathews:** But the staff requirement, when we set it, was 25 years and we design the submarine around the staff requirement. We shall send you a note.

**Q215 Chairman:** Mr Gould, may I come back to something you said which was that a 22-month/24-month drumbeat was roughly what we needed? The difference between 22 months and 24 months may be important if, as the Minister says, we are at the moment at a minimum critical mass. As I understand it, we are currently operating at a 22-month drumbeat. Do you think that the difference between 22 and 24 could be critical?

**Mr Gould:** It is the gap between deliveries. What is critical is the confidence that the industry has that that is the rhythm that they are working to, because then they can plan and size their workforce on that.

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Twenty-two is a good figure but individual submarines might actually vary a small amount without destroying or undermining that confidence.

**Q216 Chairman:** It is just that my memory is seared with memories of “We will have around 50 ships”.

**Mr Gould:** Yes, I remember that.

**Q217 Chairman:** It somehow seems to get down to about six and I worry that the “around two years” might become two- or two-and-a-half-year drumbeats. Would that entirely endanger the submarine industry in this country?

**Mr Gould:** The size of the fleet that the Government decide they want to have in terms of the number of attack submarines, SSNs, and the number of SSBNs is the critical factor. Once you have that size of fleet, you can plan the industrial programmes but what the industry tells us and what we actually agree with from our own analysis is that 22 months, or around that figure, is what we can economically and sensibly do with the size of workforce and the skill base that we now have put in place. But the critical factor is the type and number of submarines that you want to run.

**Q218 Mr Crausby:** May I just try to link that to affordability as well because affordability is all part of this in the sense that our understanding is that the price for boats two and three is not yet agreed and therefore you could not commit yourselves to boats two and three, never mind the next three, until you can agree the price of all of that. All of these things seem to be becoming dictated together: affordability, the price, the drumbeat and the 20 years or 25 years. Almost the whole business is dictating back to affordability. We hear as well that the French and the Americans are spending a good deal more than we do on submarines. Are we trying to get these boats too cheaply and is affordability affecting the whole issue of production as to whether we do produce a Vanguard successor?

**Lord Drayson:** You have rightly highlighted that there is a real interdependence between the costs, and therefore the affordability of the system and the size of the industry which can be sustained which is determined, because we are the only customer, by the number of submarines that we require. We have looked very carefully; the whole point of the Defence Industrial Strategy was to look into each sector and really get a clear understanding of where there was an interdependence between the Ministry of Defence’s requirements as customer and the supply base. In the case of submarines, given that we do not export submarines so it is entirely the MoD as customer, we need to recognise that a nuclear submarine of either type is an incredibly complex piece of machinery which requires the highest levels of skills from the defence industry at the top level of systems integration skills through to a number of vitally important, very small companies who are providing very small numbers—twos, threes, fours—of items of equipment in terms of those items required for the submarines. Those companies, in particular those smaller companies within the

supply chain, do need the clarity over the numbers of pieces of equipment that they will be asked to provide, therefore the number of submarines and the cost, and therefore the affordability, are directly related to those numbers and the frequency with which those orders will come. In the past the Ministry of Defence has had a policy which has been largely on the basis of looking for competition between bids, but in certain sectors it has become increasingly clear to us that competition does not work where the market has reached a point where it is not big enough to support competition and where there is such a small number of suppliers in that market that we have—to recognise our dependence on the supplier staying in the business at all. We recognise that some companies will take the decision to exit this business, if we do not provide sufficient clarity to them to provide us with this equipment. Our worry is that once they leave the market it is going to be much more difficult for us to be able to regain that capability in the future.

**Q219 Mr Crausby:** So back to the question of the French and the US. Why do we expect our boats to be so much cheaper than the French and American submarines?

**Lord Drayson:** I cannot speak to the way the United States or France go about their procurement processes. We can be proud of the job that is done by the defence industry in this country in this area. It really is world class. We have to recognise though that the number of orders which we are placing for submarines is a small number and therefore making sure that we are maintaining the efficiency of the industry to continue to invest to improve efficiency and therefore improve affordability is what we need to make sure happens. The data which we have seen, comparing prices which we have seen on the Astute class of submarines, are what give us the basis to believe that we are getting good value for money from the submarines which we are procuring at the moment.

**Q220 Chairman:** As a matter of fact, do you believe that the US and the French submarines are more expensive than the British ones?

**Lord Drayson:** I do, yes.

**Q221 Willie Rennie:** Is it our defence needs or is it the industry demands or their needs that are determining this debate? I am a bit confused.

**Lord Drayson:** It is absolutely the defence needs which come first. That is something which underpins our whole policy. It goes across defence in that the Defence Industrial Strategy very clearly puts the defence needs first and this is a decision which will be dictated by the decision that is taken based upon the strategic defence of the country. Once that decision is taken, an implementation of that decision needs to take into account the realities of the industrial base which we will acquire should we decide to go down a particular track. The responses I am giving really reflect our understanding of those realities as they face us today.

**Q222 Mr Hancock:** When the Rear Admiral first spoke he talked about seven Astute submarines, subject to affordability and whether we as a nation could afford them. If we cannot afford the seven and we end up with five, then Barrow have a big problem because they would not be able to hold the workforce, would they, for the period of time from the completion of the fifth boat to the start of work on the first replacement Trident? So you cannot have it both ways, can you? You cannot say there is a steady flow and this is all being done to fit in. If we cannot afford seven Astute submarines because the costs cannot be got right, then we have a serious problem in holding onto that expertise anyway, so what is the remedy then?

**Rear Admiral Mathews:** I did not say we could not afford, I said that we had to make them affordable and I cannot order seven submarines just to make them fit in; that is not the position we are in. Where we are, is that industry understand that they have to make these submarines affordable and that is what we are working hard with them to do, to deliver an affordable programme which delivers the right number of submarines to support our defence requirements. That is where we are pushing.

**Q223 Mr Havard:** May I just be clear about this business of skills? What I was getting from you Mr Gould was that what is crucial are the skills necessary to produce a nuclear-powered submarine as opposed to a nuclear-armed submarine. Is that correct? Doubtless there is a relationship here, but how crucial is that difference? Could you have a nuclear-powered conventionally-armed submarine? How different is the cost of that and the skills necessary to produce that than for a nuclear-powered and nuclear-armed submarine?

**Mr Gould:** To produce a nuclear-powered conventionally-armed submarine, which is what the Astute class is, requires very much the same skills as producing a ballistic-missile-firing submarine, but to produce the weapon system for a ballistic-missile-firing submarine is quite different. We need all the skills we have at Aldermaston to produce the warhead for that system and we had the programme of cooperation with the US on Polaris and on Trident to produce the missile and the fire control system for that. The ballistic-missile-firing submarine is the set of skills you need for the conventionally armed submarine plus a lot of others, which is where the warhead technology comes in, but also there are some issues with the design of a ballistic-missile-firing submarine which are different. A complication is that if we continue a programme of cooperation with the US, if that is the decision, the rhythms for the US programme are slightly different in terms of submarine and ballistic missiles.

**Q224 Mr Havard:** But the skills sets and the numbers of people involved in the production of the submarine, just the platform, is not hugely different.

**Mr Gould:** No, not hugely different.

**Q225 Mr Holloway:** The way you guys are talking about drumbeats, it strikes me that you are talking yourselves into the decision that you are going to make eventually. Are you?

**Lord Drayson:** Not at all. What we are doing is describing the situation as it exists in reality.

**Q226 Mr Holloway:** Well that is a powerful dialectic to make the decision to build new ones then.

**Lord Drayson:** Not at all. What we are saying is that if the decision is taken in the future to replace the deterrent, if the decision is taken to replace the deterrent, and if the decision is taken that the right basis for that deterrent should be submarine-based, these are the implications taking into account—

**Q227 Mr Holloway:** So if you decide not to build a successor to Vanguard, what effect does it have on your ability to build, construct, service and operate the rest of your submarines?

**Lord Drayson:** We would have to look then at the requirement which we would need in terms of the attack submarines, the ones which are conventionally armed and the frequency of build of those and we would still be faced with the need to maintain this capability. We could not have the option of stopping building submarines and expecting there to be a submarine building industry ten years down the track and we cannot expect, it is not realistic to expect, that that submarine industry could be re-built again. Therefore, if you want to have the option in the future to build submarines, conventionally armed or not, you have to provide a minimum number of orders and we judge that minimum number to be a drumbeat of about 22 months.

**Q228 Mr Holloway:** That is a very powerful forward-moving argument from both the Navy and from industry to help the Prime Minister, to ease him into making “the correct decision”, in inverted commas.

**Lord Drayson:** I can understand why you are making that point but I do not believe it to be fair because this fundamental point also applies to other sectors within the defence industry. Some sectors in the defence industry have customers apart from the Ministry of Defence, because the technology can be used in civilian applications, say communications, or they have customers apart from the Ministry of Defence because they have export markets. In the particular case of submarines neither of those applies. We then add on the fact that a submarine is without doubt the most complex example of a piece of defence equipment. The level of complexity is to such a degree greater than other systems that it then adds to the challenge which you have. It is because of the particular aspects which are prevalent in the submarine area, but there are other markets within the defence capability where the same applies, that if the Ministry of Defence does not maintain a certain level of orders, then industry declines and then

eventually disappears and it is then not possible for us to source that because we cannot source it elsewhere.

**Q229 Mr Holloway:** Just a final observation then. It would seem to me that the decision as to whether or not renew our nuclear deterrent is in small part considerably influenced by these arguments and not the pure argument as to whether or not we have one.

**Lord Drayson:** The first question that needs to be considered and then answered relates to the defence need; answering that question first. Then the other issues arise out of that once that decision has been taken as to what the defence need is.

**Mr Holloway:** So there will be no surprises when the announcement is made.

**Q230 Mr Borrow:** If it is felt that there is not a defence need for a nuclear-powered submarine to deliver nuclear weapons, the MoD would be faced with the option of allowing the industry to die or placing orders for nuclear-powered submarines that do not carry nuclear weapons, irrespective of the defence requirement for those particular submarines and therefore in the cost equation, should we decide to pursue a nuclear weapon option in looking at different platforms, the fact that we would have to spend a lot of money to maintain the nuclear-powered submarine base would mean that there would have to be a very, very strong argument indeed in favour of looking at acquiring any other platform to use as a base for nuclear weapons. Would I be right in reaching that conclusion?

**Lord Drayson:** If the decision were taken that there was no defence need for nuclear submarines carrying nuclear weapons, then the next question relating to the submarine industry is whether there is a defence need to have nuclear submarines carrying conventional weapons. If the answer to that is yes, then there is a minimum number of submarines which needs to be built in order to maintain that capability. So yes, on that basis you then have to look at the implications in terms of the frequency in the same way. That does apply to other areas of defence where you have these very specific capabilities for which we are the only customer.

**Q231 Mr Borrow:** Following on from the fact that this is an industry for which the MoD is the only customer with a small order book and therefore a very small number of companies involved, one key thing being worked on now, and which is mentioned in the defence industrial strategy, is greater coordination and collaboration between the different companies. How do you think that collaboration and reconstruction are going?

**Lord Drayson:** It is a mixed picture. On the one hand, there are great signs that progress is being made. When we look at the productivity which is being achieved, for example at Barrow, the improvements which we are seeing in the Astute build, the news is good. When we look at the discussions that are now going on within industry, for example between those yards, and the expertise involved in the design and development of

submarines and those yards that are involved in the maintenance and upkeep of submarines, a really good collaboration is starting to develop and what we want to do is to see that accelerated. We have expertise at both ends, what we want to do is make sure that we learn the lessons to design maintainability into our submarines and that is about good communications between the two, so that is on the positive side. On the negative side, we have seen some things recently which have worried us, for example relating to Devonport dockyard and the decision which has recently been taken by KBR which does worry us about the level of engagement which is taking place and this is something which we are very focused on within the Ministry of Defence.

**Q232 Mr Borrow:** Would you have in your own mind a degree of collaboration and cooperation that would be pre-requisite for placing orders for nuclear-powered submarines to replace the Vanguard class?

**Lord Drayson:** We have within the Ministry of Defence a clear strategy, which we call the Maritime Industrial Strategy as part of the Defence Industrial Strategy, how we wish to see industry evolve both in terms of submarines and in surface ships. We have said very clearly that we do expect industry to get on with that evolution, to improve productivity, to deliver an affordable ship and submarine programme and we do expect industry to deliver on that. We have seen some good progress in certain areas; I would say the progress which is being made on the aircraft carrier is an example. However, to answer your question directly, there is an inter-relationship between the affordability and the plan to implement a submarine build programme should a decision be taken and the industry construct that would be needed to do it in the most efficient way. Broadly speaking, that means integration of design with upgrade and maintenance to remove overlap and to make the best use of the skills and the know-how which we have in this country. One of the things we need to recognise is that this is an industry which is considerably smaller than the industry which existed at the time of the Vanguard class design and start of that process and therefore we really do need to see that industry makes these changes to ensure that we have the greatest confidence in the development and build of our future submarines. I would say that it is a mixed picture: some areas offer real positive signs and some where we do think the industry needs to go further.

**Mr Gould:** The real constitution we are trying to get is, rather than a set of three or four companies getting their benefit, their profit and their return from a piece of the industry, building the reactor, building the submarines but not maintaining the submarine, only maintaining the submarine, that actually the industry gets its benefit, as we are achieving with the carrier alliance, from the overall performance of the enterprise, so they pool resource, pool skills and they have the same intent in terms of designing for maintainability and ultimately contracting for availability. If you contract for availability, then you have to have an industrial



enterprise that can take some of the availability risk from us into the enterprise, which means they have to pool design, maintenance and engineering together into a single enterprise. What the commercial construct for that is, is of less concern to me than the management behaviour which you get by having that contracting pattern.

**Q233 Mr Borrow:** What encouragement and incentive is the MoD giving to the companies to achieve what you want them to achieve?

**Lord Drayson:** It comes primarily from the fact that we are the customer, we determine by the way in which we behave the way that industry responds. You get the suppliers you deserve, depending on how you behave as a customer and for us, the incentive comes from us making it clear to industry that there is a connection between the order that we place and the investments and the decisions that they make, so we reinforce positive behaviour. Secondly, having the commercial incentive, so we have the level in terms of the orders themselves but also in the structure of the contract. The breakthrough which the Ministry of Defence has made in these sectors where there is this clear interdependence between the supplier and the customer is coming up with new contract structures which incentivise industry to perform, in other words to deliver equipment, such as a submarine, to time and to cost and if the industry construct does that, it makes an enhanced profit. So you reward through performance incentives for good delivery, that good delivery on cost and time comes from investment in skills and so forth and that is the incentive that you bring.

**Q234 Linda Gilroy:** I would remind members that I have a declared interest in respect of DML in Devonport. Obviously I have had some concerns about the events of the past week, I am not quite sure how clear other members of this Committee will be about what has been happening there Minister, so may I invite you to flesh out a little bit more what you have said about having concerns about the recent behaviour of KBR and the extent to which that reflects on what you have just been describing as to how you achieve the positive behaviour and culture that you have been striving for.

**Lord Drayson:** What I have been talking about is this recognition of an interdependence between the supply chain, the industry and the Ministry of Defence and in the case of Devonport, Devonport is clearly a strategic asset of the United Kingdom, it is responsible for the re-fuelling of our existing Vanguard class of submarines, the maintenance therefore of the UK's nuclear deterrent and I am concerned at the way that the spin-off of KBR, who are part owners of the DML facility has been undertaken recently. The fact is that we expressed to the company, to KBR, our concern that, given the performance of KBR as part of Halliburton overall and, given the importance of DML to the UK in terms of nuclear deterrent, we needed to assure ourselves in the Ministry of Defence that any changes in the capital structure had no negative impact on the MoD and the nuclear deterrent. We

were assured by the company that we would be provided with the financial information to enable us to reach that conclusion before the company proceeded with the IPO and the start of this spin-off process. I was very disappointed to see that the company did not provide that information and has gone ahead with the IPO process. This has significantly undermined our confidence in the company and this was clearly put to the management of the company yesterday. We need to expedite this financial review, but there are serious issues that need to be resolved to the satisfaction of the Ministry of Defence because this is very important to the national security interest.

**Q235 Linda Gilroy:** From the point of view of how this has been perceived locally, where there has obviously been intense interest, they are behaving like an absentee landlord. I wonder whether you could just say a bit more about what the implications of that are for achieving the sort of investment that might be required in the dockyard to meet the continuing safety cases etc.

**Lord Drayson:** This is at the heart of the information which we require to see. This is the financial information which we asked to see before the company went ahead with the IPO process. We do need to see this information: we have not seen it yet. It is very important that we do see it, because we need to assure ourselves that there is the capital structure to ensure that the investment is provided to maintain this very important facility in the future.

**Q236 Linda Gilroy:** Could you finally tell the Committee what options are open to MoD, to the Government, if you do not receive those reassurances and what opportunities there may be in relation to the consolidation of the industry and what skills base?

**Lord Drayson:** We have a number of options. We have a special share in the company which gives us significant rights. We are reviewing those options at present. I must say that we take this very seriously indeed and we are looking at this issue right now; we have taken no decisions at the moment. We have pressed the company and made it absolutely clear that we require this information urgently and we are reviewing the position.

**Q237 Mr Holloway:** I hate to go back but I am not quite clear on the question that one of my colleagues asked about the cost of French or US submarines. Would they be more expensive because obviously you have the very high social costs of the skilled workforce that we have here already? Would it be that you still have significant expense in terms of servicing and maintaining foreign boats if you bought them? Why is it that off-the-shelf stuff would be so much more expensive? What is the reason?

**Lord Drayson:** It would be wrong to characterise a nuclear submarine as something which is off the shelf.

**Q238 Mr Holloway:** We have some common parts at the moment in terms of the re-entry vehicle and so on, so—

**Lord Drayson:** I am not clear about the question.

**Q239 Mr Holloway:** All I am saying is that there cannot be a gigantic difference, if we accept that we are going to have a nuclear submarine, between one made in France and one made in the United States. How is it that a US one or a French one would necessarily be so much more expensive? That is what I am trying to get at.

**Lord Drayson:** Do you want to talk about the differences?

**Rear Admiral Mathews:** We need to be careful that we are comparing apples with apples rather than apples with pears. For instance, the Americans design their submarines for a longer life and they have a more expensive core because it is designed for a longer life. They have gone down a different technology route to get there and we have not invested in that technology. So there are fundamental differences between the US submarine programme and our own. I am afraid I cannot comment on the French programme.

**Q240 Mr Jones:** May I ask something in terms of the Maritime Industrial Strategy? You are quite clear about what the role of industry should be, but how do you actually see the role of you as the customer? This morning we took evidence from trade unions, particularly the ones from Barrow, who were making the point that what was needed there was continuation of work to keep the skills set in place and clearly some of the decisions here are possibly going to lead to gaps in that procurement process for submarine work. How do you see your role in ensuring that industry has the orders there to keep those skills together? Would you consider, for example in Barrow, putting in surface ships to stop any gap in work orders that could actually result just from the process as your drumbeat goes through on the nuclear side?

**Lord Drayson:** We do recognise within the Ministry of Defence, not just in submarines and in shipbuilding but generally, that where we have determined that there is a strategic defence need for us to maintain in this country a sovereign capability that puts on the Ministry of Defence a responsibility to understand what level of work will maintain that capability. So if we decided that a capability was necessary for our defence needs, and there are various reasons why we may have done, as we set out clearly in the defence industrial strategy, then we have to go to the next step, which is to analyse and understand the industry well enough and to get industry to understand our military needs well enough, such that there is a joint understanding with industry of what is a minimum level of business which will maintain that capability. That is not an easy thing to do. That is something which we have been working hard to do, particularly over the last years; we have implemented the Defence Industrial Strategy. So in the particular case of Barrow and submarines, what we have learned is that yes, in the

past, for example when there was that gap which we now, with hindsight, can see was too long a gap between the Vanguard class and the Astute class, that gap was in part filled with surface ship work. Now that certainly helped but we need to recognise that the type of work involved in surface ships, both from a design and manufacture point of view, is qualitatively different from the work involved in submarines and members of the Committee have visited the various yards and you have seen for yourself that they are really quite different. So although in some part you can use work for surface ships, such as, for example, we anticipate that work from the forward surface ship programme will be in part done by Barrow, it does not totally solve the problem for you. You need to recognise that. Notwithstanding that, the issue relating to submarine design and build is only maintained by maintaining those skills at work applied to submarines.

**Q241 Mr Jones:** So how do you do that?

**Lord Drayson:** Then it is about balancing the workload and making trade-offs between the two, given a decision about the defence need. Everything comes from first determining what it is within the equipment programme we decide that we need and how then we can encourage by carrot and stick the industry to right-size itself for that forward equipment programme.

**Q242 Mr Jones:** We were told this morning that it takes nine years to train someone in submarine design and some of the other technologies involved. Clearly, in terms of the investment industry needs to make in that, they need some confidence for their shareholders that you are not going, half way through that nine-year programme, to say you are sorry but you do not really need that. How are you going to give that confidence to the industry that, for example, with submarines—and I accept all you are saying about the difference between that and surface ship work—they know that if they are going to take on apprentices and graduates to get that expertise the work is going to be there over the longer term?

**Lord Drayson:** This interdependence, which has been described by other people as the chicken and egg situation, is that on the one hand it is about the Ministry of Defence providing clarity of the forward programme and then sticking to it, but on the other hand industry then seeing that the *quid pro quo* for that clarity is that industry invests to improve, through continuous improvement, the affordability of that forward programme and not sit on its laurels and take the forward programme without making significant improvements. So we need to see both things reinforce each other and go forward together.

**Q243 Mr Jones:** I understand that but the big elephant in the room which perhaps you do need to talk about is the Treasury. Have you actually got the Treasury signed up to that type of thinking which is committing MoD spending quite a long way into the

future, if you are going to go to business and say you can give them this commitment? Is Treasury signed up to that?

**Lord Drayson:** You have put your finger absolutely on the importance of the Treasury being on board with this.

**Q244 Mr Jones:** That was not the question I asked.

**Lord Drayson:** The answer is yes. The Treasury is rightly concerned at making sure that we are generating best value for money for the taxpayer. This is an iterative process with industry. The Treasury signed up to the defence industrial strategy as a signatory to the defence industrial strategy and the Ministry of Defence is keeping the Treasury fully informed of the process of the programmes as we take them forward.

**Mr Jones:** I should be very wary if I were you, Minister.

**Q245 Mr Hancock:** In your letter that I received today, you talked about the first anniversary of the maritime industrial strategy and your disappointment that the consolidation that you were seeking within the industry had not been forthcoming with quite the speed you had anticipated. That is a fair point and I have heard you talk about it before. You also said that part of the problem there was that the order book from the MoD had never been rosier for the industry than it is at the present time, but that is a very short-term view. Does it not then make it difficult for you to be able to push the price down of say the Astute submarines to an acceptable level which would allow you to have the continuity of the programme that you need when they see very much that they have you over a barrel, very much like Devonport would claim they have you over a barrel over their refitting and refuelling of the submarines?

**Lord Drayson:** I think we have each other over a barrel. We are the only customer that this industry can go to and they are the only supplier that we can go to as the customer, so there is a useful interdependence; someone called it a Mexican stand-off.

**Q246 Mr Hancock:** But do they need you more than you need them?

**Lord Drayson:** We both need each other. It is taking more time in the maritime sector than we have seen in other sectors where there is not that rosy position in the short term relating to orders. Nonetheless, I have seen, as I indicated, some good signs: what we have seen on the aircraft carrier, what we are seeing taking place on Astute. We learned a lot, the Ministry of Defence and industry together, the hard way on the Astute programme, going back to 2003 and we are now in a position to look at the prices for boats two and three based on a real understanding as boat one comes to completion. It is about making sure we get the right limited liability in terms of the risks of the programme in respect of the costs. So we depend upon each other and it is my job as Minister for Defence Procurement to make sure that the Ministry gets the best value for money it can,

consistent with ensuring that we sustain the capability where we have determined that those capabilities are in the defence interest.

**Q247 Mr Hancock:** How could Parliament and the country know that, when we get the White Paper and the preferred option possibly is to replace the Trident boats, we can actually afford it, that the price quoted at the beginning of 2007 is actually going to be a price the nation can afford? The repercussions of not being able to meet that cost would be pretty horrendous for the Navy and probably for the MoD generally. What steps are you able to take, what lessons have been learned? It is obvious from your own words that the industry itself does not accept that they have too much of a responsibility to force the price down?

**Lord Drayson:** I do not accept that. I really have seen a recognition take root in industry, particularly over the last six months, that the Ministry of Defence means it; I really have seen that. We have seen improvements in performance, measurable improvements in performance.

**Mr Gould:** Taking Astute, we have done what we said we would do in 2003, which is use Astute one to re-establish the industry, re-establish the capability to build submarines at Barrow. That has now been done, that has been externally reviewed and the conclusion is that we have actually achieved that, which puts us in a position of knowing that we and the industry understand what a good challenge but a reasonable cost for industry of building an Astute submarine is. I am optimistic that we are close to agreeing prices on two and three. The important thing is to keep that going. So we keep that going through future orders, we have had significant overhead reductions driven by the management at Barrow to demonstrate that they can actually improve the running of the business, we have a much better approach now from Rolls-Royce and associates on how we are going to maintain and manage the nuclear-steam-raising plant throughout its life. They are investing in people, investing in capability, interested in future design changes to make it easier to build and easier to maintain. Indeed we have, with DML, the management company in Devonport, some good cooperation starting in how we can build on what we are doing with Rolls-Royce in terms of reactor maintenance into submarine availability contracting. The important thing is not to lose that momentum. We have the momentum moving in the right direction and the only way we can assure that the price that we now understand is the right sort of price for these submarines remains at that level is to maintain that activity and that engagement by ourselves and by the key companies in the supply chain.

**Q248 Mr Hancock:** Is there a price that is too high or is the decision to have a nuclear deterrent irrespective of that?

**Mr Gould:** There is a price that is too high and there is a price that is too low. A question was asked previously about whether we are trying to drive the cost down below where it is reasonable to have it in

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terms of comparison with the US and France. There is a level of cost below which you simply cannot do this kind of work.

**Q249 Mr Hancock:** I can understand that. But there is also a cost that the country cannot afford, is there not?

**Mr Gould:** Yes, there is.

**Q250 Mr Hancock:** The question really is: can we afford not to have a deterrent and can we afford not to pay for these submarines?

**Mr Gould:** This is about industrial skills and capability.

**Q251 Mr Hancock:** That is how you get to the price though, is it not?

**Mr Gould:** Yes. What is the right level of price for this industrial capability for these products? It is not for me to decide whether or not we can afford that. That, with respect, is more for you.

**Q252 Mr Hancock:** I would remind you that I did raise the issue about the 30-year lifecycle and you changed your mind then because I was actually quoting from the Strategic Defence Review of 1998, paragraph 62, where you said it was 30 years. The Rear Admiral said he was sure it was 25. You changed your mind. So the price for the existing boats that we have has decreased because we are going to have to pay now, if we extend the service, to keep them in the water for the period that they were originally designed for.

**Rear Admiral Mathews:** We promised a note on that and my understanding is that the original design life set at the staff requirement was 25 years, so I am unaware of where that figure has come from. We will get you a note on that. What we are facing here is that this is a long-term business, long-term time constants and therefore we need long-term decision making. Where we are with industry is that they have recognised that, the route that we went down with Astute was not the right way because we set off with competition and that has led to a set of behaviours which positions MoD and industry in not the best collaborative way. In looking at the future programme, we have to recognise that we need to work together here. We have downsized the industry, we have downsized MoD, we have a limited set of skills between us and the only way we are going to do this is by working together. So industry have already started to grasp that and they have done a number of things. Mr Gould has already talked about taking out the cost of the overhead at Barrow, but they are also looking at how to reduce costs in building Astute and we have made some significant cost reductions in the future programme. At DML we have taken out quite a lot in terms of the nuclear overhead charge; we have had a programme there called the Submarine Upkeep Improvement Programme which has taken out significant amounts of money from the annual expenditure there and with Rolls-Royce we have changed the relationship into a performance-based contract. So we are moving ahead here with industry. What we have not

achieved yet is joining those three up to work collaboratively together with us and that is where we need to go next.

**Q253 Mr Hancock:** To get to that point on the Astute submarines did you downgrade the specification of the next two boats as opposed to the first boat? You say you are getting the costs down. I want to know whether in getting the costs down all the give has come from one side or have you, at the Ministry of Defence, degraded our spec in any way?

**Rear Admiral Mathews:** We have looked at what we can do in terms of flexibility of specification, yes, and requirement. What we really need, because we have to make these boats affordable. So yes, there have been some changes in requirement, but the Key User Requirements are still there and we intend to meet those.

**Mr Hancock:** It would be interesting if we could know what they were and what the costs were.

**Q254 Chairman:** Can you let us have a note about what the reduction is please?

**Rear Admiral Mathews:** Yes, we can.

**Q255 Linda Gilroy:** We have talked quite a lot about the significant behavioural and structural improvements that you have been looking for, but in the event that the UK opts for renewal of a submarine-based deterrent, how are you preparing to manage a project of the likely scale of the Vanguard's successor?

**Lord Drayson:** If that is the decision which is taken, we start from the good position that we have the infrastructure and the know-how in place for the existing system and we have the recent experience, as we have discussed this afternoon, of the Astute. What we have to do though is also recognise that we are going to need to recruit into the project team additional people with expertise. We judge that in that we shall be competing with the civil nuclear industry in some areas, but we judge that it will be possible for us to do this. We also take into account that, notwithstanding that we have been operating a system which is submarine based for some time, we take into account the challenge that the size of the industry we have today is considerably smaller than the industry that we had at the start of the Vanguard programme because of the number of submarines that were being built at that time compared with the number of submarines that we are building now. Notwithstanding that, we are confident. Where does that confidence come from? It comes from initiatives which we have been putting in place within the Ministry of Defence to strengthen the Ministry of Defence's general competence across defence procurement in terms of project management, the range of skills that we need in terms of commercial project management skills, in terms of defence procurement generally. All of these are as applicable to a project such as a major submarine project as they are to other projects in addition to the skills which are needed which are peculiar to a nuclear submarine.

**Q256 Linda Gilroy:** When there were Polaris and Trident, dedicated organisations were maintained to manage the project and those no longer exist; there have been big changes in procurement of course since then. Can you just say a bit more? Will it be an IPT, will it be a special model of managing procurement, if it goes ahead? You have said that you are confident that you will find suitably qualified and experienced staff, but where will you find them to manage a project on that scale?

**Mr Gould:** It is clearly a massive enterprise doing something like this, which is why when we did Polaris and then Trident we had special organisations to do that. In many ways, those were precursors of IPTs because they were big organisations which brought all the necessary internal skills together to manage over a long period of time an extremely complex and challenging programme. That is actually what IPTs do; it is a question of scale more than anything else. The difference is that quite a lot of the things that we did in-house, especially during Polaris but also during the Trident programme, we do not now do in-house. What we shall have to do is actually recognise this is a national enterprise and what we have to create in terms of an IPT is something that is much more like the carrier. I am not talking about commercial arrangements but the behaviours where we bring ourselves and people from outside industry together into a joint team to execute a programme of this size. What is absolutely clear is that, if you are going to execute a programme of this size, you must make sure you resource it properly, not just in terms of money but in terms of the internal skill. By "internal" I mean people we recruit or bring in on secondment from outside industry as well to resource the programme properly.

**Q257 Linda Gilroy:** So accepting that no decision has yet been taken, but given the likely in-service date of the potential Vanguard successor, should there not be at least some sort of shadow project management team set up and running already? To what extent does the need to have a decision relate to having that in place?

**Mr Gould:** It clearly helps to have a decision if you are going to set up a project team. Because of what has been happening on investigating options and so forth and because of what is being done on the nuclear programme generally, quite a few of the elements of that sort of team are already in existence, but clearly we will have to grow very considerably to execute a programme of that size.

**Q258 John Smith:** Just responding to the exchanges this afternoon, is it not the simple truth that if you look at the skills bases and retaining the skills capability, the moment we put in a defence industrial strategy that we are going to retain sovereign skills in submarine building, then we effectively commit ourselves to a replacement of Trident which is submarine based?

**Lord Drayson:** No, I do not accept that.

**Q259 John Smith:** Or alternatively we are going to find a use for nuclear-powered attack submarines, whether we need them or not.

**Lord Drayson:** No, I do not accept that. Right at the start of the Defence Industrial Strategy, it says that whereas in the past we have had an industrial policy for defence, that policy set out principles by which we would take procurement decisions but it did not put them in an order of priority. The Defence Industrial Strategy, for the first time, put the decision framework in an order of priority and it said that the first priority will be the defence need. So what comes first is what the country judges its defence need to be in terms of strategic nuclear deterrent. After that decision has been made, what is the country's defence need in terms of submarines? From that, given that decision, you are then down to what it is that needs to be done to make sure that the country has the capability to implement that.

**Q260 John Smith:** But it says that for the foreseeable future the country will retain the sovereign capability. In all this discussion about the skills and the so-called drumbeat, surely the only conclusion you can draw is that if you do not replace a submarine-based Trident system then you will not be able to maintain that continuity and that sovereignty.

**Lord Drayson:** You have to put this in the context that the Defence Industrial Strategy identified those areas of defence equipment that the defence need determined we needed to have a sovereign capability to fulfil from this country. To discriminate between those areas of defence equipment where we had satisfied ourselves that we would be able satisfactorily to procure those items of equipment outside the United Kingdom and those pieces of equipment where we have judged that it is not possible or not in the defence interest of the country to procure them outside of the United Kingdom, we said that there was a relatively short list, and we spelled them out in the Defence Industrial Strategy, of those items of equipment which we do not believe it is possible for us to procure outside the United Kingdom and that is what we mean about sovereign capability. Therefore, if one requires that equipment as the defence need, and it could be for a particular piece of equipment that we decide we do not have that defence need, in which case we do not have the need for that sovereign capability. It is important for us to be very clear the order in which this decision is taken. It underpins the whole approach to our defence policy with industry.

**Q261 Mr Jones:** I accept that the defence need comes first in any of these debates and that is one of the refreshing things in the Defence Industrial Strategy. However, there is also a crunch date coming there for industry in terms of their investments, in terms of skills and knowing when to ramp up and what long-term needs are. When is that crunch date for industry then in terms of links to the defence need?

**Lord Drayson:** The crunch date with regard to what?

**Q262 Mr Jones:** A date by when decisions on the submarine capacity building, for example, in this country need to be taken in terms of investment in skills. There is no way you are going to have BAE Systems and others just waiting for the next five years, just saying it might be next year or it might be the year after when these decisions are taken. When is that crunch date for that capability, because the alternative is that they turn round and say they do not want to be in this business, it is not worth their while being in it.

**Lord Drayson:** In terms of making sure that if the decision is taken that we need to replace the nuclear deterrent and if the decision is taken that that is submarine based, then to ensure that we have the capability to deliver that in time for when the existing submarine-based deterrent comes to the end of its life, then we need to take a decision on that next year.

**Q263 Mr Hancock:** At least three of us in the room have a direct constituency interest in the outcome of the naval base review. I am interested to know how much of an issue the replacement of the deterrent is in reflecting how that decision is going to be made, particularly considering the suggestion that Devonport have an irreplaceable opportunity here when it comes to their role in servicing these boats. I really want to know whether the naval base review is being done on a fair cost basis of what can be saved, what can be achieved and the good of the Navy, or is it simply being done to facilitate KBR and DML being able to service nuclear submarines in the future.

**Lord Drayson:** I can be very clear on that. The naval base review is being carried out very clearly to address what the needs are that the Royal Navy has going forward from here in terms of the maintenance and upkeep of the fleet. It is not about those industrial considerations that you are talking about. It is what it is that we need in terms of the maintenance of the fleet, to match that with those needs and to make sure it is then done as efficiently as possible, consistent with having an industry which can be healthy and can prosper to meet those needs.

**Q264 Linda Gilroy:** I would just follow on from that by asking whether there is some relationship nevertheless between being able to drive out costs in both areas, coming from the synergies that can be obtained by co-locating certain activities.

**Lord Drayson:** I am sorry; I do not really understand the question.

**Q265 Linda Gilroy:** I took from your answer just now that you were saying that there is no relationship between the two. Perhaps I could very simply ask whether there is in fact a relationship because there are savings to be made that can be achieved by co-locating activities on submarine work next to naval support work.

**Lord Drayson:** You are absolutely right that there is an inter-relationship in that we have existing facilities around the country which are carrying out various parts of the supply chain relating to submarines. Those facilities are also connected in terms of where they are located on a naval base and therefore there is an impact across the two. It is important for us to be clear as to the purpose of the naval base review which is a separate objective to the objective which we have in terms of the maritime industrial strategy but, being smart about joined-up government is important. The way in which we manage those two is that we understand that inter-relationship and we manage it effectively.

**Q266 Willie Rennie:** Although Rosyth does not have a naval base I shall not turn down the opportunity of asking a question. How radical are you prepared to be with this naval base review?

**Lord Drayson:** Radical. It is absolutely right for us to have a proper look at what the Navy needs, how we can most efficiently provide that to the Navy and how we can do that in a way which is, firstly, taking into account the needs of our people in the Royal Navy in terms of where base porting is, how the fleet operates, what it is that makes the Royal Navy as effective a fighting force as it can be and how we can make that as sustainable as possible and then how we can do it in a way which allows us to develop modern facilities in which industry is incentivised, because of the environment which we create, to invest and to maintain into the future. What we want is something which is for the long term, delivering absolutely what people need within the Royal Navy to enable them to do their job properly and, secondly, that is sustainable for industry so that industry can make a healthy profit in working to supply these services to us but consistent with providing real value for money in the way in which it does it.

**Q267 Willie Rennie:** Could it involve the closure of one of the Navy bases?

**Lord Drayson:** We need to look at all of the options and it would not be right to pre-judge that by saying anything is off the table. We are looking at all of the options. You asked me directly and I did give a straight answer: radical. That does include looking at the potential closure of one of the Navy bases, but we have not made any decisions about that as yet.

**Q268 Chairman:** Can we move on to Aldermaston? It has been a recurring theme of the evidence session this afternoon that in essence the decision has already been taken. If you look at newspaper reports of the Prime Minister talking to the Cabinet a couple of weeks ago about the strategic nuclear deterrent, all the implications are that he has made his own private decision even if there has been no formal government decision. Is it not a bit unpersuasive to say that the Government have just not made up their mind?

