

The Opportunity Cost of Trident Replacement and the Aircraft Carriers

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Executive Summary

1. The UK Government has announced its intention to replace the UK's Trident nuclear weapons system, with a Parliamentary vote on the issue expected some time this year. Such a controversial decision is usually debated publicly with a focus on the political, military and moral grounds, but what it will cost is also an important concern.
2. The Government are also planning to procure two new aircraft carriers, along with up to 150 F35 Joint Combat Aircraft, which represents a major increase in Britain's global power projection capability.
3. These purchases will dominate defence spending, represent a major escalation of the trend in the UK's post-Cold War defence posture towards aggressive power projection and pre-emptive strikes alongside the US. It could lock Britain into a highly aggressive and militaristic course for decades to come.
4. The strategic environment changed abruptly with the terrorist attack on the World Trade Centre on the 11th September 2001 (9/11) a 'New Chapter' was produced for the SDR in July 2002. What was perceived as particularly new was the use of terrorism for strategic effect – previously it was seen as just small-scale and tactical.
5. The Trident replacement and carrier programme represents not only a backward-looking vision of security based on military power, but one based on the aggressive use of military power. The SDR was certainly a lost opportunity to

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- consider the UK's role in the new security environment. it represented a conservative stance that failed to consider real alternatives, such as "Non-Offensive Defence" and contributions towards common security through peace-keeping and peace enforcement operations in conjunction with other countries, under the auspices of the UN or the EU. As a result almost all of the cold war weapons systems survived. For many analysing the process this comes as no surprise, but a lost opportunity.
6. Using the Treasury's recommended real discount rate for evaluating future costs and benefits of 3.5% gives a Net Present Value for a Trident replacement programme, including acquisition and operations/maintenance costs, of £40bn in 2006 prices.
 7. To get a better idea of the opportunity cost of Trident replacement, it is instructive to calculate an "equivalent annual cost" associated with this NPV figure; that is, how much would have to be spent over the service life of Trident replacement to generate the same Net Present Value? This allows us to consider what alternative spending could be afforded if Trident were not to be replaced.
 8. Based on the Carriers and the aircraft beginning to enter service in 2014, and assuming that production expenditure peaks from around 2010, we calculate an estimated NPV figure of around £17.75bn, and an Equivalent Annual Cost of around £1.1bn. Combining this with the cost of Trident gives a total NPV of £48bn and an equivalent annual cost of around £5.3bn per annum.
 9. The fact that the UK economy managed to weather this decline in defence spending without any particular economic problems and in fact saw relatively good economic performance, does suggest that there is no overall economic reason that Trident replacement and the carriers could not be cut from the budget. Model based studies provide further backing for the argument of no significant impact and suggest that with military spending allocated to other forms of government expenditure it is likely that economic performance would be improved.
 10. If the two programmes were to be cancelled, or not initiated, the study suggests that savings of over £4.2 bn for every year of service life would be made for the Trident replacement and around £1.1bn for the carriers and accompanying aircraft.
 11. Using the total figure of £5.3bn for every year of the joint service life of those systems means that cancelling the programmes would allow the Government to:
 - a. Take one and a quarter pence off the basic rate of income tax
 - b. Pay the capital and running costs of around 200 new hospitals
 - c. Pay the capital and running costs of around 1130 new secondary schools in moderate/high cost areas, with 1,000 pupils each
 - d. Pay £11 per week real increase in the basic state pension

12. Also, here is clear evidence of a more general procurement crisis becoming apparent, with the long term defence equipment planning facing a serious gap between funding and programme costs.
13. Reallocating the expenditure within the defence budget away from the programmes may have a marginal positive short run impact on the economy, increasing defence orders, both domestic and abroad, and boosting defence-related employment, but will be of lesser value to the economy in the long-run than civil alternatives.
14. Taking a more general definition of security than the Strategic Review and thinking outside of the box, suggests a range of alternative security threats. Recognition is needed of the importance of the concept of human and environmental security rather than simply military security.
15. If these types of measures were combined with moves towards Non Offensive defence structures as outlined in Schofield (2004) the proposed reallocation of Trident replacement and carrier funds, could be combined with decreased military budgets and increased security.
16. The UK government has a real opportunity to improve domestic and international security and to improve the quality of life of millions of people in the world. We would hope that they start to listen to reasoned arguments, recognised the changed security environment and the opportunities available, instead of following down the well trodden path of military and political conservatism.
17. It is hoped that this will help inspire debate as to the actual security threats facing the UK at this present moment, and the most effective ways of responding to them.

1. Introduction

In December 2006, the Government published its White Paper, “The Future of the United Kingdom’s Nuclear Deterrent” which stated the intention of procuring a replacement for Britain’s Trident nuclear weapons system (“Trident replacement”).¹ A Parliamentary debate and vote is expected sometime this year. Such a controversial decision is usually debated publicly with a focus on the political, military and moral grounds, but what it will cost is also an important concern. At first sight it might seem difficult to understand why the Government wants to replace Trident by a new nuclear weapon when the government itself states that there is no direct military threat to Western Europe and it does not expect the re-emergence of such a threat.² There is, however, more to this than meets the eye. The Government are also planning to procure two new aircraft carriers, along with up to 150 F35 Joint Combat Aircraft, which represents a major increase in Britain’s global power projection capability. These two massive items of expenditure, which will dominate defence spending, represent a major escalation of the trend in the UK’s post-Cold War defence posture towards aggressive power projection and pre-emptive strikes alongside the US. This parallels the latter’s Post-Cold War policy of re-orienting its forces towards worldwide power projection, backed by an ongoing quest for ever-greater technological supremacy, as a means of attaining unchallenged global military hegemony. If the two projects go ahead, they will lock Britain into a highly aggressive and militaristic course for decades to come.

The justification for the UK’s nuclear capability is typically framed in terms of ‘deterrence’ (as it is in the White Paper), that is maintaining the capability to enact an ultimate retaliation against an unspecified threat to the nation. The reality however, is that Britain’s nuclear forces are being made increasingly ‘usable’, with Trident submarines routinely carrying both large ‘strategic’ warheads and much smaller 1-kitoton warheads that could be used in a ‘sub-strategic’ role. What is more, the UK’s nuclear doctrine sets out a variety of scenarios for the use of nuclear weapons, most of which involve ‘first use’ in situations where national survival is not at stake. (Rogers, 2006). Again, this parallels US strategy with the development of small ‘bunker-buster’ warheads explicitly designed for pre-emptive use against enemy facilities as part of otherwise conventional war-fighting. There is every reason to believe that any replacement to Trident would be designed to be at least as ‘flexible’ and usable, part of a practical war-fighting power-projection strategy rather than simply for deterrence. The explicit rationale for this is to secure our ‘vital interests’ and these are listed as preventing a new threat to Western Europe, overseas investment, overseas trade, and overseas resources – especially oil.³ In addition, the 65,000-tonne carriers will be the largest warships ever built in the UK, replacing the three 18,000-tonne *Invincible*-class boats currently operated. This will give the UK a global reach that it has not had since the early 1970s. (Rogers, 2006, House of Commons Defence Committee report, HC554).

Such a massive leap in capability cannot be considered as necessary or even particularly useful either for national defence or for peace support operations. Where they would come into their own is for attacks on nation states, attacks which the most recent Defence White Paper treats as very real possibilities, as part of US-led coalitions.⁴ This requires

UK forces to be completely technically and operationally integrated with American forces. Indeed, one of the major (usually unstated) rationales for maintaining Britain's nuclear forces is to maintain the close military relationship with the US. (Ritchie, 2006).

So what we are talking about is a dangerous resurgence of British militarism in which the principle purpose of Britain's military forces is global power projection, involving pre-emptive strikes – not excluding nuclear strikes – on so-called 'rogue' nations, and in which these forces are being developed so that they can fight alongside the US. The new aircraft carriers and the Trident replacement are major pillars of this policy, alongside a major rearmament programme, across the forces, which will stretch the defence budget to breaking point.