**Lord Drayson:** No. It is absolutely right for me to set out the situation as it exists, which is that we are now looking in detail at the options and no decision has

been taken at present. I can understand why people look at the Aldermaston decision next year and I do believe that in some quarters people have become confused about what the Aldermaston investment is for. I can understand where the worry has come from and I shall ask Nick to give some more detail on this. In essence it is very important for us to understand that the investment in Aldermaston is about ensuring that we make the proper investments in both the infrastructure and the scientific capability of the country to ensure that we fully understand, given the developments which we know take place in terms of nuclear physics and the technology which is available to us, that we invest in those tools as they develop, for example computational power, to make sure that we fully understand the existing nuclear deterrent, that we are doing everything we properly need to do to characterise it, to ensure that it is effective and to ensure that it is safe. The investments in Aldermaston are into those facilities, the Orion laser project is all about using laser technology to make sure that we fully understand the hydrodynamics within the warhead because under the treaty which we have signed we cannot carry out tests to ensure, as the warheads age, that they are operating correctly. We therefore have to do the physics, the computational analysis to ensure that they are. The investment which we are making in Aldermaston, both in terms of people and facilities, is addressing that issue.

**Q269 Chairman:** I wonder, when Mr Bennett expands on that, whether he could possibly tell us why this could not have waited until there was a formal decision on the strategic nuclear deterrent, which seems to be any moment now.

**Mr Bennett:** Because the investment at Aldermaston is unrelated to decisions on a future strategic deterrent. The work which is in place there is essential to maintain the current deterrent. If we wish to maintain the Trident warhead through until the mid 2020s then the work which is in place at Aldermaston underpins that; it underpins that entirely. It does not underpin currently a future deterrent.

**Q270 Chairman:** But it underpins that, so far as I can remember, according to Dr John Reid when he was Secretary of State, and it provides for the future level of skills needed in order to keep our options open to renew the nuclear deterrent.

**Mr Bennett:** Yes, that is quite correct. The way in which we go about ensuring ourselves of the surety and performance of the current stockpile is what we call science-based surety. There is a programme, as the Minister has said, which puts in place across a number of strands, hydrodynamics, plasma physics, materials and high-powered computing, the means of understanding the way in which the current warhead works. You need all of that and if you were in the future to wish to develop a new warhead, then you would need the skills that will produce to allow you to do it; in essence the capabilities that Aldermaston will be putting in place will allow us,

should we ever wish to, to develop a new warhead, but they are absolutely essential to the maintenance of the current one. The two are actually indistinguishable.

**Lord Drayson:** The important point is that the existing laser, for example, that we have been using up to now to enable us to replicate the conditions to be able to do this work to ensure the warhead, is 25 years' old. You can imagine the way laser technology has moved in 25 years, therefore we need to replace and update this laser. It is a very major investment and whether or not we make a decision to replace the existing deterrent, we have a responsibility to make sure that the existing deterrent we have today is safe and is effective in the context of the Nuclear Test Ban Treaty and therefore we have to make this investment.

**Q271 Chairman:** So suddenly we introduce a brand new Orion laser and you can understand how this misunderstanding that a decision has already been taken might arise, can you not?

**Lord Drayson:** In describing this area in my introduction, I absolutely understand the concerns people may have, which is why it is very important for us to explain very clearly what this investment in Aldermaston is for.

**Q272 Chairman:** What do you think the Chancellor of the Exchequer meant in that speech back in the summer when he said we would retain the nuclear deterrent?

**Lord Drayson:** I think the Chancellor was—

**Q273 Chairman:** Was he repeating manifesto policy?

**Lord Drayson:** It is the policy of the Labour Party, on the basis of which we fought the last general election in terms of the manifesto commitment.

**Q274 Mr Havard:** We had some evidence this morning from Greenpeace and they say that upgrading Aldermaston could lead to a resumption of nuclear testing by another route using exotic technologies and its access to US expertise and facilities to develop a new weapons-testing programme and that the purpose of the current investment is in fact to develop a new weapons programme. That is what they say you are doing at Aldermaston. One of the things I asked about earlier is this idea of a virtual arsenal, in other words you do not have the boat, you do not have the missiles, you retain the capability to revitalise the nuclear programme should you wish, some would say like the Japanese are and they decided yesterday not to do that in response to North Korea. I mention that now because it seems to me that what Mr Bennett is saying is what I understand the position to be and what was actually declared when you made the investment recently, which was to say that you would keep not only questions of current safety, but the minimum capability to design a successor, should it be required, and keep all the options open. So in terms of the skills there are at Aldermaston, there are all the skills required to do all of these things along this continuum. Should you wish to go

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to a position where Aldermaston, like Porton Down, which does not produce aggressive weapons in terms, say, of biological weapons, but is there to defend against them, should you wish to use Aldermaston more for a defensive process or a verification process and looking at those sorts of aspects, all of those skills are there because you need the same skills to do that end as you do to develop a new programme. Is my understanding right? So it is truly a case that Aldermaston is almost, as you said at the start, separate from the argument.

**Lord Drayson:** I think that is right. We have a responsibility as a nation to make sure that we are doing everything we need to do to ensure the safety and effectiveness of the existing nuclear deterrent and that requires an investment in Aldermaston in terms of skills and facilities and for us to invest to upgrade those where we have the potential to use developments in physics and computer science to do so. That is the basis upon which that decision was taken, the reason it was taken, but it is absolutely true to say that those skills and that know-how does have relation to the capability within this country in terms of the potential ability in the future should it be required to design a new nuclear warhead. We have to take that decision relating to the maintenance separately anyway.

**Q275 Mr Hancock:** I agree entirely with that concept that you have to test the existing warheads to be sure of their capability, their suitability and their safety. You would have had to have planned some time ago to bring these current acquisitions into play and I should be grateful if you could explain to me over what timeframe these decisions were made to buy this new equipment that you should have had, that you were thinking about, when you started to adjust the warheads in the late 1990s?

**Mr Bennett:** The programme that we put in place was started by the previous Chief Scientific Adviser some three and a half to four years ago and that led to the establishment of the current programme round about two years ago. Up until that point we had been satisfied with the process that we had there, but we were reaching a point where the majority of the facilities at Aldermaston were over 50 years' old and we were entering a regulatory regime where we were going to need either to refurbish those or replace those or we would be unable to keep those going. This is not something which came upon us suddenly: we had reached the point where finally we had to do something about it otherwise we would have found ourselves in a position where we would not be able to maintain the current programme.

**Q276 Mr Hancock:** Are we talking about the facility or the kit inside the facility? You said that the facility was now 50 years' old, but that is the organisation itself, is it not? We are talking about you having in place equipment to test the existing missiles which are now currently on boats at sea, the UK's deterrent. I am interested to know when the decisions were taken, how it was agreed and how much it cost to finance the upgrade of that to carry out that same process.

**Mr Bennett:** I am sorry, but I am still not quite clear as to the exact question.

**Mr Hancock:** I want to know when and how much it cost. When were the decisions made? We heard this morning that a lot of the investment in Aldermaston was to re-establish the buildings, that some of those needed a lot of . . . and I entirely accept that. I want to know about the specific equipment which has been purchased or is in the process of being purchased. When was that decision made?

**Chairman:** Are you talking about the laser?

**Q277 Mr Hancock:** The laser and—

**Mr Bennett:** Europe's largest computer. That was taken in 2005. That was when the programme was approved by Ministers.

**Q278 Mr Hancock:** Was there a plan before that?

**Lord Drayson:** Yes.

**Mr Bennett:** Yes, there was.

**Q279 Mr Havard:** It followed through from the decisions made in 1998 as I understand it. That is what I am trying to establish. Aldermaston is required to dismantle things as well as build things. It is their role to keep things safe in the interim. It has to do all of these things. Even if you decided to junk the whole process tomorrow, you cannot take it down to the dump, can you? You have to do something with it, so you require these skills to do that. In a sense the institution of Aldermaston might be capable of doing one and all of these things and some might be more desirable than others but nevertheless it has to be capable of doing them all and therefore is almost coincidental, though related, to the decision about whether you are going to continue and develop. Is that correct?

**Lord Drayson:** You have made a very important point, which is that the need would still be there. Even if a decision were taken to dismantle the nuclear deterrent we have a responsibility to the country to do that safely and we have to have the expertise and capability to do it. That capability would depend upon Aldermaston and we have to make the investment to ensure that the know-how and the capability are there and up to scratch. That is why that investment is needed. Whatever decision is taken about the replacement of the deterrent or not we do need to have that capability at Aldermaston.

**Q280 John Smith:** Are you concerned about the closure of the physics department at Reading University which was announced yesterday given the number of recruits you take?

**Lord Drayson:** Speaking more generally, the number of physics departments which have closed in the country is a concern to us. This country depends upon having a significant and growing pool of scientists and engineers, physicists, chemists and so forth, therefore we need to look at the way in which we encourage young people to want to go into these disciplines and then make sure that the support is there for them. We have a number of other sources of physics graduates apart from Reading, but it is



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true that we believe it is a pity that the physics department at Reading has closed. It is not affecting us in a dramatic sense, but speaking generally, if I may.

**Mr Gould:** As I understand it, recently recruitment of physicists has not actually been the main source of difficulty in recruitment at Aldermaston. Some of their other disciplines have been more challenging.

**Q281 Chairman:** What skills are most at risk and hardest to find? If a civil nuclear programme is pursued, what will happen to skill retention at Aldermaston?

**Mr Bennett:** It is interesting that the most difficult skill we have to recruit at Aldermaston is actually project management. In terms of managing a significant infrastructure programme and delivering that to time, bringing that in has proved something of a challenge and we have covered that by Aldermaston doing a partnership deal with a project management specialist company while we continue to try to grow and develop those skills. Across the rest of the organisation it is actually extraordinarily healthy and retention rates are significantly higher than the industry average; a large number of people queuing up to apply and trying to join the organisation.

**Q282 Chairman:** Would the civil nuclear programme drain skills away from Aldermaston?

**Mr Gould:** There might be some impact, but actually it is a very different operation. The civil nuclear programme being run by the power generation companies will use what is now pretty mature technology: third generation reactors are mature in terms of their design. We are really talking about engineering and not the kind of physics which goes on at Aldermaston. There might be some overlap,

some competition for disciplines, but actually there is not really a great deal of pull to the civil programme from Aldermaston.

**Mr Bennett:** We should be clear that it is not just physicists either. Across the materials and the computing and other fields a significant number of other engineering and scientific skills are required, so please do not just focus on physics.

**Q283 Mr Havard:** I am trying to concentrate on the functions it is capable of doing. The question of what it is doing and what it would be expected to do or not and how that relates to treaty obligations and other things is a separate but related set to questions and at some point we do have to get into that, because we have assertions made that some of it is not consistent with . . . That is not for today. As far as the actual facility itself and its capabilities and skills are concerned, we have cleared that issue. You would require it whether you were doing away with it or developing it.

**Mr Bennett:** You would.

**Lord Drayson:** May I make a general point that it is not just in this area? We are seeing a real pressure on project management skills. The level of growth taking place in the country, the projects, major infrastructure projects which are taking place, things like the Olympics and so forth, are having an effect in terms of the availability of top level project management skills which, along with top level systems engineering skills, are two areas of capability where we need to do more in terms of the development of numbers of graduates in the country.

**Chairman:** Thank you very much indeed for that evidence session; it was most useful. It was most helpful of the Ministry of Defence to come along and give evidence today.

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# Written evidence

## Memorandum from BAE Systems

### SUMMARY

BAE Systems Submarines is the UK's centre of excellence for the design and build of nuclear powered submarines. The BAE Systems' evidence presented in this memorandum is specifically concerned with the sustainability of the UK's ability to design and build nuclear powered submarines, rather than with the wider issues about renewal of the nation's strategic nuclear weapons capability. The UK's present strategic nuclear deterrent capability (Trident) is carried in a fleet of nuclear powered submarines (the Vanguard class), and a new class of nuclear powered submarines could offer the preferred platform from which to deploy any successor system to Trident.

The Submarine enterprise has faced significant challenges in sustaining this capability—both within the Submarines business itself and within the supply chain. The capability is very fragile. BAE Systems is working with MoD and the supply chain to understand the challenges and to establish measures to ensure that capability can be sustained.

The capability to design and build nuclear powered Submarines is dependent on sustaining a complex range of key and unique skills. Suitably qualified and experienced design, engineering and production staffs are required for the safe and efficient execution of nuclear powered submarine programmes. These skills can only be sustained by work on real submarine projects. Surface warship work, for example, can provide some very important assistance to the effective utilisation of facilities and overall skills, but cannot by itself sustain those skills that are specifically needed for nuclear powered submarine work.

It is the BAE Systems view that sustaining the required capability and skills is critically dependent on establishing and maintaining a regular drumbeat of nuclear powered submarine production work—a boat every 22 months is considered the minimum necessary drumbeat.

In addition, to sustain the core specialist nuclear powered submarine design and engineering capability, BAE Systems believes that there should be no significant delay to the start of design work on a future submarine with assumed delivery of around 2024.

### INTRODUCTION

1. BAE Systems Submarines, based at Barrow-in-Furness, is the UK's centre of excellence for the design and build of nuclear powered submarines. BAE Systems Submarines is currently engaged in the design and build of the first batch of Astute class SSNs (nuclear powered attack submarines). The business employs c 3,500 people directly. Approximately 50% of the prime contract value for a nuclear powered submarine is subcontracted to the supply chain; the top 10 companies together with BAE Systems account for c 80% by value of a nuclear powered submarine.

2. BAE Systems Submarines has also had a history of designing and building conventionally powered submarines, but the last such boat was completed in 1989, and the business has no current conventionally powered submarine design available. The business has also been engaged in design and build of surface ships for the Royal Navy (eg HMS Albion, Bulwark, Ocean), and anticipates having an important role on the UK's Carrier programme.

3. The Astute Class of nuclear powered submarines is currently under construction by BAE Systems Submarines acting as Prime Contractor. The target for the launch of the First of Class boat is June 2007, followed by Contract Acceptance in November 2008. BAE Systems Submarines is responsible, as the Prime Contractor, as the submarine builder and as the system-of-systems integrator, for ensuring achievement of the performance and programme requirements stated by the MoD Customer.

4. The modern submarine is required to deliver multiple capabilities: stealth and covertness; endurance and sustainment; reach and poise; the ability to insert Special Forces and to deliver weapons. All of these capabilities are inherent in the design of the current first batch of the Astute Class. However, further developments will be required, to keep pace with technological advances and the increased sophistication of potential opponents, for any future submarine design, particularly in the SSBN role (nuclear powered ballistic missile firing submarine).

5. This will demand the imaginative insertion of new technology (for example the use of Open Systems Architectures to both reduce procurement costs and provide protection against obsolescence) and the better utilisation and management of both design margins and space within the high density arrangement of a nuclear powered submarine. Opportunities for achieving this are already being studied and it is clear from the ideas being generated to date that there are good prospects for delivering the capability advances that are likely to be sought by the MoD.

6. However, it is not capability alone that is needed. The second key characteristic is affordability. This has rapidly become, and will continue to be for the foreseeable future, a dominant theme. It is not only Unit Production Cost, but the total Cost of Ownership that must be made affordable.

7. BAE Systems Submarines is determined to continue to nurture and develop the existing submarine engineering and construction capability (facilities and expertise, both within BAE Systems and in the supply chain) and to build on recent successes on the Astute programme. The overriding intent is to deliver affordable submarines to the Royal Navy within a sustainable business environment.

8. The need for this was fully recognised in the Defence Industrial Strategy paper published by the MoD in December 2005, from which the following relevant points are extracted:

- (a) “The DIS will promote a sustainable industrial base, that retains in the UK those industrial capabilities needed to ensure national security”;
- (b) “It is a high priority for the UK to retain the suite of capabilities required to design complex ships and submarines, from concept to point of build; and the complementary skills to manage the build, integration, assurance, test, acceptance, support and upgrade of maritime platforms through-life”;
- (c) “For the foreseeable future the UK will retain all of those capabilities unique to submarines and their Nuclear Steam Raising Plant, to enable their design, development, build, support, operation and decommissioning”;
- (d) “MoD and industry must demonstrate an ability to drive down and control the costs of nuclear submarine programmes”;
- (e) “There are a number of specific key maritime system capabilities and technologies which we should retain onshore, and the ability to develop and integrate into platforms complex maritime combat systems is also a high priority”.

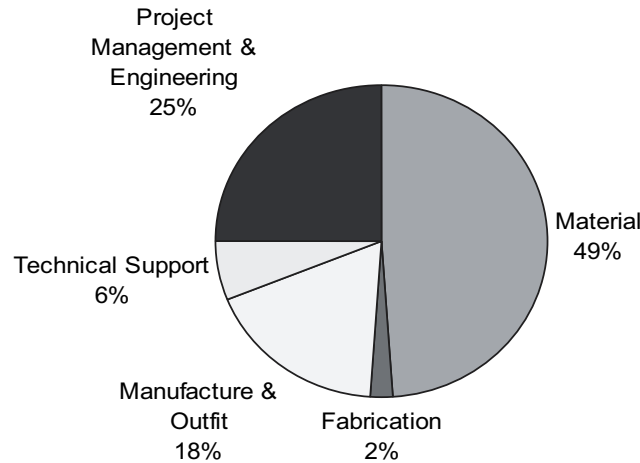
9. The “suite of capabilities” that is crucial to the successful delivery of nuclear powered submarines to the RN includes the development and maintenance of:

- (a) Systems Engineering (requirements, acceptance, configuration management, embodiment planning etc) and Systems Integration capabilities ie the ability to ensure that a complex product such as a submarine can be designed as a coherent entity, and that the individual elements can be integrated to deliver the required capability.
- (b) Submarine specific expertise. This includes: naval architecture, hydrodynamics, structures, reactor plant, combat systems, weapon handling and launch, platform systems (propulsion, energy provision and distribution, heat management, life support, habitability etc), signature management (acoustic and non-acoustic), safety engineering (nuclear, ship, munitions, environment), marine engineering, design for production, design for through-life support, procurement, manufacture, construction, test and commissioning, programme management.
- (c) Computer Aided Design skills. The detailed design of a nuclear powered submarine is very dense; space is a highly valuable and important parameter and considerable precision is required for equipment and system placement, particularly where there is extensive use of modular build (see below). Some hard lessons have been learned during the Astute Project that will form valuable experience for future First of Class design work. Computer tool selection needs to be right (supportable for the long term; customised for the specific industry ie shipbuilding; operator friendly with the required functionality—ease of initial training and upskilling; speed of use).

#### AFFORDABILITY

10. Nuclear powered submarines are very complex products. There is a “Golden (Equilateral) Triangle” of activity: design; procurement from the supply chain; manufacture and build. These are all mutually supportive and entirely interdependent activities; synchronicity of the maturity of information is hugely important for taut cost and programme management, particularly where a degree of concurrency is necessary for ensuring that the Customer’s demanding operational timescales are met. Another relevant factor is the fact that the First of Class boat is effectively the prototype. Safety engineering is a fundamental part of the design process; a cost effective and “adequate and sufficient” safety case (consisting of claim, argument, and evidence) has engineered features demonstrably meeting well structured and carefully determined “safety functional requirements” early in the overall process. Accepting that, for any future platform, a degree of Design & Development (Engineering effort) will be required, Unit Production Cost is predominantly driven by equipment procurement and construction costs as shown below.

### Astute Boat 1 to 3 Total including Design and Development



#### EQUIPMENT PROCUREMENT COSTS

11. The majority of the acquisition and through-life support costs are determined by the supply chain, which has become highly bespoke over the last decades. Almost all of the acquisition costs have now been expended for Astute Boats 1–3. There are some opportunities for improvements for Boat 4 (although some long lead orders have been placed) but the proposals which affect procurement costs that follow are mostly for the later Astute Boats. These should lead into (and thus de-risk) any potential SSBN Successor.

12. Prior to construction of the Vanguard Class, there was significant investment by the MoD in ship systems, propulsion, etc. However, in the recent past, strategic R&T investment has been targeted mainly at increasing combat capability (primarily in improving Combat System effectiveness). Investment now needs to be targeted at both capability and affordability across the whole submarine design, including propulsion and platform systems.

13. The necessary approach to cost reduction is:

- (a) Simplification (the “Lean Design” concept) at all levels ie capability→requirements→standards →design solution→support arrangements. The overall theme is to continue to meet the essential capability requirements whilst reducing complexity and the bill of materials (parts count, etc) and thus also reducing the maintenance requirement (leading to increased through-life affordability and availability).
- (b) Appropriate use of equipment and technologies in use in other related industries or environments—demonstrable performance, better resilience to obsolescence, larger customer base to share costs etc.
- (c) The greater utilisation of automation, with the purpose of matching the human input to the skills of a reducing number of operators and addressing human reliability issues whilst recognising that this is a warship that operates in a demanding environment and is purposely put in harm’s way.
- (d) Ensuring that the standards (design, manufacture, construction) chosen reflect what is actually needed for the duty to be performed, neither too high nor too low (both are significant cost drivers) either initially or subsequently. Constructively challenge traditional thinking.
- (e) Pro-active and strategic partnerships need to be developed with key suppliers and the MoD Customer to enable the supply chain to be managed better for the long term. For much of the supply chain, some current elements of which are exhibiting marked fragility, the submarine enterprise represents a very small percentage of their customer base, with the result that, increasingly, we have wanted to buy specialist components and equipment that no-one else in the general market place wants. We need to recognise that, where the submarine design *inevitably* requires specialist components, then the strategic partnership must include the lower levels of the supply chain that supply such components. Where specialist components are not *essential*, efforts should be made to engineer them out, in such a way that the necessary capability, safety and operability are retained. Developing strategic relationships across the supply chain can also contribute to this aim.
- (f) Design to enable through-life support and upgrades to be introduced at minimum cost.
- (g) Establishment of appropriate commercial frameworks that incentivise the above.

## CONSTRUCTION COSTS

14. In the past two years productivity improvements have to date resulted in a 22% reduction in man hours in the construction plans for Boats 1–3 with the prospect of more to come as a result of ongoing improvement initiatives. This is being achieved through items such as the following:

- (a) Adopting “Lean Manufacture” techniques such as “Value Stream Mapping” in the Pipe Shop, fabrication areas etc. to improve process work flows, and thus reduce level of effort and to shorten lead times.
- (b) Progressively making much greater use of modular build. The Main Propulsion Machinery Package, used in the build of the Trafalgar and Vanguard Classes, has been supplemented by three other large modules on Astute—the largest of these, the Command Deck Module, weighing in at approximately 250 tonnes. Nine major modules (and many smaller ones) will be used on Boat 2, and yet more on Boat 3.
- (c) Use of “Vertical Outfitting” to improve accessibility. Initial outfitting is now done with the pressure hull units placed in the vertical position. Specially designed platforms, themselves modular in construction, enable features, pipe systems, equipments, etc to be installed more easily and safely, whilst work can continue on the other side of the hull without interference.

## OVERALL COSTS

15. A performance management culture has been created, and continues to be developed, throughout the workforce under the auspices of an extensive programme of Organisation Development that includes Leadership Development, Trade Union partnership activities and work on a Submarines Competency Framework. The need for appropriate incentivisation through Reward and Recognition is also important and in 2005 an Incentive Bonus Scheme against specific business performance objectives was put in place for all non-executive personnel. Because of its success, this is being repeated, with refinements, in 2006. Engagement of the whole work force in continuous improvement and innovation is being encouraged through a scheme called PRIDE (Performance through Recognition of the Innovation and Dedication of Everyone).

16. During the period 2003–05, a range of “Zero Based Budget” initiatives reduced overheads by 31% and further activity is ongoing in 2006 to reduce this by a further 10%. For example, use of “Value Stream Mapping” is being extended to other functions including finance (payments of accounts)—the “Lean Office”.

17. We continually benchmark with relevant companies that operate similar processes. We use First Marine International to compare us with other shipbuilders on a global stage.

## SUSTAINABLE BUSINESS ENVIRONMENT

18. The Submarine Enterprise requires a complex range of unique skills to be maintained. Suitably qualified and experienced engineers and production workers are necessary for the safe and efficient build of a nuclear powered submarine. These skills can only be retained by performing “real” work on “real” submarine projects. Retention would be seriously threatened by any disruption to the production drum beat (22 months) or by a significant delay to the start of the design for a future submarine.

19. Whilst surface warshipbuilding can provide some assistance towards the effective utilisation of facilities and retention of overall skills in Barrow, it does not fulfil the requirement of the key core submarine workforce. Sufficient and continuous submarine specific work is necessary.

20. The positive steps taken by BAE Systems Submarines to utilise skills and technology in the supply chain and to increase productivity have reduced the number of people required to build a nuclear powered submarine in an acceptable timescale to less than 4,000. This compares with between 8,000 and 12,000 in the early 1990s when the Vanguard class was completed.

21. However, the gap between the design of Vanguard and Astute caused significant difficulties within industry. If this happens again it is the judgement of BAE Systems that the loss of capability and expertise is likely to be irreversible. In order to sustain the submarine-specific design skills, BAE Systems believes that design work needs to be focused on a future submarine to be delivered around 2024.

22. In addition to the design skills, unique and vital production and commissioning and support facilities (including Nuclear Site licence to the required NII/DSNR standards) are needed by the UK submarine programme.

23. The optimum approach is to sustain strategically an agreed level of capabilities (both skills and facilities) through a long-term well-balanced acquisition drumbeat. It will be significantly more cost-effective to take this approach than to risk losing these capabilities, with the consequent need to regenerate them, at significantly greater cost and risk, at a later date. Any subsequent drumbeat variation will inevitably drive costs the wrong way, either through the need to acquire additional expertise at short notice or through

having to attempt to retain labour during a period of reduced utilisation. In practice, it is the BAE Systems view that this production drum beat needs to be based on build of a new nuclear powered submarine every 22 months in order to sustain capability at Barrow and within the supply chain.

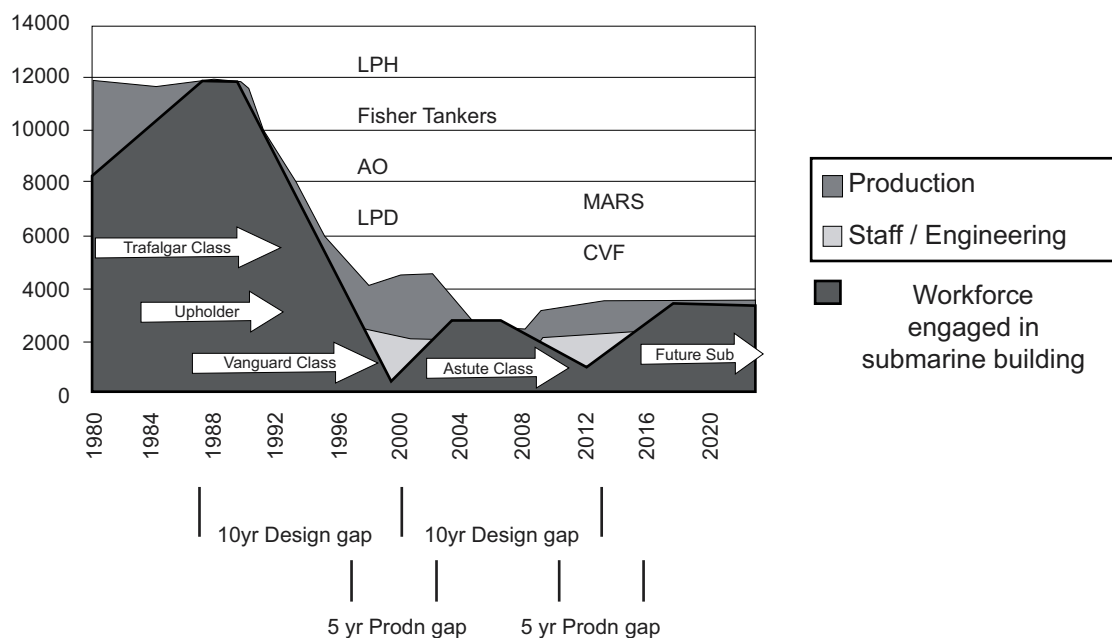
24. To realise the undoubted opportunities for improving the “Value” of the product (necessary functionality divided by the least total cost), appropriate and timely investment is needed, both for facilities and for non-recurring expenditure on design. Safety methodologies are emerging (although they need further development) that will provide a much needed mechanism for advising on the Balance of Investment between the reactor plant and the supporting dockyard site services. This should help significantly in minimising overall costs.

25. The submarine enterprise as a whole, which includes all those who undertake activities throughout the lifecycle of the current submarine flotilla, from concept studies to support and eventual disposal, all need to play a part in this, and methods need to be sought to ensure that creative, productive and well-managed co-operative arrangements for working together are established. In order to assess the relative merits of emerging options, rigorous joint assessment processes need to be put in place that determine the way forward based on achievability, cost, timescale and overall benefit.

26. The design and delivery of a nuclear powered submarine is a very complex undertaking that inherently attracts significant risk. The contracting strategy for this enterprise needs to take account of who really owns these risks and who is best placed to manage them. A “decider—provider” model has been conceived to express this concept, with industry being the provider of design options, recommended solutions, assessed benefits, cost data, programme proposals, etc, whilst the expert customer takes the role of “decider”.

27. In addition, in the nuclear powered submarine business, there are clearly also opportunities for close working with our US colleagues. This primarily is a government-to-government activity, with the appropriate participation by industry, and the information exchange agreements that have been put in place have the potential to be hugely helpful. This should cover not only design ideas, but should also investigate supply chain fragility issues. There is undoubtedly a broad agenda of common problems that could benefit from joint endeavour. Our recent and ongoing experience with General Dynamics/Electric Boat, where a strong and productive liaison has been put in place, has clearly demonstrated the considerable utility of this approach. But this alone will not deliver a sustainable industrial capability within the UK, and is unlikely to deliver increased affordability.

*Historic and potential forward workload, depending on MoD decisions on programme like CVF, MARS and Future Submarine*



#### NUCLEAR SKILLS

28. This section covers design, justification, build, commissioning, support and disposal of Naval Nuclear Propulsion Plant.

29. The scope of the Naval Nuclear Propulsion Plant within a submarine is significantly greater than the reactor and the primary systems (ie the Nuclear Steam Raising Plant, NSRP). It also includes all those supporting propulsion and ship systems, equipments and structures that provide any form of functionality for the continuing safe operation of the nuclear reactor plant for the full range of normal, emergency and

accident conditions. These latter items are in the Platform scope of supply and nuclear safety case skills are required for the production of the Safety Reports for steam, feed, electrical power, containment etc and the Manoeuvring Room Substantiation Report.

30. BAE Systems Submarines, by contract from the MoD, is the Design Authority (DA) for the whole Astute submarine and a particular individual is identified for this role. This arrangement explicitly confers responsibilities on this individual, and on others designated by that individual, for ensuring that the product meets the required integrated performance requirements, is safe to operate, complies with legislation and is overall fit for purpose.

31. BAE Systems Submarines will, whatever the DA arrangements for any future submarine, have significant safety management obligations, and hence significant need for nuclear suitably qualified and experienced personnel. This requires:

- (a) Production of the Design Safety Justification for the appropriate elements of their nuclear scope of supply.
- (b) The production also of a Build Assurance Justification for all elements of the NRP.
- (c) All the safety management arrangements to be in place that are necessary for a Licensed Site on which the submarine is constructed, tested and commissioned, and authorised to operate for the first time.

32. In all of the above, there is a need for close working with the NSRP designer who provides the Reactor Plant information that is fundamental to the Plant and Site Safety Cases. BAE Systems Submarines, as both the DA and Site Licensee, has an obligation to be an intelligent customer of this information and subject it to an appropriate level of “fitness for purpose” scrutiny, even though much of it may go through “Independent Nuclear Safety Assessment” in accordance with the MoD’s current requirements. Currently effort is being put into attempting to streamline these arrangements.

33. All of the above activities require nuclear skills, which are in short supply and increasingly expensive. Those required to design, justify, commission and operate the Naval Nuclear Propulsion Plant (NNPP) would appear obviously submarine-specific (and therefore need to be sustained in accordance with DIS)—but since they currently represent the only *active* nuclear power plant design and build capability within the UK, there is a significant risk that an emergent Civil Nuclear Power Generation programme could deplete the available skill base within the broad submarine focussed industrial enterprise (BAE Systems, RR, DML and key suppliers) to below the level needed to sustain the submarine programme before a larger pool of expertise in UK can be regenerated.

34. The availability of enough suitable qualified and experienced nuclear managers, safety case authors and reviewers is already a challenge. Initiatives are being taken to:

- (a) Formally develop a Nuclear Engineering and Safety Function within BAE Systems.
- (b) Establish a training and development plan for Nuclear Engineering and Safety skills.
- (c) Reduce the reliance on subcontractors where able to do so.
- (d) Pursue proposals for the implementation of improved Naval Nuclear Propulsion Plant Safety Case methodologies for later Astute boats (Industry-wide Steering Group with solid support from all Naval Nuclear sites established)—a key objective is the appropriate integration of NSRP and Site safety cases—see earlier reference to Balance of Investment technique.
- (e) Seek appropriate nuclear engineering and safety contracts from both NNPP and civil nuclear sectors to level out the resource demand in a cooperative manner with other NNPP contractors. With regard to civil work, this supports the Defence Diversification programme.
- (f) Support Cogent’s proposals for the establishment of a National Nuclear Skills Academy.

17 October 2006

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#### Memorandum from Rolls-Royce

1. Rolls-Royce is the UK’s only naval nuclear propulsion supplier and has been so since the introduction of nuclear powered submarines to the Royal Navy. For nearly 50 years, Rolls-Royce has developed, designed, supplied and supported the nuclear steam raising plant (NSRP) powering the submarine propulsion system.

2. Supply of the NSRP is a highly specialised sector of the UK submarine industrial base. The 1958 Mutual Defence Agreement, between UK and USA, constrains non-UK provision of components and therefore the NSRP industrial base is predominantly within the UK. Rolls-Royce subcontract spend on the NSRP (flotilla and new build) is circa £100 million per annum, 95% of which is in the UK.

3. Historically the demand profile of the UK submarine programme, and therefore the NSRP demand profile, was relatively stable until the eleven-year gap between the last Vanguard class and the first Astute class. Delays in order placement led to discontinuity in production and a reduction of skills throughout the

NSRP supply chain. In parallel, the civil nuclear programme has declined in the UK and the supply base has drastically reduced. Limited recruitment and investment has led to an ageing, reducing infrastructure and workforce across the UK supply chain.

4. The absence of any major NSRP development programme since the late 1980s has put pressure on sustaining capability to develop and design new reactor plant for the UK submarine programme. This has in turn impeded capability and opportunity to reduce cost and improve availability.

#### SKILLS AND RECRUITMENT

5. RR and other defence companies rely heavily on recruiting and training graduates and in 2005 we recruited a total of 185. In the region of 60–70% of our graduate intake each year are engineers and scientists and our target for 2006 is 20% up on 2005 levels.

6. Problems with the teaching of maths and physics are well documented. A Royal Society Study comparing 1991 with 2004 showed a 34% decrease in students taking A-level physics and a 22% decrease in students taking A-level mathematics.

7. The decline of UK nationals among the PhD students and researchers in UK universities is also a problem for a high R&D intensive company like Rolls-Royce. This population is a key source of people who will develop into the deep technical specialists needed by the Company. At present, around 50% of the researchers in our University Technology Centres (the focus for our collaboration with the science base) are people born and educated outside the UK. Many of these overseas research students make a major contribution to our activity while they are in the UK but retention of this skill as a result of mobility is more difficult. In addition, they are also precluded from undertaking work on major defence projects.

#### *These Difficulties are Exacerbated in the Nuclear Sector*

8. The severe cuts in naval nuclear R&T programmes in the 1990's, combined with the steady reduction of manpower and research laboratory closures in the civil nuclear sector, have affected the long term skills base in the UK: nuclear chemistry is one of the areas that has run down over the past 20 years. Public research in nuclear fission has dropped by 95% (DTI spend in 1990 was c £164 million compared with £17 million in 2001) and the civil industrial R&D skills base has fragmented and decreased from manpower of 8,500 in 1980 to 1,000 in 2004 (ie a 90% reduction).

9. The Government recognised this dilemma in its Report of the Nuclear Skills Group (December 2002), which concluded that the state of nuclear skills in the UK is extremely fragile due to public under-investment and exacerbated by the successive privatisations and reorganisations undergone by the sector.

10. There has also been a severe reduction in University first-degree courses in Nuclear Engineering since the 1990s and currently other more general engineering courses offer a very low nuclear content.

#### NSRP SKILLS

11. The decline of general investment in naval nuclear technology, in the 1990's, occurred at the same time as significant NSRP issues affected submarine availability. This put pressure upon the limited flotilla R&T funding allocated to the NSRP.

12. This continued until, in 2003, the MoD Chief Scientific Advisor asked Professor Burdekin to investigate the effect of these low levels of investment. He concluded that effective management of these age related problems was required and recommended that £25 million per annum was necessary to establish and implement a sound proactive position against future ageing plant issues.

13. It was also recognised that continuous workflow was essential to the retention of the skills base. At the time, immediate skills continuity gaps were identified in core design and physics; and further medium-term skills gaps anticipated in the area of safety. The MoD through the Nuclear Propulsion Capability Study has injected more than £10 million per annum into R&T to address immediate concerns over skills shortages. Without this funding, it is Rolls-Royce's view that the design and manufacturing base in the UK would rapidly decay and may impact on the UK's ability to meet successor timescales.

14. Of Rolls-Royce's current c 930 submarines' engineering population, around 270 are in the over 50 age group with a further 290 in the 40–50 age group, indicating a significant skills continuity challenge over the next decade.

15. To meet current and future workloads, and in recognition of the demographic issues noted above, Rolls-Royce submarine business recently conducted a recruitment campaign. Whilst generally successful in the short term, difficulties arose in the areas of nuclear safety/reliability and in materials stress analysis. As predicted, individuals with good domain knowledge are few and far between.



16. RR also supplements its workforce with qualified subcontractors from the civil nuclear field: via managed service agreements (with eg Serco, AMEC NNC and Atkins). The depletion of civil nuclear skills has not only reduced the support network available to the military programmes but should there be a future civil nuclear generation programme, there would also be considerable pressure on the UK's remaining skills capacity.

#### NSRP MANUFACTURING INDUSTRIAL BASE

17. There are substantial barriers to entry into the market for manufacture of NSRP components and systems. These barriers include large capital investment, specialised facilities, uncertainty of future orders, low production rates, high standards of production and quality assurance and, finally a highly qualified and skilled workforce.

18. Rolls-Royce, on behalf of MoD, has recently conducted studies to assess the status of the NSRP supply base. These studies found the supply base to be fragile and 12 components were identified as "supply critical" now or likely to become so before 2008. Rolls-Royce is working with MoD to mitigate supply chain threats to current class submarines at sea (obsolescence, spares etc), to the Astute class in build and any future classes of submarine. The cost of securing the supply base for these 12 components is estimated at over £50 million. A typical example is the consolidation of the manufacturing facilities for components such as vessels, steam generators and primary circuit valves in order to maintain an economic workload.

19. Sole or single source suppliers provide the majority of NSRP equipment and the supply base contains some design and manufacturing skills and capability which, in specific cases, are retained in only two or three individuals in the UK.

#### THE DEFENCE INDUSTRIAL STRATEGY (DIS)

20. The affordability, availability and the sustainability of a sovereign capability relating to submarines all feature in the DIS and MoD has recognised that it has a leading role in a solution, which involves major rationalisation of organisations, facilities, programmes and processes.

21. Rolls-Royce's core competence is based on design, supply and support of nuclear steam raising plant (NSRP), providing a "total care" capability for submarine propulsion. We are working closely with the rest of the Submarine community (MoD and industry) to demonstrate the potential to drive down cost, improve availability and to help sustain UK capabilities in this high value added, specialised area.

22. Rolls-Royce practises the partnership principles set out in the DIS, at the Vulcan Naval Reactor Test Establishment in Scotland where we operate and maintain the establishment as part of a thirteen year, incentivised contract, delivering savings to MoD. Additionally, the forthcoming Flotilla Reactor Plant Support contract will feature a combined Rolls-Royce/MoD team delivering reduced costs and improved plant availability based on a philosophy of shared risk and reward. We would hope to continue working to these principles in any future programmes.

#### IMPROVEMENTS AND SUSTAINABILITY

23. A long-term view of the submarine programme in the UK is crucial for industry to determine when and how to invest.

24. Rolls-Royce believes that cost control within the submarine programme is challenging and MoD recognise this position. The challenge arises partly because there is no planned sustainment of the programme into the future and costs of much of the new build supply base are being borne by the Astute programme.

25. Timescales for design and development of improved NSRP plant and systems to meet increased availability and safety targets are long (over 10 years) and require experienced engineers and management.

26. Rationalisation or greater coherence and collaboration within industry—to drive improvements and cost reductions—is harder to determine and achieve without clarity of a forward load programme; and improvements in manufacturing processes and facilities require to be planned into any build programme to maximise the benefits whilst not delaying the programme.

27. Any industrial rationalisation within the UK shipbuilding industry would need to ensure maintenance of the nuclear skills (associated with the build, refit and disposal of submarines) in the appropriate geographic location for those activities.

### *The Consequence of a Gap in the Build Programme*

28. During the 11 year gap between build of Vanguard class and Astute class the number of manufacturers of heavy pressure vessels in the UK declined from five to two, and subsequently only one remains: Heavy Pressure Vessels (Rolls-Royce owned).

29. Due to market changes in the Oil and Gas market, the workforce at Heavy Pressure Vessels has reduced from 650 in 1995 to approx 100 currently and is solely dependent on MoD NSRP work. When an order gap occurred following Astute 1–3, the facility was downsized and threatened with closure. Rolls-Royce has enabled the facility to survive but cannot guarantee continued operation without a committed drumbeat of work.

### *The Impact of Another Gap in the Build Programme*

30. The impact of another gap in the submarine building programme on the supply base is dependent on the timing and length of any gap.

31. The Submarine community and areas of the supply base might interpret a further gap as a signal that the principles of openness and partnering championed by the DIS are difficult to achieve. A commitment to a longer term, funded programme would avoid this problem.

### *NSRP Supply Chain and Capability*

32. Rolls-Royce has two main manufacturing facilities which are totally dedicated to supplying NSRP components.

33. Rolls-Royce estimate that a short gap (maximum one year) in the current build programme for Astute 4 would require approx £10 million investment to ensure sustainability of the Rolls-Royce based design and manufacturing skills and capabilities. This does not include any costs due to the fragility of the wider supply chain or any restart costs. A longer gap would require progressively greater levels of investment.

34. A gap at the end of the Astute build programme (which remains undefined) is likely to have increasing impacts on Rolls-Royce capabilities and dedicated manufacturing facilities. Our facility which manufactures components such as heavy pressure vessels, control rod drive mechanisms and primary circuit valves would be forced to operate below minimum economic throughput with many inefficiencies which would inevitably drive up costs.

35. Progressively, investment would be required to retain skills but facility closure would occur if sufficient investment was not forthcoming. Again restart costs would also be incurred.

36. The wider supply chain would also be significantly impacted and it is not unlikely that other elements of the supply chain would exit the market or face closure.

### *Reactor Core Factory*

37. A gap at the end of the Astute build programme would also require a substantial change in the programme for the facility which manufactures reactor cores, including the proposed site regeneration programme. A complete revisit of this programme and the introduction of further skill retention initiatives would be required.

38. In 2004, a Rolls-Royce study indicated a one year gap in production of cores, after completion of the current programme in 2011, would cost approx £45 million, rising to £180 million for a five year gap. These figures are estimates and dependent upon timing.

### **CONCLUSION**

39. Rolls-Royce aspires to provide a Next Generation Nuclear Propulsion Plant for the successor to the Vanguard class submarine and low level concept work is being undertaken with support from MoD which will help sustain a level of skill. This will be a long term programme (15 years + ) to provide the Royal Navy with a propulsion plant fit for the 21st century. Removing uncertainties would contribute to the successful implementation of this long-term programme.

9 October 2006

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### **Memorandum from Devonport Management Limited**

There is a highly specialised skill and knowledge base required to support and sustain the UK's nuclear-powered submarine capability across all stages of the platform life cycle. It also requires the use of large scale capital intensive physical infrastructure at Barrow, Faslane and Devonport. The skill base and the infrastructure each represent significant levels of fixed cost.

The UK now operates a relatively small number of nuclear-powered submarines compared to, say, the 1980's. The total number of platforms is moving towards a force level of seven SSNs and four SSBNs. At this level the retention of an affordable and viable programme requires careful consideration of all activities (design, build, operational support, deep maintenance) and how these programme elements affect manpower loading and utilisation in the key industrial facilities.

The overall composition of the submarine programme is determined by the design and build schedule for new submarines combined with the operational and support cycles of existing submarines. The precise programme composition has increasingly to take account of industrial base factors. This is because the relatively small number of submarines unavoidably leads to high variability in design, build and support workload over, say, any two to three year timescale. If this particular issue is not pro-actively managed then sustainability of the industrial base (and the affordability of the military capability that it generates) will be threatened.

Hence, if Government policy determines the requirement for a submarine-based strategic deterrent system beyond the effective life of the Vanguard class submarines, industrial base issues will have to be taken into account. These issues directly influence the UK's ability to design and manufacture new submarines, whilst in parallel keeping a viable and cost effective support capability for existing operational submarines.

The need to generate balance in this highly specialised part of the defence industrial base is therefore an important influence on the optimum in-service date for the first and subsequent submarines of a new strategic deterrent system. This date in turn determines when work on the submarine needs to begin, given the lead time for the design and development of the platform and its systems. Other factors that influence this date are:

- any fundamental life limitations in major components or systems in the existing SSBNs;
- forecast reductions in reliability, availability or supportability of the existing SSBNs as their operational life extends; and
- any unacceptable level of expected escalation in the total operating cost of the existing system.

As indicated in Written Evidence to the previous stage of this enquiry (Ev 141), the programme leading up to the entry of the Vanguard class into service is relevant in estimating the lead-time for a new SSBN. A review of this data indicates that preliminary work should begin imminently on a successor SSBN if the requirement is to achieve a planned operational availability for the first of class around 2025.

From the industrial base perspective this date will generate a design programme that is needed to sustain key front end design and development skills and, in the longer term, a sensible overlap with the final stages of an assumed seven boat Astute class build schedule.

This assumed schedule also generates a requirement for second, non-refuelling refits (LOPs), on a minimum of three of the existing Vanguard class submarines to sustain continuous availability of the deterrent over the transition period between systems. This provides a sustained, albeit highly variable, workload through the Devonport refit facility prior to the start of the Astute class LOPs.

There is merit in doing further analysis work to determine the optimum work content of these second Vanguard class LOPs, based on the known material condition of the submarines at their first refit and the planned length of their third commissions. This analysis work should also consider the possibility of an increased work content for these second LOPs, to give scope for extended operational lives of some of the existing SSBNs if the new SSBN in-service date is delayed beyond 2025 for any reason.

Adequate funding to ensure these various activities start at the pace required to meet the planned availability date for the new SSBN and to support the Vanguard-related risk mitigation work is essential. Otherwise the expenditure will be inefficient and holistic progress in sustaining continuous deterrence will be compromised from the outset.

#### LINKAGE BETWEEN THE DETERRENT DECISION AND THE DEFENCE INDUSTRIAL STRATEGY

A decision not to replace the deterrent would have a fundamental effect on the maritime element of the DIS through:

- a potential impact on the operational and support strategies for the existing deterrent system;
- knock-on effects into the planned Astute procurement programme (the SSN force is partly committed to supporting the SSBNs); and
- changed priorities in respect of build and support yards that are required to deliver the other elements (ie, non SSBN-related) of military capability in the naval sector.

Conversely, a decision to replace the current deterrent system would make the existing UK submarine-related engineering skill-base and infrastructure essential in maintaining availability of the current and future SSBNs and the SSNs that support their deployment.

A positive decision on a future submarine-based deterrent must, in turn, influence decisions about where and when other naval build and support work is carried out—a good example is Devonport where the availability of surface ship support work will be vital during the inevitable periods of low submarine throughput that the future upkeep programme contains, if submarine affordability is not to be seriously impaired.

There is also therefore a very important interaction with the current Naval Base Review where, for instance, the resultant surface ship base porting strategy will influence the availability of ship maintenance work in Fleet Time at Devonport.

Hence a positive decision to replace the current deterrent with a new submarine-based system will generate a “pivot point”, centred on the UK’s sovereign submarine build and support infrastructure, around which a wide range of other maritime industrial base issues should be determined if the affordability and availability of overall naval capability is to be optimised.

#### RELATIONSHIP BETWEEN UK CIVILIAN AND MILITARY NUCLEAR CAPABILITY

The UK’s military nuclear programmes have historically attracted and developed their own specialists. This situation has begun to change over recent years, particularly as the influence of the civilian regulator over the design and operation of military facilities has increased following the introduction of contractor management and privatisation.

This regulatory influence has led to the move of civilian expertise into the military domain, in part on the back of large scale facilities upgrade programmes, such as that carried out between 1997 and 2002 in Devonport. This trend also now operates in reverse, where “best practice expertise” is in some cases returning to the civilian sector as a result of the NDA requirements and other developing aspects of the civil nuclear programme.

Arguably, if and when the UK civil nuclear generating programme begins to ramp up, perhaps the most important point I would wish to make is that confidence in retaining a vibrant, stable and long term submarine programme will be fundamental to attracting and retaining the key technical resources that will be essential to the naval nuclear programme’s success.

*11 October 2006*

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#### Memorandum from MacTaggart Scott & Company Limited

MacTaggart Scott & Co. Ltd. is a privately owned engineering company employing approximately 250 people in Loanhead which is on the outskirts of Edinburgh.

Since the formation in 1898 MacTaggart Scott has been involved in the design, manufacture and support of innovative bespoke engineering equipment for both submarine and surface ship naval application.

MacTaggart Scott has supplied high integrity submarine equipment since the earliest days of submarines in Royal Navy service. The equipment covers a broad range of electrical, electronic, hydraulic and mechanical handling systems including retractable periscope and sensor masts, emergency propulsion systems and high torque, low speed, quiet hydraulic motors and pumps capable of operating both inside and outside the pressure hull.

Today the company is an acknowledged leader in the design and supply of specialised handling equipment for both above and below water naval markets and it has used its selection and supplier status to the Royal Navy to achieve significant export success in the rest of the world. Company turnover for the last trading year was approximately £30 million with 60% of this output deriving from export business.

#### KEY ISSUES AND CHALLENGES

- (a) Retention of skills and experience in both design and manufacturing personnel to fulfil the special requirements of the sub-sea environment.
- (b) Maintaining the investment levels in research and development and training to develop new concepts and to continue to attract new engineering blood into the industry.
- (c) Retaining and growing export market business to afford the investment in R&D and training.
- (d) Maintaining continuity of participation in existing and new generation Royal Navy equipment programmes to consolidate status in export markets.
- (e) To develop further the progress achieved to date from the Astute Key Supplier Forum. To use continuity of existing and future submarine programmes to achieve improved design focus, greater efficiency, lower costs and better affordability arising from a more open and less confrontational procurement environment.

*6 November 2006*

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### Memorandum from Amicus

Amicus is the UK's second largest trade union with 1.2 million members across the private and public sectors. Our members work in a range of industries including manufacturing, financial services, print, media, construction and not for profit sectors, local government, education and the health service.

1. There are currently 115,000 people employed in the Aerospace and Shipbuilding sector, Amicus represents 63,000 members within this sector, and at the BAE Systems factory at Barrow-in-Furness there are currently 1,000 Amicus members, at Devonport Dockyard there are 1,500 Amicus members with a further 13,500 jobs dependent on the yard, at the Faslane Naval Base there are 500 Amicus members with a further 6,000 jobs supported by the naval base and at the Coulport Naval Base, out of 400 employees, 200 are Amicus members and there are 1,200 people whose jobs are dependent on the shipyard. A further 140,000 people are also indirectly supported by the Aerospace and Shipbuilding industry. These figures show that a very large number of workers are wholly dependent on the work commissioned by the MoD in relation to the nuclear deterrent and the platforms designed and built at these sites.

2. The most significant concern for Amicus members within this sector is the protection of their jobs, their skills and their livelihoods. Barrow is the only submarine production yard in the UK, the capability, skills and expertise of the workers is unique in the UK. This level of skills and expertise demands to be protected, encouraged and utilised. The only way this will happen is with the continued investment by the MoD in providing a UK replacement nuclear deterrent.

3. The UK Government has clearly committed itself to a replacement for the existing nuclear deterrent "strong in defence in fighting terrorism, upholding NATO, supporting our armed forces at home and abroad and retaining our nuclear deterrent".<sup>1</sup> The Government has indicated that a decision on replacing Trident will be needed during the current Parliament. Tony Blair has promised "the fullest possible debate" on the replacement of Trident.

4. In any discussion regarding a replacement for Trident, consideration needs to be accorded to what that replacement should be. Trident was designed and developed to counteract the threat posed by the size and technical capabilities of the Soviet Union, however this threat no longer exists but there have emerged other and as equally challenging areas of conflict within the world today. As a consequence of this, questions need to be asked about the existing nuclear capabilities and what is needed for these future strategic operational challenges.

5. UK current capability comprises four Vanguard class nuclear powered submarines (SSBNs) each with 16 launch tubes of trident D.5. Missiles. All other nuclear weapons systems were phased out by the end of the 1990s and the situation now is to clarify whether the replacement of Trident is also to be a submarine based capability.

6. Government surveyed other weapons delivery options before the 1980 Trident option was taken and the alternatives currently being looked at are not very different from those available when Trident was chosen. The other replacement options currently being looked at are:

- (a) Land based missiles, these present an unacceptable level of vulnerability, with little capability of supporting protection commitments in distant regions.
- (b) Air launched missiles, there would need to be a significant increase in the financial investment if this option were chosen. This investment would need to create and provide for aircraft, missiles and warheads of a kind that the UK currently does not possess. There are also serious concerns about where this type of capability would be based.

7. The most obvious option is to retain the existing operational base and established infrastructure of submarine based missiles, with something that is more flexible but with the strategic capabilities of the submarine, whereby it is difficult to detect and also difficult to attack.

8. The cost of the new capability (£15–20 billion has been suggested) is a sizeable sum but is manageable when viewed as part of the whole defence budget. The procurement of a new generation of submarines designed and built in Barrow-in-Furness would ensure the retention of the existing jobs and skills base, while encouraging companies and workers to up their skills levels to take on board the new skills requirements for this new generation of submarines. It should also be noted that the Royal Navy currently possesses the experience and skills to operate the submarine deterrent system, while any change to the existing system could result in significant operational problems that could take decades to overcome and would need a momentous investment in re-skilling, training and resource capabilities of Royal Navy personnel.

9. Other agencies have argued that the money spent on defence, and in particular the nuclear deterrent could be better utilised with spending on health or education. This is a totally impractical suggestion. If the money spent on the defence budget ceased, this money would not necessarily be used for further public sector provision. The idea is unsustainable and impractical. The funding of the replacement nuclear deterrent will ensure that many high skilled jobs are retained, new jobs created and many workers in the industry will be allowed to enjoy a position of relative security.

<sup>1</sup> Gordon Brown—Speech at the Mansion House, City of London, 21 June 2006.

10. The UK needs a British designed and built deterrent. The considerable amount of investment required within the industry would ensure a programme of research and development that would take the UK to the forefront of technological design and manufacture. In real terms this will ensure the future prosperity and security of many jobs in this manufacturing sector. It would be insupportable to envisage that this amount of investment could be sent out of the UK and off-shored to another country. Amicus is prepared to do all it can to support its members in retaining their jobs, protecting their livelihoods and encouraging them to further the view of workers in the UK manufacturing sector as highly skilled and highly trained.

11. The existing Vanguard class submarine has a design life of 25 years, to ensure there is something in place before 2020; replacements will need to be on the drawing board by 2007. The Trident programme was the largest ever UK defence procurement project and was delivered on time and within budget. The domain expertise and intellectual property remains at Barrow and Amicus hopes this will encourage and enable the MoD to aim for a similar outcome by retaining the submarine capability system at Barrow, while acknowledging the substantive contribution the workers have made to the success of the project.

12. The design capability at Barrow is unique; no other place in the UK has this level of design concentration. If this capability is lost the capacity to design and build other ships is also lost. SEMTA<sup>2</sup> has undertaken a supply chain analysis on training and skills and the local dependency on this employer. The training and skills capability of this sector cannot be ignored; BAE Systems has taken on 50 new apprentices as part of their commitment to the continued investment in training and skills. This opportunity for training in an "Objective 2"<sup>3</sup> area, that is polarised, disenfranchised and with high levels of unemployment cannot be stressed too strongly.

2 October 2006

### Memorandum from the Keep Our Future Afloat Campaign

#### PART A: EXECUTIVE SUMMARY

*"the need for freedom to operate in an uncertain world, make the sea a very attractive location from which to project power"<sup>4</sup>*

(Defence Industrial Strategy, Ministry of Defence, December 2005)

(i) The "Keep Our Future Afloat Campaign", (KOFAC), is a trade union-led lobby Campaign that was launched in April 2004 in response to a further round of large scale job losses at the BAE SYSTEMS' owned Barrow shipyard in north west England associated with completion of HMS BULWARK. The CSEU, Amicus and GMB are the lead unions involved. The campaign seeks further investment by the UK Government in naval shipbuilding in north west England and specifically orders for a batch of four more "Astute" class submarines, a follow-on "Vanguard" class submarine class and major surface ship work for the shipyards, principally Barrow, and supplier base located in north west England.

(ii) KOFAC has considered each of the five questions posed by the Defence Select Committee<sup>5</sup> in the context of the Defence Industrial Strategy 2005 and offers views in relation to each of them.

(iii) The UK Submarine Industrial Base (SIB) is a unique, small volume business serving one customer, the Ministry of Defence. Affordability of the nuclear submarine fleet is a key challenge because at present "there is no new submarine programme following on behind Astute, as such Astute is really paying for the whole of the submarine build industry."<sup>6</sup> British nuclear submarines cost around 40% less than their American counterparts.

(iv) The SIB is fragile. Ministry of Defence, (MoD) in August 2006 stated, "we are now at a point where the supply chain is fragile and is costing significant sums to buy and support equipment that is close to obsolete. This is forcing us to take a fundamental look at the Astute class with a view to redesigning systems within the boat and the supply chain that supports those systems to reduce both initial procurement and through life costs. Our relationship with our suppliers is also a key focus for us. We need to ensure we've got the right relationships that have reward for performance at their core. This team is really a pioneer for joint working."<sup>6</sup> To assist the Inquiry, we offer findings of a recent, 2003, survey of the supplier base, and refer to current supply chain work BAE SYSTEMS are undertaking.

(v) It is the submarine that carries the existing Trident missile that needs replacing, not the missile system itself. More Astute class submarines are needed to replace ageing attack submarines. KOFAC, therefore supports the replacement of the existing Vanguard class submarine fleet with a new submarine fleet to carry

<sup>2</sup> The Sector Skills Council for Science, Engineering, Manufacturing Technologies Alliance.

<sup>3</sup> Funded through, the England Rural Development Programme [www.defra.gov.uk/rural/structure/obj2.htm](http://www.defra.gov.uk/rural/structure/obj2.htm)

<sup>4</sup> Page 68, para B.2.2, Defence Industrial Strategy, Ministry of Defence, December 2005.

<sup>5</sup> House of Commons Defence Select Committee inquiry into UK manufacturing and skills base. Terms of Reference (Source: Defence Committee press release 21 July 2006).

<sup>6</sup> The nuclear cluster, Rear Admiral Andrew Matthews, Director, General Nuclear, Defence Logistics Organisation in DLO, the Nuclear Cluster, August 2006, UK Ministry of Defence.

the existing strategic deterrent. An order to build of a batch of four more Astute submarines will help create a “level load” of work that can sustain key skills, and capabilities within the SIB, This will generate greater efficiencies, savings to the MoD and make the overall submarine programme more affordable.

(vi) KOFAC believes gaps in submarine production should not be allowed to occur. Conceptual design work on a Vanguard replacement submarine needs to start in 2007 in order to avoid a significant workload gap for designers located at Barrow shipyard, and build on embedded submarine design expertise. This conceptual design of the new boats should be concentrated in Barrow shipyard rather than elsewhere, because Barrow is the only shipyard that has experience of designing, building, integrating, testing and commissioning nuclear powered submarines.

(vii) A significant workload gap would arise and costs would increase for the SIB from a decision not to proceed with a replacement Vanguard class submarine.

(viii) Since 2003–04, considerable progress is being made in making the new build of submarines more affordable. Industry is responding within the terms of the DIS to Government’s expressed desire to see “closer working between MoD and industry and within the industry”. Alliance and/or joint venture arrangements should be encouraged. Regional development agencies working with sub-regional partners have a key role to play in helping the SIB supply chain invest to achieve the MoD affordability criteria by enabling businesses to make use of existing Government capital grants and other business support schemes.

(ix) There is a need to sustain and grow skills development for the civil and defence nuclear industry, and to promote the career opportunities systems integration based naval shipbuilding offers over the next decade to people of all ages. MoD and industry need to set out a long term view soon so that individuals can be encouraged to take-up apprenticeships, undergraduate, postgraduate studies and careers in the nuclear sector of the submarine industrial base. Financial incentives for individuals may be needed to help achieve this objective.

## 1. *The Keep Our Future Afloat Campaign (KOFAC) and the Defence Industrial Strategy (DIS)*

1.1 The trade union led “Keep Our Future Afloat Campaign” (KOFAC), launched in April 2004, has the support of the CSEU, Barrow Borough and Cumbria County Councils, Furness Enterprise and Northwest Regional Development Agency. In September 2004 the then Secretary of State for Defence the Rt Hon Geoff Hoon MP described the lobby as “one of the most effective defence lobbies he had come across.” The Rt Hon Alun Michael MP, Minister for Industry and the Regions on 13 December 2005 indicated “this (KOFAC) type of approach by management, trade unions and the local authority is very powerful”.<sup>7</sup> On the 27 September 2006 Lord Drayson, the Ministry of Defence Under-Secretary of State and Minister for Defence Procurement, said “you do realise you are effective”, adding “no-one else is doing this type of thing”.<sup>8</sup>

1.2 The Keep Our Future Afloat Campaign’s aims are threefold, to:

- Sustain and grow jobs in naval shipbuilding in north west England.
- Secure full utilisation of the unique naval ship and submarine building assets found in the north west of England’s naval shipbuilding industrial base—the shipyard at Barrow and a supply chain of 1,700 companies.
- Sustain the naval ship/submarine design capability, which is located in Barrow—600 designers comprising 60% of UK total capability.

KOFAC sets out to influence the policy of Government, its Agencies, leading companies in the defence industry and trade union policy. KOFAC sought to influence the Defence Industrial Strategy throughout 2005.

1.3 KOFAC welcomed the Defence Industrial Strategy (2005),<sup>9</sup> in particular its commitment to the submarine industrial base contained within paragraphs B2.26 to B2.28 which states “for the foreseeable future the UK will retain all those capabilities unique to submarines and their nuclear steam raising plant, to enable their design, development, build, support, operation and decommissioning”. KOFAC notes that “the Astute programme is really paying for the submarine build industry”<sup>11</sup> and UK needs “to find a way of making it affordable with industry”, in line with the Defence Industrial Strategy”.<sup>11</sup>

1.4 KOFAC also supports the Government view that “a minimum nuclear deterrent . . . is likely to remain a necessary element of our security”.<sup>10</sup> KOFAC notes that “introduction of any new submarine would probably be planned for around 2024”.<sup>11</sup>

<sup>7</sup> Meeting with Keep Our Future Afloat delegation, London, 13/12/05.

<sup>8</sup> Lord Drayson in visit to Keep Our Future Afloat stand G2 at Labour Party Conference, 27/9/06.

<sup>9</sup> Defence Industrial Strategy, UK Ministry of Defence, 2005.

<sup>10</sup> Delivering Security in a Changing World, Cmnd 6041, December 2003, para 3.11.

<sup>11</sup> The Nuclear Cluster, Defence Logistics Organisation, UK Ministry of Defence, August 2006.

1.5 KOFAC considers Government should place orders to sustain the design, build, test and commissioning capability of the UK submarine industrial base at its current level, in particular Government should continue to support the significant cost reduction initiatives being achieved by BAE SYSTEMS at Barrow and MoD “to reduce both initial procurement and through life costs”.<sup>11</sup>

## 2. *The UK Submarine Industrial Base (SIB)*

2.1 The UK submarine industrial base (SIB) is a unique UK Defence Industry, it is a small volume business delivering to one customer, the UK Ministry of Defence. There are only orders for three Astute class submarines, these are currently being assembled at Barrow in Furness. The Major gap in design and production work between Vanguard class completion and the start of the “Astute” programme created major challenges for the SIB. KOFAC’s understanding of the key characteristics of the industry<sup>12, 13</sup> are as follows:

- (i) An estimated total employment in the UK SIB in the region of 5,000 personnel.
- (ii) It depends on one buyer, namely, the UK Government which buys nuclear-powered submarines for the Royal Navy.
- (iii) It produces one product, which cannot be exported, namely, nuclear-powered submarines and has exited from the conventional submarine market (after the Upholder class). Nuclear-powered submarines are highly specialised and technically complex weapons systems which require special skills and facilities for aspects of design and construction. They differ from surface warships in that they are designed to operate for long periods underwater at great depths, at speed, and quietly, with a range of weapons whilst providing a safe environment for the crew living close to a nuclear reactor.
- (iv) There is only one UK firm with the experience and facilities for designing, building, testing and commissioning nuclear-powered submarines, namely, BAE SYSTEMS Submarines Limited based at Barrow-in-Furness (see Appendix A) where 3,310 people are employed. Barrow is the only UK nuclear site licensed for the construction, test and commissioning of nuclear powered submarines. Plymouth has the DML dockyard available for refit of nuclear powered submarines—3,800 people are employed there. It is conceivable that demand for, and cost of, refits will reduce as “Astute” submarines are introduced into the fleet. Faslane is the operational base.
- (v) The nuclear requirement imposes major barriers to new entry, competition, and until recently, international collaboration (Electric Boat/BAE recently partnered on production improvements for “Astute”). It also creates some highly-specialised resource requirements, especially in the construction (BAE SYSTEMS, Barrow), power plant (Rolls-Royce Marine Power, Derby) and refitting and refueling stages (Devonport Management Limited) of the procurement cycle.
- (vi) New “Astute” submarines are being built with reactors which do not have to be refueled over their operational lives. Nuclear powered submarines that precede “Astute” have to go through periodic “deep refits” which include reactor refueling which are costly and account, historically, for 75% of the budget spend “on the overhaul programme in Devonport where at 12 year intervals, we refuel and upgrade all the safety systems on submarines. A typical Vanguard class (HMS Victorious) LOP(R) takes about 160 weeks and costs £250 million.”<sup>14</sup>
- (vii) Much of the cost debate for naval ships has focused on acquisition cost, a truer metric may be total life cycle costs. Nuclear submarines inherently possess low total operating costs due to their minimal manning, they require no at-sea logistics train, no protective escorts and little support infrastructure ashore.<sup>15</sup>
- (viii) The UK SIB supply chain is “now at a point where the supply chain is fragile and is costing significant sums to buy and support equipment that is close to obsolete (for existing submarines). DLO are taking a fundamental look at the Astute class with a view to redesigning systems within the boat and the supply chain that supports those systems to reduce initial procurement and through life costs.”<sup>14</sup> The supply chain is dominated by a few large companies with a large number of relatively small firms, examples included BAE SYSTEMS Marine Limited as prime contractor, design authority, ship/submarine builder and integrator, with its yard at Barrow. Other submarine specialists include Weir/Strachan & Henshaw as design authority for weapon handling; Thales Underwater Systems as a prime and design authority for sonar systems; and Thales Optonics (Barr and Stroud) as design authority for periscopes.
- (ix) UK submarine expertise includes world leaders in the supply of naval electric propulsion; staff trained and specialised in naval ship and submarine building; weapons handling and discharge,

<sup>11</sup> The Nuclear Cluster, Defence Logistics Organisation, UK Ministry of Defence, August 2006.

<sup>12</sup> The UK Submarine Industrial Base, a report to Furness Enterprise Limited, Centre for Defence Economics, University of York (December 2003).

<sup>13</sup> The Nuclear Cluster, August 2006, DLO, Ministry of Defence, August 2006.

<sup>14</sup> The Nuclear Cluster, August 2006, DLO, Ministry of Defence, August 2006.

<sup>15</sup> Page 16, Life Cycle Support Maintenance Modernisation in the Contribution of the New London Naval Submarine Base and Electric Boat to the Economy of Connecticut and SE Connecticut, The State of Connecticut, 3 May 2005.



submerged systems ejectors and countermeasures; the UK's only supplier of high pressure seamless cylinders; rubber lining for battery compartments; copper based alloy castings to naval standards; electrical and fibre optic cables; design and manufacture of propeller thrust bearings; design of autopilot systems; sensors and systems for vibration monitoring; prime contractor and design authority for dehumidification systems; low weight, low fatigue stealthy structures; sonar reflective tiles; design and installation of chilled water plant; structural design and analysis; waste shredders; submarine hull penetrations; nuclear radiation shielding; naval shock-rated switchgear; and hydrodynamics, stealth and signatures. Manufacture and design of many of these components require skills unique to the SIB that it is critical to retain in the UK. These include mechanical engineering, hydrodynamics and safety simulation staff, research, software, design and development staff, specialist moulds teams; welding and test engineers; clean assembly and radioactive teams; tile preparation teams; Fitters and adjusters; sub hull penetrator assemblers.

2.2 A survey we commissioned at the end of December 2003<sup>16</sup> highlighted some of the challenges facing the UK SIB. It revealed that a number of companies were concerned about an insufficient workload to justify future investment and retention of key skills. They foresaw reduced opportunity for sales; and a lack of opportunity to maintain and grow the company's submarine expertise. These concerns could re-emerge if further submarine orders do not materialise soon.

2.3 The survey also showed that companies would likely respond to order gaps in a variety of ways, including reducing workload in the short-term, reallocating resources and downsizing, looking for other work, seeking other naval work, re-focusing on other non-MoD work. They would consider moving, re-deployment, redundancy and re-training or mothballing facilities.

2.4 The survey also asked companies for solutions which UK MoD could offer to help them with the challenges they face. These included:

- (i) Order Astute submarines 4–6.
- (ii) Buy British.
- (iii) Provide other contracts for maintenance and order additional systems (eg for Trafalgar and Vanguard refits).
- (iv) Continue to fund development programmes which maintain capability.
- (v) Provide information on future MoD plans.

2.5 On skills, looking ahead over the next 10 years, 20% of companies anticipated problems in attracting skilled labour for their submarine business<sup>16</sup>. Firms planned a variety of policies to overcome any skilled labour problems. Their responses were typical of solutions likely to be used by private enterprise firms and included:

- Increase the training of apprentices and graduates and other bespoke training developments.
- In-house re-training and “upskilling” of existing staff.
- Employ and train to our level.

2.6 The companies felt MoD might help firms with their skilled labour problems by agreeing a long-term design and build programme (a number of firms supported this policy), supporting the UK defence industrial base and supporting UK submarine research and development (R&D).<sup>16</sup>

2.7 KOFAC considers that many of the points raised at the end of 2003 are just as relevant today in the context of the need for new boat orders.

2.8 In summary, in 2006 key risks to future UK submarine programmes include:

- Unexpected failure or withdrawal of key suppliers.
- Perceived fragility of the supply chain due to changes in submarine procurement strategy, eg slower drumbeat.
- The impact of earlier delays to boats 1 to 3 of the “Astute” class.
- Global market influences.
- Concerns over affordability.

2.9 BAE SYSTEMS are continually working with partners in the supplier chain to identify “supplier sustainability solutions” and adopt new ways of working that will help MoD with their initiative for “transforming submarine support”<sup>17</sup> and achieving the affordability identified in the Defence Industrial Strategy. Detailed studies of the fragility of the supplier base identified that over 50% of suppliers regard their equipment supply as bespoke for the UK SIB, over 52% considered any future single boat procurement strategies would have a negative impact on their business. Other work has categorised equipment by status to better define that which is critical equipment/materials that would require extensive development to replace, and that which is critical equipment/material that could impact boat integration. The introduction

<sup>16</sup> The UK Submarine Industrial Base, a report to Furness Enterprise Limited, Centre for Defence Economics, University of York (December 2003).

<sup>17</sup> The Nuclear Cluster, August 2006, DLO, Ministry of Defence, August 2006.

of modularization and new facilities for integration such as the Barrow “Warspite” facility enable extensive and earlier completion of key parts of the submarines prior to module insertion on the boats. Some suppliers have set up facilities in Barrow to help deliver key components in a more effective way. Seacon Phoenix from USA have partnered two local companies to assemble, deliver and help install specialist hull penetrators. More recently BAESYSTEMS “Wavelength” of October 2006 reports, “an industry/MoD ‘rainbow team’ has exceeded expectations . . . as part of a design for cost reduction contract . . . the boat 4 combat system team has demonstrated the potential to avoid tens off millions of pounds of cost”.<sup>18</sup>

### 3. *The level of investment needed to sustain essential infrastructure and core skills in the UK Submarine Construction Industry*

3.1 KOFAC considers that the level of investment needed to sustain essential infrastructure and core skills should be as follows:

- A batch of four more Astute submarines to be ordered in a 2007–08 timeframe. The First Sea Lord has told the House of Commons Defence Select Committee that “We need to keep building Astutes because once I have got these my worries about accountability will go”.
- A “drumbeat” sustained at one attack submarine delivered every 22 months, as at present.
- A “like for like” replacement for each of the existing Vanguard class submarines with significant work commencing in 2007 in order to sustain key design skills.

3.2 Industry should continue investment in cost reduction and productivity improvements, building upon the achievements made at Barrow since 2003 (see Appendix B).

3.3 There needs to be sustained development of core skills, in investment in the universities (as we describe in section 7), and in MoD to support the industry. MoD in August 2006 observed “it is difficult to find design engineers in the MoD with a deep specialism in submarines.”<sup>19</sup> More new graduates and young entrants through apprenticeships need to be attracted into the industry along with fiscal and promotional initiatives to encourage them to consider a career in the industry. BAE SYSTEMS’ involvement with schools and in education in the Barrow area may be a model to be replicated by key partners in the SIB.

3.4 The core skills base at Barrow of 3,310 people includes 1,275 management and support staff, 1,302 trades people and 600 designers. Employment has reduced to the 3,000 mark over recent years such that it has, in many disciplines, fallen to levels that are critically low. Any further reductions could result in capability being lost from the SIB. DIS recognises the fragility of the design skills base, which account for 600 jobs at Barrow. Fragility also applies in a number of key production areas. The Select Committee may wish to seek further evidence on these points from SIB industry representatives.

3.5 Britain’s existing nuclear powered submarine fleet is modest in size and ageing (see Table 1),<sup>20</sup> the attack submarine fleet especially so, and it will need replacing in the next few years. The expected operational life of an attack submarine is around 30 years. Submarines produced in the 1980’s will reach retirement age and begin to leave service in 2010. The Vanguard class submarines incorporate 1980’s/1990’s technology. Delivery of a replacement for the Vanguard class into Royal Navy service by 2024,<sup>19</sup> when HMS Vanguard will be 31 years old will enable the UK’s strategic deterrent to be carried in a 21st century submarine that is safer, quieter and more efficient operationally than its predecessor.

3.6 KOFAC understands that design work on the “first of class” “Astute” submarine is complete. Current design work relates to improving affordability and reducing costs for boats 2, 3 and 4 of the Astute class. That design work will be largely completed by mid 2007. KOFAC foresees a need, over the next six months, to identify new design work in order to ensure critically important design skills are retained in the UK. KOFAC welcomed the Government announcement that £20 million would be invested in 2006 and 2007 in the field of nuclear propulsion.<sup>21</sup>

3.7 It is a well known fact in the naval shipbuilding and submarine building industry that naval architects specializing in submarine design work can temporarily be transferred to design work on sophisticated large naval ships. However, the same cannot be said of naval ship designers. Submarine designers therefore need continuity of work a point recognized in UK and in USA. Ronald O’Rourke of the USA’s Congressional Research Service said “unless a major submarine design project is begun the design and engineering base will begin to atrophy through departure of experienced personnel. Rebuilding a design and engineering base would be time consuming, adding time and cost to the task of the next submarine design effort whenever it might begin.” The UK’s difficulties, delays and cost over-runs in early design of the Astute class submarine were a direct result of the UK design and engineering base having atrophied for lack of work.<sup>22</sup> If order gaps occur, individuals will leave the industry, and not return, making it then difficult and costly to resume design work.<sup>23</sup>

<sup>18</sup> “Team aids affordable sub drive”, Wavelength, page 7, BAESYSTEMS, October 2006.

<sup>19</sup> The Nuclear Cluster, August 2006, DLO, Ministry of Defence, August 2006.

<sup>20</sup> Parliamentary Answer, Hansard, 26 January 2005 and table 1, Royal Navy Submarine Fleet Ageing and Justification for More Boats to Create Fleet of eight Modern Submarines.

<sup>21</sup> House of Commons Defence Select Committee—Ninth Report of Session 2005–06, The Future of the UK’s Strategic Nuclear Deterrent: The Strategic Context—Government Response to the Committee’s 8th Report of Session 2005–06, House of Commons 1558.

<sup>22</sup> USA Submarine Industrial Base Council 2006 “World’s Premier Submarine Design Capability Leaflet”.

<sup>23</sup> Defence Industrial Strategy 2005 and “Reducing Strains on the Labour Resource available for Warship Building in the UK”, Furness Enterprise, July 2003.