There are many aspects to the debate over Trident replacement: moral, strategic, legal, economic, and the effect on non-proliferation and disarmament efforts amongst others. We believe it also needs to include a broader debate about the type of security structure and stance these programmes are pushing the UK towards and the changing nature of UK foreign and security policy. This report focuses on the economic aspects of Trident replacement and the carrier programme, and in particular the *opportunity costs* – what else could be done with the money, and how it could be used to promote a broader concept of the UK's security – as well as the headline cost figures. The next section considers the evolution of the UK's defence policy, which led to the procurement decisions, followed in section 3 by an attempt to estimate the cost of Trident replacement and the carriers, using publicly available information. This also includes computations of the net present value of the projects. In section 4 an analysis of the likely impact of cancelling the procurement is undertaken, followed by an analysis of the opportunity cost in section 5. The wider security issues are then addressed in section 6, including the main non military threats to the UK and the likely need for peacekeeping roles. A hypothetical budget that allocates the Trident replacement and carriers money to other security area is then presented. Finally section 7 presents some conclusions.

2. Post Cold War UK Defence Policy

Current UK defence policy can be argued to have its basis in the 1998 Strategic Defence Review (SDR), which was sold as a comprehensive review of UK defence requirements with the end of the Cold War. This has subsequently been developed by the 2002 New Chapter to the SDR and the 2003 White Paper, *Delivering Security in a Changing World*, which continue and indeed accelerated many of the trends in the SDR, although there were some significant changes.

Military spending had fallen markedly and some cold-war related capabilities had been reduced, particularly with the reduction of troop levels in Germany. But while there was no longer a direct or potential military threat to the UK mainland or Western Europe, the SDR suggested there were a whole range of new threats, including crime, terrorism, drugs, regional conflict and instability, dangerous regimes (possibly with access to weapons of mass destruction) and environmental degradation, which could require a military response. It was also recognised that new technology could also create potential new vulnerabilities, through information warfare, and that future threats were likely to be 'asymmetric' in nature, with the military facing less powerful adversaries operating in non conventional ways (guerrilla tactics, car bombs, suicide bombers etc.). While the UK's vital interests were seen to be in maintaining the peace and stability in Europe, there were also important concerns about trade and protection and access to resources (especially oil) that extended the area of the UK's security concerns. The EU and NATO were seen as the pillars of UK security, with permanent five (P5) UN Security Council membership giving the UK the responsibility of helping to ensure global stability and to be a 'force for good' in the world⁵.

Aside from the expected involvement in UN missions, the SDR suggested rather less plausibly that there was a need to be able to deal with a strategic attack on NATO. While it was accepted that there was no current threat, possible future threats necessitated the retention of the nuclear deterrent, though with fewer missiles and warheads. The possibility of this changing through arms control negotiations was not dismissed, but unilateral nuclear disarmament was.

The SDR also saw the need to project force in response to distant crises. Most future operations were considered likely to be multinational and joint operations between services, with the underlying aim of being able to either undertake combat operations on the scale of the 1991 Gulf War, or two smaller longer-term deployments, but not both.⁶ No conflict involving war fighting or simultaneous deployment was considered likely to last more than 6 months⁷. While an increase in regular forces was not seen as necessary, changes in structure were, in order to improve flexibility and readiness for deployment. This would comprise a restructured and trained army sustaining deployed operations, reoriented naval forces undertaking rapid deployment operations, with amphibious forces assisting the Rapid Reaction Forces and would require new equipment, with larger aircraft carriers needed for deterrence and coercion.⁸ New investment was expected, but combined with savings through rationalisation, increases in efficiency, smart procurement and cuts in cold war related programmes.⁹

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The strategic environment changed abruptly with the terrorist attack on the World Trade Centre on the 11th September 2001 (9/11) a 'New Chapter' was produced for the SDR in July 2002¹⁰. What was perceived as particularly new was the use of terrorism for strategic effect – previously it was seen as just small-scale and tactical. The move towards expeditionary operations had already been foreseen in the SDR, but was seen to need strengthening to provide the ability to operate further afield to 'prevent, deter, coerce, disrupt and destroy' both terrorist forces and those of states supporting terrorism. The New Chapter also emphasised the importance of knowledge superiority over terrorists and the need to counter terrorists with non-conventional weapons and operations, including both stabilisation/prevention and find-and-strike operations¹¹. It was accepted, however, that prevention also needed to tackle the conditions that enable terrorist groups to flourish, by both military (peacekeeping and support) and non military means (assisting weak/failing states, etc).

The new environment suggested several concurrent smaller-scale operations, which could be more demanding on 'key enablers' such as deployable headquarters, communications and logistics. As terrorists groups may be small, dispersed, hard to locate, monitor and target, in mountainous terrain, intermingled with civilians and using asymmetric techniques, Network-Enabled Capability was seen as vital.¹² Similarly, speed and precision were considered crucial, with new technologies, such as unmanned aerial vehicles (UAVs) and the BOWMAN communications system, plus a Future Rapid Effects System on land and new design faster and more adaptable ships, vital. This was all considered to require clearer command and control structures, with reaction forces for emergencies, and air defence and maritime integrity¹³.

The 2003 Defence White Paper, *Delivering Security in a Changing World* (MOD, 2003) confirmed and extended the direction of the New Chapter, with the focus on expeditionary operations, effects-based warfare and NEC, aimed at countering threats from terrorism and asymmetric warfare. Some significant changes from the SDR in particular included a goal of being able to sustain three concurrent small-medium operations instead of two, of which one would be a long-term peace support operation. Geographically, while the SDR expected that the key areas of operations outside Europe would be the Mediterranean and Gulf regions, the White Paper envisaged operations further afield, especially South Asia and Sub-Saharan Africa.

The White Paper envisages that most operations will be in coalitions, although Britain would be prepared to take the lead role in those in which the US is not involved. However, large scale operations – against state adversaries – would only be undertaken as part of a US-led coalition. Thus, interoperability with US forces, both in terms of technology, doctrine and operational tempo, are given a high level of importance.

As a result, the White Paper calls for new equipment and organisation to match the high-tempo, expeditionary focus. It describes the planned acquisition of the new large aircraft carriers and the Joint Combat Aircraft as a 'step-increase' in Britain's ability to project power from sea to land. Programs such as the Future Rapid Effects System (FRES)

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family of medium-weight land vehicles are also designed to increase the capability for rapid interventions. On the other hand, the capability to defend against a major conventional threat to the UK or its allies is no longer considered necessary. There will accordingly be less requirement for main battle tanks and heavy artillery, in favour of more medium and light-weight forces, and some naval vessels will be retired. There will be increased investment in C4ISR systems for network-enabled capability warfare, and on 'key enablers' such as logistics which tend to be required in all expeditionary operations, and which are particularly overstretched at present.

Clearly, the process of the Strategic Defence Review, the New Chapter and the 2003 White Paper represent a comprehensive reconsideration of UK security policy following the end of the Cold War. But not only have all of the cold war weapon systems in production and even pre production survived (albeit with reduced numbers in some cases), but a massive rearmament programme is being undertaken, in support of an aggressive power projection strategy, in most cases as an adjunct to US operations. The UK failed to consider the possibility of non offensive defence or even to question a commitment to NATO, an organisation developed for the cold war conflict¹⁴. This left a commitment to nuclear weapons and so to a Trident replacement, which when combined with the aircraft carrier programme represented an unquestioning commitment to unilateral power-projection capability, with distant offensive air capability. The New Chapter and the 2003 paper have accelerated the trend towards expeditionary operations, especially in the context of actions against terrorist groups or states supporting terrorism¹⁵.

This concern for 'expeditionary' abilities and 'power projection' has become increasingly apparent in recent years¹⁶. As a result the procurement of the two new carriers has continued to remain unquestioned, despite the fact that they represent a much larger force than the three outgoing Invincible class carriers and represent such a large expansion of the UK's distant offensive air capabilities.¹⁷ The air wing of a single carrier is equal to the entire offensive air fleet deployed (from land) by the UK for the invasion of Iraq in 2003.¹⁸ This does not really fit well with the purpose of combating terrorist groups, nor of operations such as peace support. Rather is it more suited to large-scale operations against nation states, on the scale of the invasion of Iraq or greater.