#### 4. *The potential consequences of a gap in the submarine building programme for long term viability of the domestic manufacturing and skills base*

4.1 KOFAC recommends that a start on conceptual design of the Vanguard class replacement submarine should start early in 2007 to avoid any risk that skills atrophy from the industrial base's design capability at Barrow.

4.2 DIS (page 74) highlighted the fact that "UK military shipbuilding requires a highly skilled workforce can be confident in an enduring and stable career path". It also observed (page 74) that "when shipyards lay off workers, 70% of them leave the industry for good and are unavailable for hire by their former employer".<sup>24</sup>

4.3 KOFAC endorses the view expressed by Rand to UK MoD that "starting new submarine programmes after gaps in submarine production at Barrow will incur substantial costs and risks".<sup>25</sup>

4.4 Rand pointed out that if there is no follow-on to the Vanguard class production of the remaining Astute-class boats may have to be stretched (ie built at a slower drumbeat), and the start of any successor attack submarine programme accelerated. Rand went on to say "smoothing out the demand on submarine production resources would allow the industrial base to operate at peak efficiency and could reduce production costs by 5 to 10% per boat, thereby contributing to affordability",<sup>25</sup> a view KOFAC supports.

4.5 To ensure that the United Kingdom's nuclear submarine industrial base is sustained and operates efficiently KOFAC believe that MoD need to:

- Decide as soon as possible whether there will be a next generation SSBN class and when it will be designed and built. This decision is needed to inform any further actions to sustain the design base and schedule remaining Astute production to maximise efficiency. If the Vanguard class is not to be replaced, then planning should begin for an early follow-on SSN class if the submarine design base is to be sustained.
- Plan on annual investments to sustain a core of submarine specific design resources. A core of 600 designers, engineers, and draughtsmen would require annual funding to permit the core to participate in meaningful work such as "spiral development" of Astute class and continuous conceptual design development of future classes of submarine.
- Explore whether collaboration between BAE SYSTEMS' Barrow-in-Furness shipyard and the contractors employing engineers and draughting teams for in-service support is advantageous.
- Decide on the timing of construction for the next Astute-class contract. Currently the drumbeat is at 22 months. KOFAC considers this contract should be a multi-ship contract for four boats rather than one boat in order to give forward visibility of orders, encourage investment by the supply chain in facilities and training.

#### 5. *The implications of the rationalisation of the UK Shipbuilding Industry for the construction, maintenance and affordability of a possible successor to the Vanguard Class Submarine*

5.1 The DIS<sup>26</sup> proposed negotiation with key companies in the submarine supply chain to form a single industrial entity (DIS para 2.73). Since the DIS was published Ministers have announced (Hansard, 25 July 2006, Column 1544W) that, "given the number of industrial players in the submarine domain, consolidation to one entity may not be possible, other solutions such as an alliance or joint venture are being examined. MoD is considering a number of possible options with industry . . . negotiation is underway." KOFAC welcomes this latest policy statement, and supports the idea of an alliance or joint venture as a way forward.

5.2 KOFAC considers this approach will help achieve DIS objective for MoD and industry to "demonstrate an ability to drive down and control costs of nuclear submarine programmes"<sup>27</sup> (DIS para B2.63). Key partners should, under the new arrangements "play to their strengths" rather than seek to compete for work or offer new designs, not based on proven technology.

5.3 Co-operation is already underway between MoD, Rolls Royce, BAE SYSTEMS and DML on certain aspects of the submarine programme, as outlined in paragraph 2.8. Considerable progress has been made in making the submarine industry more affordable and sustainable. Examples include:

- Current design work at Barrow introducing spiral or incremental developments that help reduce costs and include commercial off-the-shelf technologies where appropriate in boats 2, 3 and 4 of the "Astute" class.
- Use of reactors that do not need refueling through a submarine's life, which will help save substantial sums of the MoD budget currently spent on refit work (see para 2.1, earlier).

<sup>24</sup> Reducing the strains in the labour force available for warship building in the UK, Furness Enterprise, July 2003, and Defence Industrial Strategy, UK Ministry of Defence, December 2005.

<sup>25</sup> The UK's Nuclear Submarine Industrial Base, Volume 1, Sustaining Design and Production Resources, Rand UK, 200.

<sup>26</sup> The UK Submarine Industrial Base, a report to Furness Enterprise Limited, Centre for Defence Economics, University of York (December 2003).

<sup>27</sup> The Nuclear Cluster, August 2006, DLO, Ministry of Defence, August 2006.

- Continuing annual cost base reduction/cost base challenge initiatives designed to address duplication/affordability and operational improvements which lead to reduced costs as outlined in Appendix B.

5.4 KOFAC urges MoD to concentrate lead design work on future Astute follow on boats and Vanguard class replacement submarines at Barrow in order to take advantage of the embedded expertise in actual design, build, test and commissioning, a capability that is not available anywhere else, in any other company, in the UK.

#### *6. The linkage between the Government's Defence Industrial Strategy and the decision on retention, replacement or abolition of the UK's Trident System*

6.1 DIS (2005) "endorsed, but has not yet committed funding for a 24-month SSN drumbeat," (paragraph B2.56) recognised "in the short term key design effort is focused on improving the whole life costs in the Astute design, in areas that have direct benefit to subsequent classes" (para B2.62), such as a Vanguard class replacement boat, and ensures "options for successor to the Vanguard class . . . are kept open" (paragraph B2.63).

6.2 A decision to retain and replace the UK's Trident submarine is seen by KOFAC as essential, in order to maintain the effectiveness of the Trident missile deterrent which we understand has a long life span. It is also essential in order to sustain the SIB workforce and critically important skills.

6.3 Rand have advised MoD "if the UK wishes to retain a submarine based strategic nuclear deterrent, design of a follow-on SSBN class would have to begin immediately".<sup>28</sup>

6.4 Abolition of the UK's Trident system would create a significant workload gap for submarine design and production skills. Rand informed MoD that "alternative work, such as conceptual design, spiral design, and unmanned undersea vehicle design could not by themselves adequately sustain a submarine design core,"<sup>29</sup> adding, "If there is no follow-on to the Vanguard class, Astute class boats may have to be built to a slower drumbeat and the start of a follow-on submarine accelerated . . .".

6.5 KOFAC considers gaps in submarine production are not something that should be favoured because they would result in:

- Loss of embedded expertise from the industry.
- Lower productivity.
- Difficulty in maintaining certification of key production personnel.

6.6 Level loading of the future submarine programme is essential as part of the DIS's Comprehensive Long Term MoD Shipbuilding strategy to make more efficient use of shipyard facilities and workforce skills. KOFAC therefore endorses Rand's view that,

"To sustain and make most efficient use of the submarine production base, an 18-month (or, at most, 24-month) drumbeat should be employed, with no additional break between the third and fourth boats of the class (ie the last boat under the current contract and the first under the next)".

#### *7. The extent to which nuclear expertise in the Civil Nuclear Industry and Higher Education Sector underpins the UK knowledge and skills base in the Military Nuclear Field*

7.1 Only around 7,000 people are employed in the nuclear defence sector, although there are around 56,000 people employed in the UK civil and defence nuclear sector as a whole.<sup>30</sup> The number employed on nuclear propulsion is quite small. Skills shortages are emerging in safety case/radiological protection and in MoD where on the design authority side (in August 2006) they are "over 15% undermanned", because "it is difficult to find engineers with a deep specialism in submarines."<sup>31</sup>

7.2 Unless action is taken nuclear education will not be robust or flexible enough to support the industry and its growth. Only 22 of the UK's 130 universities include a nuclear element to their courses, and nuclear education in the UK has recently been described as being "in a very fragile state", with "those" (students) "experiencing nuclear education constitute a woefully small percentage".<sup>30</sup> Unless action is taken nuclear education will not be robust or flexible enough to support the civil or defence segments of the industry and its growth, particularly if UK proceeds to build new electricity generating capacity. At undergraduate level only taster courses are offered. This reflects the "low demand" for specialist university training and lack of nuclear related job opportunities in the UK in recent years. The 13 universities offering post-graduate studies cater for 320 students per year, however, only 72 are on 100% nuclear courses. At undergraduate level around 360 students take courses with more than a 5% nuclear content. The Royal Navy deliver 11 courses

<sup>28</sup> Rand indicated a Vanguard class submarine needs 50% more labour hours than Astute and envisaged a 36-month drumbeat for the delivery of the new boats.

<sup>29</sup> The UK's Nuclear Submarine Industrial Base, Sustaining Design & Production Resources, Vol 1, Rand 2005.

<sup>30</sup> COGENT, November 2003, Nuclear Industry Appendix to market assessment for the Sector Skills Council for the chemical, nuclear, oil and gas, petroleum and polymer industries and HSE/N11, February 2002, "Nuclear Education in British Universities".

<sup>31</sup> The Nuclear Cluster, DLO-MoD, August 2005.

a year, training around 500 students. HMS Sultan (the Royal Navy college), universities of Birmingham, Surrey, and in the north west of England Lancaster, Liverpool and Manchester, are some of the core universities offering postgraduate “nuclear” studies.

7.3 The future supply of graduates for the civil and defence nuclear industry is likely to be drawn from mechanical, electrical, electronics, chemical, civil, physics and chemistry degree courses. In 2001, there was a supply of 13,250 students taking these courses.

7.4 The challenges therefore facing the civil and defence nuclear industry as a whole are to:

- Promote the profile of the nuclear sector to young people by increasing the apprentice intake and attracting them into the sector from the pool of engineering and physics university students at a time when such subjects are less popular.
- Underpin essential learning pathways to develop the skills needs of the civil and defence nuclear industry and Support the educational institutions, especially those in the north west in delivering graduates.
- Reduce indecision about future investment in new civil nuclear industry and in the nuclear submarine industry.
- Address the problem of pay which is often a “lure to leave”.
- Address competition for control and instrumentation engineering skills and safety case writing skills and competition for numerate graduates from insurance and financial services companies.

## 8. *The economic characteristics of Barrow-in-Furness*

8.1 Barrow-in-Furness is the home of the UK’s nuclear submarine systems integration facility, it employs 3,310 people directly and accounts for 9.7% of the 34,181 person workforce in the Travel to Work Area. The Barrow “Travel to Work Area” contains a population of 97,000 people. The main town is Barrow-in-Furness (population 72,000). The labour market is one of the most defence dependant, and isolated in the UK. The next nearest towns are 47 and 34 miles away. The Northwest Regional Economic Strategy identifies Barrow as being the one area where there is a concentration of worklessness remote from the engines of growth (city regions) in the northwest. Barrow is ranked 29th most deprived District Council area in England.<sup>32</sup> Employment at Barrow shipyard fell from 14,250 in 1990 to 5,800 in 1995, and to below 3,000 in June 2004. It now stands at 3,200, and constitutes the largest manufacturing employer in the Travel to Work Area. The next largest is GlaxoSmithKline with 570 employees. The real level of unemployment in Furness is high, with Sheffield Hallam University citing the rate as being 18.6%. Job vacancies levels are low—the current figure being 305 (July 2006). New job creation rates in Furness average 533 jobs per year, in 2005, 507.5 jobs were created through the work of the Furness Enterprise Partnership.<sup>33</sup>

8.2 Barrow is one of England’s most “business deprived districts” and the most deprived in north west England. It has acute levels of worklessness, 60% higher than the England average.<sup>34</sup>

8.3 BAE SYSTEMS contributes significantly to the Barrow and Furness economy. The total annual wage bill is around £77 million. Average managerial wage is £45,000. Average skilled tradesperson wage is £20,000. The workforce is relatively young, but experienced, 76% (2,387) of employees being under the age of 45. The multiplier effect of the shipyard is high, and it is one of the largest contributors to Cumbria’s Gross Value Added (GVA).

8.4 Given that “Astute” class submarine design work is largely completed, any decisions to delay further “Astute” class boat orders or to abandon a Vanguard class replacement submarine or delay it by several years could put at risk a significant number of well paid jobs in design, administration and skilled trades which would be difficult to replace in a relatively short period of time. It is highly likely any replacement jobs would be on a lower salary in another sector.

8.5 KOFAC considers that the economic “wellbeing” of the Furness area still depends to a large extent on sustaining the nuclear submarine building industry in the Barrow shipyard. In 2003 PA Management Consultants concluded “our research has shown that the value of one additional (“submarine”) boat, employing 2,000–3,000 people for 18–24 months is worth more to Barrow than any combination of diversification possibilities”.<sup>35</sup>

8.7 KOFAC therefore advocates MoD should smooth out demand on submarine production resources to enable the industrial base to operate at peak efficiency, ie a drumbeat of 18–22 months for Astute submarines and a 36 month drumbeat for Vanguard replacement boats.

<sup>32</sup> The English Indices of Deprivation 2004 (revised), Office of the Deputy Prime Minister.

<sup>33</sup> Assisting Companies to Create Jobs 1992–2005, Furness Enterprise, March 2006.

<sup>34</sup> City Markets—business location in deprived areas, IPPR Centre for Cities 2006.

<sup>35</sup> PA Management Consultants Barrow Shipyard Study for the Barrow Task Force, 12 September 2003.

## APPENDIX A

### BARROW'S COMPETITIVE EDGE AS A SUBMARINE CENTRE OF EXCELLENCE<sup>36</sup>

A.1 Barrow's competitive edge can be considered in terms of the strengths and weaknesses associated with the shipyard and its specific skill base.

A.2 Barrow's strengths as a Submarine Centre of Excellence are:

- Senior management personal commitment to the Astute programme in the long-term by relocating into the local area.
- Senior level visibility of, and buy-in to, Submarine Centre of Excellence concept with BAE SYSTEMS.
- Committed management team vertically integrated up to Prime Contract Office.
- Clarity of strategy, market, role, focus associated with Centre of Excellence role.
- Potential Astute workload of six–nine boats, with the last production possibly extending through to 2020.
- Unique and strong submarine capability: people; processes; facilities.
- Value for money: it is believed by BAE SYSTEMS that Astute will deliver  $\frac{2}{3}$  of a US boat capability at 40% of the cost.

A.3 In addition to their proven strengths in overall submarine and surface ship design and build, Barrow has particular capabilities and skills that are not readily available elsewhere in the UK. These include in particular:

- Design of a highly complex, high tech product:
  - Systems Engineering.
  - Nuclear.
  - Noise and vibration.
  - Modular design.
  - Large, complex fabrications and structures.
  - Complex spatial layouts and routings.
  - Advanced propulsion systems.
  - Combat systems.
- Production:
  - Large, complex metal forming, fabrication and assembly.
  - High integrity (nuclear) pipe work.
  - Military and commercial outfitting.
  - Complex test and commissioning.
- Design and physical integration of highly complex, “through boat/ship” systems and availability of the SMITE facility.
- Complex programme management.

## APPENDIX B

### PRODUCTIVITY IMPROVEMENTS 2006 AT BAE SYSTEMS, BARROW

#### COST BASE REDUCTION/COST BASE CHALLENGE 2006

Duplication/Affordability/Operational Improvements aim to reduce overhead and direct man hours:

- |              |   |
|--------------|---|
| Overhead     | further reduce the overheads before the end of 2006.                          |
| Direct costs | a reduction in the remaining costs to go in terms of man-hours and materials. |

#### LEAN MANUFACTURE

Across whole production process using “Value Stream Mapping”. New layouts and key manufacturing principles are being deployed to reduce material and people movement, to shorten lead times and produce the product more efficiently. Enhanced quality inspection methods are being developed to increase efficiency by creation of a portable inspection system that allows QC inspectors to input direct to their database whilst on the boat rather than a paper then PC based system in use at the moment.

<sup>36</sup> PA Management Consultants 2003, Barrow Shipyard Study for the Barrow Task Force, 12 September 2003.

## LEAN DESIGN

Design for cost—initially looking at part count and labour reduction. Pilot workshops have shown that low innovation ideas could reduce the cost of certain equipment by a significant amount not including the ripple effect created by removing the need to purchase, store, install, test and commission items on the boat. It has become clear that potential major savings could be achieved if certain requirements can be successfully challenged and modified.

## LEAN OFFICE

Pilot project in staff areas using “value stream mapping”. The project is being used to increase efficiency in staff areas and to develop a staff process improvement methodology for expansion into other areas.

## ORGANISATIONAL DEVELOPMENT

The behavioral change program started in mid 2004 continues to embed real change. The project continues to align processes and systems with a set of Submarines values and competencies. Projects include continued development of organisation strategy and objective deployment, supported by the all employee bonus and hard wired changes to the PDR process. We also see the maturity of an innovative employee involvement scheme “PRIDE” which will be the core driver for continuous improvement and engagement in Submarines, the development of a strategic leadership development programme as well as a continuation of the Trade Union partnership work.

# APPENDIX C

## RAND OBSERVATIONS ON THE NUCLEAR SUBMARINE DESIGN SKILLS BASE

“Gaps in design and production can lead to the departure of experience personnel to other industries and to the erosion of defence system production skills.”

“The submarine design base is rapidly eroding. Demand for the design and engineering resources is declining as the design of the first of class nears completion. The number required will be fewer than that needed to sustain a viable nuclear submarine design base.”

“To sustain the United Kingdom’s nuclear submarine design expertise, some minimum core of professionals must continuously work in that area. The number required varies with the domain of expertise. The total number required across all domains is approximately 200. The workforce could drop below this critical level in the near future without a new design programme.”

There are options for sustaining the 200-person submarine design core, the ideal way would be to soon commence the design effort for a new class of submarines. No decision have been made regarding any programmes beyond the Astute class. The current Vanguard SSBN class could begin retiring as early as 2018. Design of a follow-on SSBN class would have to start approximately 15 years prior to the desired in-service date for the replacement submarines. The design for a follow-on class would have to begin immediately. The Astute-class design would have to begin some 10 years in advance of delivery of the first of class.”

“There may still be a period of time when the design core is inadequate in at least some of the specialties required to sustain expertise. How might the design core be sustained through periods of slack demand? There are several possibilities:

- Evolution of the Astute design as more boats are built to take advantage of new technologies.
- Continuous work on conceptual designs for new submarine classes, whether or not those classes are ever built.
- Design of unmanned undersea vehicles.”

“These options could be exercised simultaneously. However, taken together, they could not by themselves adequately sustain a submarine design core.”

“Collaboration with the United States or another submarine-producing country should also be considered. Design work on each country’s submarine programmes could help sustain the other’s design core.”

“A core of 200 designers, engineers, and draughtsmen would require annual funding of perhaps £15 million.”

*Source:* Rand Europe 2005, Volume 1 of The UK’s Nuclear Submarine Industrial Base: Sustaining Design and Production Resources.

**Table 1**

**ROYAL NAVY SUBMARINE FLEET AGEING AND JUSTIFICATION FOR MORE  
BOATS TO CREATE FLEET OF 8 MODERN SUBMARINES**

(based on Parliamentary Answer of 26 January 2005 and Keep Our Future Afloat Research\*)

Mr Ingram: The Royal Navy has four Vanguard class (SSBN) and 11 Swiftsure and Trafalgar class (SSN) submarines in service. Based on their in service dates the age of each boat in 2005 is as follows:

<i>Submarine</i>	<i>Age in Years 2005</i>	<i>Age in Years 2009*</i>	<i>Age in Years 2011*</i>	<i>Age in Years 2013*</i>	<i>Age in Years 2015*</i>	<i>Age in Years 2017*</i>	<i>Age in Years 2019*</i>	<i>Expected Ship Payoff Date Source: Hansard 7 Jan 2004 Col 414 W</i>	<i>Design life Assumptions For SSN and SSBN Submarines with source</i>
<b>SSBNs</b>									
HMS Vanguard	12	16	18	20	22	24	26		30
HMS Victorious	10	14	16	18	20	22	24		30
HMS Vigilant	9	13	15	17	19	21	23		30
HMS Vengeance	6	10	12	14	16	18	20		30
<b>SSNs</b>									
HMS Sovereign	31	35	37	39	41	43	45	2006	32 :Hansard
HMS Superb	29	34	36	38	40	42	44	2008	32 : Hansard
HMS Sceptre	27	31	33	35	37	39	41	2010	32: Hansard
HMS Spartan	26	30	32	34	36	38	40	2006	27: Hansard
HMS Trafalgar	22	26	28	30	32	34	36		33 US Navy CRS-26***
HMS Turbulent	21	25	27	29	31	33	35		30–33
HMS Tireless	20	24	26	28	30	32	34		30–33
HMS Torbay	18	22	24	26	28	30	32		30–33
HMS Trenchant	16	20	22	24	26	28	30		30–33
HMS Talent	15	19	21	23	25	27	29		30–33
HMS Triumph	14	18	20	22	24	26	28		30–33
<b>ASTUTE SSNs</b>									
HMS Astute**	0	1	3	5	7	9	11		
HMS Ambush**	0	0	1	3	5	7	9		
HMS Artful**	0	0	0	1	3	5	7		
Boat 4**	0	0	0	0	1	3	5		
Follow on boats 5	0	0	0	0	0	1	3		

*Notes:*

Government in 2004 announced they would sustain a fleet of eight rather than 10 SSN submarines, originally proposed in the Strategic Defence Review.

The UK Government have said any decision on replacing Vanguard class would need to be made in the next Parliament, (2005–09).

\*\*assumption made a new boat is delivered into service every 24 months.

\*\*\*USA Congressional Research Service Report:CRS-26 , 8 November 2004, “Navy attack submarine force level goal and procurement rate : background and issues for congress”.

5 October 2006

### **Memorandum from Greenpeace UK**

Greenpeace’s submission looks at the Government’s investment programme at AWE Aldermaston. In Annex C of its November Memorandum to the Defence Select Committee, the Ministry of Defence wrote about the investments that the Government is now making in AWE that:

“The additional investment at AWE is required to sustain the existing warhead stockpile in-service irrespective of decisions on any successor warhead.”

And then Defence Secretary John Reid told Parliament on 19 July 2005 that:

“The purpose of investing some £350 million over the next three years is to ensure that we can maintain the existing Trident warhead stockpile throughout its intended in-service life.”

In our evidence to the Committee (attached) we give reasons for doubting that this is in fact the case:

- The quantum leap in the capacity of technology now being put in place at Aldermaston, and the hiring of a new generation of scientists, engineers and technicians, does not make sense if the purpose is to maintain the safety and reliability of the existing warheads;
- There is considerable a tension between statements by AWE itself that the purpose of this investment program is both to maintain the safety and reliability of existing warheads and to develop its capacity to build a new nuclear weapon with out testing, AWE statements that most



of the scientific effort at AWE is focused on problems associated with building a new nuclear weapons, and the Government's emphasis that these investments are for maintaining the safety and reliability of the existing stockpile;

- Leading US nuclear weapons scientists argue that a science-based stockpile stewardship programme is not what is needed to maintain the safety and reliability of existing warheads. They argue that, to the contrary, this is best done by engineering-based inspection and remanufacture. Most seriously, they argue that if science-based stockpile stewardship leads to alterations in warheads, or new warhead design, this will lead to uncertainties about their functioning and this will create political pressure for a return of nuclear testing. This is a particularly serious concern at present as the USA has recently carried out a test, named "Unicorn," to ready the Nevada test site for a return of nuclear testing should that be ordered by the President.

There is also the serious concern that the cost of the facilities now being developed at AWE Aldermaston may turn out to be far larger than currently anticipated. Take the Orion Laser now being built. The precedent set by the US facility, the National Ignition Facility is not reassuring. Its cost has escalated from \$1.2 billion to \$4.5 billion and is still climbing.

This program of investment raises two linked concerns.

- Undermining Deliberative Democracy and the Sovereignty of Parliament. The Government's investment programme is undermining deliberative democracy and the sovereignty of parliament. The proper procedure should be an open and informed debate first, then a decision by parliament on whether to go ahead with the investments necessary to make a bomb, and finally the investments. Instead, the evidence strongly suggests that we have an "Alice in Wonderland" situation of investments first, official decision second, and public debate and parliamentary vote last of all.
- Undermining the Nuclear Non-Proliferation Treaty and the Comprehensive Test Ban Treaty. These investments directly threaten treaties that Britain has signed. Greenpeace believes that if the UK and other nuclear weapon states continue to flout the deal they made with the international community first in 1968, when they signed the Nuclear Non-Proliferation Treaty (NPT), and again in 1996 when they signed the Comprehensive Test Ban Treaty in part fulfilment of their NPT obligation to negotiate disarmament, then the system of international cooperation will fail.

The two issues are linked because Parliament's ratification of the NPT and the CTBT made it a guardian of these treaties and a duty to ensure that the UK does not undermine them. In the light of the evidence set out in our submission to the inquiry, Greenpeace strongly urges the Defence Select Committee to conduct a thorough inquiry into the real purpose of the investments now being undertaken at AWE Aldermaston.

In particular we would strongly urge the Committee to use its powers of investigation to question nuclear weapons scientists, engineers and technicians at AWE Aldermaston and that it will also invite those leading US nuclear weapon scientists who have questioned the need for science-based stockpile stewardship to maintain the existing deterrent and raised very serious concerns that science-based stockpile stewardship will lead to a return of nuclear testing to give written and oral evidence to the committee.

As these are issues of some technical complexity it would make sense for the Committee to secure independent counsel with a knowledge of this area, two persons who might be able to assist the Committee in this way in the UK are Professor Donald MacKenzie at the Science Studies Unit, the University of Edinburgh (widely regarded as one of the top international experts on the sociology of science and technology and who conducted in-depth studies of nuclear weapons expertise in the US), and Dr Graham Spinardi also at the Science Studies Unit (whose particular expertise is the Trident nuclear missile system).

There is much that needs to be cleared up here and the Committee is in a unique position to gather and probe the UK and US expert evidence needed to find out the truth.

#### THE GOVERNMENT'S PROGRAM OF INVESTMENT IN AWE ALDERMASTON

1. The Government will spend more than £1 billion over the next three years on upgrading AWE Aldermaston and Burghfield.<sup>38</sup> The actual money for the upgrades, however, will almost certainly be larger. Similar US projects have typically ended up being many times their predicted costs. For instance the US National Ignition Facility laser costs have escalated from \$1.2 billion to \$4.2 billion and is still climbing.<sup>39</sup>

2. The Government has stated that its current program of investment in Atomic Weapons Establishment (AWE) Aldermaston is "necessary" to maintain the safety and reliability of the UK's existing nuclear warheads "irrespective" of any decision to make a new nuclear weapon. AWE's statements that a central purpose of the current investment program is to ensure that that it can build a new nuclear weapon programme, and the scientific and technical details of the facilities being developed and scientists, engineers, and technicians being hired make the this claim very hard to believe. When combined with statements by

<sup>38</sup> Ministerial Statement by the Secretary for Defence, John Reid, *Hansard*, Column 59WS, 19 July 2005.

<sup>39</sup> Maryliia Kelly, "National Ignition Facility Update," *INESAP Bulletin 21*, <http://www.inesap.org/bulletin21/bul21art33.htm>

independent US nuclear scientists and top US nuclear weapons scientists that the kinds of facilities being developed at AWE Aldermaston are not necessary at all to maintain the safety and reliability of the nuclear deterrent, the Government's claim becomes incredible.

3. Ten years after all five declared nuclear weapon states signed the Comprehensive Test Ban Treaty (CTBT), the US nuclear weapons scientists raise a further issue. They argue that any attempt to improve existing nuclear weapons, or to make new ones, using the kind of exotic technologies being developed at Aldermaston will, inevitably, lead to uncertainty about the performance of nuclear warheads and this will create political pressure for a return of nuclear testing. The fact that the UK does not possess its own test site means that it could not carry out such tests on its own. AWE's warhead development, however, will be done in close cooperation with the giant American nuclear weapons laboratories—Los Alamos and Sandia in New Mexico, and Lawrence Livermore in California—and there are already serious concerns that their developments of new warheads will lead to a return to nuclear testing.

4. The entry into force of the Comprehensive Test Ban Treaty is a major foreign policy goal of the UK. The UK should not, therefore, cooperate in any US-UK warhead development work which may lead to nuclear testing. The seriousness of this issue is underscored by the fact that, with the Unicorn sub-critical nuclear test, the US is bringing the Nevada test site into an advanced state of readiness for a resumption of nuclear testing. The upgrading of Aldermaston may also lead to a resumption of nuclear testing by another route. The use of exotic technologies to design and build a new nuclear weapon will lead other countries to ask: "Why should we continue to respect the CTBT when the UK is using exotic technologies, and its access to US expertise and facilities to develop a new nuclear weapon without testing?"

#### THE UPGRADING OF ALDERMASTON'S CAPACITY TO BUILD A NEW NUCLEAR WARHEAD

5. The quantum leap in AWE Aldermaston's capacity to design and build a new nuclear weapon, and the hiring of a new generation of scientists, engineers, and technicians now underway strongly suggest that a major purpose of current investments is a nuclear weapon development programme.

6. *The Blue Oak and Larch Supercomputers:* Supercomputers are used by nuclear weapons laboratories to simulate in great detail the detonation of a nuclear weapon and can be used as a tool to improve nuclear weapon design. Aldermaston plans to purchase two new supercomputers—known as Blue Oak and Larch. *They will improve its capacity to model nuclear weapons explosions nine hundred times.*<sup>40</sup> The Blue Oak computer, with a power of just under three teraflops,<sup>41</sup> was installed in 2002. Then in 2006 an order was placed for Larch, a £20 million computer with a peak performance of 40 teraflops. If it were in service today, Larch would be the most powerful computer in Europe.

7. *The Core Punch Hydrodynamic Facility:* Hydrodynamic testing allows nuclear weapons laboratories to gather test data previously only available from underground nuclear tests. Specifically it is used to study the behaviour of plutonium and other nuclear materials under the pressure of high explosives. For example, it is used to examine how the primary stage of a nuclear warhead implodes under the pressure of its detonating high explosive. The term "hydrodynamic" is used because under the high pressures produced in these experiments, solid materials flow like liquids. AWE is planning to build a brand new hydrodynamic testing facility, known as the Core Punch Facility. This will have the capacity to make measurements *an order of magnitude more precise* than the existing hydrodynamic facility.<sup>42</sup>

8. *The Orion laser:* AWE plan to build a new laser called Orion that is 1,000 times more powerful than its current "Helen" laser. Lasers are used to simulate conditions found within a nuclear detonation on a minute scale. They enable scientists to study the processes of nuclear fusion and boosting, and construct predictive models for nuclear explosions. Multiple laser beams are focused on targets containing deuterium and tritium. These targets are heated and compressed sufficiently for fusion to occur. The technical term for this is "inertial confinement fusion". Data from the Orion laser will supplement that received from the vast new US laser, known as the National Ignition Facility (NIF). In 1999 the UK committed £29 million to NIF, for British tests on the facility.

9. *Sub-critical testing* Sub-critical tests are exactly the same as nuclear tests, except that when the atomic bomb is detonated it has insufficient fissile material in its core for a self-sustaining nuclear chain reaction to build up. Data from the tests are then fed into supercomputers to model how a nuclear weapon would work. AWE Aldermaston and the US Los Alamos National Laboratory undertook their first joint sub-critical underground nuclear explosion, Vito, on 14 February 2002 at the US Nevada nuclear test site. A second, Krakatau, was carried out on 23 February 2006. The Ministry of Defence has insisted that it is using these tests solely to test the safety and reliability of the Trident warhead. However sub-

<sup>40</sup> "The Way Ahead: AWE Annual Report 2002," (AWE, April 2003 ): 4.

<sup>41</sup> A teraflop is a unit of computing speed, equal to one trillion floating point operations per second.

<sup>42</sup> *Ibid*: 5.

critical tests are regarded as extremely provocative, as the data can be used to model new nuclear weapons designs. Indeed in March 2006 the *Sunday Times* reported that results of the Krakatau sub-critical test will be used to help both US and Aldermaston scientists to design a new warhead.<sup>43</sup>

10. *New laboratories for materials testing* It is proposed that new facilities will be built at Aldermaston, and possibly also at Burghfield, for research into material science. This research will look not only at how individual materials behave but also at how components of a nuclear warhead may interact. Additionally AWE plans to build a new explosives handling facility, as well as a facility for uranium and tritium.

11. *Hiring a New Generation of Scientists, Engineers, and Technicians.* As well as building these new facilities, Aldermaston is also having a huge recruitment drive—to hire a new generation of nuclear scientists, engineers and technicians. During the period July 2005 to March 2006, Aldermaston recruited 90 scientists, 250 engineers, 57 technical support staff, and 98 business services staff. By contrast, it lost only 180 staff. It now plans to recruit a further 700 staff by the end of March 2008, in roughly the same proportion.<sup>44</sup> Of particular interest are plans to increase the number of scientists with expertise in hydrodynamics testing from 70 to 95 over the next three years. The only real use for hydrodynamic expertise, according to Greg Mello, the Director of the Los Alamos Study Group, is for designing a new nuclear weapon.

12. *Increased US-UK nuclear weapons cooperation.* We are also seeing the kind of increased co-operation between the UK and US that might be expected if a nuclear weapon programme was underway. In 2004, the UK government prepared the way for the scientific and technical co-operation with the US necessary to develop a new nuclear weapon by renewing the Mutual Defence Agreement. This agreement provides for technical co-operation between the US and the UK on the manufacture of nuclear weapons. Furthermore, the government has authorised officials to begin talks with the US and with defence companies about a successor to Trident. In recent years there has also been a significant increase in co-operation between Aldermaston and the giant US nuclear weapons laboratories, including a rough doubling in the number of meetings between Aldermaston scientists and their US counterparts.<sup>45</sup> Answers to Parliamentary Questions confirmed that UK and US nuclear scientists are currently on 16 joint working groups, “nuclear weapons engineering” and “nuclear weapon code development” being prominent among them.<sup>46</sup> The level of intimacy between the US and UK nuclear weapons laboratories is also reflected by the fact that the Ministry of Defence has appointed a top US nuclear weapons scientist, Don Cook, to manage Aldermaston.

#### *All about safety and reliability?*

13. When questioned, the UK Government has repeatedly claimed that investments in AWE are necessary irrespective of any decision to develop a new nuclear warhead. For instance on 19 July 2005 then Defence Secretary John Reid stated that: “The purpose of this investment of some £350 million over each of the next three years is to ensure that we can maintain the existing Trident warhead stockpile throughout its intended in-service life.”<sup>47</sup> Also in its November Memorandum to the Defence Select Committee the Ministry of Defence stated that: “This additional investment at AWE is required to sustain the existing warhead stockpile in-service irrespective of any decision on any successor warhead.”<sup>48</sup>

14. The Atomic Weapons Establishment (AWE) itself however takes a different view. In 2002 it stated that “The capability to build a successor (to trident) will have to be achieved without conducting nuclear tests. *This poses considerable scientific and technical challenges. We are therefore developing a complex science-based program at AWE that will require special facilities across a variety of disciplines.*”<sup>49</sup> On the AWE website Dr Clive Marsh, AWE’s Chief Scientist also states: “Our research & development work splits into two main but inter-related areas. The first is the requirement to maintain the current Trident stockpile. The second is to develop our overall warhead design and assurance capabilities, including the ability to provide a new warhead lest our government should ever need it as a successor to Trident. *Most of our research is conducted in this capability area.*”

15. Leading US nuclear weapons scientists, who have been at the heart of US science policy and nuclear weapons physics, also believe that such facilities are unnecessary simply to maintain the safety and reliability

<sup>43</sup> Michael Smith, “Britain’s Secret Nuclear Blue Print,” *Sunday Times*, (12 March 2006).

<sup>44</sup> Written Answer, *Hansard*, 3 July 2006, to question by Mike Hancock MP.

<sup>45</sup> Nicola Butler and Mark Bromley, “Secrecy and Dependency: The UK Trident System in the 21st Century,” (BASIC, 2001): 21.

<sup>46</sup> *Ibid*: 20.

<sup>47</sup> Ministerial Statement by the Secretary for Defence, John Reid, *Hansard*, Column 59WS, 19 July 2005.

<sup>48</sup> The Future of the UK’s Strategy Nuclear Deterrent: Written Evidence from the Ministry of Defence, HC835 (The Stationary Office, 30 June 2006): Ev 5.

<sup>49</sup> The AWE Site Development Plan 2002, (AWE, July 2002):3.

of nuclear weapons.<sup>50</sup> They include: Ray Kidder—a Senior Nuclear Weapons Designer at Lawrence Livermore and advisor to the Senate Armed Services Committee; Norris Bradbury former Director of Los Alamos; Carson Marks—former Head of Los Alamos Theoretical Division; Physicist Jonathan I Katz, who was a member of the elite JASON group of eminent scientists formed to give high-level science advice to the US government; and Richard Garwin—who not only headed research at IBM's Thomas J Watson Research Centre, but has also been a member of the President's Science Advisory Committee and the Defense Science Board.

16. These scientists have repeatedly argued that the maintenance of existing US nuclear weapons stocks (weapons which were the subject of repeat nuclear tests before a testing moratorium was imposed in the US) is best done via engineering-based inspection and re-manufacture.

17. In essence inspection and re-manufacture involves detaching and checking each of the thousands of individual parts that make up a nuclear weapon and its subsystems. If there are any problems or signs of deterioration the part is simply replaced by an identical part. Stocks of identical parts are created through re-manufacturing parts according to their original specifications. As long as the basic weapon design, particularly the plutonium pit in the warhead itself, is not changed then this method will continue to work.

18. This engineering approach (sometimes referred to as curatorship) is the way that the US stockpile was maintained during the Cold War. The small number of nuclear tests that were done to check the safety and reliability of the stockpile showed that the method worked. Hisham Zerriffi and Arjun Makhijani of the Institute for Energy and Environmental Research conducted an extensive survey of past flaws with US nuclear weapons. They concluded that existing procedures for maintaining their safety were entirely adequate and that science-based stockpile stewardship was not—as claimed by the weapons laboratory directors—needed for this purpose.<sup>51</sup>

19. Two reports commissioned by the US Department of Energy from the JASON group, an elite body of US scientists set up to give high-level advice to the government, reinforce the point that unless nuclear weapons are modified or re-designed, an engineering approach is adequate: *"The primary—if not the sole—nuclear weapons manufacturing capacity that must be provided for in an era of no nuclear testing is the remanufacture of copies of existing (tested) stockpile weapons . . . the ultimate goal should be to retain the capability of remanufacturing SNM [special nuclear materials] components that are as identical as possible to those of the original manufacturing process and not to "improve" those components. This is especially important for [plutonium] pits."*<sup>52</sup>

#### THE COMPREHENSIVE TEST BAN TREATY

20. These developments will increase pressure for a return to nuclear testing—thereby undermining UK efforts to get the Comprehensive Nuclear Test Ban Treaty to enter into force, and the international norm of not testing which emerged from the long moratoria on nuclear testing during the 1990s and the fact that no country has tested since 1998. The concerns expressed by leading scientists about the "virtual" design and testing of new nuclear weapons rather than simple remanufacture of old designs is also inextricably linked to the issue of nuclear testing. The creation of completely new nuclear weapons through the use of advanced computer modeling and laboratory experiments will inevitably lead to reduced confidence in the reliability of those weapons because the conditions created by the use of powerful lasers or hydrodynamic tests are very different to those created by an actual nuclear explosion. It will only be a matter of time before politicians and the military begin to create pressure for a return to full-scale nuclear testing to make sure their new weapons "really work".