Thus the programme could be seen as part of an aggressive military posture that considers the possibility of full-scale invasions of nations considered a threat. It also fits well with continued subordination of UK foreign policy to the US, as it would be almost inconceivable (as former Defence Secretary Geoff Hoon has stated verbally and confirmed in the White Paper) for the UK to undertake such invasions except in coalition with the US. As retired Air Marshal Garden and General Ramsbotham (2004) argue the UK can only ever provide a small contingent as part of a US-led operation in any case, and this concentration on high-intensity war-fighting, and dedication to supporting the US at all costs comes at the expense of the UK's forces' ability to carry out other, more desirable missions – such as conflict prevention and post-conflict reconstruction missions.¹⁹

At the same time the Defence Select Committee, has been expressing concern about “overstretch” of British troops in the wake of the Iraq invasion²⁰. In particular, the Committee notes the lack of “key enablers”, such as the high-technology network of sensors, communications and precision-guided missiles involved in “Network-Enabled Warfare”, as well as the specialist troops and logistics that are considered more significant than numbers of major weapons platforms and tend to be needed for all expeditionary operations, of whatever size. Hence, when multiple concurrent deployments are undertaken, there is a shortfall. The Committee has also expressed concern that the government was not moving as rapidly as necessary towards investing in new technologies, and questioned whether the increased equipment expenditure announced in the previous spending review would be going towards new technologies, or merely making good previous budget shortfalls. In other words, the commitment to the two programmes could have important implications for defence policy and require a fundamental rethink of the nature and composition of the forces.

In summary, the Trident replacement and carrier programme represents not only a backward-looking vision of security based on military power, but one based on the aggressive use of military power. The SDR was certainly a lost opportunity to consider the UK’s role in the new security environment. It represented a conservative stance that failed to consider real alternatives, such as “Non-Offensive Defence”, which is discussed in Appendix 1, and contributions towards common security through peace-keeping and peace enforcement operations in conjunction with other countries, under the auspices of the UN or the EU. As a result almost all of the cold war weapons systems survived. Subsequent developments have gone even further, and represent a dangerous resurgence of militarism. For many analysing the process this comes as no surprise, but a lost opportunity.

3. Trident and the Carriers: The Cost

Having considered the background to the decision on the Trident replacement and the aircraft carrier procurement, we now move on to estimate the total cost of these two weapon systems.

3.1 Costs of Trident

The Government’s White Paper on Trident replacement envisages essentially a like-for-like replacement of Trident, with a new generation of ballistic nuclear submarines replacing the *Vanguard*-class submarines carrying Trident. These will carry the existing Trident II D5 missiles, which will be upgraded through the US’s Service Life Extension Programme (SLEP). These will eventually be armed with a new generation of warhead produced by the Atomic Weapons Establishment at Aldermaston. As expected by many commentators, this option has been preferred over for example land, air or surface vessel-based systems (too vulnerable to pre-emptive attack), a wholly independent system (far more expensive), or submarine-based cruise missiles (also more expensive). The fact that the government’s plans are for a like-for-like SSBN-based system makes it easier to make cost projections based on historical examples.

The government's claim that a decision on the Trident replacement is needed during this Parliament is based on the remaining service life of the four *Vanguard* nuclear class submarines that house the Trident ballistic missiles. The current expected decommissioning date of the second of these, HMS *Victory*, is 2020 – or 2024 with a 4-5 year service-life extension - and at this stage the Royal Navy would not be able to maintain the “Continuous-at-Sea Deterrent Cycle” that it considers essential²¹. A 4-5 year service life extension for the submarines would not be too difficult, but government advisors say that a longer extension would bring the safety of their reactors into question²². The White Paper notes that the gap between the initial order for Trident and the first operational patrol was 14 years, but argues that this would be more like 17 years for Trident replacement²³. Thus, the paper argues, initial work must begin now to allow Trident replacement to enter service in 2024. Other commentators, however, argue that the life of the submarines could be extended much further (though presumably at a price).²⁴ However, given that a short extension would actually worsen the mismatch between the life of the replacement submarines and the Trident missiles (see below), while a long extension would render the issue of replacement irrelevant for the next couple of decades, we base our assumptions on the government proceeding with the timetable set out in the White Paper.

Trident, and any replacement, consists of three elements: submarines, warheads, and missiles. The submarines will most likely involve a completely new system and will determine the timetable²⁵, while the Atomic Weapons Establishment are confident they can keep the current warhead design, based on the US W76, going until the mid to late 2020s with relatively minor upgrades. This does, however, mean that a new warhead will be needed fairly early on in the life of the new boats, so this element most certainly affects the costs.²⁶ As for the missiles, the US is currently embarking upon a Service Life Extension Programme (SLEP) for its Trident missiles, upgrading them to a D5-A model. Britain could presumably participate in this, which would be less costly than a new system²⁷. However, this is a small proportion of the total cost²⁸. Another issue worth bearing in mind is that the SLEP will extend the life of Trident missiles to 2042, when the US's *Ohio*-class ballistic missile submarines are due to leave service.²⁹ After this, a completely new missile system would be needed, and what plans the US has for this are not known. Thus by 2042, we would already be looking at the replacement for Trident replacement, so that money spent on Trident replacement would only purchase 22 years of capability.

The Government has estimated the procurement costs of Trident replacement at £15-20bn. This is a highly provisional figure with little or no detail or basis for justification given, before any plans have actually been laid on the table. We believe that based on past experience, it is likely to be a severe underestimate. The original complete Trident system cost £12.52bn in 1997/98 prices³⁰, which would be roughly £15bn in today's prices; Thus the White Paper assumes that the replacement costs will be little more than the cost of Trident itself, adjusted for civilian inflation; this is a decidedly optimistic assumption, given the tendency for rapid inflation in the costs of new military technology which can be as much as 10% per year (Hartley, 2006).³¹

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A more realistic estimate can be made using the rule of thumb that the cost of new weapons systems tend to cost around twice as much as their predecessors³². For example, the acquisition cost to the US of the Poseidon C-3 missile system (in service 1971) was \$13.9bn in 1996 prices, while the cost of the Trident II D-5 (in service in 1990) was \$30bn - just over a doubling of cost over 20 years.³³ The US's *Virginia* class nuclear attack submarine (first boat ordered in 1998) cost \$2.1bn, an increase in real unit cost over the preceding *Los-Angeles* class by a factor of around 1.9, over a period of 27 years³⁴. Given that the UK ordered the Trident II D5 in 1982, 24 years ago, meaning the next generation would be ordered around 25 years later, it seems reasonable to assume a successor to Trident is likely to cost double the price. However, an allowance must be made for the planned participation by the UK in the US SLEP for the missiles. The White Paper states that the missile upgrade will cost £250m³⁵. An estimated 13% of the total cost of the Trident programme was due to this element, or around £2bn in 2006 prices³⁶. This suggests an estimate for a direct replacement system to Trident of around £26.25 billion in acquisition costs, in 2006 prices. This is of course a highly provisional estimate and likely to be a lower bound³⁷. The continuing tendency for cost overruns in major defence projects, and the fact that in particular the *Astute*-class nuclear attack submarine project is heavily over budget³⁸, are not encouraging.

On top of the acquisition costs there are also the operational and maintenance costs, which the White Paper estimates at up to 6% of the current Defence budget, which would mean £1.8 billion per year.³⁹ This is a considerable increase on previous figures for Trident itself, and is due to increased spending at the Atomic Weapons Establishment at Aldermaston (AWE), which the White Paper expects to continue and indeed increase further.

However, this does not cover all costs associated with maintaining and operating the UK's SSBN fleet.

A 1998 estimate by Scottish CND, based on Parliamentary answers, also included allowance for the cost of conventional forces assigned to the defence of Trident (£303m), plus other costs (£60m, including an allowance for major refits over the 30-year life span), giving £440m per year in 2006 prices⁴⁰. In line with the general tendency to increasing costs, it is likely that this figure would be somewhat higher for a Trident replacement, but the figure also gave the high-end estimate for the cost of the conventional forces assigned to the defence of Trident. On this basis, we suggest a total figure of around £2.24bn per year for operational and maintenance costs. Over 22 years, this gives a total cost (for procurement and operations) of **£75.5bn**, which is indeed very close to estimates produced by other recent studies.