21. As Sidney Drell, US nuclear weapons physicist and long-time advisor to the US government put it: *"If anybody thinks we are going to be designing new warheads and not doing testing, I don't know what they are smoking. I don't know of a general, an admiral, a president or anybody in responsibility who would take an untested new weapon that is different from the ones in our stockpile and rely on it without resuming testing."*<sup>53</sup> And Jonathan I Katz has also commented: *"Nuclear weapons are not well enough understood to permit the*

<sup>50</sup> Ray Kidder, "Problems with stockpile stewardship", *Nature*, 386 (17 April 1997); Richard L Garwin, "The Maintenance of Nuclear Weapon Stockpiles Without Nuclear Explosion Testing," 24th Pugwash Workshop on Nuclear Forces in Europe, September 1995; Jonathan I Katz, "Curatorship vs Stewardship," <http://www.physics.wustl.edu/~katz/curator.html>; Frank von Hippel, "The Department of Energy's Stockpile Stewardship Program," *Journal of the Federation of American Scientists* (FAS Public Interest Report, January/February 1997), <http://www.clw.org/archive/coalition/fasvonhippel010297.htm>; Hugh Gusterson, "Nuclear Weapons Stockpile Stewardship: A Debate About the Future of Weapons Science," (MIT, October 1997), <http://web.mit.edu/sts/SSBS/>; and Robert Civak, *Managing the US Nuclear Weapons Stockpile: A Comparison of Five Strategies*, (Tri-Valley CAREs, July 2000).

<sup>51</sup> Hisham Zerriffi and Arjun Makhijani, "The Nuclear Safety Smokescreen: Warhead Safety and Reliability and the Science Based Stockpile Stewardship Program," (IEER, 1996).

<sup>52</sup> S Drell *et al* "Science Based Stockpile Stewardship," JSR-94-345 (The MITRE Corporation, November 1994): 81; Greg Mello, "Ask Few Questions, Get Few Answers: The JASONS' "Science Based Stockpile Stewardship," (Tri-Valley CAREs, February 1995), <http://www.lasg.org/archive/1995/jasons.htm>; & Greg Mello, "No Serious Problems: Reliability Issues and Stockpile Management," (Tri-Valley CAREs, February 1995), <http://www.lasg.org/archive/1995/noprob.htm>

<sup>53</sup> Quoted in Robert W Nelson, "If it Ain't Broke: the Already Reliable US Nuclear Arsenal," *Arms Control Today*, (April 2006).

*development of new weapons, or the modification of those we now possess, without tests at substantial (multi-kiloton) nuclear yield. Despite 50 years of experience, including large numbers of tests at full nuclear yield, we do not have sufficient confidence in our design tools. It is unlikely that any future work without nuclear testing could give us that confidence”.*

22. So the new hi-tech developments being built at Aldermaston are not only unnecessary if the aim is simply to maintain the UK’s existing weapons, they also undermine the CTBT and NPT, and set Britain on the road towards resuming full-scale nuclear tests. Worryingly, the US administration, which often supplies the UK with nuclear test data, seems to be already preparing to resume testing. On 16 September 2003 the US Senate voted to spend \$45 million over three years, to reduce the time needed to prepare the Nevada Test Site for underground nuclear tests from 24–36 months to 18 months.

23. The upgrading of Aldermaston threatens the Comprehensive Test Ban Treaty (CTBT) through another route. Readers of George Orwell’s *Nineteen Eighty Four* will not be surprised that this is being done in the name of respecting the CTBT. Thus AWE insists that it is developing the scientific capacity and the exotic technologies it needs to make a new nuclear weapon so that it can comply with the CTBT ban on nuclear testing! In a strictly legal sense AWE may be right that it is complying with the CTBT which only commits its signatories not to carry out nuclear tests. These developments are, however, completely against the disarmament and non-proliferation purposes of the treaty.

24. The negotiating record of the CTBT and its preamble show that it is intended as a non-proliferation and a disarmament measure. At the 1995 Nuclear Non Proliferation Treaty (NPT) Review Conference the non-nuclear nations insisted that they would only agree to the indefinite extension of the Treaty demanded by the US and other nuclear states if the declared nuclear weapon states deliver on their obligations under Article 6 of the NPT to negotiate nuclear disarmament. In particular the non nuclear states insisted that they would only agree to indefinite extension of the NPT if the declared nuclear weapon states agreed to negotiate a CTBT by 1995 as part of their NPT Article 6 commitment to negotiate disarmament. The CTBT is, therefore, part of the grand bargain at the centre of the NPT whereby the declared nuclear weapon states agree to negotiate disarmament and the non-nuclear states agree not to acquire nuclear weapons.

25. The disarmament purpose of the CTBT is clearly set out in the preamble to the Treaty which states that the State Parties to the Treaty recognize that: *“The cessation of all nuclear weapon test explosions and all other nuclear explosions, by constraining the development and qualitative improvement of nuclear weapons and ending the development of advanced new types of nuclear weapons, constitute an effective measure of nuclear disarmament and non-proliferation in all its form.”* The preamble concludes by emphasising the disarmament purpose of the CTBT. All the States Parties who sign the Treaty, it emphasises, recognize that “an end to all such nuclear explosions will thus constitute a meaningful step in the realization of a systematic process to achieve nuclear disarmament.”

26. More broadly, AWE’s invocation of the letter of the CTBT to justify a program of investments which goes directly contrary to its disarmament purpose is out of step with the majority of the world’s nations. As Hans Blix’s timely report on Weapons of Mass Destruction underscores, the majority of the world’s nations continue to see themselves as stakeholders in a jointly managed system of treaties and organizations for disarmament, arms control, verification and the building of security. Crucially, they do “not accept a de facto perpetuation of a licence for five—or more—states to possess nuclear weapons and they resist measures that would expand the inequality that exists between the nuclear haves and have-nots. Renouncing nuclear weapons for themselves, they wish to see steps that will lead to the outlawing of nuclear weapons for all.”<sup>54</sup>

27. The future use of high technology to develop a new bomb is only one way that Aldermaston is seeking to get round the CTBT. This is especially grating to the majority of the world’s states because they do not have access to the immense financial and technical resources needed to upgrade or develop nuclear weapons in this way. There is, therefore, a danger that they will come to accept the Indian Government’s claim that the Treaty is simply as means for perpetuating a global system of nuclear apartheid.<sup>55</sup>

28. Equally threatening to the CTBT is the fact that AWE Aldermaston, and its US counter-parts, are already working to get round the CTBT by adopting a systems approach which enables them to transform the capabilities of a nuclear weapon without actually having to develop an entirely new warhead. Since the end of the Cold War the US and the UK have developed Trident so as to make it more “usable” against a non nuclear state. The rationale set out by the UK Government is that Trident can be used to secure the UK’s “vital interests” (trade, investment, alliances, and access to raw materials such as oil) and to destroy chemical or biological weapons before they could be used against UK troops fighting overseas.<sup>56</sup>

<sup>54</sup> Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms, (The Blix Report), (The Weapons of Mass Destruction Commission, June 2006): 25.

<sup>55</sup> Praful Budwau and Achin Vanaik, “New Nukes: India, Pakistan and Global Disarmament,” (Signal Books, 2000), see especially Chapter 3 and Appendix 2.

<sup>56</sup> “Why Britain Should Stop Deploying Trident,” (Greenpeace, 2006); Paul Rogers, “Determining Britain’s role in the Long War,” *International Affairs*, 82.4 (July 2006); Frank Barnaby, “The Future of Britain’s Nuclear Weapons: Experts Reframe the Debate,” (Oxford Research Group, 2006).

29. The UK has upgraded Trident to carry out these tasks. These developments have been guided by the fantasy that a highly precise, low yield, Trident strike would be able to destroy military targets without disproportionate civilian casualties. To accomplish this vision the UK has deployed missiles with only a single warhead, acquired a new targeting system from the US, and given Trident a low yield capacity. Aldermaston's development of the upgraded system was quietly slipped out in the history section of its 2000 Annual Report which announced: "*With high accuracy, targeting and an option of two warhead yields, [Trident] can now operate in both strategic and sub-strategic roles.*"<sup>57</sup>

30. Trident's two yields may mean that Trident can now function as a mini-nuclear weapon (ie have a yield below five kilo-tonnes). The Ministry of Defence, however, has refused to tell MPs whether or not it has actually done this.<sup>58</sup> The UK is now being asked by the US whether it wants upgrades to Trident which take its transformation into a "usable" nuclear weapon further.<sup>59</sup> Specifically, the UK is being asked whether it wants a new guidance system which will use satellites to steer a new Trident re-entry vehicle to within metres of its target and whether it wants a new contact fuse which will allow a smaller warhead to be used to destroy hardened military targets.

31. The systematic development of the whole Trident weapon system, then, is providing the US and the UK with a way of making the major part of the US and UK nuclear arsenal more usable against non-nuclear nations while nominally respecting their commitments to nuclear disarmament under the NPT and to not to test under the CTBT.

9 October 2006

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### Memorandum from the Campaign for Nuclear Disarmament

#### TRIDENT REPLACEMENT: THE JOBS AND SKILLS QUESTION

##### 1. Introduction

CND welcomes the decision of the Defence Committee to focus on the UK's manufacturing and skills base in the second of its inquiries into the future of Britain's nuclear weapons system. This submission will comment on some of the issues around the argument that the continued support and advance of the UK's nuclear weapons programme is necessary for the maintenance and development both of jobs and skills. These issues are of considerable significance in the debate around a Trident replacement and ones which CND takes very seriously. In particular we are aware that the preservation and expansion of skilled jobs, such as those found within this sector, is an issue which carries considerable weight within some local communities and work forces. There is an understandable fear that a decision not to replace Trident could lead to loss of employment and that alternative employment would be in different sectors, leading to a loss of earnings and conditions, and that the UK's skills base in science, engineering and technology could be diminished.

This submission considers these concerns and advances some initial findings. In particular we note the temporary short-term nature of many of the jobs involved—often based on just the construction of nuclear facilities; the actual number of jobs that are created in comparison to the massive investments made; the comparative effect on jobs of investing in other areas instead such as housing, health and even renewable energy sources; and ways in which the skills base can be maintained through investment in the transferring of skills to comparable non-nuclear sectors. We conclude that an effective alternative employment and defence diversification strategy can meet concerns about the maintenance of jobs and skills whilst enabling the UK to comply with its obligations to disarm under the nuclear Non-Proliferation Treaty.

##### 2. The current system and replacement options

Much information about the defence industry is typically classified, particularly regarding nuclear weapons, and so this makes it difficult to obtain exact figures and skills audits of those who work specifically in the nuclear facilities. In addition, some nuclear facilities also provide employment for both Vanguard class nuclear weapon-armed and conventionally armed nuclear-powered submarines and so it is also difficult to completely define exactly those jobs that are only related to nuclear weapons. Since the government is denying any decision has been made yet on replacing Trident it is even harder for detailed assertions to be made on the likely nature of jobs that might ensue from such a decision. For the purpose of this paper, certain assumptions will be made based on the most likely options for a replacement and the history of employment in this sector.

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<sup>57</sup> AWE Annual Report 2000, (AWE, June 2001): 14.

<sup>58</sup> Norman Baker, *Hansard*, column 1221W, 22 May 2006.

<sup>59</sup> "The Future of the UK's Strategic Nuclear Deterrent: the Strategic Context," HC 986, (Stationary Office, 2006): ev 117–118. 9 October 2006.

It is generally thought, and evidence from the first inquiry seemed to confirm this belief, that a likely replacement nuclear weapons system will also be submarine based with more advanced warheads to allow improved targeting and upgraded US missiles. Because of the similar nature of such a replacement system to the previous system and the consolidation and mergers of many companies in the last 25 years, it could be inferred that similar companies and workforces would stand to gain from a replacement.

### 3. *Review of previous work on arms conversion*

A body of knowledge exists in this area, based on work previously undertaken on the subject of arms conversion and defence diversification. This has often arisen from concerted and intelligent efforts, made by members of the workforces of the various facilities producing the UK nuclear weapons system, to formulate alternative employment strategies for their workplaces. Time and again the belief was that alternative employment could be found if the UK made a decision to disarm.

As early as 1964, a Scottish CND Conference “Swords into Ploughshares” was held in Dumbarton in response to announcements that Faslane and Coulport would be the operational bases for the planned Polaris nuclear weapons system. In February 1975, two major CND conferences with a strong trade union focus were held in London and Glasgow in response to rising unemployment and cuts in spending on arms projects. Around this time workforces at defence companies like Lucas Aerospace and Vickers created detailed plans for the diversification of production into alternative product lines. The Shop Stewards Combine Committee at Lucas Aerospace drew up a “Lucas Plan” with about 150 alternative products that would be “socially useful” in an attempt to save their jobs. The company ignored the plan and factory closures and redundancies ensued<sup>60</sup>.

In 1984, with the prospect of the Vickers Shipyard being used to build the proposed Trident submarines, discussions started by Barrow Trades Council resulted in the setting up of the Barrow Alternative Employment Committee (BAEC). The BAEC attempted to identify alternative long-term non-defence employment producing civilian marine products for the Vickers Shipyard workforce including renewable energy technologies; a detailed examination of the alternative products was given in their 1987 report *Oceans of Work*.<sup>61</sup> Vickers management refused to co-operate with BAEC.<sup>62</sup>

The Alternative Employment Study Group (AESG) was also launched in the early 1980s in response to the decision to replace the Polaris/Chevaline system with Trident. The group was funded by Scottish Education and Action for Development and was supported by a number of different bodies including several Scottish District Councils and the Transport and General Workers Union in Scotland. The group held a major conference in Dumbarton in 1984, which was followed by two comprehensive reports of their findings.

In the mid 1990s the Arms Conversion Project (ACP) established in 1988 by the Nuclear Free Local Authorities was holding workshops, conferences and seminars on the subject. In 1996, an ACP report “Killing Jobs” revealed that over 28,000 defence and defence-related jobs had been lost in the Strathclyde region where the Clyde Submarine Base is located since the end of the Cold War. The job losses were estimated to have cost the Strathclyde economy in excess of £65 million per year in terms of lost income.

The ACP working with the Scottish Trade Union Congress prepared a draft Working Paper for a governmental Defence Diversification Agency (DDA). Such an agency was launched in 1999. However as Ian Goudie, who ran the Project, explains, “the DDA will only deal directly with diversification as a means of technology transfer from DERA, rather than the diversification of companies and communities.”<sup>63</sup>

## CONTEMPORARY ISSUES

### 4. *Relative number of jobs created and actual cost of jobs*

In the UK there has been a significant trend of job losses dependent on military expenditure over the last few decades with the end of the Cold War and cuts in military spending.<sup>64</sup> Employment dependent on MoD expenditure and defence exports has more than halved from 740,000 in 1980 to around 305,000 jobs being currently supported by MoD expenditure and defence exports providing just over 1% of all employment.<sup>65</sup> In spite of this, over £30 billion was spent on defence in 2005–06 and that figure is set to rise to £33.4 billion by 2007–08.<sup>66</sup>

The relative number of jobs created by Trident is said to have been much less than originally claimed<sup>67</sup> especially in Scotland. American academic Brian Jamison, working at the Mountbatten Centre for International Relations at Southampton University, explains that Trident failed to invigorate the economy: “though the national deterrent

<sup>60</sup> The Alternative Employment Study Group, (1985) *Polaris and Trident the Myths and Realities of Employment*, Lomondprint, Scotland.

<sup>61</sup> Steve Schofield, *Oceans of Work: The case of non-military research, development and production at VSEL Barrow* Barrow Alternative Employment Committee, August 1987.

<sup>62</sup> Steve Schofield, *Employment and Security—Alternatives to Trident, An Interim Report*, Barrow Alternative Employment Committee, Peace Research Reports No 10, July 1986.

<sup>63</sup> Ian Goudie, *Diversification or Dole?*, The Citizen, issue 16, 2001 <http://www.thecitizen.org.uk/articles/vol2/article16e.htm>

<sup>64</sup> Ian Goudie, *The Employment Consequences of a Ban on Arms Exports*, Campaign Against the Arms Trade, September 2002 p 5.

<sup>65</sup> UK Defence Statistics 2005 Table 1.9 at <http://www.dasa.mod.uk/natstats/ukds/2005/c1/table19.html>

<sup>66</sup> See the Ministry of Defence website at:

<http://www.mod.uk/DefenceInternet/AboutDefence/Organisation/KeyFactsAboutDefence/DefenceSpending.htm>

<sup>67</sup> Brian P Jamison, (2006), *Britannia's Sceptre: Scotland and the Trident System*, Argyll Publishing.

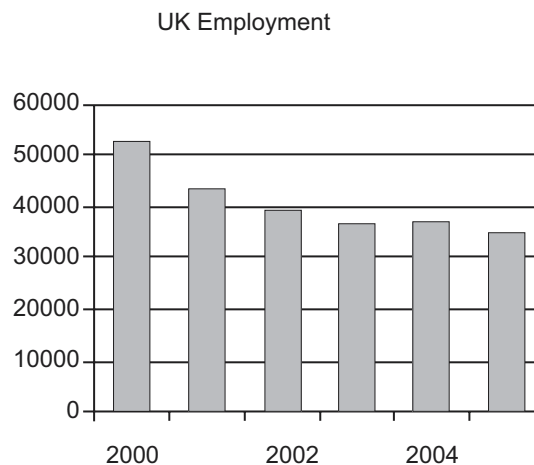
supported almost 4,000 civilian jobs in 1989 the Strathclyde Region still had the highest unemployment rate in all of Scotland at that time.”<sup>68</sup> 72% more in real terms was spent on the Trident Works Project (providing missile storage and shore based docking and maintenance facilities at Faslane and Coulport) than was originally anticipated.<sup>69</sup> Acquisition of the system is said to have cost £12.52 billion in 1998 prices.

According to Dr Steven Schofield, in *Oceans of Work*, prior to the contracts for the first generation Trident programme, initial estimates for employment put the figures as high as 20,000 direct and 25,000 indirect jobs. But MoD reports during the 1980s on the progress of Trident construction consistently reduced those figures until, by the mid 1980s, they had declined to only 7,000 direct and 9,000 indirect jobs. Contracts included the construction of the submarines at Barrow, and the PWR 2 nuclear propulsion plant built by Rolls Royce at Derby. Although it is beyond the scope of this paper and would require a fuller analysis of the Trident network and employment at each facility, a reasonable assumption would be that the major capital investment of recent years has resulted in reduced demand for labour and that employment generated now will be at low levels.

### 5. Market forces and industry fluctuations

Defence employment is heavily dependent on market forces and ensuing MoD contracts. Although in the short term a replacement of Trident with a similar nuclear weapons system might boost jobs for some local areas it does mean reliance on employment from a handful of private companies whose commercial interests are naturally predominant. In Scotland, according to Jamison, “The SSBN was a source of considerable expenditure on the Clyde and as a consequence, of various forms of short-term employment, but it was not liable to be a source of long-term employment.”<sup>70</sup>

The UK Defence Industrial Strategy (DIS) was launched in December 2005 and was consequently criticised by Dr Steven Schofield in a BASIC paper.<sup>71</sup> Schofield highlighted the significant internationalisation and privatisation of the military-industrial sector during the 1980s and 90s with the emergence of BAE Systems as a “global military-industrial giant” being given over 50% of the major MoD contracts. The DIS drives “for ever-more sophisticated and expensive military platforms” and does nothing to reduce BAE’s “stranglehold” on defence procurement. In fact Schofield points out that since BAE took over GEC in 1999 there was a decrease in jobs at the company from 115,600 to 68,100 in 2002. The following graph shows that employment at BAE has since declined even further.



#### BAE Systems

(Source: CAAT report, BAE Systems in 2005)

Any replacement of Trident would likely be subject to these kinds of trends. Other examples of where market forces and industry fluctuations have resulted in job losses rather than increases was in the 1990s saw the refitting contract for Trident controversially being given to Devonport, Plymouth rather than Rosyth in Scotland where jobs relating to the complex were worth more than £200 million to the local economy and £100 million had already been spent on building new facilities for Trident. The loss of the contract is said to have resulted in 10,000 job losses<sup>72</sup> and overruns led to the work in Devonport costing £300 million more than it should have.

A controversial privatisation in 2002 led to many of the operations at the Clyde Submarine Base being handed over to a private UK dockyard company, Babcock Naval Services, with the loss of 500 jobs.<sup>73</sup>

<sup>68</sup> Brian P Jamison, *ibid* p 56.

<sup>69</sup> HM Treasury Central Unit on Procurement, The Trident Works Programme (A Case Study), No 49, February 1995.

<sup>70</sup> Brian P Jamison, *ibid*, p 53.

<sup>71</sup> Dr Steven Schofield, *The UK Defence Industrial Strategy and Alternative Approaches*, Occasional Papers on International Security Policy Number 50, March 2006 at <http://www.basicint.org/pubs/Papers/BP50.htm>

<sup>72</sup> Brian P Jamison, *ibid*.

<sup>73</sup> <http://thescotsman.scotsman.com/index.cfm?id=327382002>



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 ALTERNATIVE EMPLOYMENT
6. *Timescale*

Work on alternative employment strategies would clearly need to take the regional nature of employment created by nuclear weapons facilities into account. If a replacement was not chosen and Trident was allowed to continue until it became obsolete then this would give ample time to allow diversification plans to be put into place. The Defence Diversification Agency could be instrumental in developing such plans. Research into how the Rosyth workforce moved into alternative employment after losing the Trident re-fitting contract might be particularly useful.

Moreover, facilities would not close down overnight, this would happen over many years and any employment decline in some areas could be managed. Dr Stuart Parkinson of Scientists for Global Responsibility believes that because the UK economy had the experience of quite recently being able to absorb a substantial reduction in employment dependent on the military sector following the end of the Cold War (from 555,000 direct and indirect jobs in 1990–91 to 300,000 in 1999–2000) a further reduction of several thousand jobs could similarly be absorbed.<sup>74</sup> An important increase in employment would actually result from the process of nuclear weapons being safely dismantled and the materials being stored and of the sites being decommissioned and cleaned up.

7. *Opportunity costs*

The opportunity cost of investing such large amounts of money into nuclear weapons should not be ignored. Investment in other areas can also create economic growth and substantial job opportunities—without providing a means of killing and mass destruction. A US assessment of this issue estimated that spending a billion dollars on education would create 41,000 jobs, spending this much on public transport would create 30,000 jobs but £1 billion spent on military procurement would create just 25,000 jobs.<sup>75</sup>

8. *Skills*

It is also argued that there will be a loss of skills if the UK chooses not to continue with a nuclear weapons system. Dr Stuart Parkinson argues that the nuclear weapons workforce could be swiftly re-employed elsewhere because it includes large numbers of highly skilled physical scientists and engineers for whom there is a high demand from other sectors of the economy. This demand comes from actual skills shortages as a result of the low number of graduates in these areas. This situation is becoming worse with enrolments for mechanical engineering degrees falling by 8% from 1999 to 2003 and 18 physics departments and 28 chemistry departments closing since 1997. Any replacement could actually increase this skills shortage with even more skilled workers being taken from other important sectors of teaching, research and manufacturing.<sup>76</sup>

Options for alternative employment opportunities, which could use the skills of the nuclear weapons workforce, could cover the areas of decommissioning and international disarmament work, development and production of renewable energy resources.

9. *Decommissioning and international disarmament work*

The decommissioning of nuclear facilities is a very large undertaking, which can go on for many years. If Trident was not replaced and some of the Trident facilities were closed down then dealing with the waste and the decommissioning process from these facilities and all of our old nuclear power stations would provide crucial alternative and regional employment for many years to come. An example of this is at the Dounreay nuclear plant where, according to the UK Atomic Energy Authority (UKAEA), responsible for “cleaning up” this site, the decline in employment at the end of the Dounreay research programme has been reversed, with 1,200 people now employed in engineering, radiological protection, planning, environmental and waste management.

Several argue that Aldermaston Atomic Weapons Establishment could become a centre of expertise for issues of verification, decommissioning and the dismantling of nuclear facilities and secure disposal of weapons-usable materials.<sup>77</sup> Dr Stuart Parkinson argues that the change in role could mirror that of Porton Down’s when the UK signed up to the Chemicals Weapons and Biological Weapons Conventions.<sup>78</sup>

10. *Renewable energy resources*

Tony Blair has called climate change the greatest threat to civilisation.<sup>79</sup> It is widely agreed, however, that renewable energy sources can realistically and effectively provide sustainable and low-carbon energy. Major job opportunities for skilled physical scientists and engineers, amongst others, exist in this growing sector and this is where the government should encourage investment.

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<sup>74</sup> Dr Stuart Parkinson, *Trident the reality of the jobs issue*, CND Campaign, number three 2006, p 6–7.

<sup>75</sup> Harigel G (1997). The impact of the military-industrial complex on society. In: D Schroeder and A Pascolini (eds). *The weapons legacy of the Cold War*. Ashgate.

<sup>76</sup> Dr Stuart Parkinson, *ibid*.

<sup>77</sup> Including Dr Stuart Parkinson, *ibid* and Rebecca Johnson House of Commons, Memorandum from Dr Rebecca Johnson as evidence to the DSC Inquiry, HC 986-i.

<sup>78</sup> Dr Stuart Parkinson, *ibid*.

<sup>79</sup> <http://www.number10.gov.uk/output/Page6333.asp>

The Green Party maintains that green policies in the transport, recycling and waste management, agriculture and industry sectors could create a million UK jobs.<sup>80</sup> Several forecasts by the Department of Trade and Industry (DTI) have also been very positive. The DTI projects that renewable energy sector employment will rise from the current figure of 8,000 to 35,000 jobs by 2020.<sup>81</sup> Even just a Round Two development of offshore wind developments alone, the DTI estimated, could bring a further 20,000 jobs for Britain.<sup>82</sup>

## 11. Conclusion

There are other factors that also need to be taken into account when considering the livelihoods and wellbeing of nuclear-related workforces. A local economy with facilities to produce or support a nuclear weapons system must also consider the increased threat of being targeted by a conventional or nuclear military attack, the increased risk of radiological contamination from any accident, and the increased risk of terrorism directed at such a facility in the region. The risks from maintaining employment in nuclear weapons are considerable and are likely to increase in the current global situation. It is also the case that a decision to replace Trident will contribute to global instability by further undermining the nuclear Non-Proliferation Treaty, under which we are required to disarm our nuclear weapons.

Redirection of investment and subsidies into non-nuclear production and facilities can more than compensate for jobs currently located in the nuclear sector, and the same applies to potential future jobs related to any proposed new nuclear weapons system. What is required is the political will to make the necessary choices. A majority of the British population opposes a Trident replacement when it is known that the acquisition and running costs may be as high as £76 billion. The investment of that sum in the health service or housing, education or alternative energy forms, could provide both significant employment in construction, engineering, nursing, teaching, scientific research and a range of other employment sectors, and at the same time contribute substantially to the social wellbeing of the British people. For the majority of the population, this is the preferred option, and it is not an option that will let down the UK in terms of either jobs or skills; on the contrary, it will make a significant contribution to peace and social progress.

9 October 2006

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### Memorandum from the Ministry of Defence

#### SUSTAINING CORE SKILLS AND INFRASTRUCTURE

The Ministry of Defence recognises the importance of maintaining an affordable and viable submarine design and manufacture capability. Our position was set out in some detail in the Defence Industrial Strategy, which stated that “for the foreseeable future the UK will retain all of those capabilities unique to submarines and their Nuclear Steam Raising Plant, to enable their design, development, build, support, operation and decommissioning”.

At the same time, however, the Defence Industrial Strategy highlighted serious concerns at the efficiency of the organisation of the submarine-building industry and the need for rationalisation. As a consequence, work is proceeding to help industry deliver an indigenous industrial base that remains affordable for the procurement and maintenance of submarines and which sustains critical capabilities. It is our aim that significant behavioural and structural improvements should be achieved across the MoD as client, and the industrial parties strategically involved, ie BAE Submarines at Barrow, Rolls-Royce and Associates, Devonport Management Ltd (DML) and Babcock Naval Services. In this context, the Government will require industry commitment to team working, provision of qualified, skilled and empowered personnel, continuous improvement in design for best through life cost, and improved supply chain management.

The submarine industry is currently heavily engaged in the programme to design and build the Astute class of submarines. Three vessels have been ordered but the eventual size of the attack submarine flotilla has yet to be decided. Work on the Astute programme has done much to restore and sustain key skills in the submarine industry, although this has come at some cost. The break between the Vanguard and Astute programmes in the hitherto continuous process of designing nuclear-powered submarines in the UK was a significant contributor to the cost increase in the Astute programme. As the design element of the Astute programme gradually decreases, the potential risks to future submarine programmes (should any be required) will increase. Diverting surface ship design and construction work can help to reduce some risks but skill fade will occur if submarine-specific skills are not kept alive. This applies to submarine design and construction skills, not just specifically to nuclear-related skills.

The maintenance of core skills and capabilities has also been a key issue with respect to the Atomic Weapons Establishment (AWE). In a written statement to the House of Commons on 19 July 2005, the then Secretary of State for Defence, John Reid, announced plans for additional investment at AWE amounting to an average of an additional £350 million per annum over the period up until 2007–08. Funding beyond

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<sup>80</sup> Dr Spencer Fitz-Gibbon, *Best of Both Worlds*, Green Party, May 2001.

<sup>81</sup> Department of Trade and Industry, (2004), Renewable Supply Chain Gap Analysis, at [www.dti.gov.uk](http://www.dti.gov.uk)

<sup>82</sup> British Wind Energy Association website at <http://www.bwea.com/ref/econ.html>

that point has yet to be determined. This programme will ensure that the effectiveness and safety of the existing Trident warhead stockpile can be maintained throughout its intended in-service life in the absence of live nuclear testing under the Comprehensive Test Ban Treaty. It will also ensure that we retain a minimum capability to design a successor for the existing warhead, should one be required and keep our options open in the meantime.

The programme falls into three broad categories: upgrading a range of research facilities to underpin the science that enables AWE to underwrite the safety and performance of the warhead; refurbishment of some of the key infrastructure on the sites; and investment in sustaining core skills within the Establishment. To achieve this, major investment in manpower and facilities will be necessary including the replacement of many of the major science, manufacturing and assembly facilities at AWE's two sites at Aldermaston and Burghfield. Details of the programme were set out in the memorandum sent to the Defence Committee by the Ministry of Defence in November 2005.

#### THE DEFENCE INDUSTRIAL STRATEGY AND THE LINK TO TRIDENT REPLACEMENT

The Defence Industrial Strategy stated that the UK would retain all those capabilities unique to submarines, including the Nuclear Steam Raising Plant, "for the foreseeable future" (B2.18). It also stated that the submarine design programme would ensure options for a successor to the current Vanguard class deterrent would be kept open in advance of eventual decisions (B2.63).

As we have made clear in the Defence Industrial Strategy, we would expect that any commitment by the Government to a long-term submarine build programme would be matched by a commitment by industry to rationalise and reduce costs. There is much to be gained from cooperation and rationalisation between the build entity (principally BAES at Barrow-in-Furness), the two support entities (Devonport Management Ltd and Babcock Naval Services at Faslane) and the Nuclear Steam Raising Plant provider (Rolls Royce), together with the Ministry of Defence as the customer/operator.

Potential benefits from such cooperation and rationalisation include the removal of overcapacity and overlapping competencies, avoidance of duplication, application of common processes, spread of best practice, more efficient procurement, supply chain management and sharing of knowledge and information across the enterprise—all leading to behavioural change and the potential for significantly improved enterprise performance and affordability. Transformed commercial arrangements are required to incentivise and deliver these benefits. Cooperation of this type is already being pursued to improve affordability and performance for in-service submarines and for the Astute programme.

In considering the future of the submarine industry we also need to take account of the requirement to service our current commitments (Astute class build, and support and disposal for Swiftsure, Trafalgar, Vanguard and Astute classes).

#### THE NUCLEAR SKILLS BASE IN THE UK

The Atomic Weapons Establishment (AWE) has a strength in depth in nuclear science and engineering which is rare elsewhere in the UK. The average age of the workforce at AWE had been increasing, as the generation recruited to meet the initial requirements of the Chevaline and Trident programmes reached the end of their careers. There was therefore a requirement to recruit new members of staff to ensure that the core skills within AWE are sustained. Other new staff will be required to assist the infrastructure sustainment programme and also to operate the new facilities as they come on stream. AWE has therefore been undertaking a programme of recruitment: last year a total of 415 new staff were recruited, including 94 scientists, 196 engineers and 49 technical support personnel. It plans to recruit in the order of 90 scientists, 150 engineers, and 50 technical support personnel this year and similar numbers in 2007–08.

The areas of expertise are diverse, and will include chemistry, computer science, materials science, nuclear physics, chemical engineering, manufacturing, metallurgy, electrical and electronic engineering, mechanical engineering, assurance, laboratory support, and IT/telecommunications. To date, this recruitment process has proceeded very well, with sufficient numbers of high quality staff being brought into the Establishment. The availability of sufficient suitably trained graduates has in part resulted from the fact that AWE, along with other institutions, including the civil nuclear industry and Universities, has developed new educational courses in this area, up to and including doctorate level.

Nuclear expertise in the civil nuclear industry does not currently underpin the defence nuclear knowledge and skills base to any significant degree. Although there is some interchange in specialist areas, there is limited cross-fertilisation between the sectors. One reason for this is that the UK Atomic Energy Authority has not developed Pressurised Water Reactor (PWR) technology (which is used in nuclear-powered submarines) for civil use: only Sizewell B is a PWR, but it incorporates a commercial Westinghouse design. There is some exchange of engineering and scientific knowledge, particularly in the field of metallurgy, but this is limited by security constraints, type of plant and differences in operation (propulsion versus power generation). The remaining civil nuclear sector is now focussed on providing handling and disposal facilities for radioactive material.

The limited supply of suitably qualified engineers and scientists is more of a problem. With the end of the Vanguard Class build programme in the late 1990s and a reduction in research and testing and forward design work, Rolls-Royce Submarines (which manufactures the nuclear propulsion system installed in Royal Navy submarines) reduced the number of engineers and scientists it employed. More recently, as activity has picked up again with the Astute Class build programme, a chronic shortage of high quality engineers and scientists emerging from UK universities has led to key skills shortages within the company. This UK skills gap affects many engineering disciplines, but the lack of physics graduates is proving to be particularly difficult to overcome. The 1958 Mutual Defence Agreement with the United States means that only UK nationals can be employed on the naval nuclear propulsion programme. Therefore, Rolls-Royce Submarines has now developed links with UK universities and is developing links with schools in order to promote the necessary skills.

23 October 2006

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### **Memorandum from the West Midlands Campaign for Nuclear Disarmament**

1. We are glad to see that the possibility of the non-replacement of the Trident system is included in the considerations—And it will consider the linkage between the Government's Defence Industrial Strategy and the decision on retention, replacement or abolition of the UK's Trident system (Defence Committee Operational Note, 21 July, paragraph 2).

2. We hope that the inquiry will ask not only how the possible future of the UK nuclear weapons will affect the UK manufacturing and skills base, but also on the wider question of how desirable it is that this base should be dependent on the military.

3. In particular, we hope the inquiry will consider not only whether the extent to which the level of investment [in AWE Aldermaston] is consistent with maintaining key skills and infrastructure in the design and manufacture of nuclear warheads and with the stewardship of the UK's existing nuclear stockpiles, but also whether such investment is the best way of meeting the UK's security needs.

4. Similarly, we hope the inquiry will consider whether there is a better use of nuclear expertise than in the military nuclear field.

31 August 2006

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### **Memorandum from the Nuclear Information Service**

#### **SUMMARY**

This submission argues that much of the investment programme underway at AWE Aldermaston in 2004–08 is not relevant to the objective of maintaining the key skills and infrastructure necessary for the design and manufacture of nuclear warheads and the stewardship of the UK's existing warhead stockpile. Current company acquisitions mean that AWE is to be managed by Unites States' companies with implications for disarmament prospects, financial, legal, safety and political issues. With regard to nuclear submarines, the long-term consequences of creating, decommissioning and storing nuclear waste must be factored into any decision. Further, the submarine building capacity at Barrow-in-Furness should not rely only on a military application and BAE Systems should be supported to diversify into the renewable energy sector.

#### *1. Investment at AWE Aldermaston and Burghfield*

##### **1.1 Aldermaston Developments**

The 2005 AWE Aldermaston Site Strategy Development Plan is a grandiose scheme, despite modifications to reduce the number of construction projects contained in the original 2002 proposals. The Plan promotes an industry-led vision of a nuclear weapons' "garden city" estate, rather than a maximum-security military site. It seems as though money is no object.

1.2 Escalating costs at AWE appear to be driven by the military industrial complex, both here and in the USA. The AWE management consortium, AWE Management Limited (AWEML), controls the AWE plc operating company's workforce and consists of Lockheed Martin Ltd, BNFL and Serco Ltd. BNFL's sell-off of its one-third interest in AWEML is expected to go to a company in the USA and Serco has joined Bechtel, the giant US construction company to bid for UK nuclear decommissioning contracts.<sup>1</sup> Lockheed Martin is a wholly American-owned company whose UK subsidiary now owns INSYS, formerly Hunting Engineering, an AWE consortium member from 1993–2000.

1.3 Clearly there are significant profits to be made out of AWE. In the first years of privatisation, 1993–2000, financial incentives for projects completed ahead of time were shared between Hunting Brae and the MoD. But now, in addition to company profits and in the case of Serco, shareholder dividends, a profit-sharing scheme for AWE plc staff also requires funding from the public purse. In reference to its stake in AWEML, Serco's recent report to shareholders states:

“Growth in the first half [of 2006] was driven by the continued expansion of our joint venture with BNFL and Lockheed Martin to operate the UK's Atomic Weapons Establishment. Since it commenced in 2002, the contract has seen substantial growth, which was boosted further by a three-year uplift from July 2005, valued at £350 million to Serco.”