To get the Net Present Value cost of the Trident replacement means considering both the cost of capital and the likely life-cycle of payments in relation to the service life of the system, as discussed in Appendix 2.⁴¹ The White Paper anticipates that the bulk of spending on the new submarines and infrastructure will occur from 2012-2027. It seems reasonable to suppose a small level of costs at the start, before peaking in the middle and

then declining; we also assume that the missiles are paid for over 5 years up to 2020, when the US Trident SLEP is due to be completed, and that spending on a new warhead is heavily back-loaded towards the late 2010s and the 2020s.⁴² Using the Treasury's recommended real discount rate for evaluating future costs and benefits of 3.5% gives a Net Present Value for a Trident replacement programme, including acquisition and operations/maintenance costs, of roughly £39-40bn in 2006 prices, with 2006 also the base year for the NPV calculation.⁴³ (This sum is dependant on the precise assumptions made about the timing of spending, and should thus be considered approximate. However, even some quite substantial shifts in assumption about when these costs fall do not change the figure by more than £0.5-1bn either way.)

To get a better idea of the opportunity cost of Trident replacement, it is instructive to calculate an "equivalent annual cost" associated with this NPV figure; that is, how much would have to be spent over the service life of Trident replacement to generate the same Net Present Value? This allows us to consider what alternative spending could be afforded if Trident were not to be replaced – the benefits that will be foregone in return for having the 'benefit' of Trident over that period. Based on the above assumptions, an Equivalent Annual Cost of around £4.2bn per year is obtained, which is around fourteen percent of the 2005-06 defence budget.

3.2 Cost of the Aircraft Carriers and Joint Strike Fighters

As we have seen, the UK is ordering two new Future Aircraft Carriers (CVF), each with a displacement of 65,000 tonnes and an air-wing of around 40 F35 Short Take-Off Vertical Landing (STOVL) Joint Combat Aircraft (JCA). In total, up to 150 aircraft are to be procured to operate from sea and land bases.⁴⁴ The CVF and JCA projects, together with the Maritime Airborne Surveillance and Control programme (MASC) form the 'core projects' of the "Carrier Strike Capability", which represents a massive expansion of the UK's offensive air capability. The contract for the carriers was initially awarded to BAE Systems as Prime Contractor and Thales, whose design won the competition, in 2003, forming the "Carrier Alliance". In late 2005, Kellogg Browne and Root were added to the Alliance as "Physical Integrator", due to doubts over the ability of the other two firms to carry out that process themselves. Initial Gate⁴⁵ approval for the carriers was given in December 1998, with Main Gate approval originally intended for 2003-04, but the Assessment Phase was extended in 2004⁴⁶. The project has now moved from the Assessment to the Demonstration phase, but with no new date set for full Main Gate approval, which will be required before the Manufacture phase can begin⁴⁷. Originally, the Assessment Phase was forecast to cost £118m, but this figure has increased to £300m⁴⁸. The intended in-service dates for the two carriers were originally 2012 and 2015. The House of Commons Defence Select Committee, in December 2005, suggested that the planned in-service date may now be delayed, and described the lack of a target for Main Gate as "extraordinary".⁴⁹ Once in-service the life of the carriers is expected to be 30-50 years, with 50 years a "stretch" target, likely to require a major refurbishment. The UK is also participating in the development and manufacture of the JCA, principally through BAE Systems, but also with Rolls Royce. The UK's role in the current

Development and Demonstration phase has already received Main Gate approval, with a forecast cost of just under £2bn. Main Gate for Manufacture and In-Service Support, the point at which the full cost of procurement will be determined has not yet been reached.⁵⁰ The Joint Combat Aircraft were initially intended to enter service in 2012, but this has now slipped to 2014. The third component of the Carrier Strike Capability, the MASCS is also running late, reaching Initial Gate in 2005, with best guess for in service of 2015-2018.⁵¹

The total life-cycle costs of the three 'core projects' is forecast by the MOD to be £31bn, of which £12bn is procurement costs.⁵² However, this figure for procurement would seem to be based on fairly conservative assumptions. The Assessment Phase was originally forecast to cost £118m, but has since increased to £300m⁵³, yet the Government forecast of the total acquisition costs for the carriers themselves is £3bn, a figure that is very close to that presented at the inception of the project.⁵⁴ There have been numerous suggestions that the actual cost may well exceed this figure, with BAE Systems Chief Executive Mike Turner suggesting a figure of £4b in July 2004.⁵⁵ Recent press reports suggest that the companies believe the final cost may be much higher⁵⁶. Given the increase in Assessment Phase costs and the continuing tendency for cost overruns in the MOD, especially for such large-scale projects, a figure of £4b seems hardly unreasonable.

Procurement Minister Lord Bach has estimated the additional life-time cost of the carriers as £6.4b.⁵⁷ For the aircraft, estimates suggest an acquisition cost at £7-10bn, depending on the number procured.⁵⁸ The Maritime Airborne Surveillance and Control Programme was initially expected to cost £700m-£1bn, which would imply a lower-end figure for the Joint Combat Aircraft, as well as the optimistic original figures for the acquisition costs of the carriers⁵⁹. On the other hand, some money has already been spent in the Assessment Phases, and some of the remaining costs of the current phase of the JCA programme may be committed, so we use the figure of £31bn given in the House of Commons report. Based on the Carriers and the aircraft beginning to enter service in 2014, and assuming that production expenditure peaks from around 2010, we calculate an estimated NPV figure of around **£17.75bn**, and an Equivalent Annual Cost of around **£1.1bn**. Combining this with the cost of Trident gives a total NPV of **£57bn** and an equivalent annual cost of around **£5.3bn** per annum.

4. Disarmament and Conversion: The Opportunity

We can see that the cost of these weapons systems is very high and the need for the weapons systems very much open to question. When arguments are made that the UK needs to reduce its military spending the first defensive response is normally to point to the economic costs of disarmament. Certainly, during the Cold War there was considerable debate over the economic impact of military spending. It ended up with relatively inconclusive results, but with some suggestions that military expenditure could have a negative effect on growth, through its impact on investment, in developed economies, with an insignificant effect for developing economies. This suggested that reductions in military spending would not have a negative impact on growth and indeed

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could produce a peace dividend if the expenditures were reallocated to other forms of expenditure (Dunne, 1996). With the end of the Cold war global military spending fell markedly in the 1990s and this confirmed the findings of the research in that there were no obvious economic problems despite the magnitude of the changes. The decline ended around 1998, and global military spending levels are now not far short of their Cold War peak, mostly driven by rapid increases in US military expenditure since 2001.⁶⁰ The experience of that period of adjustment, suggests that one would not expect particular economic problems from relatively large changes in military expenditure and the literature suggests that if some of the savings were diverted to assist with short run industrial adjustments there could be improved economic performance.

To get some idea of the likely impact of cancelling the two programmes it is useful to develop some future scenarios. Using the Treasury's forecast for GDP and the GDP deflator⁶¹, from 29th March 2006 until 2010-11 and assuming

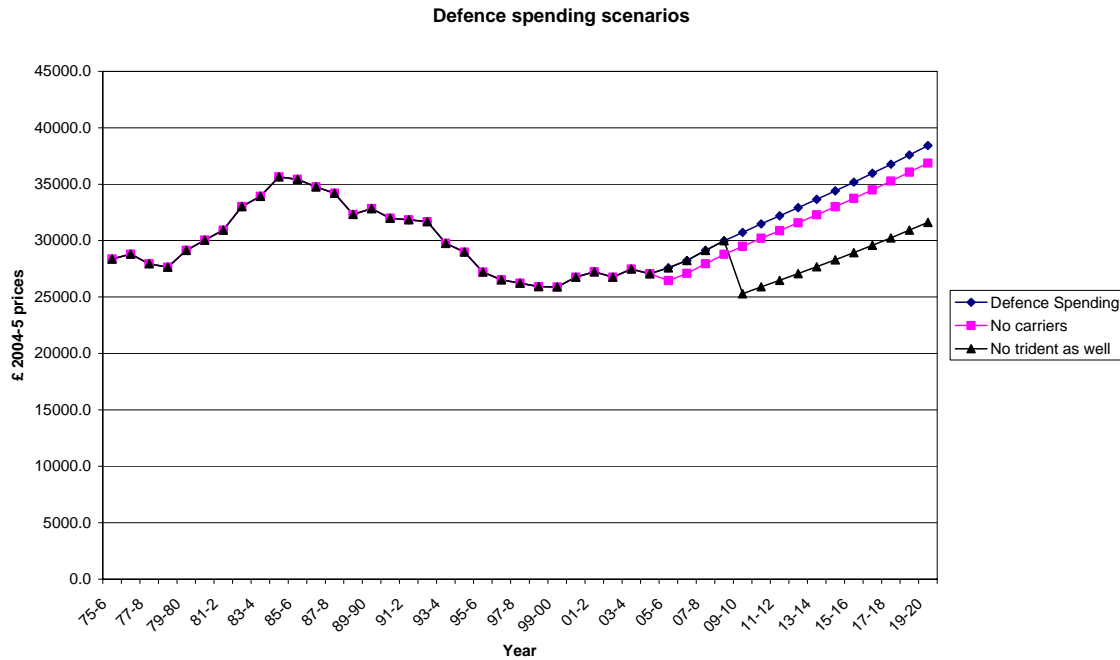
- For the base projection the share of defence spending in GDP stays constant at 2.3% its value since 2004-05.
- That beyond the Treasury forecast period the GDP deflator grows at 2.7% per annum, its forecast value for the last 3 years.
- That beyond the Treasury forecast money GDP grows at 5% per annum, just below its forecast value of 5.22% for the last two years.

Factoring in the impact of cancelling the aircraft carriers and Trident.

- For the aircraft carriers take an estimate of annual cost of £1.1bn as a proportion of the 2004-5 total defence spending, around 4%, and reduce the projected defence expenditure by this proportion each year⁶².
- For the Trident replacement take the estimate of annual cost of £4.2bn and take this from defence spending starting in 2010, 14.4% of the total defence spending minus the carrier estimate⁶³.

These give us the results in Figure 1, which charts as a baseline scenario a relatively high rate of growth in defence spending, such as might be needed to accommodate a Trident replacement and the carriers along with other programmes. This is compared with scenarios which remove the cost of the carriers and the costs of the Trident replacement. Even with these savings, defence spending in real terms is around the same level as in the early 1990s and not far below its mid 1980s peak. Indeed, the sustained decline in defence spending with the end of the Cold War, from the mid 1980s to the end of the 90s, was much greater than any likely reduction that would result from the cancellation of the Trident replacement. The fact that the UK economy managed to weather this decline in defence spending without any particular economic problems and in fact saw relatively good economic performance, does suggest that there is no overall economic reason that Trident replacement and the carriers could not be cut from the budget. To consider this further some model based studies are reported in Appendix 3, which also deals with the dynamics of the changes and the possibility of reallocating the defence savings to other government spending. These provide further backing for the argument of no significant impact and suggest that with military spending allocated to other forms of government expenditure it is likely that economic performance would be improved.

Figure 1



5. The Opportunity Cost

If the two programmes were to be cancelled, or not initiated, the previous section suggests that savings of over £4.2 bn for every year of service life would be made for the Trident replacement and around £1.1bn for the carriers and accompanying aircraft. Using the total figure of £5.3bn for every year of the joint service life of those systems we can get some idea of the opportunity cost of this expenditure by considering what it is equivalent to if used differently. Firstly, as a way of gauging the opportunity cost of undertaking these programmes in a very concrete way, we consider some of the more headline-grabbing ways in which this money could be spent. Thus, cancelling the programmes would allow the Government to:

- Take 1.25p off the basic rate of income tax⁶⁴
- Pay the capital and running costs of around 200 new hospitals⁶⁵
- Pay the capital and running costs of around 1130 new secondary schools in moderate/high cost areas, with 1,000 pupils each⁶⁶
- Pay £11 per week real increase in the basic state pension⁶⁷

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The studies reviewed in Appendix 3 have suggested that reallocating expenditure from the defence budget to civil areas, such health and education as suggested above, would have a positive effect on the economy. It would be likely to lead to an overall increase in employment, as jobs in the defence sector, particularly industrial jobs, are higher paid so there are less of them for a given amount of money, and the activities have a greater capital intensity (require more money for the specialised components, plant and machinery for each job created). This is particularly the case in strategic submarine construction. There would be some reallocation of jobs across regions, gender, and industrial sectors but more would be created. Adverse regional effects, in particular around the Barrow shipyard that would build the replacement submarines, could be dealt with by a regional investment programmes using some of the saved expenditure. An increase in economic growth would be likely as a result of the increase in employment and potentially from the increase in labour supply (e.g. patients being dealt with in a speedier and better manner – assuming the spending is well used). Allocating the expenditure to education has similar effects, as well as improving human capital, while the impact of increases in pensions on the economy will increase domestic demand⁶⁸.

As we have seen the two programmes could have important implications for defence policy as a whole. There is clear evidence of a more general procurement crisis becoming apparent, with the long term defence equipment planning facing a serious gap between funding and programme costs. This is the result of the major rearmament programme that is planned, including the carriers and the Joint Combat Aircraft, as well as the Eurofighter Typhoon, the new Type 45 Destroyers, and the Future Rapid Effects System, which would radically upgrade Britain's land-based capability. Overall, MoD projections for the period 2011-2021 show a gap of £11.6bn over the period between the cost of planned projects and the likely procurement budget.⁶⁹

This shortfall arises even without considering the cost of Trident replacement. But as Table 2 shows, the Trident replacement and carrier programmes dwarf the other major procurement projects apart from Typhoon. This means that a commitment to the programmes is likely to introduce some very hard choices for the Government. The massive scale of commitment of military resources to the nuclear deterrent makes it likely that Trident replacement may result in further scale downs in present conventional acquisition plans. Indeed, comparing the lifecycle costs, the average annual spending on the Trident replacement plus the carriers would be equal to around 42% of general spending on the navy, 48% of the air force, 59% of the army, and around 133% of money spent on the "Building for the Future" objective. Total Military R&D Expenditure in 2003-2004 was £2.74bn, so Trident replacement alone would consume more than 100% of this amount⁷⁰. Clearly, if the programmes are funded from the defence budget there will be a huge impact on the composition of procurement and the allocation of expenditures across the forces and other programmes.

Table 2: Costs of Programmes

Trident Replacement and the Carriers

Programme	Number of units	Estimated costs at March 2004/05 (£ million)
Trident Replacement	Prob. 4 subs, ~60 missiles	26,250 (our est.)
Carrier Strike Capability	2 carriers, 150 planes	12,000+
Typhoon	232 (unit production cost of £64.8 million)	19,014
Type 45 destroyer	6 (unit production cost of £562 million)	5,896
Astute class submarine	3	3,492
A400M airlifter	25	3,484
Skynet 5	Satellite communications	2,775
Bowman	Communications system	2,007
Beyond visual range air-to-air missile	Unit production cost of £1 million	1,204

Source: Hartley (2006) from NAO (2005)

Reallocating the expenditure within the defence budget away from the programmes may have a marginal positive short run impact on the economy, increasing defence orders, both domestic and abroad, and boosting defence-related employment, but will be of lesser value to the economy in the long-run than civil alternatives.