Serco Group plc 2006 Interim Report

1.4 At a day-to-day level, AWE plc has a managing director and four senior managers who are US citizens with 87 subcontractors from US corporations.<sup>2</sup>

## 1.5 “Orion” Laser

A significant building project underway in 2006 at AWE Aldermaston is that of the “Orion” laser facility.<sup>3</sup> It is advertised by AWE and MoD as being a high-powered 12-laser configuration facility, which academics also will want to use to test materials under extreme heat. However, the scientific community is not agreed that this high-powered laser system is necessary in order to maintain existing Trident warheads.<sup>4</sup>

1.6 In the USA, a project to build a vast 192-laser facility, the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory, has run into the sand with little prospect of Senate funds being approved to complete it. NIF sought to overcome the effects of the Nuclear Test Ban Treaty, but has been dogged by failures and probably has become out-dated before completion.<sup>5</sup>

1.7 According to AWE, cooperation between AWE and the US Labs. has been stepped up in recent years<sup>6</sup> and nuclear weapons manufacturers in the USA will have access to the Orion laser under the 1958 Mutual Defence Agreement. Apart from political pressures, with US firms in the driving seat of management at AWE, it must be assumed that development of US nuclear weapons will get preferential access over UK universities. Worse, from a UK point of view, it may be that the US's need for a facility such as “Orion” will lock us into nuclear weapons development, with little option to respond to current trends pointing away from having nuclear weapons in the UK armoury. The acquisition of the new laser will fuel the nuclear arms race. MoD could hardly sanction US testing of warhead materials at AWE while Britain concentrated only on Decommissioning and Verification!

## 1.8 AWE Recruitment

Current advertisements for scientific posts at AWE usually require a willingness for applicants to travel to the USA. This applies to the posts of “Task Leader/Laser—Orion Project” and also to “Lead Systems Engineer”. The latter also is required to “Attempt to influence MoD thinking in respect of warhead system options.”

### **Lead Systems Engineer**

Discipline: Engineering Location: Aldermaston Salary: £41,000 to £55,000

### **Responsibilities**

- Ensure that appropriate technical standards are maintained across the Programme.
- Develop a systems approach within the project team.
- Attempt to influence MoD thinking in respect of warhead system options.
- Represent the technical programme at senior levels within AWE, including the TPG.

Extract from AWE website jobs list<sup>7</sup>

1.9 Safety at AWE is paramount. While it is reasonable to have confidence in AWE plc and the regulators to ensure high standards of nuclear safety, the distance from financial decision-makers in the USA is worrying. Accountability to concerned citizens and the local community will be hard to trace.

## 2. Decommissioning Skills at AWE

2.1 A good deal of decommissioning has been achieved by AWE staff during 1996–2006 with the consequent development of a valuable skills base. The AWE Aldermaston site is a mixture of new, old and very old facilities. Highly contaminated glove boxes and other weapons production infrastructure has been changed into nuclear waste that either remains on site, in the case of Intermediate Level Waste (ILW) or has been transported by road to the Drigg site at Sellafield as Low Level Waste (LLW). Much remains to be done. Out-of-use buildings scheduled for decommission and facilities reaching the end of their life in the coming years will need expert attention. The technical and managerial skills needed to achieve safe decommissioning; packaging and storage of nuclear waste must be maintained into the foreseeable future.

These skills have been gained and developed from the skills-base employed in weapons production. Conversely, skills and knowledge maintained during decommissioning would be readily available should they be needed for production in future.

### 3. *Verification Techniques: Innovation and Experts*

3.1 The five-year AWE Verification Research Project in 2000–05 has developed the technical knowledge for “the verification of warhead dismantlement and for arms control monitoring of a nuclear weapons complex.”<sup>8</sup> The Project reported to NPT Prep-Coms. and to the 2005 Review Conference, attracting international interest. The study of “obstacles to verification” has application for both the IAEA and for new weapons’ production. In 2004 the key AWE researcher moved back into weapons production armed with the experience of how to design sensitive systems to be protected from a verification regime should it ever apply to AWE. The project report concludes:

“While considerable technology exists to support verification of a disarmament programme, much still needs to be done in a number of areas to develop and prove these. New technologies continue to emerge requiring further detailed assessment of their potential application to this field.”

“From the outset of the programme the United Kingdom had identified the four key areas to be addressed as authentication, dismantling, disposition and monitoring the weapon complex.”

“For the future, the United Kingdom will continue to monitor and evaluate technological developments with relevance to verification but in terms of the processes and procedures needed to underpin any verification exercise, it is felt that a more focused approach should now be adopted addressing specific areas and issues.”

Conclusions. Verification of Nuclear Disarmament: Final Report to the UN NPT Review Conference on studies into the verification of nuclear warheads and their components. May 2005

3.2 The role of verification experts is an integral part of any disarmament process and as such would give AWE an international task (and income). For this role of providing Confidence Building Measures to be acceptable, Britain would need to declare itself a non-nuclear weapons state and be open to inspection, once the existing stockpile of warheads had been dismantled.

### 4. *Civilian Nuclear Industry*

4.1 The establishment of the Nuclear Decommissioning Authority will ensure that the government itself employs nuclear physicists who are essential practitioners in the scientific community. Whatever decisions are made on nuclear new build in the coming years, the waste storage sector will always be in business, developing and maintaining the expert skills and techniques to handle nuclear materials.

### 5. *Scientific Higher Education Sector*

5.1 University research projects linked to AWE’s needs will doubtless remain in place, and follow the available funding. But it is MoD, rather than international/US commercial interests, that should commission such work.

5.2 Collaborative projects between academics and AWE to use the new laser will give rise to concern if they are specifically related to testing warhead materials. Such research is likely to fail the legal justification test if its purpose is to undermine the Comprehensive Nuclear Test Ban Treaty (CTBT). Education institutions should not be led down this route, where their legal standing might be compromised. While the same point applies to MoD, government may be more prepared to contest any legal challenge.

### 6. *Submarine Construction Industry*

6.1 In relation to the submarine construction industry based at Barrow-in-Furness, there is an assumption that it must be MoD investment that is required to keep the manufacturing base alive during a gap in military orders. However, alternative projects, funded by a different Ministry should not be ruled out. There are possibilities of research and development in renewable energy and other projects that in the end could benefit international security and the submarine industry. In June this year, the local press in Barrow published an article headed, “Barrow Jobs Joy at Brown’s Trident Pledge”. The following letter was published in response:

“Job Security in Barrow-in-Furness

Job security in Barrow is essential—as it is in every town in the country. However, building nuclear submarines will not secure jobs in the long term and will do nothing to ease the real threats to our security. Barrow could be a world leader in defending us against climate change, contribute to global security and benefit from financial security. The workforce has skills and technology at its fingertips to research and build massive submersible turbines to harness the power of the sea

for renewable energy. Is it beyond engineers to design and develop a system to transfer wave power from the surface to seabed installations from where it can be cabled ashore? The trouble with Trident is that there is always an end to the jobs. The next generation wants secure jobs into the future, and supplying an international market with renewable energy systems is the means to get them. Trident is old thinking. If ever there was a time to press for new thinking in political and economic investment in Barrow, this is it.”

Di McDonald  
North West Evening Mail 23/06/06

6.2 Ship builders take no responsibility for the nuclear waste they create in building nuclear submarines. The consequences of creating, decommissioning and storing more nuclear waste must be born by the government and in the end, by the citizens of the UK. No solution has yet been found for the safe storage of decommissioned and existing submarines.<sup>9</sup>

6.3 The submarine building capacity at Barrow-in-Furness should not rely only on a military application and government should support BAE Systems financially to diversify into the renewable energy sector.

## 7. Conclusion

7.1 Current and projected investment in AWE is at an unreasonable level, given that the Aldermaston Site Strategy Development Plan is to build facilities to design, test and produce unusable weapons. A stop should be put to this waste of the country's precious resources, and a plan adopted for AWE that serve the nation's needs. Attempts by industry to influence MoD decisions should be resisted. AWE should be returned to UK hands for financial, political and military reasons. Nuclear warheads are not commodities, and many would agree that they are not assets either. Decommissioning would maintain the technical skills-base for the future and Verification that of the weapons' scientists. The "Orion" Laser building now under construction will provide materials testing facilities that will drive nuclear weapons' research and development scientists into illegal activity if its purpose is to undermine the CTBT.

## REFERENCES

1. The Independent Newspaper 23/07/06.
2. John Reid, Minister of State, Hansard Parliamentary Record 21/11/06 20051558W.
3. See: <http://www.nuclearinfo.org/sites/awe> for a view of the site and projected building.
4. What Next for Aldermaston? Scottish CND 12 June 2006.
5. See: <http://www.trivalleycares.org/newsletters/cwjul05.asp>
6. Parliamentary Answers 22 February 2005. [216675]  
There have been 180 visits to the United States by personnel from [AWE].  
[T]here were 128 visits by US personnel to AWE. Personnel from AWE visited 29 facilities in the United States during the 12 months ending January 2005. These were: National Nuclear Security Administration, Lawrence Livermore National Laboratory, Sandia National Laboratories Livermore, Los Alamos National Laboratory, Honeywell Kansas City Plant, Sandia National Laboratories Albuquerque, NWSC Seal Beach, Savannah River Site, Y-12 Oak Ridge, Pantex, Titan Corp, Mission Research Corporation, Brookhaven, Laser Technology Inc., ITT Colorado, ITT Washington, Defense Threat Reduction Agency, Lockheed Martin Missiles and Space, Air Force Research Laboratory, Visidyne Nevada Test Site, Naval Research Laboratory, ITT Crystal City, New York Port Authority, LLE Rochester, Washington Group International, Princeton New Brunswick Laboratory, Manufacturing Sciences Corp, Oak Ridge Remote Sensing Laboratory.
7. AWE website: [https://careers.awe.co.uk/wd/plsql/wd\\_pds?p\\_web\\_page\\_id=30297](https://careers.awe.co.uk/wd/plsql/wd_pds?p_web_page_id=30297)
8. Discovery No 7 AWE journal, July 2003.
9. MoD ISOLUS Project.

29 September 2006

## Memorandum from the Aldermaston Women's Peace Campaign

### 1. INTRODUCTION

1. This submission focuses on one of the aspects under review of the “UK manufacturing and skills base”, and relates to the committee’s decision to examine “the Government’s investment programme at the Atomic Weapons Establishment, Aldermaston”.

2. In a presentation of evidence, most of which is already in the public domain, this submission seeks to inform the committee’s consideration of “the extent to which the level of that investment is consistent both with maintaining key skills and infrastructure in the design and manufacture of nuclear warheads and with the stewardship of the UK’s existing warhead stockpile”.

3. We will argue that investment in the manufacturing and skills base at Aldermaston far exceeds that required for stewardship of the extant stockpile and that investment in both infrastructure and personnel indicates that the government has already made a substantial investment towards the development of the next generation of nuclear weapons in advance of a public debate and a publicly announced government decision on the replacement of the current Trident system.

### 2. PUBLIC SPENDING ON ALDERMASTON

4. The most recent estimates for the replacement of the current Trident system range from £25 billion to £76 billion.<sup>83</sup> Disaggregated figures for AWE Aldermaston are currently not available. The current contract with AWEML is worth £5.3 billion, over 25 years (2000–25).

5. The current annual budget is some £493 million; from figures made available in June 2006, this represents an increase in spending of 36% over the previous financial year.<sup>84</sup>

<i>2000–01</i>	<i>2001–02</i>	<i>2002–03</i>	<i>2003–04</i>	<i>2004–05</i>	<i>2005–06 est</i>
£311 million	£291 million	£278 million	£300 million	£363 million	£493 million

6. An additional investment programme for the period up to 2007–08 of £1 billion over three years (at £350 million per year) was announced by the government in July 2005,<sup>85</sup> and confirmed in September 2005. It is understood that this additional £1 billion is managed for AWE by Jacobs, the managing agents for the major modernisation construction projects.<sup>86</sup>

7. According to John Reid, “additional investment at AWE Aldermaston . . . would be required to establish the levels of investment necessary to sustain the minimum capability required to support the policies described in the 1998 Strategic Defence Review . . . Of the total forecast expenditure at AWE between now and the end of 2007–08, around 45% is capital costs, principally on new facilities including the new Orion laser, and around 55% is operating costs.”<sup>87</sup>

8. The only major facility for which costs are currently available is the Orion laser—at a cost of £183 million.<sup>88</sup> Additional expenditure in this current period may include one or more of the remaining proposed major facilities outlined in AWE’s Site Development Strategy Plan (published in 2002 and updated in 2003 and 2005), perhaps the hydrodynamics facility (see below), which is expected to be underway before April 2008.

<sup>83</sup> “New Trident system may cost £76 billion, figures show”, Guardian, 21 September 2006, <http://politics.guardian.co.uk/homeaffairs/story/0,,1877260,00.html>

<sup>84</sup> As at 31 March 2006, written answer, Des Browne to Alan Simpson, 7 June 2006.

<sup>85</sup> “Trident to get £1 billion boost—Reid”, 19 July 2005, [http://news.bbc.co.uk/1/hi/uk\\_politics/4697605.stm](http://news.bbc.co.uk/1/hi/uk_politics/4697605.stm) and confirmed as “new” money by John Reid in answer to Mike Hancock MP, November 2005: <http://www.publications.parliament.uk/pa/cm200506/cmhansrd/cm051103/text/51103w07.htm>

<sup>86</sup> Jacobs Engineering Summary Annual Report 2005, p 15, Environmental Programmes. “This year, we began our relationship with AWE, serving as managing agent of their three-year, £1 billion (US \$1.7 billion) government investment programme to sustain key skills and facilities at Aldermaston and Burghfield in Berkshire, England.”

Chairman’s Remarks Minutes of the 42nd AWE Local Liaison Committee Meeting, 15 September 2005.

See also Health and Safety Executive, Quarterly report 2005 (October to December), which describes Jacobs as managing agent to the “current investment programme”.

<http://www.hse.gov.uk/nuclear/lc/2005/awe4.htm>

<sup>87</sup> Written Answer to PQ: John Reid to Mike Hancock, 29 November 2005.

<sup>88</sup> Written answer to PQ: Des Browne to Nick Harvey, 16 June 2006.



### 3. INVESTMENT IN INFRASTRUCTURE AT AWE ALDERMASTON AND BURGHFIELD

9. Significant investment in infrastructure has taken place over the last two years, with the construction of new buildings, as anticipated in the 2002 site Development Strategy Plan. The most significant of these is the Orion laser, at an estimated cost of £183 million, reportedly 1,000 times more powerful than the existing HELEN laser. According to a recent AWE report, the Orion laser, the Core Punch (Hydrodynamics) Facility and the new Uranium facility “are expected to reach commissioning between 2008 and 2012”.<sup>89</sup>

10. Two new IT buildings were also constructed in 2005, presumably associated with AWE’s decision to procure a 40Teraflop Cray XT3 supercomputer at an estimated cost of £20 million and will be Cray’s largest system in Europe: “The Cray XT3 is expected to provide at least a 20-fold increase [on the performance of the current Blue Oak system]; this may well turn out to be nearer 30-fold”.<sup>90</sup>

11. According to IT specialists consulted by AWPC, the levels of supercomputer performance required by AWE far exceeds any reasonable requirements for the modelling and management of the UK’s nuclear stockpile, or of its disposal and long term storage. They believe its capabilities are consistent with the development of a successor to Trident.

#### *In the pipeline: Hydrodynamics (core punch) facility*

12. It is anticipated that contracts for the proposed new hydrodynamics research facility may be issued soon. Addressing a parliamentary question in June 2006, the Minister of Defence responded that it was planned to increase the number of staff working on hydrodynamics research and, with regard to the new facility he stated, “A number of options are under consideration. Mature costings are not available.”<sup>91</sup> To date, no planning application for this facility has been made by the MoD to the West Berkshire Planning Committee.

13. According to the 2005 Site Development Strategy Plan, the following further production facilities are planned: a warhead assembly facility at Burghfield; plutonium component manufacture (refurbishment of the A90 complex); highly enriched uranium component manufacture (secondary (fusion) part of any future thermonuclear weapon); Tritium Facility; Explosives Handling Facility and—under consideration—a new facility to manufacture an assemble Highly Enriched Uranium (HEU) components for submarine reactor fuel.<sup>92</sup>

14. In order to house both additional staff and contractors (see blow), three new office buildings have already been constructed and more are planned, including a “forthcoming” £60 million two-phased new build office development. In March 2006, two concrete towers at the west end of site had been demolished to make way for offices.<sup>93</sup>

### 4. CONTRACTORS AND CONTRACTUAL OBLIGATIONS ALREADY UNDERTAKEN

15. The committee should, when considering the level of investment at AWE, use a realistic forecast of future investment for which there is evidence in the public domain. Our evidence shows that commercial contracts have been announced for [the building of] more than one facility at AWE Aldermaston and which refer to a timescale longer than to 2007–08.

16. According to Dr Glue, acting managing director of AWE, the number of contractors [at Aldermaston] is expected to rise to approximately 1,200 in total over the next three years.<sup>94</sup>

17. Evidence from publicly available sources shows that there is optimism in the building and nuclear industries that the MoD intend to make further investment for many years to come. Information is publicly available about contracts which have already been put out to tender, bid for, issued and announced.

18. Some of this information is included in this submission, and should be disclosed to Members of the present Committee and to MPs in a timely fashion in the interests of a fair and informed debate, and where no decisions have apparently yet been taken. This information should be available to the committee from the Ministry of Defence (MoD) and not as the results of our research on the internet.

<sup>89</sup> Information to support proposals for revised Radioactive Substances Act 1993 Radioactive Waste Discharge & Disposal Authorisations for AWE plc at Aldermaston, AWE/DSDG/B/EC/AD/011, AWE report, November 2005, p 58.

<sup>90</sup> “AWE’s workload benchmark picks 40Tflop/s Cray XT3” 1 March 2006  
<http://www.hoise.com/primeur/06/articles/weekly/CL-PR-04-06-1.html> AWE’s announcement:  
[http://www.awe.co.uk/main\\_site/scientific\\_and\\_technical/featured\\_areas/hpc\\_contents/Larch/index.html](http://www.awe.co.uk/main_site/scientific_and_technical/featured_areas/hpc_contents/Larch/index.html)

<sup>91</sup> Hansard, 6 June 2006, Written Answers.  
<http://www.publications.parliament.uk/pa/cm200506/cmhansrd/cm060606/text/60606w0702.htm> 0606 088000815

<sup>92</sup> A planning notice for an Explosives Handling Facility was submitted to the local planning authority in August 2005, and withdrawn a few days later; “What Next for Aldermaston?”, Scottish CND Briefing.

<sup>93</sup> Minutes of 44th Local Liaison committee, March 2006. On 5 July 2006, an advert appeared for a Building Surveyor/Project Manager—to manage a forthcoming £60 million two-phased new build office development—Aldermaston, West Berkshire, see <http://www.justrail.net/vacancies/vacancy-display.asp?id=21077>

<sup>94</sup> Minutes of the 42nd AWE Local Liaison Committee Meeting, Thursday 15 September 2005.

19. The following examples make clear that the government investment programme is anticipated by industry to continue beyond 2007 and is expected to be an ongoing and long-term programme:

- Information disclosed by company contract announcements has been accurately predictive in the past: in 2003 RPS Engineering announced that they had won a five year contract (to 2008) in support of major processing facilities saying: “. . . it is anticipated that further significant work will follow [. . .] AWE are likely to increase their capital expenditure for the provision of new and refurbished facilities over the coming years.”<sup>95</sup>
- Jacobs Engineering announced in December 2004 a three-year contract (2004–07) to manage the government’s £1 billion investment programme. This contract was “for a three year period extended annually”.<sup>96</sup>
- According to the Energy Industries Council (EIC), the proposed new warhead assembly buildings at Burghfield were put out to tender and bid for by Amec in April 2005. It appears from the EIC minutes that there has been a delay associated with this facility. In June 2006 Des Browne answered that no decisions about the proposed new warhead assembly buildings had been taken.<sup>97</sup>
- WS Atkins announced in 2005 a major design house contract at AWE making clear this was in support of an “ongoing programme of modernisation and refurbishment at the AWE sites”. In their interim results published in November 2005 they made clear that this appointment for AWE was “in respect of a major infrastructure programme spanning several years” . . . “In particular, Atkins will be driving forward the development of major new ‘high nuclear’ complex research and processing facilities at AWE’s sites”.<sup>98</sup>
- It was reported in *Building Magazine* on 16 December 2005 that the government were in talks with Jacobs, WS Atkins and four other companies about the £1 billion investment at AWE. These were Amec, RWE Nukem, Jacobs Babtie and Mott Macdonald.<sup>99</sup> AWE confirmed that they had entered into contracts with three companies of whom Atkins was one, and that they intend to engage with a total of five companies. The MoD have consistently answered that no decisions have been taken (other than to build the Orion laser) and that no costs are available for any major facility other than the Orion laser.
- In December 2005 it was announced that Bob Irvin, ex-Operations Director with Jacobs Engineering, had joined the board of AWE plc. This is the company owned by the AWEML consortium, and responsible for delivering AWE’s programme for the MoD. AWE have said that his role on the board of AWE plc is to direct the major modernisation and construction projects. This suggest that AWE expect their commercial relationship with Jacobs to be significant.<sup>100</sup> NII/HSE have reported that they have been told by AWE that AWE and Jacobs staff will, from now on, be indistinguishable. Again, this suggest a significant and long term commercial relationship is planned.<sup>101</sup>
- In February 2006 Anders Elite Recruitment Agency advertised for building contractors at AWE Aldermaston, saying: “The agreement should be renewed in three years, with a view to the value of works rising to £20 million a year, and we are optimistic that the agreement will be extended to 20 years.”<sup>102</sup>

<sup>95</sup> RPS Group News, 9/05/03, “RPS Engineering and Safety Division Wins Contracts”, [http://www.rpsplc.co.uk/News%20Stories%20Folder/RPSEngineering\\_Safety\\_Contracts.pdf](http://www.rpsplc.co.uk/News%20Stories%20Folder/RPSEngineering_Safety_Contracts.pdf), accessed 9/21/06.

<sup>96</sup> [http://www.babtie.com/company/1-2-2\\_newsstory.aspx?id=1&s=165&c=1&d=1550](http://www.babtie.com/company/1-2-2_newsstory.aspx?id=1&s=165&c=1&d=1550), Jacobs Babtie News headlines, “Jacobs receives contract from AWE”, 8/12/04, accessed 9/21/06; [http://www.jacobsbabtie.com/uploads/pdf/jacobs2005\\_FINAL.pdf](http://www.jacobsbabtie.com/uploads/pdf/jacobs2005_FINAL.pdf), see also, Jacobs Engineering Summary Annual Report 2005, p 15, Environmental Programmes. “This year, we began our relationship with AWE, serving as managing agent of their three-year, £1 billion (US \$1, billion) government investment programme to sustain key skills and facilities at Aldermaston and Burghfield in Berkshire, England.

<sup>97</sup> Energy Industries Council, Minutes of the Northern Region Committee Meeting held at Mistui Babcock, Gateshead, 18/04/05, <http://www.the-eic.com/meetings/regional/minutes/18apr05.pdf>, “35.Burghfield Assembly Building based at Aldermaston. M & E tenders out to bid. Amec bidding. Possibly delayed”

<sup>98</sup> Atkins Global news release, “AWE awards major Design House contract to Atkins”, 23 November 2005; <http://www.ukworksearch.co.uk/Construction/Buckinghamshire/Job/424895/>, 3 December 2005, accessed 9/21/06; <http://ir.atkinsglobal.com/atkinsglobal/news/releases/archive/2005-11-29/2005-11-29.pdf>, Atkins (WS) PLC, “Interim results for the six months ended 30 September 2005”, 29 November 2005.

<sup>99</sup> “Five firms set to share £1 billion Aldermaston revamp” 16 December 2005, <http://www.building.co.uk/story.asp?storycode=3060489&sectioncode=284>

<sup>100</sup> Minutes of the 43rd AWE Local Liaison Committee Meeting, 1/12/05, [http://www.awe.co.uk/Images/43rd%20Minutespdf\\_tcm6-4-111.pdf](http://www.awe.co.uk/Images/43rd%20Minutespdf_tcm6-4-111.pdf)

<sup>101</sup> HM Nuclear Installations Inspectorate, AWE Aldermaston and Burghfield, Quarterly Report for 1 October to 31 December 2005, <http://www.hse.gov.uk/nuclear/lc/2005/awe4.htm>, accessed 9/21/06.

<sup>102</sup> AndersElite Technical Recruitment’s website, Site Manager, “The framework, at the Aldermaston Atomic Weapons Research Facility, represents around £10 million of building works a year, currently. The agreement should be renewed in three years, with a view to the value of works rising to “20 million a year and we are optimistic that the agreement will be extended to 20 years.” [http://66.249.93.104/search?q=cache:zIRyIrwNDu4J:www.anderselite.com/Construction/Site\\_Manager\\_jobs\\_0CE54BE5-137C-48FE-A426-3E7A8448889D](http://66.249.93.104/search?q=cache:zIRyIrwNDu4J:www.anderselite.com/Construction/Site_Manager_jobs_0CE54BE5-137C-48FE-A426-3E7A8448889D)

- In March 2006 Boulting plc announced that they had become a preferred supplier at AWE saying “a series of Frameworks, by discipline, has been put in place to construct and deliver an extensive 10 year build programme of site works to modernise and improve the manufacturing facilities at AWE to allow for the next generation of Research and Development Projects.”<sup>103</sup>
  - Tip Top Job, an online recruitment source, are currently advertising for a quantity surveyor at AWE Aldermaston: “Due to increases in project work (contracts secured to 2009)”.<sup>104</sup>
20. Contractors seen working on the Orion laser site as of September 2006 included, Select Plant Hire (cranes) and Expanded Piling (pile driving for the foundation of Orion); Raymond Brown (diggers and JCBs), NRC (cranes) and Garic.<sup>105</sup>
21. Crown House Engineering have mechanical engineering and plumbing contracts and will be on site in the coming months.<sup>106</sup>

#### 4. RECRUITMENT OF PERSONNEL AT AWE ALDERMASTON

22. According to a statement made in September 2005 by Acting Managing Director Dr David Glue to the AWE Local Liaison Committee, “Although not in the Ministerial Statement, the MoD has also confirmed to journalists that this will involve increasing the workforce by around 350 in each of the next three years. This investment will allow AWE to press ahead with the modernisation of the sites and the LLC will be kept informed of progress”.<sup>107</sup>

23. According to an AWE advertisement placed in a physics journal, new posts will involve the development of warhead concepts into working engineering designs, through to fabricated and tested prototypes. The production of prototypes would in itself suggest that staff are being recruited to develop a successor warhead, rather than manage the existing stockpile. Recruitment also provides an indication of the scale of the programme, with advertisements that call for teams of engineers and numbers of specialists.<sup>108</sup>

24. In September 2006, for example, AWE advertised approximately 204 posts, including 31 warhead-related vacancies.<sup>109</sup> One of these vacancies involves “managing a team of Requirement Engineers that will be a focal engineering requirement for *future weapon systems* [our emphasis]”. Some examples of these adverts for these posts appear in Appendix 1.

25. In response to a parliamentary question, Adam Ingram confirmed on 3 July 2006 that “In the period July 2005 to end March 2006, a total of 504 staff (including 180 to replace natural wastage) were recruited to the Atomic Weapons Establishment at Aldermaston and Burghfield”. Half of these were in engineering.<sup>110</sup>

26. Amongst many other warhead-related jobs on offer, AWE are currently recruiting a “Lead Systems Engineer”, one of whose stated responsibilities will be to “Attempt to influence MoD thinking in respect of warhead system options.”<sup>111</sup>

#### 5. CONCLUSIONS AND RECOMMENDATIONS

*AWE: So advanced,  
we're answering questions  
that haven't yet been asked.*<sup>112</sup>

*Stockpile Stewardship or the next generation of nuclear weapons?*

27. In this submission, we hope to have demonstrated that investment at AWE Aldermaston has shown a dramatic increase, far more than that required for “stockpile stewardship” which has been ongoing at the site since the initial deployment of the Trident system. The budgetary increase of some 36% has brought with it a projects 1,050 additional staff, an anticipated 1,200 contractors onsite and significant building work. the longevity of contracts, the employment of staff to build prototypes, and the construction of state-of-the-art laser and IT facilities (both with a massive increase in technical specifications and capacity over the

<sup>103</sup> <http://www.boulting.co.uk/article.asp?id=87> Boulting Group plc website news item, “AWE Aldermaston Supply Chain Framework”, March 2006, accessed 9/21/06.

<sup>104</sup> Tip Top Job “Quantity Surveyor—Aldermaston”, [http://www.tiptopjob.com/search/jobs/1296973\\_job.asp?souce=JL\\_RSS](http://www.tiptopjob.com/search/jobs/1296973_job.asp?souce=JL_RSS), accessed 9/21/06.

<sup>105</sup> Crown House Engineering, Select Plant Hire and Expanded Piling are all part of Laing O'Rourke.

<sup>106</sup> Crown House Engineering currently hold mechanical, electrical and plumbing sub-contracts, as part of the £20 million MW Zander contract for the Orion laser.

<sup>107</sup> Minutes of the 42nd AWE Local Liaison Committee Meeting, Thursday 15 September 2005.

<sup>108</sup> <http://physicsweb.org/jobs/jobdetail/6853>.

<sup>109</sup> <https://careers.awe.co.uk>

<sup>110</sup> <http://www.publications.parliament.uk/pa/cm200506/cmhansrd/cm060703/text/60703w1331.htm>

<sup>111</sup> [http://careers.awe.co.uk/wd/plsql/wd\\_pds?p\\_web\\_page\\_id=30297](http://careers.awe.co.uk/wd/plsql/wd_pds?p_web_page_id=30297)

<sup>112</sup> <http://physicsweb.org/jobs/jobdetail/6853>

existing HELEN laser and Blue Oak computer respectively) is indicative of a massive increase in investment at AWE. Indeed, the scale of developments has been compared in AWE's in-house magazine, with that of Heathrow's Terminal 5.<sup>113</sup>

28. We conclude that "the Government's investment programme in the manufacturing and skills base and construction at the Atomic Weapons Establishment, Aldermaston" far exceed that required for stewardship of the extant stockpile. The current levels in both infrastructure and personnel indicates that the government has already made a substantial investment in the development of the next generation of nuclear weapons. This has taken place in advance of a public debate, promised by John Reid in September 2005, and a public decision by the government on the replacement of the current Trident system.

## RECOMMENDATIONS

### *Recommendation 1*

The Ministry of Defence should disclose information about the nature and costs of contractual obligations already entered into with contractors and companies by the MoD/AWE to parliament, or at least to members of the committee.

### *Recommendation 2*

The Ministry of Defence should disclose information to the Committee on the numbers of staff recruited since 2002, specifying the job-titles, skills-base of recruited staff and programme areas in which staff will work, include whether for stockpile stewardship or for research and development of new weapons. The same information should be provided on plans for future recruitment.

### *Recommendation 3*

The Ministry of Defence should provide the Committee with details of all construction which has taken place at AWE since 2002, and building work which is currently in design, planning or is currently out to tender, specifying in detail the precise role and function of these buildings, including whether for stockpile stewardship or for research and development of new weapons.

## APPENDIX 1

### EXAMPLES OF WARHEAD-RELATED POSTS ON OFFER AT AWE DURING 2006

<https://careers.awe.co.uk>

#### **"Warhead Electrical Engineer**

To provide electrical/electronic design analysis, evaluation and qualification of a Warhead Electrical System.

- To support the approval programme for the introduction of the System in UK Trident.
- To be responsible for maintaining the Design Authority design record for the System.
- To be responsible for preparing trials requirements and trials specifications.
- To participate in electrical trials in the UK and functional trials in the US.
- To be responsible for preparing trials evaluation reports for trials.
- To be responsible for preparing technical assessments based on UK and US qualification evidence.
- To review formal analysis and design evidence to support approval submissions.
- To undertake modifications to the UK Trident design package.
- To support warhead Process Run Throughs at AWE(B).
- To represent the Design Authority at AWE meetings.
- To represent the Design Authority at US/UK exchanges."

This person will be expected to travel to test facilities in US.

#### **"E&SD Warhead Electronics Design Engineer (Graduate Trainee)**

Development of Warhead Electrical System sub-assemblies and related items.

The design and development of electronic control systems in support of Programme Elements as tasked by line management; notably the development and maintenance of demonstrable capability to develop nuclear warhead arming and firing control systems."

This job also involves travel to US.

<sup>113</sup> Bob Irving, *AWE Today*, January 2006.

#### **“E&SD Warhead Electronics Design Engineer**

Development of Warhead Electrical System sub-assemblies and related items.

The design and development of electronic control systems in support of Programme Elements as tasked by line management; notably the development and maintenance of demonstrable capability to develop nuclear warhead arming and firing control systems.”

#### **“E&SD Warhead Electrical Systems Engineering Technician**

Layout and construction of electronics hardware for use in Warhead Electrical System (WES) sub-assemblies/related items, and provision of design support.

Produce electronics hardware to a suitable standard in support of Warhead Electrical Systems (WESA) design activities, including assembly and wiring of electronics circuits and module.

Design and procure printed circuit boards (PCBs) for use within WES assemblies.”

#### **“E&SD Manufacturing Engineer**

To be a member of a small group concerned with the build, test, and analysis of small mechanical systems which are the main safety components in Nuclear Weapon Arming, Fuzing and Firing systems.

Become a technical expert in the technologies associated with manufacturing precision mechanical mechanisms. These include precision machining, specialised welding, and glass-ceramic sealing.

Develop and maintain a detailed knowledge of UK industrial capability for providing these specialised processes. Visit potential suppliers and engage in meetings regarding manufacturing processes and future production of components and assemblies.

Place and manage external contracts aimed at providing AWE with an assured source of these critical manufacturing processes. Write visit reports and assessments/recommendations on supplier suitability for long term production.

Co-ordinate all manufacturing operations for AWE strongline designs through the prototype, full development, and final production stages of manufacture and assembly. Co-ordinate the design and procurement of all necessary tooling, jigs, and fixtures for pre-production batches, and make recommendations for all production taking in conjunction with the selected suppliers.

Assess designs and recommend changes for ease of manufacture and assembly. Conduct research into new manufacturing processes, assess their usefulness and make recommendations to designers as to their suitability for component manufacture. Actively take part in design review meetings.”

#### **“E&SD Graduate Mechanical Engineer**

Undertake warhead design, trials and evaluation tasks.”

#### **“E&SD Senior Systems Engineer**

Provide project support and systems engineering management of through life integration activities for electro-mechanical systems.” (This is for Warhead Electrical System).

#### **“E&SD System Integration Requirements Engineer**

The role will involve managing a team of Requirement Engineers that will be a focal engineering requirement for future weapon systems.”

#### **“E&SD System Integration Requirements Manager**

The postholder will manage a team of requirement engineers that will be a focal point for capturing and managing engineering requirements for future weapon systems.”

“E&SD Systems Engineer” (WES).

#### **“E&SD Systems Engineer**

To conduct and co-ordinate Warhead Systems Engineering studies.

Co-ordination and conduct of Warhead Systems Engineering studies.

Being proactive in the generation and maintenance of Warhead System and Warhead sub-system requirements.

Preparation of estimates for inclusion in bids for future work.”

“E&SD Warhead Electrical Systems Formal Methods Hardware Developer.

To be involved in the design and development of Warhead Electrical Systems.

To undertake research and development in support of Warhead Electrical Systems (WES), including development of relevant skills and professional standing.

Member of the Warhead Electrical System Development Team.

Maintenance and develop Warhead Electrical Systems capability, in particular High integrity hardware (HIH) development with formal methods.”

#### **“Precision Fitter**

The manufacture, assembly, modification, disassembly and maintenance of warhead and special related assemblies and equipment. The machining and manufacture of components.

To support the Technical Facilities Supervisor in meeting the requirements of the following programmes:

- Warhead Development Centre training.
- Threat Reduction Division training and exercises.
- In-service Support trials.
- Capability trials.”

#### **“Analytical Instrumentation Chemist**

To work as an integral part of an internationally acclaimed team of scientists and provide a world class capability for the chemical characterisation of special warhead materials.

Install, commission and develop the advanced analytical instrumentation needed to underwrite fabrication & certification of warhead components, aid assessment of materials design & performance characteristics and support materials ageing & surveillance programmes.”

#### **“E&SD Graduate Formal Methods Developer**

To be a member of a team involved in the design and development of Warhead Electrical Systems.

To undertake research and development in support of Warhead Electrical Systems (WES), including development of relevant skills and professional standing.

Maintenance and develop Warhead Electrical System (WES) capability, in particular High integrated software development with formal methods. Support requirements analysis and modelling of designs with formal methods, including liaison with customers.”

“E&SD Warhead Electrical Systems Formal Methods Hardware Developer.

To be involved in the design and development of Warhead Electrical Systems.”

#### **“Member of the Warhead Electrical System Development Team**

Maintenance and develop Warhead Electrical Systems capability, in particular High integrity hardware (HIH) development with formal methods.”

#### **“E&SD Systems Engineer**

To conduct and co-ordinate Warhead Systems Engineering studies.

Co-ordination and conduct of Warhead Systems Engineering studies.”

#### **“Hydro Design Group Shock Physics Researcher**

Shock physics research relevant to warhead applications.

Designing and assessing experimental research trials to further the understanding of relevant shock and detonation phenomena.”

**“Mechanical Design Engineer**

Mechanical Design Engineer—Warhead Systems Engineering.

Liaison with Engineering Manager for Warhead processing on design related assembly/disassembly issues.

Management of Warhead Design.

To provide mechanical engineering support to AWE Design Authority.”

**“Metallurgist/Materials Scientist**

To work as part of an acclaimed team of metallurgists material scientists and provide a world class capability for the metallurgical and micro-structural characterisation of special warhead materials.

Apply advanced physical properties measurement and materials composition determination techniques to underwrite, manufacture and through life behaviour of warhead components, aid assessment of materials design and performance characteristics and support surveillance programmes.”

**“NMR Spectroscopist**

To contribute to the delivery of the organic warhead materials programmes. Develop predictive capabilities to assess the lifetimes of such materials and work on developing new replacement materials”.

**“Polymer Materials Specialist**

Responsible for developing, manufacturing and characterising polymeric warhead materials, specialising in syntactic foams.

To contribute to research, development, component fabrication and production, post design services, in-service support and life assessment activities for syntactic foams.

To develop expertise in polymeric warhead materials through a structured programme of agreed and appropriate training.”

**“Secondary Physicist**

To contribute to research, development, component design, fabrication and production activities for warhead materials.

Theoretically model nuclear device performance and increase the understanding of the underlying physics.

To develop an expertise in warhead materials.”

**“Theoretical Chemist**

01rk as a member of a team of highly skilled Theoretical Chemists applying cutting edge techniques to the modelling of warhead materials. Develop an expertise in the application of advanced computational techniques to the modelling of warhead materials.

Contribute to research activities of warhead materials and help understand and explain synthesis of new materials.

Operate and develop computing systems to perform data handling and analysis of nuclear weapons test data.

Contribute to reports on nuclear weapons test data through interpretation of radionuclide measurement data.

Maintain and develop databases and websites to efficiently archive nuclear weapon diagnostic data.”

**“Warhead Electrical Engineer**

To provide electrical/electronic design analysis, evaluation and qualification of a Warhead Electrical System.

To support the approval programme for the introduction of the System into UK Trident.

To be responsible for maintaining the Design Authority design record for the System.