6. Wider Security Issues

While allocations of expenditure, between defence and civil and even within defence can be considered readily within the framework of the modelling studies discussed above, they are less helpful when we consider what the SDR should have done, namely try to identify the new security threats and ways to deal with them. Thinking more widely, some of the greatest security threats facing the UK, and indeed the world, today, are those of climate change, the related problem of oil/energy security, and the problems caused by weak and failing states, amongst which are terrorism, crime and narcotics flows. This has indeed been acknowledged by government ministers, but the resources currently devoted to finding solutions are currently very limited. Savings made by cancelling the two programmes could very reasonably be earmarked for these areas, seen as part of an overall security strategy, rather than a purely military defence strategy. Indeed, there is a case for a reorientation of defence policy to take on a wider concept of security rather than a myopic focus on military issues.⁷¹

6.1 Oil, Energy and Climate change

One increasingly apparent threat to the UK's security comes from climate change. The threat of global warming increasing flooding and coastal erosion quite literally threatens the "territorial integrity" of the United Kingdom, the protection of which is traditionally the State's first duty. Abroad, climate change threatens to create increased drought, famine and extreme weather conditions, with accompanying poverty, instability, resource

conflicts and migration. Aside from their devastating humanitarian and environmental impact, all of these pose grave challenges to the security of the UK. Indeed, the British government has long recognised tackling climate change as one of the fundamental problems facing both the UK and humanity in general⁷². Most recently, the Stern Review on the economics of climate change has estimated that the economic cost alone of allowing carbon emissions to continue on their current path would be an expected 20% of global GDP by 2050, while the cost of prevention would be only an expected value of 1% of global GDP.⁷³

A related security issue is the high level of oil dependency of Britain's economy. While the UK remains a net exporter, current trends in oil demand and the decline in North Sea Oil production suggest that by 2020 – when Trident replacement would be entering service – the UK will be a net importer of oil, with net imports representing about 18% of demand.⁷⁴ With oil prices rising due to increasing demand and probably falling supply, this will not only be a burden for the economy, but may also represent an increasing dependence on a highly unstable Middle East region.⁷⁵

Despite the importance of these issues in 2002/03 the UK government spent no more than around £200m on carbon reduction technologies.⁷⁶ This compares very unfavourably with other European countries, Japan and the US, and seems inconsistent with the government's rhetoric on climate change. Statements by ministers repeatedly underline the devastating consequences to the UK and the world that could follow from unchecked climate change, and the government has a long-term target of reducing carbon emissions by 60% by 2050, which might be considered unlikely with current levels of resource commitment. The government appears to be moving towards a general carbon trading scheme; however the Stern Review argues that this alone will not be sufficient to achieve the necessary level of reductions, but must be complemented by greatly increased levels of investment in R&D for renewable energy and carbon reduction-technologies, support for commercialisation and deployment of low-carbon technologies, and removal of institutional and non-market barriers to such technologies.⁷⁷

One specific area of under-funding is renewable-related R&D, an area highlighted as which in 2002/03 this was only £12.2m, a figure criticised by the House of Lords.⁷⁸ The New Economics Foundation recommended that this figure should be raised at least to the level of nuclear energy R&D when that was at its height, which was £164m in 1989/90⁷⁹. In today's prices this would be roughly £230m, and so would mean increasing R&D by around £218m per year. Such a figure would also be consistent, given the size of UK GDP, with the Stern Review's recommendation that global low-carbon R&D funding needs to rise to \$20bn per year.⁸⁰

The Stern Review also advocates support for deployment of renewable energy and low carbon technologies. Such support can include capital grants, fiscal incentives, feed-in tariffs (price-support plus purchase incentives), tradable quotas, infrastructure subsidies and public procurement policies.⁸¹ A similar set of policies was argued for by a coalition of trade associations for renewable energy companies in a 2005 manifesto; this argued for the production of 25% of the UK's energy needs from renewables by 2025.⁸² They

suggested creating a Cabinet level post with responsibility for climate change efforts, extension of renewable energy targets, support for new technologies, tax breaks, capital allowances and output-based subsidies.⁸³ Similar policies would be required to reduce oil dependency, especially in the transport sector, which accounts for almost 90% of oil demand in the UK, of which 73% is road transport.⁸⁴ Suggested policies include investment in R&D and developing laws, tax incentives and penalties to encouraging greater fuel efficiency in vehicles, use alternative fuels such as bio-diesel, use more fuel-efficient modes of transport (e.g. trains) and change driving habits (e.g. lower speeds and car-sharing). Some of these policies would involve costs, but others could be fiscally neutral, and ultimately reductions in oil demand would probably save money for the UK economy (IEEP, 2006).

Most of these schemes have not been costed, although the Stern Review (*ibid.*) recommends that global deployment support should rise by a factor of 2-5 times, from its current level of \$34bn. However a useful comparator is from a US output-subsidy scheme for renewable energy, give some idea of the likely cost of such policies⁸⁵. The scheme provides a subsidy of 1-2 cents per kWh for renewable energy output, which given present levels of UK electricity generation and the 3.6% share of renewables, suggests a cost of £150m per year, which will rise as the share of renewables increases, assuming total electricity consumption continues to increase⁸⁶. If the renewables share reaches 10% by 2010, the cost would be roughly £460m per year by then, and £1.1b per year if it reached 20% by 2020, an average of around £600m per year over the period⁸⁷.

Of course, the UK's precise circumstances, including industry structure, desired energy mix etc. is likely to differ, and this only covers one of the areas of support emphasised by the Stern Review, the 2005 Manifesto and other bodies. Other measures could include subsidies for capital schemes, especially in the early years to boost renewable capacity. Clearly the necessary funding for averting climate change cannot come from Trident replacement and the CVF programme alone; but we would suggest that an average annual sum of £800m would represent a modest but worthwhile sum for fiscal and capital support measures for renewable energy, energy conservation and fuel efficiency, which would allow a significant effort towards tackling the UK's carbon emissions and oil dependence.

The area of transport policy is one which is highly relevant both towards tackling climate change and reducing the UK's oil dependence. The government has at various times talked of the creation of an 'integrated transport strategy', and of increasing use of public transport; but the delivery has to a large extent disappointing, with adequate resourcing a key problem.

In 2004, the "Way to Go" coalition of 25 environmental, transport and social justice organisations put together a costed manifesto containing a wide range of measures to promote public transport use and reduce vehicle emissions and oil consumption.⁸⁸ This included various tax measures, but also a range of expenditure items. The money saved from Trident replacement would not be sufficient to fund all these measures, as well as the other spending areas we have suggested, but would go a significant way towards it. In

particular, the following measures recommended by the report could be funded for around £655m per year (where the capital costs have been spread over ten years using the government's recommended 3.5% discount rate for assessing public capital projects): a cycle friendly road network and cycle training for all (£990m capital expenditure plus £22-32m revenue per year), increased funding for public transport, particularly in rural areas (£336m revenue per year), purchase incentives for smaller, cleaner vehicles (£120m revenue per year) and grants for rail freight projects (£290m capital plus £18m revenue per year). As noted, funding the other measures in the report would require additional sources of revenue, such as green taxes, but the items listed here would give a valuable head-start in reducing the UK's oil dependence in transport, to the benefit of both the global climate and UK national security.

6.2 Peace Keeping and Peace Making

The dangers of weak and failing states security of western countries has been emphasised by UK Secretary of State for International Development Hilary Benn— as well as the profound moral and humanitarian concerns raised by these countries.⁸⁹ Amongst the security threats posed by weak states are the potential for them to become havens for terrorism and organised crime, the spillover effect of conflicts, the inability of such states to participate in effective global governance (where in many cases success depends on the 'weakest link'), and the threat to global health through transmission of HIV/AIDS and other diseases. It has become increasingly recognised that it might be better to focus on preventing conflict and degeneration rather than dealing with the consequences.⁹⁰

In a report for Department for International Development (DfID), Chalmers (2004), presents six case studies of recent and prospective conflicts, considering a range of conflict-prevention packages – from diplomatic support to robust peace-enforcement missions – and comparing the cost of the conflict-prevention packages with the actual or expected cost to the international community and the countries concerned, together with the likelihood of conflict with and without conflict prevention package. In all the cases considered (Afghanistan, Rwanda and Former Yugoslavia in the past, and Afghanistan, Sudan and Uzbekistan in the future) the proposed packages were found to be highly cost-effective. They 'break even' on the basis of quite low reductions in the probability of conflict, meaning it is cost effective to get involved in conflict prevention early, when the probability of conflict remains low. Thus the international community and Britain in particular, would be better served by devoting resources to conflict prevention than to war-fighting⁹¹.

Conflict prevention measures can be both military and non-military. The military measures tackle the immediate threats of conflict, but in the longer term it is sustainable economic development in poorer countries that offers the best way of reducing the likelihood of conflict and state collapse (Collier and Hoeffler, 2004). The main contribution the UK makes to this is its international development budget, which has been rising steadily. However, the Official Development Assistance (ODA) of £4,302b per year, still represents only 0.36% of GDP, half of the UN target of 0.7%, which is not scheduled to be reached till 2013.⁹² An obvious way to improve this would be to increase

the Overseas Development Aid (ODA) budget. A rise of 10% would cost £430m per year would enable the UN target to be reached 1-2 years sooner.

The UK's armed forces have already participated effectively in a number of successful low-intensity peacekeeping and enforcement operations in recent years, including in Sierra Leone, the Balkans and East Timor. An example of the type of mission that could be undertaken and supported at a reasonable cost is one of the proposed conflict-prevention packages for Sudan in the aforementioned Chalmers et al. (2004) study. They argue (writing before the outbreak of the Darfur conflict) that the peace deal between the Sudanese government and the SPLA rebels in the south, while highly welcome, faces severe tests in the future and is highly likely to revert to conflict without strong support from the international community. They consider two possible conflict prevention packages, the first a range of non-military measures (discussed later) and the second a robust long-term peacekeeping mission with 5-15,000 troops (depending on the progress of events). They estimate that such an operation would reduce the probability of renewed conflict by 65%, at a cost of \$300-600m per year (around £170-340m).

Naturally, such an operation would not be carried out or funded by one country alone, but this operation gives an idea of the type of activities that could be carried out by UK forces. In calculating the full costs of the hypothetical Sudan mission, we must bear in mind the fact that maintaining an overseas operation also requires maintaining other forces not on operation so as to enable force rotation. Taking an annual cost figure of the operation towards the higher end at £300m, we apply a ratio of 3:1, based on the MoD's Force Structure tables from the 2004 Defence White Paper, to estimate a full opportunity cost of £900m per year.⁹³ This is a very rough estimate, but what can reasonably be said is that a sum of this order would enable Britain to make a very significant contribution to operations of this nature.

UK military involvement in peacekeeping and conflict prevention requires somewhat different force structures, training and weapons systems than the armed forces have at present. Given the commitment to continuing conflicts in Iraq and Afghanistan, the armed forces, especially the army, are experiencing problems of 'overstretch' – a lack of the necessary human resources to fulfil its numerous missions without placing an excessive burden on its soldiers⁹⁴. Shortages are particularly acute amongst certain "key enablers" that tend to be required in all operations. These include medics, logistic specialists, and engineers.⁹⁵ In addition to personnel shortages, there have been well-publicised shortages in certain areas of key equipment, such as body armour and desert boots. Increases in conflict prevention activities could exacerbate such problems, although refraining from adventures such as Iraq would help. Further peacekeeping and especially peace-enforcement operations can require some out of area capability, including amphibious capability.⁹⁶ £500m per year seems a reasonable figure to devote to tackling problems of overstretch related to international peacekeeping operations, in particular to the recruitment of key enablers and to procuring and maintaining additional equipment.

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In addition to these initiatives the UK has two Conflict Prevention Pools (CPPs) – the Global CPP, and the Africa CPP, which are joint funds combining the activities of the Foreign and Commonwealth Office, the Ministry of Defence and the Department for International Development in the field of conflict prevention. Africa CPP, funds activities such as enhancing peace support operations capabilities, enabling security sector reform, demobilisation, disarmament and reintegration, curbing small arms proliferation and misuse; and addressing the economic and financial causes of conflict.⁹⁷ In 2004/05, it received £60m of annual funding, and the Global CCP received £74m. An example of the type of effort that could be funded is the more limited, non-military conflict prevention package proposed by Chalmers et al. (2004) for Sudan, which they estimate would reduce the probability of renewed conflict between the Sudanese Government and the South by 50%, and would cost \$141m a year (2004 prices), or around £80m in 2006 prices.⁹⁸ Sudan is of course far from the only situation that could benefit from swifter and stronger conflict-prevention efforts, and Chalmers et al. suggest others for Uzbekistan and Afghanistan.

A doubling of the total CPP budget, at a cost of £134m per year would be a reasonable start could make a very positive impact on conflict and instability worldwide, with arguably a far stronger positive impact on the UK's long-term security than the one-third of the carrier programme this money would pay for.

A related issue to peace-building and conflict-prevention is the prevention of dissemination of nuclear, chemical and biological weapons material worldwide, something Tony Blair has described as an urgent matter in the light of global terrorist threats. One of the most important aspects of this is the Co-operative Threat Reduction programme involving the US, Russia and other western nations including the UK, aimed at securing and destroying WMD material in the former Soviet Union. To this end, a group of 20 nations including the G8 signed the G8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction at the G8 summit in Kanansakis, Canada, in 2002, pledging to spend \$20bn between them over 10 years, of which \$10bn from the US.⁹⁹

The Government's Third Annual Report on the Global Partnership¹⁰⁰ describes good progress on the programme, and the House of Commons Foreign Affairs Committee agrees that much good work is being done, although it expresses concern at the slow progress in disposal of chemical and biological material, and of a general danger of loss of momentum.¹⁰¹

The Global Partnership, and the UK's role in it, is to be commended, and represents one of the genuine gains in global co-operation and security following the end of the Cold War. However in absolute financial terms, the UK's contribution is fairly small. According to the 3rd Annual Report (ibid.), the UK's total pledge out of the \$20bn is just \$750m, less than Germany or Italy for example, although the UK is one of the 5 recognised nuclear powers and permanent members of the Security Council. At present, the UK's contribution is just £40m per year (ibid.), a small sum for what is described as an urgent set of measures against WMD proliferation. Raising this sum by £60m £100m

per year would put the UK on a par with Germany as the largest contributor after the US and Russia, and might go some way towards tackling the shortfalls in the programme discussed in the Foreign Affairs Committee report, and restoring momentum to the whole project. It would make us a leader in counter-proliferation, as opposed to a leader in proliferation as Trident replacement would make us.

6.3 Hypothetical budget

The above suggestions merely provide examples of the types of activity that could be funded from the savings from the cancellation of Trident replacement and the carriers programme, and give an idea of the opportunity cost of these weapons systems. The idea that security goes beyond military security is in fact well-established and the American Foreign Policy in Focus think tank has proposed a unified security budget for the United States, which seeks to rebalance the relative budgetary priorities for military and non-military security.¹⁰² It is beyond the scope of this report to produce such a complete and wide-ranging set of proposals, such an exercise would be valuable. Table 4 presents an illustrative package of policies that could be undertaken in place of Trident replacement and the carrier programme. It is not meant to be comprehensive, but gives an idea of the true opportunity cost of these weapons systems, in terms of possible foregone alternatives.

As the proposed areas of spending are annual sums, they are compared to the equivalent annual cost of both programmes combined over 25 years. We have calculated the annual equivalent cost for the programmes at £4.3bn, based on a time path of the expenditures on the programmes, and on the period the programmes are in service. This represents a direct measure of the opportunity cost, what could be supported instead of Trident replacement and the aircraft carriers, for the duration of their life.

However, this assumes that the alternative £4.3bn is spent in the future, over the years when Trident replacement and the carriers would be in service. But the problems of global warming and conflict resolution we have discussed are problems that need resources devoted to them now. Therefore, we consider instead what alternative spending could be supported over the next 25 years, starting in 2007. As expenditure in the future has a lower NPV than expenditure today, this reduces the annual amount available that would have the same NPV as the spending on Trident replacement and the carriers. (See Appendix 2 for an explanation of these calculations.) We calculate a figure of £3.7bn as the annual equivalent cost of the programmes treated as if they both starting to costs money now. It should be borne in mind, however, that the benefits of these alternative expenditures will begin to be enjoyed in the present, while the hypothetical ‘benefits’ of Trident replacement and the carriers will not appear until some time in the future.