To be responsible for preparing trials requirements and trials specifications.

To participate in electrical trials in the UK and functional trials in the US.

To be responsible for preparing trials evaluation reports for trials.

To be responsible for preparing technical assessments based on UK and US qualification evidence.

To review formal analysis and design evidence to support approval submissions.

To undertake modifications to the UK Trident design package.

To support warhead Process Run Throughs at AWE(B).”

### “Warhead Processing Engineer

To provide engineering warhead design support in aid of the Burghfield processing programmes as directed by the Engineering Manager (Warhead Processing).

To represent the Engineering Manager (Warhead Processing) during Slow Run Throughs (SRTs) and Process Run Throughs (PRTs) held in the Burghfield Licensed Site.

To provide warhead design support and guidance to production staff during the processing activities.

To produce technical reports/minutes as requested by the Engineering Manager (Warhead Processing).

To assist the Warhead Processing team with additional warhead processing activities where necessary.”

30 September 2006

### Memorandum from the Scottish Campaign for Nuclear Disarmament

The points made below respond to Government plans for the Atomic Weapons Establishment (AWE).

#### HOW MUCH WILL IT COST TO REBUILD AWE?

1. Des Browne said that the £1,050 million expenditure on AWE, which had been announced in July 2005, would fund a wide range of developments.<sup>114</sup> He has refused to disclose the budget for individual facilities in the plan saying “mature costs are not available”.<sup>115</sup> These figures are essential if there is to be any proper scrutiny of these proposals.

2. Nuclear safety requirements would have a substantial impact on cost. The Shiplift at Faslane went over budget and still did not meet safety standards. The A90 facility built at Aldermaston cost far more than budgeted. (The Audit Office report into A90 should be placed in the public domain). The MoD have just written off £147 million which had been spent on the A91 radioactive waste treatment plant. The cost of the new nuclear facilities at Devonport increased from an initial budget of £576–£650 million to at least £812 million.<sup>116</sup> The Audit Office report into Devonport also revealed that a number of the initial designs did not meet safety requirements.

3. The US Department of Energy have plans to rebuild many of their nuclear weapons’ facilities. Table 1 shows some of the projects planned for AWE and published estimates of the cost of related facilities in the US. These examples show not only the scale of expenditure involved but also how final costs may be several times higher than the initial estimate.

**Table 1**

<i>New AWE Facility</i>	<i>US Example</i>	<i>Cost of US Facility</i>
		<i>£ million</i>
High Powered Computing	Advanced Strategic Computing	£320 per year
Orion Laser	National Ignition Facility	Initial estimate £500; current estimate £2,000
Core Punch Facility	Dual Axis Radiographic Hydrodynamic Test	Initial estimate £32; current estimate £174
Uranium Production Facility	Uranium Production Facility	£400–500
Material Science Facilities	Chemical & Metallurgical Research Replacement	£450–550
Tritium Facility	Tritium Extraction Facility	£270

4. The Orion laser is a smaller project than the National Ignition Facility. However the Uranium Production Facility could be similar to that planned for the Y-12 site at Oak Ridge, Tennessee.<sup>117</sup> The Core Punch Facility at Aldermaston would be more complex than the new hydrodynamic facility at Los Alamos.

5. This suggests that implementing the AWE Site Development plan in full would cost several billion pounds.

<sup>114</sup> Reply by Des Browne MP to a written question from Nick Harvey MP who asked which facilities would be funded by the £1,050 announced in July 2005; Hansard 5 July 2006.

<sup>115</sup> Replies to written questions in July 2006.

<sup>116</sup> National Audit Office report into the Construction of nuclear submarine facilities at Devonport; 6 December 2002.

<sup>117</sup> Report of recent visit by AWE staff to their US counterparts in the Y-12 newsletter.



## WHAT ARE AWE PLANNING TO DO?

### *Life Extension*

6. Des Browne said the developments at AWE were “necessary to sustain Trident for its remaining in-service life.”<sup>118</sup> The term “remaining in-service life” is misleading. The life of the warhead is flexible and AWE’s main priority has been to extend it.

7. In 2001 an official statement on British nuclear weapons’ research said:

“the overarching objective of the UK nuclear warhead programme is to keep the Trident warhead in service, and to be able to underwrite its performance and safety over a period much longer than its originally intended service life.”<sup>119</sup>

8. AWE will have some confidence in the safety and reliability of the Trident warhead up to a life of 25 years. The substantial programme of production, surveillance, experiments and research is not primarily to support this initial planned life, but to provide a basis for extending it.

9. As part of this “Life Extension” approach AWE continues to manufacture a number of warheads every year. For surveillance purposes some of the oldest warheads are completely dismantled. These are replaced with new warheads. The continuous production of warheads means that the average age of the stockpile is lower than would otherwise be the case.

### *Upgrade*

10. AWE are preparing to upgrade the Trident warhead in the first half of the next decade.<sup>120</sup> Job advertisements reveal that AWE will shortly replace the Warhead Electrical System.<sup>121</sup> This component is also called the Arming, Fuzing and Firing System (AF&F).<sup>122</sup> A new AF&F for the US Trident warhead has just been designed.<sup>123</sup> Some American warheads will be upgraded with the new AF&F between 2006 and 2020. The modified warheads have the designation W76-1.

11. The introduction of the new AF&F on US and British warheads will increase the capability of Trident. Los Alamos say that the W76-1 will have increased “targeting flexibility and effectiveness”, compared with the original design.<sup>124</sup> Modifying British warheads to a W76-1 specification would be more than a “relatively minor” upgrade.<sup>125</sup> Defence Ministers have refused to discuss AWE’s involvement in the W76-1 programme or the new AF&F.<sup>126</sup>

### *New warhead*

12. The US Administration are now moving away from the Life Extension approach and focusing instead on designing new warheads under the Reliable Replacement Warhead (RRW) programme. During Congressional scrutiny of the budget for 2007 the W80 Life Extension project was cancelled and the amount allocated to RRW was increased. It is likely that the W76-1 Life Extension project will be curtailed and resources switched to the Trident RRW.

13. A choice between Los Alamos and Lawrence Livermore designs for the Trident RRW will be made in November 2006. The third US nuclear weapons’ laboratory, Sandia, is substantially involved in both options. Lockheed Martin operates Sandia. They are likely to use their role in AWE Ltd to advocate that Britain develops an equivalent of RRW.

14. A crucial difference between Life Extension and RRW is that the latter involves redesigning the plutonium pit at the core of the primary of the warhead. The decision on whether to replace the pit in British warheads will be related to estimates of its service life. Des Browne said that AWE undertakes a range of studies to: “enable regular assessments of the service life of any particular pit.”<sup>127</sup>

15. As with the submarine platform, the MoD may be preparing for both Life Extension and, later, replacement of the warhead.

<sup>118</sup> Reply by Des Browne MP to a written question from Nick Harvey MP Hansard 5 July 2006.

<sup>119</sup> High Energy Density Physics, National Nuclear Security Administration, April 2001, Appendix G—United Kingdom Statement on High Energy Density Physics.

<sup>120</sup> MoD Memorandum to Defence Committee 19 January 2006; Annex B Expected Life of the Trident System.

<sup>121</sup> A vacancy for a Warhead Electrical Engineer refers to “the approval programme for the introduction of the [Warhead Electrical] System into UK Trident”. There are other related positions. [www.awe.co.uk](http://www.awe.co.uk)

<sup>122</sup> Appendix F to the Report of the Fundamental Classification Policy Review Group Report of the Weaponization and Weapons Production and Military Use Working Group, 15 January 1997, James B Wright, Chair Sandia National Laboratories.

<sup>123</sup> The new US Arming Fuzing and Firing System is designated MC4700. It has a similar fuzing system to the W88 warhead and a replacement contact fuze.

<sup>124</sup> [www.lanl.gov/orgs/d/d5/projects/W76/W76-1-LEP-Overview.htm](http://www.lanl.gov/orgs/d/d5/projects/W76/W76-1-LEP-Overview.htm)

<sup>125</sup> MoD Memorandum to Defence Committee 19 January 2006; Annex B Expected Life of the Trident System.

<sup>126</sup> Reply by Lewis Moonie MP to a written question from Lynne Jones MP Hansard 6 February 2002, and reply by Des Browne MP to a written question from Nick Harvey MP 6 July 2006.

<sup>127</sup> Reply by Des Browne MP to a written question from Nick Harvey MP Hansard 13 July 2006.

*Facilities and options*

16. Table 2 indicates how the proposed facilities relate to future options.

**Table 2**

<i>Facility</i>	<i>Dismantle Trident 2020–25 with no replacement</i>	<i>Trident Life Extension</i>	<i>Design and build replacement warhead</i>
High Powered Computing	No need to increase capability	Some investment	Substantial investment
Hydrodynamics	New facilities not essential	Limited programme of experiments to extend pit life	Substantial programme of experiments for new pit
Orion Laser	Not required	Limited programme of experiments	Substantial programme of experiments
New Uranium Production Facility	Not required; use A90	Limited production related to the surveillance programme	Substantial production if secondary or radiation case replaced
A90 Plutonium Production Facility	Plutonium and Uranium work	Limited production related to the surveillance programme	Upgrade of A90 required for substantial production of new pit
Tritium Extraction Facility	Not required	New facility	New facility
Warhead Assembly and Disassembly Facility	Scaled down new facility	New facility	New facility
Explosive facilities	Limited requirement	New facility	New facility
Material science facilities	Not essential	New facility	New facility

17. The workload of AWE, in terms of research, surveillance, production and dismantlement, will vary depending on what the plans are for the future of British nuclear weapons. That workload would be substantially greater if a decision was made to design and build a new warhead. It would be much less if Trident was scrapped in 2025 and not replaced.

18. The Site Development Plan would create a range of new facilities which could design, build, sustain and dismantle two-stage thermonuclear warheads between 2020 and 2050, with assistance from the US.

**COMMENT**

19. The MoD are trying to preempt crucial decisions on the future of nuclear weapons by initiating a very expensive rebuilding programme. Vital resources should not be committed to expanding an infrastructure for building and maintaining nuclear weapons. Britain clearly has no need for these weapons and they undermine our potential to tackle global issues of proliferation and disarmament.

20. In addition to the billions of pound which may be wasted, we would also be squandering the talents of men and women whose skills could make a valuable contribution to the future welfare of this country. The computer scientists who are being recruited to perfect the design of nuclear warheads could use their expertise for climate modelling, which also requires supercomputers. The hundreds of mechanical and electrical engineers being drafted into AWE would be far better employed designing and producing alternative sources of energy supply.

21. AWE are not, as they claim, a forward looking establishment. They are a historical relic whose time has passed. Scarce human resources and capital expenditure should be directed towards projects which tackle the real needs of the 21st century.

30 September 2006

**Memorandum from BMT Defence Services Ltd**

**THE FUTURE OF THE STRATEGIC NUCLEAR DETERRENT: THE UK MANUFACTURING AND SKILLS BASE**

A SUBMISSION TO THE HOUSE OF COMMONS DEFENCE COMMITTEE BY BMT DEFENCE

**BACKGROUND**

1. This short paper is submitted to the House of Commons Defence Committee as evidence for the inquiry (advertised via news release No 61) into The Future of the Strategic Nuclear Deterrent: the UK manufacturing and skills base.

2. The paper is prepared by BMT Defence Services Ltd, an independent maritime consultancy, and part of the BMT Defence division, with much experience in nuclear submarine design and in-service support. For example, we designed for GEC-Marconi the winning design that was to become the Astute Class; and for several years we have been providing Design Authority services for the in-service support of the Vanguard, Trafalgar and Swiftsure Classes, teamed with Devonport Management Ltd and Systems Engineering and Assessment Ltd.

3. BMT Defence is a division of BMT Ltd, an international design, engineering and risk management consultancy working principally in the defence, energy, environment, marine technical services and transport sectors. The company's assets are held in beneficial ownership for its staff, reinforcing our complete and enduring independence from manufacturing interests, allowing us to be an impartial advisor to the UK MoD and other government departments.

**THE SUBMARINE DESIGN CONTEXT**

4. BMT can offer views on many aspects of the design, construction and in-service support of nuclear submarines but we choose here, for our evidence to the Defence Committee, to focus solely on the design elements of the skills base. We are in a position to offer insight and advice on an impartial basis.

5. A nuclear submarine is the most complex piece of engineering known to man. Thus nuclear submarine design is complex, of course, and it embraces many disciplines requiring specialist skill and experience. It is particularly challenging because of the vast range of interdependent elements that on the one hand must be closely integrated, while on the other must be balanced through careful compromise to achieve an optimum solution. The solution must satisfy the competing demands (and motivations) of the prospective owner, the builder, the user and the in-service maintainer. Furthermore, design proceeds through many overlapping phases: from the small team of system engineers and naval architects who establish the fundamental "architecture" of the solution and lock-in the characteristics that will define overall performance, cost and timescale; through the production designers who are looking for the optimum way of fabrication and assembly; to the very large numbers of manufacturing draftsmen and women who determine and detail each and every "nut and bolt".

6. Yet successful submarine design is not a serial process and it is certainly not one that starts with a completely blank sheet. Designers need to be able to call upon and integrate many unique technologies that are not found in the commercial market. These technologies exist (and survive) through continuous research and development to both further their understanding and to be ready when designers need to call on them. Furthermore, whole platform design integration skills are necessary to bring together all of these specialist skills and technologies to deliver a successful submarine design.

**THE CHALLENGES**

7. Not only is a nuclear submarine itself a very significant design challenge but a nuclear submarine-based strategic deterrent has the added complication of requiring low engineering risk to assure excellent submarine availability and thereby Continuous at Sea Deterrence. This was very much the philosophy for the Vanguard Class and the preceding Resolution Class. Low risk solutions require reliance on as much proven technology as possible yet with the ability to survive the in-service challenge of obsolescence.

8. Furthermore, in the current climate the UK would be seeking a low cost solution against an industrial cost base that today is far from fully understood. One lesson from the Astute procurement is that the attempted "transfer" of risk to industry has cost government dear and the full cost remains uncertain, in part because so many of the suppliers have suffered from lack of investment since Vanguard.

9. Finally, we are clear that much of the skill and experience that existed to allow the Vanguard Class to be such a success has perished and worse, the investment needed to sustain knowledge, skill or keep technology moving has been ad hoc at best.

## THE CRITICAL SUCCESS FACTORS

10. With respect to any future campaign, it is instructive to remind ourselves what history tells us, ie what were the Critical Success Factors for the Vanguard Class? From our perspective the following are relevant:

- (a) The MoD took the key risks of the project onto their own shoulders at the outset, particularly the major design architecture and hence the major performance parameters. Key contractors were then employed for their proven strengths, avoiding unnecessary stretch or risk transfer (and hence cost).
- (b) The skills inside the MoD had been nurtured for many years with a selection, training and active career development that gave confidence to take and manage the major risks. There was accessible and cost-effective expertise at all levels, from research and development, through design, construction oversight to in-service support.
- (c) In addition, these MoD skills had been continually exercised through a well-paced, steady programme of nuclear submarine design and construction. For the rarer, front-end concept design skills, the MoD had kept these exercised through a continuous programme of design and technology exploration, developing many new concepts on paper. That they were never built was not the point; a full new design sees fruition every 10 years or so, however the core design skills need to be kept cycled more regularly than this to ensure they are refreshed and available when needed.
- (d) This constant design exploration did expose the technological weaknesses and defined the investment needed in development programmes that had long lead times, for example in propulsion technology. Many relatively small, but long-lead, developments were taken forward by specialist contractors, driven by the MoD's leadership and investment. This in-turn kept many specialists in industry alive, stimulated and continuing to develop their experience.
- (e) At initiation of the Vanguard project, many factors were already in place thanks to years of prior investment. The MoD's own people were ready to provide professional leadership and ownership of the major risks. Many of the critical technologies were already well advanced, understood and of low enough risk. The many specialist industrial suppliers were well-stimulated by the build of the Trafalgar class, and those involved in design and development had benefited from several years' prior investment.
- (f) From a design point of view the Vanguard jigsaw puzzle was relatively easy: most of the pieces were well under development through foresight that was not necessarily anticipating the Vanguard Class per se. This foresight was driven simply by the belief that to stay in the business of nuclear submarines, one had to keep submarine technology moving for an inevitable new design at some stage. The propulsion system had started development years earlier and would be sufficiently well proven in its shore test facilities; the strategic weapon system was a choice of systems developed or developing in the US; and the "tactical" weapon system and other platform systems were taken from the Trafalgar class which continued to benefit from investment, improvement and the avoidance of obsolescence in its systems.

## THE CRITICAL SUCCESS FACTORS FOR THE FUTURE

11. While we would never have been able to repeat that formula exactly for a new system, the comparison between the foundations of the successful Vanguard project and where we are today are stark.

12. We would suggest that there are two key questions for government to address as it shapes the way forward for the skills it needs:

- (a) Where are the project's main risks to be owned and managed? If in industry, then there will be a substantial and presently unquantifiable premium of money and time involved, but industry needs early investment to recruit and train. If in-house, then there needs to be a very rapid investment in skills and a conscious effort to re-brigade those skills where they do still exist in other projects, to enable the technical and project leadership to be undertaken in a similar fashion to the successful Vanguard project.
- (b) Are we ready to invest early in the rapid development and de-risking of the new technologies needed? If yes, then the associated specialist skills can still be preserved, stimulated and readied for the eventual overall design activity; and those more fragile specialist suppliers can be helped to survive, ready to play their part.

13. In short, nuclear submarine designers and submarine design technology exist for only one customer, the government. This is not a competitive market and there are no other customers for these specialist skills. That single customer has to preserve and nurture the skills it needs—directly through investment that allows recruitment and training, and indirectly through sponsoring the essential design and development activity that is needed to keep that skill current and available, as well as readying the technology that we will need.

14. Recognising the lessons we should be learning from Vanguard and Astute and given the likely in-service date of a new submarine-based deterrent, we may already be too late. But that should not deter the simple decision that is needed now. Nuclear submarine ownership is not about discrete projects that arrive from time to time, it is about a continuum of activity. If the UK wishes to remain a nuclear submarine

owning and operating nation then we should stop trying to switch the skills on and off like a tap—we must invest now and be ready to sustain that investment. We can, of course at any time, turn the tap off—but that should only be on the basis that the UK is certainly pulling out of an indigenous nuclear submarine business.

#### CONTACT DETAILS

15. BMT Defence remains happy to help further the Committee's inquiry in any way it can.

2 October 2006

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#### Memorandum from Nexia Solutions Ltd

1. Nexia Solutions Ltd has extensive experience and understanding of the science and technology underpinning delivery of the UK Civil Nuclear Industry. Other than the design and manufacture of nuclear warheads, virtually all the nuclear skills needed to support the UK's Strategic Deterrent are also found in the civil nuclear sector in the UK.

2. A key area is expertise in nuclear reactor design and operation. This exists in the civil nuclear sector although substantial experience is vested in relatively few individuals on water reactor systems and many more on gas-cooled systems. If the UK proceeds with replacement of its ageing nuclear capacity with advanced Light Water Reactors there will be a demand for expertise to support vendor selection and licensing. These skills are highly relevant to the submarine programme and new build in the civil sector will stretch the existing skills base by diverting resources from one sector to another. We therefore perceive a need to increase the overall skills base for the benefit of both civil and defence sectors.

3. Other areas where there are strong technical synergies with the civil nuclear area include:

- Post Irradiation Examination of nuclear materials
- Processing of fissile materials, including treatment of residues
- Treatment, packaging or encapsulation of wastes
- Long term storage of irradiated fuel,
- Disposal of low level waste
- Assessment/survey of condition of radioactive materials, equipment & buildings (including nuclear reactors)
- Decontamination & decommissioning of nuclear facilities
- Treatment of radioactive effluents (gases & liquids)
- Management of nuclear criticality safety
- Management of radiological safety

4. Nexia Solutions is aware that the numbers of technologists and R&D facilities has markedly declined over the last 20 years. Our conclusion is that the current level of R&D programmes is sufficient to maintain a UK capability. Further reductions could compromise skills availability, which would take a long time to rebuild.

5. We continue to focus on a number of vulnerable skills, mainly in the area of reactor physics. Nexia Solutions builds and maintains skills in all of these areas in order to serve its customers, primarily in the civil nuclear sector. Such skills maintenance relies heavily upon undertaking R&D projects which have a prime aim to deliver workable solutions within the nuclear industry. A major part of skills development is through our continued recruitment of people with appropriate academic disciplines and giving on-the-job training through embedding in technical teams with support provided through in-house and external training

6. Working with the Nuclear Decommissioning Authority (NDA), we have put in place a strategy to work with a number of key university departments where placement of selected R&D encourages the training of engineers and scientists with appropriate nuclear expertise through Master and Doctorate programmes.

7. In parallel with development of skills, we have also developed a strategy with the NDA to maintain key nuclear research facilities—including highly active cells to handle highly radioactive materials and glovebox facilities to handle plutonium and other highly radio-toxic materials. Some of the highly active cell facilities are regarded as vital to support the nuclear submarine fleet by providing means to investigate unforeseen reactor problems and their ability to handle highly radioactive components. One particular facility is ageing and likely to need capital investment to maintain its availability.

8. The Department of Trade and Industry is investigating the need for a National Nuclear Laboratory in order to maintain the skills and capability base in nuclear research. The first phase of this project has

concluded with the statement included in “The Energy Challenge”, the Government’s report on the Energy Review, released on 11 July this year:

“UK Research and Development capability will be critical to the nuclear clean-up programme going forward and may also become important to support other strategic initiatives such as new nuclear build in the future. While the market should provide much of the nuclear R&D that will be needed, Government will want to ensure in any transitional period that current key R&D capabilities are preserved and developed, potentially as part of a National Nuclear Laboratory”.

These messages were reinforced by Alistair Darling during a visit to Cumbria on 14 July.

Nexia Solutions looks forward to playing its part in the formation of the National Nuclear Laboratory and providing a valuable contribution to the nuclear skills in the UK.

2 October 2006

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### Memorandum from Dr Dan Plesch

I do not wish to reiterate the evidence that I and other witnesses have given regarding the independence of the system and the industrial base that supports it. However this memoranda is intended to be taken in the context of, and to build upon, that evidence.

1. In its response to the Committee’s report, the MoD made no effort to counter arguments that I and other witnesses made concerning the lack of independence of the system and the industrial base that supports it beyond making a general claim against evidence given to the Committee. The MoD confined itself to arguing that command and control was independent. This may, by implication, lead to the conclusion that the MoD concedes that there is no independence of procurement, even for warheads.

2. Sir Michael Quinlan has, in evidence to the committee, argued that there is a difference between independence of procurement and of operation. He agrees that there is no independence of procurement, and does not appear to make an exception for warheads.

3. If the previous points lead us to the conclusion that there is no independence of procurement, then the next question to be asked is how far, if at all, one can say that there is a distinct UK industrial base supporting nuclear weapons and their delivery systems?

4. In this regard I suggest that Committee might ask what are the provisions of the Mutual Defence Agreement (MDA) and its amendments regarding the sharing by the UK with other states of technology supplied by the US. And further, what provisions there are for the physical withdrawal of that technology if the MDA ceases to operate. Clearly some technologies such as reactors and submarine and missile launch-tube technologies have been transferred, but could they be operated independently or with third parties?

5. The point is not to encourage or discourage continuation of support for the MDA, but to obtain a clear assessment of its terms and conditions and the impact they have on a realistic assessment of British defence industrial capacity.

6. In the past there was an assumption that there were British bombs. Indeed, as one former JIC chair put it, “I always thought the warheads were independent.” It is now a matter of public record that the US is required in warhead design, nuclear parts, non-nuclear parts, machine tools, management, arming-fusing-firing and related computer software.

7. Since Nassau, there has been an assumption that despite reliance on the US to supply SSBN and SLBMs, there was, in reserve, a British aircraft capacity. Will this remain after the introduction of the Joint Strike Fighter?

8. My own view is that a consideration of the industrial base for the strategic nuclear deterrent leads to the conclusion that it is not British, certainly not in the sense that any other state regards such capability as national.

9. From this emerges further reinforcement for my central argument made in previous evidence that the British enjoy the self-delusion of independent nuclear status at the price of losing strategic independence of policy. In this respect, the 2003–04 negotiations on the MDA renewal are key matters that the Committee might enquire into.

10. If it has not already done so, the Committee might ask Robert S Norris for a copy of documents that he and his colleagues at the Natural Resources Defense Council in Washington DC hold that pertain to US-UK nuclear weapons collaboration, and similar enquiries might be made of the National Security Archives project of George Washington University, also in Washington DC.

3 October 2006

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## Memorandum from The Royal Academy of Engineering

### INTRODUCTION

1. The Royal Academy of Engineering is pleased to respond to the House of Commons Defence Committee's second-stage inquiry into the future of the strategic nuclear deterrent focusing on the UK manufacturing and skills base. This response has been compiled from a number of contributions from Fellows of the Academy, all of whom have in-depth knowledge of the subject and many years' experience working in the field. In particular, it includes input from Fellows who were directly involved in the design and manufacture of nuclear powered submarines and input from Fellows involved in the civil sector who have provided support across both military and civil programmes.

2. The response concentrates on three main areas: the UK submarine construction industry; the Atomic Weapons Establishment (AWE), Aldermaston; and the relationship between civil and military nuclear fields.

3. The Academy would be pleased to provide oral evidence or supplementary evidence if this would be helpful to the Committee

### UK SUBMARINE CONSTRUCTION INDUSTRY

4. Submarine design, engineering, project management and construction represent an area of substantial complexity when compared with other engineering projects. There are particular challenges arising from the extremely constricted space of the hull envelope requiring particular skills in Computer Aided Design (CAD) and planning as well as advanced dimensional control issues resulting from the need for modular construction.

5. Thanks to a more or less continuous design and build programme of nuclear submarines from Dreadnought in the 1960s to the four Vanguards in the 1980s and early 1990s, almost all our submarines were built to time and cost. However, a change in government policy in the late 90s, which led to contracting out the design and build of submarines, along with a gap in the submarine programme, has resulted in a major decline in the skills required. Although many of the decisions taken during the 90s were well intentioned, the reality is that they failed to address the steps required to build on Vanguard expertise and maintain a national nuclear submarine capability and they resulted in very large financial overspends and delays. The important lesson is that continuity of both design teams and construction activity is vital if major cost and time overruns are to be avoided. This lesson is also valid in the civil sector where both utilities and vendors recommend construction of a series or fleet of one design to maintain capability and reduce costs. It is reported that the current issues with Finland's fifth nuclear reactor under construction at Olkiluoto are at least in part due to the industry relearning key project management and nuclear specific construction skills. France is choosing to proceed with the new follow on unit at Flamanville as a means to maintain skills and continuity of expertise.

6. In order to deliver affordable submarines to the Royal Navy within a sustainable business environment it must be recognised that the complexities of a nuclear submarine programme require a strategic approach from the MoD. This strategy should cover all aspects of design, procurement and manufacture with particular attention paid to the system integration capabilities, management and skills specific to submarine design such as CAD and safety. All these aspects have their own associated problems and considerations but they are all equally important as well as being interdependent on each other. Competition alone is not sufficient to achieve results. What is needed is an integrated strategy involving all the interested parties from government and industry.

7. The recent decision to adopt a Defence Industrial Strategy (DIS) is a positive move towards addressing these issues and is welcomed. However care must be taken to avoid some of the mistakes made in the 1990s. In particular, efforts must be made to ensure the UK has the intellectual capabilities to undertake the necessary research along with the ability to manage such large scale and complex projects.

8. The DIS is also crucial if the UK is to maintain a strategic nuclear deterrent. However, if a decision is taken not to replace Trident, this would call into question the future of all the nuclear submarines in the fleet.

9. It is also important to continue our collaboration with the US Department of Defense on the missile-related aspect of the submarine design, although increased industrial involvement may cause some security concerns. This must primarily be a government to government activity which has the potential to help in all aspects of the submarine programme.

10. With regard to the rationalisation of nuclear capabilities, it is important that expertise is maintained in the various centres currently active in the UK. These include the new build facility at Barrow, the refit facility at Devonport and the Royal Navy docks at Faslane as well as related sites such as the Rolls Royce nuclear reactor establishment at Derby and the experimental centre at Haslar. It is possible that future submarine designs will not require specialised refit facilities, however, for the present these must be retained in order to maintain the Vanguard class submarines.

## AWE, ALDERMASTON

11. The Government's investment programme at the Atomic Weapons Establishment (AWE) Aldermaston is welcomed. It is seen as essential if we are to maintain the UK's nuclear weapons design and manufacturing capability not only for future systems but also for the maintenance and stewardship of our existing weapons stockpile.

12. It is recognised that the design and manufacture of nuclear weapons is a particularly specialised field and limited to a small number of countries. Continued investment is therefore seen as important to maintain the UK's political position within the UN.

13. The importance and success of UK/US collaboration on AWE programmes is also recognised and needs to be continued on the basis of scientific and technical knowledge in a wide range of capabilities.

## NUCLEAR SKILLS BASE

14. Over the last 20 years there has been a massive reduction in the R&D associated with the civil nuclear sector. The privatisation of the electricity supply industry and the demise of the UKAEA as a research organisation removed a cornerstone of the R&D supply chain which impacted heavily on the academic sector in the UK. This affected the skill base available to serve both military and civil sectors particularly in the area of reactor technology where skills are most at risk. The problem is compounded by Government's failure to deliver on its commitment to fund modest UK participation in relevant international R&D projects such as Generation IV, an initiative specifically designed to bolster both industry and academic skills. Capabilities most at risk and relevant to both civil and military sectors include, core physics and fuel technology, materials performance, water chemistry, criticality, thermal hydraulics and transient analysis, systems engineering and safety performance. Links between the civil and naval sector need to be encouraged through enhanced funding of generic research. This is particularly relevant in academia where important work on the fundamental understanding of mechanistic processes such as irradiation assisted corrosion and radiation damage can be carried out.

15. As a result of the aforementioned decline, the skills required in the design, build, operation and disposal of Naval Nuclear Propulsion Plant (NNPP) are in short supply and increasingly expensive. Similarly, the number of Suitably Qualified and Experienced People (SQEP) is limited and seen as a concern within the nuclear defence industry, although efforts have been made to counteract this situation. Overall, the decline of the civil nuclear programme has forced the military nuclear programme, and in particular the nuclear submarine programme, to develop and fund its own expertise and personnel in order to remain operational.

16. Ultimately, a strong civil industry is very much in the interests of the military, and this may become the case in the future. However, with the prospect of a new generation of nuclear power plants it is possible that skills and knowledge from the military nuclear field, already in short supply, will be lost to the civil nuclear industry in the short term.

17. Therefore, if we are to maintain the civil and defence capabilities of the UK, it is vital that we increase the level of investment for education in nuclear engineering and safety and recognise the interdependence of universities, industry and defence establishments.

4 October 2006

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## Memorandum from GMB

GMB is Britain's General union with members of 600,000 working in the public, private sectors and manufacturing.

In Manufacturing GMB has members working in Shipbuilding, Aerospace, Engineering Construction, Steel, Thermal Insulation, Furniture, Textiles and Offshore.

One of the immediate concerns for the UK manufacturing and skills retention is the uncertainty of the future of the nuclear submarine programme.

1. GMB have members working at BAE Systems yard at Barrow in Furness and DML.

GMB members working for BAE Systems at Barrow in probably the most modern submarine build facility in the world are predominantly steelworkers, welders, platers etc.

There is in the region of 1,000 GMB members from a workforce of 3,200 direct labour. At DML where the nuclear submarines are maintained there is again approximately 1,000 GMB members from a workforce of 4,700 direct labour.

These two yards employ approximately 7,900 core workforce with possibly double or triple that number in the supply chain.

2. The skills required to build and maintain nuclear submarines need to be of the highest quality because of the nature of the nuclear submarines and the conditions they work under.



So it is necessary to keep the capability of a highly skilled competent and motivated workforce, to meet the capacity demands. It is common knowledge through the industry that it takes up to nine years to become truly proficient in the submarine environment.

We need to move away from the industry peaks and troughs and get stability and consistency in order to attract new blood and apprentices who will be the future of the industry so we can keep the world class skills to build world class ships and submarines in the UK.

3. It is imperative that we have and maintain a future nuclear submarine build strategy because the defence capability needs these submarines as a deterrent, other country's have nuclear submarines and we are all aware of the recent test in Korea which is causing worldwide concerns, we need the orders for the UK economy and manufacturing jobs.

If the Nuclear Submarines are not built in the UK they will be built elsewhere, taking our design technology, capability, skills and work from local communities and yet more jobs out of UK manufacturing.

Orders for four more ASTUTE submarines would be a lifeline for thousands of permanent jobs and more in the supply chain.

There is no diversification or export opportunity for Barrow because it is geared up solely to build submarines.

4. We need to support jobs in support of the Nation and Governments policy on defence.

In places like Barrow, DML and Faslane if they didn't have the submarine orders the yards would undoubtedly close.

All three sites are in remote parts of the country and without this work, very little other skilled or semi-skilled work of this type is available, and to lose these jobs would be a drain on the country and the UK taxpayer, and so would losing yet more UK manufacturing jobs, would be a devastating blow to the local communities.

So it's imperative we maintain a continued flow of work and skills capability, or these skills could be lost forever.

20 November 2006

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### **Memorandum from Scientists for Global Responsibility (SGR)**

#### **ABOUT SGR**

Scientists for Global Responsibility (SGR) is an independent UK membership organisation of approximately 850 science, design and technology professionals. Our main aim is to promote and support science, design and technology which contributes to social justice, environmental sustainability and the reduction of conflict. The issues raised by the potential replacement of UK nuclear weapons and the related skills base as outlined in the call for evidence obviously have strong links with these concerns.

#### **EXECUTIVE SUMMARY**

The focus of this submission is the impact that a decision to replace Trident could have on the UK science and technology skills base. We provide evidence of the shrinking skills base in science and technology in the UK and then discuss it in the context of three issues:

- (i) the extent to which the military use of science and technology resources (both skills and funds) can and does compete with urgent civilian uses;
- (ii) the low level of employment generated per unit of investment in military programmes compared with civilian programmes; and
- (iii) the extent to which military involvement with science and technology can adversely affect the public image of science and technology and so undermine recruitment and retention.

We conclude that a decision to replace Trident will have a significant and detrimental impact on the UK's ability to maintain the science and technology skills base needed in order to support the civilian economy. In particular, we are concerned that this problem will seriously undermine the UK's attempts to play its role in tackling global issues such as climate change and energy insecurity.

One specific recommendation we make in the context of this argument is the need to carry out a detailed economic assessment which compares the job creation potential for any Trident replacement programme with those in skilled civilian sectors, eg energy efficiency or renewable energy technology.

We also make brief comment on the current expansion of the Atomic Weapons Establishment (AWE), and express serious concerns that this is significantly beyond what is necessary for "stockpile stewardship".

## MAIN SUBMISSION

1. *Introduction*

The Defence Committee has called for evidence regarding the UK manufacturing and skills base in relation to the future of the country's nuclear weapons.

Much of the evidence already submitted to this inquiry has examined the question of how to find enough skilled employees both to keep the option of "Trident replacement" open and, should the government decide in favour of this, to carry out this replacement. Meanwhile, other submissions have argued against Trident replacement on the grounds of morality and/or international security. In this submission, however, we examine the issue from a somewhat different direction. We look at the implications for the overall science and technology skills base for the UK if the government decides to retain nuclear weapons.

In short, our argument is that we believe that a Trident replacement decision will have a significant and detrimental impact on the UK's ability to maintain the science and technology skills base needed in order to support the civilian economy. In particular, we are concerned that this problem will seriously undermine the UK's attempts to play its role in tackling global issues such as climate change and energy insecurity.

2. *Current concerns over science and technology skills shortages*

Both government and industry are very concerned about the availability of science and engineering skills across the economy both now and in the future. This is reflected in many policy initiatives, not least the current science, technology, engineering and maths (STEM) programme which is aimed at increasing the numbers of students taking these subjects [1].

One principle reason for this concern is the falling numbers of UK undergraduate students studying many of the STEM subjects as shown in Table 1.

**Table 1**

PERCENTAGE CHANGE IN UK UNDERGRADUATE NUMBERS 1999–2000 TO 2004–05

<i>Subject</i>	<i>% change between 1999–2000 and 2004–05</i>
Engineering	– 3%
Physics	0%
Maths	– 11%
Chemistry	– 20%

*Source:* HEFCE [2]

These figures are especially worrying when considered against the 13% *increase* in the number of undergraduates during the same period [3]. Little solace can be taken from the fact that the number taking physics has been static during this period, given the fact it is the least popular of the four subjects in the table. And to make matters worse, the number of computing undergraduates—which had been rising—is now starting to fall, causing the British Computer Society to warn of a skills "crisis" [4].

This shortage in skills is obviously not something that just affects the military science and technology sector, but the whole economy and society in general. It is therefore important that decisions on military programmes take into account these wider concerns.

3. *Concerns related to the expansion of military use of skilled employees*

SGR believes that three very important factors related to the issue of military skills are rarely raised in these discussions and should be. They are:

- (i) the extent to which the military use of science and technology resources (both skills and funds) can and does compete with urgent civilian uses;
- (ii) the low level of employment generated per unit of investment in military programmes compared with civilian programmes; and
- (iii) the extent to which military involvement with science and technology can adversely affect the public image of science and technology and so undermine recruitment and retention.

### 3.1 *Competition with civilian science and technology*

Probably the most important civilian areas where military industry, including a Trident replacement programme, might compete for skills and resources are those areas related to tackling climate change. For example, graduates in the physical sciences, maths and all the main engineering subjects are needed by the low carbon energy sectors (such as renewable energy) as well as in military industry. This section looks at the potential for competition.

Senior policy-makers and scientists all acknowledge the huge threat of climate change and the importance of taking urgent steps to reduce the greenhouse gas (GHG) emissions that cause it. For example, in the wake of the recent Stern review, Tony Blair said the consequences for failing to curb emissions were “literally disastrous” [5]. Meanwhile Chief Scientific Advisor, Professor David King, has gone further, saying “climate change is the most severe problem that we face today—more serious even than the threat of terrorism” [6]. It is also acknowledged that reducing the threat of climate change, and by implication reducing our use of fossil fuels, could have security benefits, eg less potential for conflict over diminishing supplies of fresh water or crude oil.

However, the Labour government’s efforts to control UK GHG emissions have only led to quite limited overall reductions—with carbon dioxide emissions now actually greater than they were when Labour came to power in 1997 [7].

One significant reason why the UK is failing to achieve sufficient emissions reduction is especially relevant to the discussion on skills: a lack of government spending on research, development and demonstration (RD&D) of low carbon technologies. Despite being warned by the Royal Commission on Environmental Pollution in 1999 [8] about the low level of funding in this area, especially of renewable energy, the government has only made modest increases since that time. For example, the most recent statistics show the government spent only £37 million on renewable energy RD&D in 2005 [9]—little more than 1% of the Ministry of Defence’s R&D spending that year.

However, in the last year, there have been several UK initiatives to change the situation. Perhaps most significant was the Energy Review which laid out a range of policies and measures to reduce GHG emissions in the energy sector. Also significant in this context was the announcement of the Energy Technologies Institute, whereby the government will provide £500 million over ten years for R&D on low carbon technologies, with matching funding to come from industry [10].

Interestingly, even before these initiatives were announced, the Department of Trade and Industry (DTI) projected that employment in the renewable energy sector could, given supportive enough policies, expand from 8,000 jobs in 2004 to up to 35,000 by 2020 [11]. The expansion of other energy sectors favoured by government during the same period, for example, energy efficiency, carbon capture and storage, and nuclear power (fission and fusion), would also lead to a high demand for skilled workers.

Even without a decision on Trident replacement, these sectors face stiff competition for skills (and the resources to support those skills) from the military industrial sector. This is illustrated by the UK Defence Industrial Strategy (DIS)—released in 2005 [12]—and its sister volume, the Defence Technology Strategy (DTS)—released in October of this year [13]. These documents detail the extensive government efforts to further utilise science and technology skills and resources in the military sector. No equivalent civilian sector benefits from such strategic government support.

Another illustration of the advantage held by military industry comes from the nuclear weapons sector itself. The recent increases in funding for the Atomic Weapons Establishment (AWE) took its 2005–06 budget to £493 million [14]. This single year figure is nearly as high as the government contribution *over 10 years* for the Energy Technologies Institute discussed above.

Hence, there are major concerns about skills shortages across science and technology, the DIS and related efforts represent a major effort to expand the use of such skills in the military industrial sector, and we have an urgent need to move to a low carbon economy which is critically dependent on such skills. Even without Trident replacement, SGR is extremely concerned that there would not be enough skilled labour to go around. With Trident replacement, we think it very likely that skills shortages will be serious. Furthermore, we think it likely that the military would be in a position to exert its influence over the labour market—through, for example, the promise of higher wages and more technically advanced facilities—to ensure that it was the civilian sector which bore the brunt of any shortages. This could have serious repercussions on UK efforts to tackle climate change, not to mention the country’s attempts to improve energy security.

### 3.2 *Employment generated by military projects*

Some advocates of Trident replacement cite employment generation as one of the arguments to support their case. However, the military industrial sector in general is very capital-intensive, and nuclear weapons technology especially so, hence the employment benefits of public investment are not as high as many other parts of the economy.

This is illustrated by economic research from the USA which suggests that the unit cost of each military job is greater than other sectors [15]. The study estimated that for each billion dollars spent on military procurement 25,000 jobs were created, while the same figure created 30,000 jobs in public transport, 36,000 in housing and 41,000 in education.

The situation for Trident replacement is likely to be significantly worse. For example, building new nuclear weapons-capable submarines would be very capital-intensive. With a rolling programme for four replacement submarines—each one costing in the region of £1 billion [16]—maintaining a shipyard workforce (almost certainly at Barrow) of only about 10,000 employees, it is hard to see how this could be considered effective in job creation terms.

In contrast, a sector such as building energy efficiency—which needs to be expanded rapidly in order to reduce GHG emissions and improve energy security—has very good job creation potential because it is not very capital-intensive.

No economic assessment seems to have been carried out to date comparing the job creation costs for any Trident replacement programme with those in skilled civilian sectors, eg energy efficiency or renewable energy technology. We therefore believe it essential that such an assessment is carried out before any decisions on Trident are made.

### 3.3 *Perception of military science and technology*

There has been a lot of discussion recently on which factors might be to blame for the decline of students taking physical sciences, maths and engineering as discussed earlier. Suggested factors include:

- these subjects are considered boring or “geeky” by students;
- the quality of teaching has declined;
- the resources available for teaching have declined; and
- the potential for better pay is higher if other subjects are studied (eg financial, management or media studies).

One possibility that is little acknowledged is the degree to which the public image of science and technology may be tainted because many of the UK industries that rely heavily on them are perceived to contribute to major problems such as international conflict and environmental damage. The unpopularity of current British military deployments, for example in Iraq, is likely to be adding to this.

Credence for this idea comes from a number of sources. Firstly, in contrast to the physical sciences and engineering, the number of undergraduates in the biological sciences has grown in recent years [17]. Since biological sciences are closely associated with health issues, this gives an indication why it bucks the trend. Secondly, the physical sciences and engineering have historically had problems recruiting girls and woman into their profession. Recent research [18] suggests that girls are interested in working in science, but only if it involves a strong consideration of ethical issues. A third indicator is this year’s survey of the organisations which university students see as their ideal employers [19]. Among science and engineering students, the top three were:

- (i) BBC (unchanged from last year);
- (ii) NHS (up from 56); and
- (iii) Environment Agency (up from 86).

Meanwhile, the Ministry of Defence and BAE Systems both fell.

Further anecdotal evidence comes from SGR’s own work on careers issues. We regularly attend university careers fairs around the UK to highlight the opportunities for scientists, engineers and the related professions in areas such as sustainable energy, environmental protection or peace-building. We are frequently told by students that our presence at these events is a welcome alternative to many of the mainstream employers, not least those with military connections.

Concern within the science and technology community about the current level of military involvement in this sector was also discussed in a recent SGR report [20].

Given these data, we are very concerned that a Trident replacement programme and the associated recruitment drive will negatively affect the public image of the science and technology employment market and therefore the inclination of young people to pursue studies in this area, making it even harder to attract and retain qualified scientists and engineers.

## 4. *AWE’s current expansion*

Finally, we wish to make some brief comments on the current expansion of the AWE in advance of the official decision on Trident replacement.

The expansion has so far involved recruitment of several hundred staff (mostly in science and engineering) [21], ostensibly for a nuclear weapons “stockpile stewardship programme”. New and expensive laser, supercomputer, hydrodynamics and other facilities are being constructed to enable new studies to be carried

out concerning nuclear weapons components and assemblies in reinforced explosion chambers, in collaboration with US scientists and weapons designers [22]. Like the Trident system, much of this is large-scale capital spending which, together with the increased use of highly-skilled staff, adds to the pressure on limited resources (similar to that discussed earlier).

SGR, however, has other serious concerns about this expansion. Having studied the plans and proposals for the AWE development carefully, SGR is of the view that the new facilities cannot be justified on the basis of maintaining existing stockpiles. There is a remaining suspicion that work is being undertaken or planned which could assist in or is already part of the development of a new warhead capability or design. This is of very real concern as it is likely to further undermine progress in implementing the nuclear Non-Proliferation Treaty and adherence to the Comprehensive Test Ban Treaty. This is particularly worrying at a time when reports suggest six Middle-Eastern countries are seeking civil nuclear technology [23], and hence non-proliferation controls need to be seen to be adhered to by all countries.

### References

- [1] DfES & DTI (2006). The STEM programme report. <http://www.dfes.gov.uk/hegateway/uploads/STEM%20Programme%20Report.pdf>
- [2] HEFCE (2006). Undergraduate students in STEM subjects. <http://www.hefce.ac.uk/news/hefce/2006/stem/students.pdf>
- [3] The number of full-time undergraduates at UK universities has risen from 1,027,400 in 1999/2000 to 1,165,445 in 2004/05. Higher Education Statistics Agency (2006). Student tables. <http://www.hesa.ac.uk/holisdocs/pubinfo/stud.htm>
- [4] Ghosh P (2006). Computer industry “faces crisis”. BBC News website, 17 November. <http://news.bbc.co.uk/1/hi/technology/6155998.stm>
- [5] Anon (2006). Climate change fight “can’t wait”. BBC News website, 31 October. <http://news.bbc.co.uk/1/hi/business/6096084.stm>
- [6] King D (2004). Climate change science: adapt, mitigate or ignore? *Science*, 303: 176–7.
- [7] DEFRA (2006). UK Emissions of Greenhouse Gases. <http://www.defra.gov.uk/environment/statistics/globalatmos/gagccukem.htm> (Accessed November 2006)
- [8] Royal Commission on Environmental Pollution (1999). Energy—the changing climate. 22nd Report. <http://www.rcep.org.uk/>
- [9] International Energy Agency (2006). IEA Energy Statistics. <http://www.iea.org/Textbase/stats/rd.asp> (accessed November 2006).
- [10] DTI (2006). Energy Technologies Institute. <http://www.dti.gov.uk/science/science-funding/eti/page34027.html>
- [11] Department of Trade and Industry (2004). Renewable Supply Chain Gap Analysis. <http://www.dti.gov.uk/>
- [12] Ministry of Defence (2005). Defence Industrial Strategy. <http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/PolicyStrategyandPlanning/DefenceIndustrialStrategyDefenceWhitePapercm6697.htm>
- [13] Ministry of Defence (2006). Defence Technology Strategy. <http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/ScienceandTechnologyPublications/SITDocuments/DefenceTechnologyStrategy2006.htm>
- [14] *Hansard* (2006). Written answer to parliamentary question, Des Browne to Alan Simpson. 6 June: Columns 504W & 505W.
- [15] Harigel G (1997). The impact of the military-industrial complex on society. In: D Schroer and A Pascolini (eds). *The weapons legacy of the Cold War*. Ashgate.
- [16] p26 of Ainslie J (2005). The Future of the British Bomb. WMD Awareness Programme. <http://www.comeclean.org.uk/>
- [17] Higher Education Statistics Agency (2006). Student tables. <http://www.hesa.ac.uk/holisdocs/pubinfo/stud.htm>
- [18] Haste H (2004). Science in my future. Nestlé Social Research Programme. <http://www.spreckley.co.uk/nestle/science-in-my-future-full.pdf>
- [19] Universum Communications (2006). The Universum UK Graduate Survey. <http://www.universumeurope.com/ukgs2006.aspx>
- [20] Langley C (2005). Soldiers in the Laboratory: Military involvement in science and technology—and some alternatives. Scientists for Global Responsibility. <http://www.sgr.org.uk/ArmsControl/Soldiers—in—Lab—Report.pdf>

[21] *Hansard* (2006). Written answer to parliamentary question, Adam Ingram to Mike Hancock. 3 July: Column 702W. <http://www.publications.parliament.uk/pa/cm200506/cmhansrd/cm060703/text/60703w1331.htm>

[22] AWE annual reports and other related documents. <http://www.awe.co.uk/>

[23] *The Times* (2006). Six Arab states join rush to go nuclear. 4 November. <http://www.timesonline.co.uk/article/0,,3-2436948,00.html>

23 November 2006

### Supplementary memorandum from Devonport Management Limited

**Minimum skill levels:** A note on the breakdown of the minimum number of personnel in each key skill area necessary to sustain core skills [Q17]:

These numbers are based on the resources needed to support a single stream of SSBN refuelling/refits (which will be the submarine refit load when Devonport completes the current, final Trafalgar class refit on HMS *Triumph* in early 2008) in parallel with a single defuelling and lay-up workload on end-of-life SSNs:

250 mechanical fitters, 140 electrical fitters, 150 fabricators, 30 welders, 15 nuclear welders, 50 marine pipe fitters, 150 health physics/radiological/environmental support staff, 200 test and commissioning engineers, 140 refuelling and fuel handling personnel of all types, 400 infrastructure/plant management, technical and safety case specialists and 300 planning and programme management staff.

Note that within the large groups such as fitters there are very many instances of sub-sets of typically two to four individuals who have unique experience in, say the strip, survey, rebuild and commissioning of particular equipments and systems within the submarines.

There are other personnel involved in support to overall site operations, etc, but these have not been detailed in the above answer.

**Decommissioning:** A note on the number of people required to decommission the current Vanguard submarines if a decision was taken to abandon the deterrent and how those numbers compare to current employment levels at Devonport [Q19]:

These numbers are based on the experience with SSN defuelling and lay-up preparation, but do not include any work to take the submarines beyond the stage where they are prepared for long term storage afloat (ie it does not allow for complete scrapping and disposal):

440 defuelling and lay-up preparation staff (includes all planning, project and management team), 50 health physics/radiological/environmental support staff, 100 plant management and technical specialists and 50 infrastructure maintenance personnel.

**Naval Base Review:** A note on the scale of what is involved in the Review, how the Review relates to the deterrent decision, and how DML is consulting with the MoD on the Review [Q47]:

The Review is looking at the options for reducing the scale of Naval Base infrastructure to re-establish the balance between operational base port capacity/costs and the current requirements of the Royal Navy.

The way in which the Review relates to the deterrent decision is explained in my written evidence—<sup>159</sup>

“A decision not to replace the deterrent would have a fundamental effect on the maritime element of the DIS [and the Naval Base Review] through:

- a potential impact on the operational and support strategies for the existing deterrent system;
- knock-on effects into the planned Astute procurement programme (the SSN force is partly committed to supporting the SSBNs); and
- changed priorities in respect of build and support yards [and Naval Bases] that are required to deliver the other elements (ie, non SSBN-related) of military capability in the naval sector.

Conversely, a decision to replace the current deterrent system would make the existing UK submarine-related engineering skill-base and infrastructure essential in maintaining availability of the current and future SSBNs and the SSNs that support their deployment.

A positive decision on a future submarine-based deterrent must, in turn, influence decisions about where and when other naval build and support work is carried out—a good example is Devonport where the availability of surface ship support work will be vital during the inevitable periods of low submarine throughput that the future upkeep programme contains, if submarine affordability is not to be seriously impaired.

There is also therefore a very important interaction with the current Naval Base Review where, for instance, the resultant surface ship base porting strategy will influence the availability of ship maintenance work in Fleet Time at Devonport.

<sup>159</sup> The text in [square brackets] is additional to the written evidence text but is relevant to the specific question asked.

Hence a positive decision to replace the current deterrent with a new submarine-based system will generate a “pivot point”, centred on the UK’s sovereign submarine build and support infrastructure, around which a wide range of other maritime industrial base issues [as well as Naval Base strategy] should be determined if the affordability and availability of overall naval capability is to be optimised.”

DML is providing a wide range of cost and other data to the Naval Base Review team relating to the various options that are being considered. Much of this is being supplied and justified through direct discussions with RN and civil service personnel who work in Devonport Naval Base.

#### ASTUTE KEY SUPPLIER FORUM

DML is not actually a supplier into the Astute programme and I assume that this is why my company is not a member of this group.

DML’s input to the Astute design has been limited. However, DML has extensive knowledge of the current classes of RN submarines and their in-service support, knowledge which is relevant to the development of the Astute class support strategies.

DML is fully engaged in the work streams that are considering the requirements for future nuclear submarine capability and associated designs.

24 November 2006

#### Supplementary memorandum from BAE Systems

Further to the hearing of 7 November 2006 I would like to provide this written note to expand on the following questions:

- Q17—“minimum number necessary in each specialist area”.
- Q31—“*timeline for ourselves—our resource plots*”.

To address Q17 first BAE Systems Submarines is currently organised to support a 22 month interval between each ASTUTE Class Submarine. This results in three submarines in various stages of production at any one time. The 22 month drumbeat has been agreed with MOD as the optimum interval to retain key skills and to address the issue of affordability. Work has taken place with trade unions to remove the last vestiges of demarcation and promote flexibility. Significant opportunities have been taken to outsource non specialist activities (eg laying electrical cables in predetermined routes) and stringent ‘make v buy’ analysis has taken place to ensure that manning is at a minimum whilst maintaining key skills. Further investigation has shown that even single digit changes in manning levels can impair performance.

Retention of resource surplus to immediate requirements is seen as both uneconomical and also unrealistic because of the irreversible attrition of skilled and particularly experienced personnel which would inevitably result. Skilled workers need real and challenging work to retain their qualifications and expertise in the design/build of such a complex product.

The current production headcount represents the minimum requirement to support the 22 month drumbeat, and the figures for Production and Engineering are as follows:

#### Production

<i>Skill</i>	<i>Number</i>
Steelworkers	298
Pipe Mechanical	379
Electrical	174
Sheet Metal Workers	51
Joiners	17
Painters	21
Ancillaries	150
Direct Support	200

#### Production Support

<i>Skill</i>	<i>Number</i>
Weapons Systems Engineers	60
Test and Commissioning	60
Supervision/Management	160

**Engineering**

<i>Skill</i>	<i>Number</i>
Professional Engineers	148
Detail Designers	220
Technical Support	60

**Engineering Support**

<i>Skill</i>	<i>Number</i>
Combat Systems Engineers	150
Systems Engineers	140
Nuclear Safety Engineers (Site and Submarine)	50

These skill sets can be further sub divided, and a detailed breakdown for Steelworkers, Pipe Mechanical, Electrical, Professional Engineers and Detail Designers is shown at Annex A.

It should also be noted that the retention of Nuclear Safety Engineers is critical to the maintenance of the Nuclear Site Licence, without which the construction of Nuclear Submarines is impossible.

In addition to this the following should be recognised:

Expansion from the minimum capability levels will be required to support a potential Successor Programme, and there would be a significant time delay before full operating capability and efficiency was reached whilst personnel are recruited, trained and gain experience.

Consideration should also be given to what work would be available to maintain the skills and currency of these minimum levels. Unless it is possible to secure challenging, relevant work, it would be difficult to retain the workforce.

These figures were presented to MoD ASM IPT in August 2006 and have since been independently reviewed for the MoD. They are a development of the analysis prepared for the Rand report “Sustaining Design and Production Resource”.

With regard to Q31, the graphs at Annex B show the minimum level of Production and Engineering resource required to support current contracts (Boats 1-3 of the ASTUTE Programme)

During the Select Committee hearing Mrs Linda Gilroy raised an issue regarding why DML had not been included in the Key Supplier Forum, a focus group of key contractors who’s objective is to pursue significant improvements in affordability, (led by BAE Systems and which to date has been highly successful). Our reason for not including them, although through-life cost issues are covered by the inclusion of the Defence Logistics Organisation representative, are that they do not procure a significant amount of first fit items; however they are, and increasingly will be, an active participant in our Lean Design studies for the Astute Class which look not only into opportunities to reduce the UPC (unit production costs) but also in particular to include considerations of through-life maintenance and support into the design.

I trust this is helpful should you require any further information please do not hesitate to contact.

*Murray Easton*

Managing Director, Submarines

30 November 2006

**Annex A****STEELWORKER SKILL SET BREAKDOWN**

<i>Steelworkers</i>	<i>Welders</i>	<i>Caulkers/Gougers</i>	<i>Other</i>
Reactor Lead/Poly Lining—3	Cladding—8	Burners—2	Plumbers (Reactor lead/Poly fitting)—2
Machine Specialists—13	A-grade—40	Gougers—9	Joiners (Reactor lead/Poly fitting)—4
Unit/Module Fabrication—21 (Qualified to Tack)	A-grade (sub-arc)—13	Dry Survey Grinders—5	Ships Loft men (Mock ups, templates)—5
Pressure Hull Erectors—19 (Qualified to Tack)	Specialist Stainless—7	Tank Testing Team—8	Drillers—all areas inc pressue hull and reactor—20
Technically based Liner Offs/ Dry Survey Specialists—6	A—grade Instructors—2	Apprentices—5	Apprentices—6
Minor Fabrications—9	Service Welders—11		
Outfit/Boat Steelworkers—27	Apprentices—20		
Flank Array Trained and Qualified—7			
Apprentices—17			



## PIPE MECHANICAL SKILL SET BREAKDOWN

<i>Fitters</i>	<i>Pipeworkers</i>	<i>Pipe Welders</i>	<i>Turners</i>
Test Team—17	Pipe Manufacture—40	Boat Restricted Welders—18	DDH Machine Shop—16
Nuclear Facilities—build of primary plant—12	Plant Maintenance—11	Nuclear Coded—12	
Plant Maintenance—16	Nuclear Facilities—build of primary plant—12	PPS Specialist Welders—10	
SMITE—Gearbox/Main Engine build—11	SMITE—pipe installation—11	SMITE Restricted Welders—2	
SMITE—Testing—6	Pipe Installation—105		
Boat Restricted Access—83			

## ELECTRICIAN SKILLS SET BREAKDOWN

<i>Electricians</i>
Nuclear and Combat Systems Experience—44
Termination Specialists—36
Plant Maintenance and Production Services—32
Test Electricians Services and General Electricians—40

## PROFESSIONAL ENGINEERS AND DETAIL DESIGNERS SKILL SET BREAKDOWN

*Minimum Engineering skills base:*

## Professional Engineers:

Electrical	32
Mechanical	40
Structures	9
Stress and Dynamics	14
Naval Architects	7
Signatures	4
Noise and Vibration	8
Radiation and Shielding	4
Metallurgists and Welding	10
Safety	5
Weights	3
Engineering Management	8
Operability	4
<b>Total</b>	<b>148</b>

## Detail Designers:

Electrical	27
Electrical Layout	9
Cable Management	12
Electrical Specialists	7
Electrical Management	7
HVAC	6
Mechanical Systems	27
Mechanical Integration	11
Mechanical Specialists	7
Mechanical Reactor	5
Mechanical Management	7
Hull Outfit	11
Hull Structure	25
Hull Mechanics	8
Hull Specialist	6
Hull Integration	5
Hull Management	6
Production Engineering	6

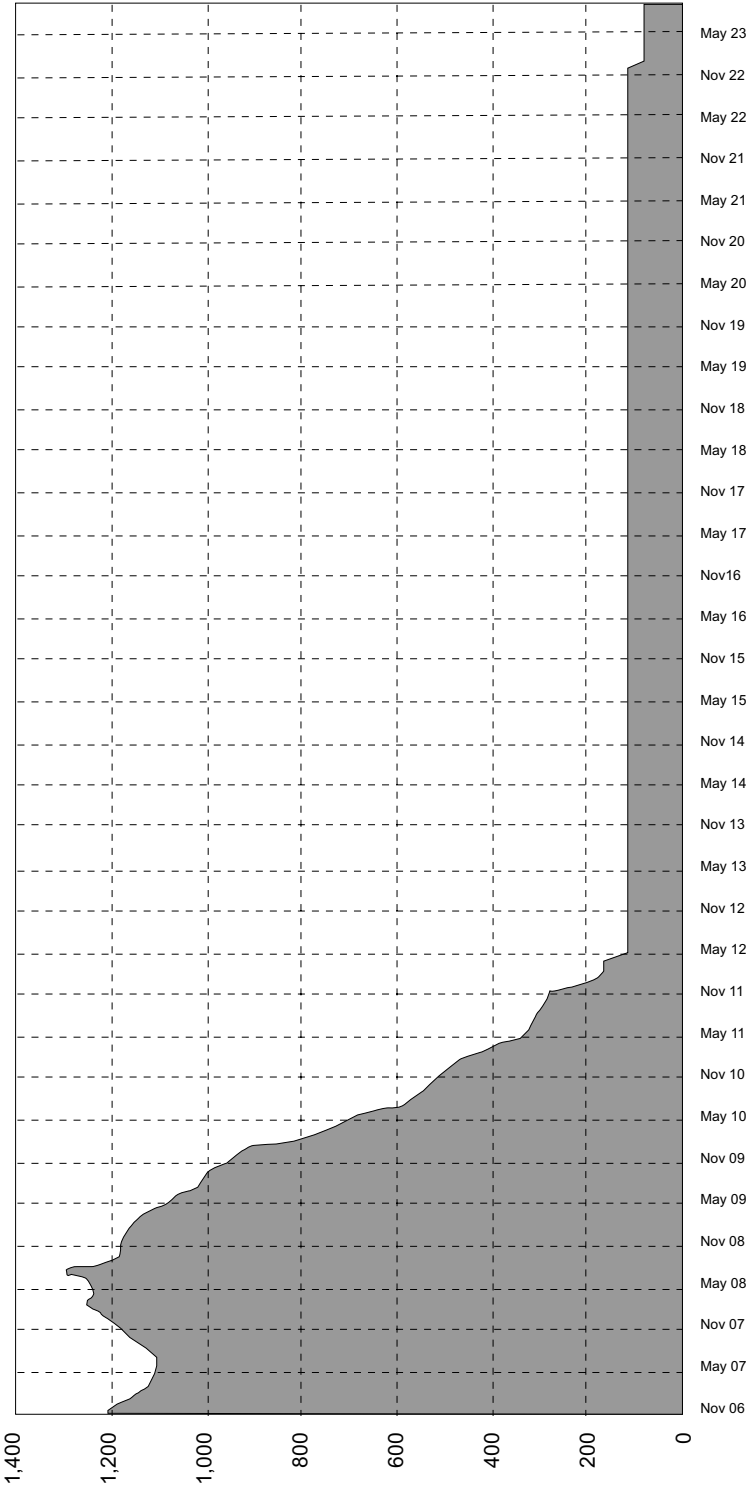
Minimum Engineering skills base:

Field Engineering (liaison with Operations)	6
Standards	13
Bill of Materials	9
<b>Total</b>	<b>220</b>

Annex B

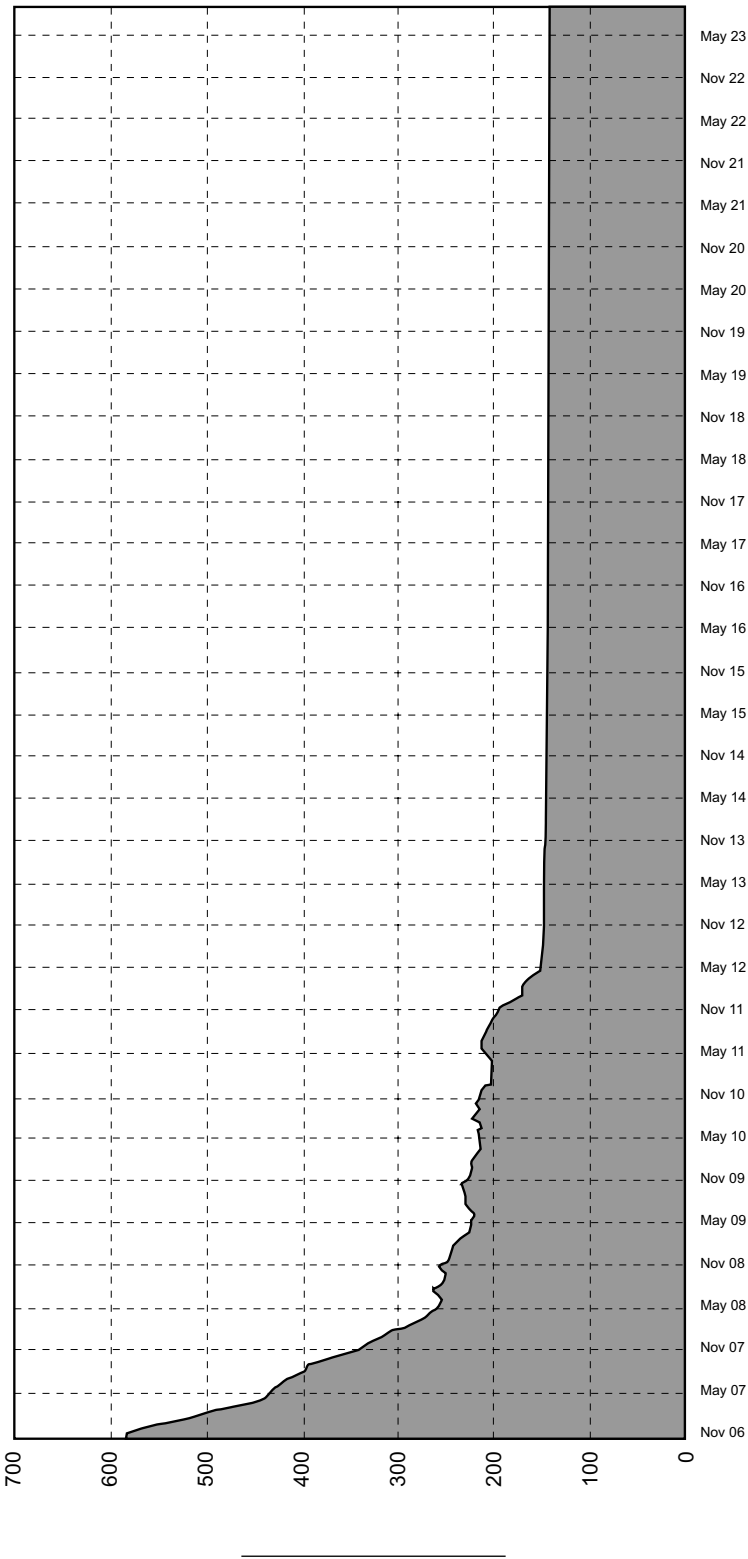
PRODUCTION RESOURCE

Graph showing production resource to support Boats of 1–3 of the ASTUTE class



ENGINEERING RESOURCE

Graph showing engineering resource to support Boats 1–3 of the ASTUTE Class



## Further memorandum from the Keep Our Future Afloat Campaign

### 1. EXECUTIVE SUMMARY

A number of organisations are opposed to the continuation and/or replacement of the UK's Strategic Nuclear Deterrent.<sup>160, 161, 162, 163</sup>

#### 1.1 *The concerns of those opposed to Trident system replacement*

1.1.1 In summary their view is that the strategic deterrent cannot counter terrorism, that the traditional superpower adversaries no longer pose a threat to the UK, Britain should take a lead in non-proliferation and resources presently allocated for funding the deterrent could be better used for other activity to benefit society as a whole. As regards workforce and industrial capability, these organisations believe that if there is no further investment in the deterrent capability highly skilled people presently employed in building and maintaining it will be able to find alternative employment because they have the skills to do so and there would be ample time in which to do so, in other activities. Alternative sources of employment are identified for redundant workers in industries involved in tackling climate change, health and renewable energy.

#### 1.2 *KOFAC's response to the concerns*

1.2.1 The reality is that nations are still investing in their own nuclear deterrent capability, UK maintains a minimum nuclear deterrent and experience shows that it is extremely difficult once defence employment turns into redundancy for alternative comparable waged and technically demanding forms of employment to be found. Long lasting severe economic consequences follow.

1.2.2 KOFAC<sup>164</sup> considers that gaps in workload should not be programmed to occur, a successor submarine should be delivered and supports designs work starting soon to keep strategic deterrent options open as described in the Defence Industrial Strategy.<sup>165</sup>

### 1. INTRODUCTION

1.1 This supplementary submission by the Trade Union-led "Keep Our Future Afloat" Campaign (KOFAC) addresses the views being raised those opposed to the continuation of the UK's strategic nuclear deterrent. In looking at the issues overall one thing is certain, *"the world in 2030 and beyond will not be more predictable than today"*.

### 2. REPLACING THE SUBMARINES, NOT THE MISSILES AND WARHEADS

2.1 A clear distinction to be made about the decisions that UK Government is currently reviewing. It is investment in a replacement submarine system that carries the strategic nuclear deterrent that is being considered not the missile or its warhead. The Trident warhead need not be replaced.

2.2 The British Pugwash Group (BPG) highlight the fact that it is the submarine lifetime that limits the lifetime of the deterrent,<sup>166</sup> the current proposal involves replacing only the submarines. BPG state *"The Trident warhead can be maintained in service indefinitely through a programmed inspection refurbishment and manufacture within the original specification"*.

2.3 KOFAC consider investment in a replacement submarine fleet is necessary to enable the UK's deterrent capability to be maintained with a high likelihood it will remain hard to detect. It will be safer and more effective to operate, because it will use 21st century technology and new boats will therefore sustain the capability to deter an aggressor well into the middle of this century and beyond.

### 3. THE CONCERNS OF THOSE OPPOSED TO TRIDENT SYSTEM REPLACEMENT

3.1 The views of those opposed to a successor submarine system and continuation of Trident may be classified as follows:

- Public opinion is against replacement of Trident.
- Nuclear weapons are no use in countering terrorism.
- There is no superpower threat to UK—the "cold war" adversaries are no longer a threat.

<sup>160</sup> British American Security Information Council—Does Britain need Trident—you decide.

<sup>161</sup> CND No Trident replacement September 2006.

<sup>162</sup> CND campaign No 3 2006—Trident, the reality of the job issue September 2006.

<sup>163</sup> Greenpeace.

<sup>164</sup> Novosti: Russia prioritizes strategic forces on security agenda—16 November 2006.

<sup>165</sup> Defence Industrial Strategy December 2005.

<sup>166</sup> An end to UK nuclear weapons (British Pugwash Group 2004).

- Proliferation will increase if UK reinvests, UK should support non-proliferation.
- The resources saved by not investing in a replacement could be used to tackle other priorities such as climate change.
- There would be time to adjust local economies adversely affected by curtailment of investment in the deterrent, their workforces, who are highly skilled could find work elsewhere. Shutdown of facilities would happen over many years making the transition easier.
- Renewable energy and other forms of manufacturing could absorb the job losses and give alternative employment.<sup>160, 161, 162, 163</sup>

Taking each of these issues in turn, we have the following observations to make to the Select Committee:

### 3.2 Public Opinion

3.2.1 Surveys by The British Pugwash Group<sup>166</sup> and Ministry of Defence show that UK public opinion only favours disarmament by the UK if other nations disarm. When “*the question of the UK’s possession of nuclear weapons is put to the before the British Public, a substantial majority continue to favour retaining nuclear weapons so long as other nations have them*”.<sup>166</sup> A survey conducted for the Ministry of Defence in 1998, asked “*Should Britain keep its nuclear weapons?*”, “35% said they should be kept in all circumstances, and a further 35% said they should be kept in some circumstances, which is to say a large majority of 70%”. The paper goes on to conclude, “*It is easy to see that the major political parties can see no electoral advantages, only potential risks, in raising the questions of the UK’s nuclear status*”.

3.2.2 There is clear public support in Britain for a policy of No First Use. A 1998 study conducted for the Ministry of Defence reports that: “When pressed, most respondents agreed that we could only legitimately use nuclear weapons if we had been subjected to a nuclear attack”. This is reinforced by a separate study<sup>167</sup> which showed that “53% of the population would approve of UK using nuclear weapons against a country we are at war with and uses nuclear weapons against the UK, only 37% disapproved”.

### 3.3 Countering Terrorism

3.3.1 There are two aspects to the second point, firstly the look ahead in the next 50 years no one can predict where a threat will come from; terrorism is only the current threat uppermost in our minds due to recent events. The nuclear deterrent may have a role in countering state sponsored terrorism.

### 3.4 Threats to UK and Proliferation by maintaining the minimum necessary deterrent

3.4.1 The “traditional” nuclear threat has not gone away. Russia for example has 5,830 operational warheads and is building and commissioning new submarines. As recently as 16 November Russia announced it “*would completely modernise its naval component of its nuclear triad*”.<sup>168</sup> KOFAC considers it prudent to continue with a strategic deterrent in such circumstances.

3.4.2 UK is supporting non proliferation by maintaining the minimum necessary deterrent.

### 3.5 Impact on and adjustment of local economies

3.5.1 Whilst KOFAC has limited experience on which to comment on the aforementioned factors, we are very experienced and well acquainted with the impacts arising from downturns in naval shipbuilding workloads, the effects of workload gaps on capability and skills retention and the impact on the workforce of orders being completed. There are well documented parallels in other industries<sup>169</sup>

3.5.2 In submarine building there would be little time to adjust. Workload gaps are likely to appear soon, as the Select Committee heard on 7 November 2006. Redundancies in design and in production would occur initially in 2007, and on into 2008. This would put undue extra strains on the Furness economy which currently has a worklessness rate 62% higher than the England average.

3.7 When any major employer or PLC company decides to address a workload gap, it will invariably put shareholders interest and Group interests first. As they adjust to forecast demand, Job losses invariably arise and arise quickly, lots of people are faced with the following options:

- Taking early retirement.
- A need for retraining.
- Moving away to find alternative employment.
- There is social and economic disruption, which takes a long time to repair.

<sup>167</sup> Greenpeace 2005—British Attitudes to Nuclear Weapons.

<sup>168</sup> Novosti: 16 November 2006.

<sup>169</sup> House of Commons Trade and Industry Select Committee—23 May 2006: Lessons of the MG Rover Taskforce HC1123ii “British attitudes to Nuclear weapons” GreenpeaceUK—October 2005.

- Many people never work again.
- The brightest and best often leave the area.

3.8 Those who have previously undertaken high value added jobs, end up being employed in lower value jobs, earning less—a point highlighted earlier this year at the House of Commons Trade and Industry Select Committee<sup>169</sup> hearing on 23 May 2006 (HC 1123-ii) into the Rover collapse.

3.9 The Rover Taskforce inquiry showed that 50% of the workforce is still unemployed; of the 50% that are employed as many as 80% of these are in temporary, part time, or agency work and invariably on a significantly lower income.

3.10 Here in Barrow, over 15,000 jobs have gone since 1990. In the 1990's completion of the Vanguard class submarines saw over 8,600 jobs disappear between 1991 and 1995. What did we learn? Firstly it proved difficult to diversify into non defence markets (Pieda)<sup>170</sup> other large scale job losses occurred locally compounding the problems the problems in the shipyard.

- Jobs disappeared in other firms as a knock on effect from the shipyard redundancies.
- There was a doubling of unemployment and an absolute increase of 2000 over five years.
- Relative to UK average unemployment went from 20% below to 15% above the national average
- Male unemployment rose 135%.
- 2–2,500 people left the area.
- Many older workers retired, and most strikingly the numbers on invalidity benefit rose from 4,500 in 1991 to 8,600 in June 1995 giving a true rate of worklessness of 15%. By 1997 it was 25.6% for males and the 2,500–3,300 hidden unemployed men represented 10–14% of the entire male working age population.

**Table 1**

**FURNESS—CHANGE IN ECONOMIC ACTIVITY 1990–95**

Total job losses	13,000	100%
Rise in official unemployment	2,000	15%
Out migration	2,000	15%
Offsetting employment growth	1,500	12%
Rise in no on incapacity benefit	4,000	31%
Retired	3,000	23%
Withdrew from labour market	500	4%

3.11 In 2003 and 2004 over 1,400 job losses were announced by BAE Systems as Albion and Bulwark were completed. In April 2004 BAE SYSTEMS anticipated a June completion of Bulwark gave 90 days notice of 700 redundancies. The ship sailed in June, the job losses took effect in July.

3.12 The Defence Industrial Strategy reinforces these findings quoting that when shipyards lay off workers, 70% of them leave the industry for good and are unavailable for hire by their employer.

3.13 Barrow is described in the 2006 Northwest of England Regional Economic Strategy as being “*the one district with high concentrations of worklessness remote from areas of major growth*” in northwest England. KOFAC echoes the independent conclusion by PA Management Consultants “*the value of one additional (submarine) boat employing 2,000–3,000 people for 18–24 months is worth more to Barrow than any combination of diversification opportunities*” and urges the Select Committee to recommend HM Government that it should retain the strategic deterrent and sustain high value added employment by starting to fund design work on a successor submarine immediately.

21 November 2006

<sup>170</sup> Source Pieda—Furness 2010, report to Furness Enterprise, November 1995.