Table 4: Illustrative Package

Total Net Present Value of cost of the programmes =	£57bn
Equivalent annual spend over next 25 years =	£3.7bn

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Military spending	
Tackling ‘overstretch’	£500m
Peacekeeping (roughly equivalent to the cost of a major peace support operation in the Sudan)	£900m
Subtotal for military spending	£1,400m
Broader security spending	
Raising renewable Energy R&D to level of Nuclear R&D in late 80s	£218m
Fiscal and capital support for renewables	£800m
Measures to reduce oil use in transport	£654m
Funding a conflict prevention package for Sudan	£134m
10% increase in ODA	£430m
Increase in Global Partnership contribution	£60m
Subtotal for broader security spending	£2,296m
<u>Total</u>	<u>£3,696m</u>

In sum, the savings from from the Trident replacement and CVF programs would be sufficient to make substantial and meaningful increases in spending in a number of important areas: peacekeeping, military overstretch, conflict prevention, renewable energy, overseas aid and counter-proliferation. We would argue that these measures would make a strong positive contribution to the UK’s and the world’s security, and help move towards the government’s stated objective of acting as a ‘force for good’¹⁰³. The offensive weapons programmes they would replace, in contrast, would offer little or no security benefit, and indeed could lead us into new wars and an escalated nuclear arms race. The alternatives proposed above would also carry major humanitarian benefits worldwide, and economic benefits to the UK (in the case of the renewable energy spending). If these types of measures were combined with moves towards Non Offensive defence structures as outlined in Appendix 1, this reallocation could be combined with decreased military budgets and increased security.

7. Conclusions

This report has considered the issues and costs involved in the UK’s forthcoming decision to upgrade its Trident nuclear weapons programme and its recent decision to procure two new aircraft carriers. The programmes are seen to represent not only a vision of security based on military power, but one based on the aggressive use of military power. It is argued that the Strategic Defence Review was a lost opportunity to consider the UK’s role in the new security environment. It represented a conservative stance that failed to consider real alternatives, such as “Non-Offensive Defence”¹⁰⁴, combined with contributions towards common security through peace-keeping and peace enforcement

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operations in conjunction with other countries, under the auspices of the UN or the EU. As a result almost all of the cold war weapons systems survived. Subsequent developments in defence policy represent a frightening escalation in offensive military capability and war-fighting intent, of which the carrier strike capability and Trident replacement are major components.

Our estimates of the cost of the two programmes suggest a total net present value of £57bn, which implies an equivalent annual cost of around £5.3bn per annum. When the economic issues involved in cutting the two programmes are analysed it is clear that the reducing the defence budget by the amount of the programmes need not create economic problems. There may be some localised problems but these could be dealt with by government policy. If the expenditures were to be reallocated to other forms of government spending then the cuts in the budget are likely to lead to improved economic performance.

Aside from the usual reallocations of government spending to the general categories used in the UK national accounts, the report also considered alternative uses for the funds made available by cutting the programmes, to give a more developed idea of the opportunity costs. If the two programmes were to be cancelled the savings for the duration of the cancelled programmes are estimated to be equivalent to:

- 1.25p off the basic rate of income tax
- The capital and running costs of around 200 new hospitals
- The capital and running costs of around 1130 new secondary schools in moderate/high cost areas, with 1,000 pupils each
- A real increase in the basic state pension of £11 per week

Taking a more general definition of security than the Strategic Review and thinking outside of the box, suggests a range of alternative security threats. In particular the use of funds to deal with threats to environmental security and the security threats presented by the heavy reliance on Middle Eastern Oil. Giving the same support to research on renewable energy sources as nuclear energy has received in the past, would have great benefits to environment and security and could make the UK a world leader in such technologies.

In addition, the UK government has shown a creditable concern for international development and has made important contributions to peacekeeping and an increasing awareness of the importance of conflict prevention. Aside for their role in Iraq, the forces do have important roles to play in conflict prevention and peace keeping that require different capabilities that their usual roles. Allocating funds to development assistance initiatives and to conflict prevention activities would be an important contributor to improved international security and welfare. Recognition is needed of the importance of the concept of human and environmental security rather than simply military security and the important international. If the UK really wants to be secure it needs to improve wider security for all and to put money into development initiatives. The report has also suggested what an alternative budget might look like, one that uses the money saved from the programmes in other ways.

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If these types of measures were combined with moves towards Non Offensive defence structures as outlined in Schofield (2004) the proposed reallocation of Trident replacement and carrier funds, could be combined with decreased military budgets and increased security. The UK government has a real opportunity to improve domestic and international security and to improve the quality of life of millions of people in the world. We would hope that they start to listen to reasoned arguments and recognise the changed security environment and the opportunities available, instead of following well trodden path of military and political conservatism.

It is hoped that this will help inspire debate as to the actual security threats facing the UK at this present moment, and the most effective ways of responding to them. There are many other options that could be considered along this line of thinking, but we believe that the illustrative measures outlined here would carry far greater security benefits than a new generation of nuclear weapons and a massively enhanced capacity to launch major acts of military aggression as part of a US-led force.

References.

Bai, Hong, Stephen Hall, James Nixon and Ron Smith (1996) "The Macroeconomics of the Peace Dividend in the UK", Chapter 7 in Nils Petter Gleditsch, Adne Cappelen, Olav Bjerkholt, Ron Smith and Paul Dunne (eds) *"The Peace Dividend"*, North Holland, 1996.

Barker T, Dunne P and Smith R (1991) "Measuring the Peace Dividend in the United Kingdom", *Journal of Peace Research*, Vol 28, No 4, November, pp345-358.

CAAT (1996) *Killing Jobs*. Campaign Against Arms Trade, London.

Chalmers, Malcolm, Neil V Davies, Keith Hartley and Chris Wilkinson (2001) *"The Economic Costs and Benefits of UK Defence Exports"*. Report: University of York.
http://www.york.ac.uk/depts/econ/rc/defence_exports_nov01.pdf

Chalmers, M., Davies, N.V., Hartley, K. and Wilkinson, C. (2002): "The economic costs and benefits of UK defence exports", *Fiscal Studies*, Vol. 23, No. 3, September, pp 305-342.

DTI (2002) See: http://www.mod.uk/industrial_policy/

Dunne, P (1996) "Conversion in Europe: Challenges and Experiences", Chapter 8 in Bjorn Moller and Lev Voronkov (eds) (1996) *"Defensive Doctrines and Conversion"*, Dartmouth, pp 56-62.

Dunne, P. & Perlo-Freeman, S. (2003) "Bigger than the Sum of Its Parts: Components and the Impact of a Responsible Arms Control Policy on the UK Economy". *Mimeo, Oxfam*.

Hartley, K. and T. Sandler, 1995, *The economics of defense*, (Cambridge University Press, Cambridge)

Ministry of Defence (1998) *UK Defence Statistics*, The Stationery Office, London.

Dunne P (1990) "The Political Economy of Military Expenditure: An Introduction" *Cambridge Journal of Economics*, Vol 14, No 4, Dec, pp395-404.

Dunne P and Smith R (1992) "Thatcherism and the UK Defence Industry", Chapter 5 in Michie J (1992) *"1979-92 The Economic Legacy"*, Academic Press.

Dunne JP, D Willenbockel and Smith R "Models of Military Expenditure and Growth: A Critical Review". *Defence and Peace Economics*, 2005, Vol. 16, No. 6, pp. 449 - 461.

Melman S (1985) *"The Permanent War Economy"*, Simon and Schuster.

Melman S (1981) *"From Military to Civilian Economy: Issues and Options"* Occasional Paper Series No. 8, Centre for the Study of Armament and Disarmament, California State University.

Trident Replacement and the Carriers

Oden M D (1988) "A Military Dollar Really Is Different: The Economic Impacts of Military Spending Reconsidered" Employment Research Associates, Lansing, Michigan.

Rogers, Paul (2006) "Big Boats and Bigger Skimmers: Determining Britain's Role in the Long War", *International Affairs*, 82, 4, pp651-665.

Southwood P (1991) "Disarming Military Industries", Macmillan.

SIPRI, various years, *SIPRI yearbook* (Stockholm International Peace Research Institute, Blackwell, Oxford).

IEEP (2006): Malcolm Fergusson, Ellie Mackay & Ian Skinner, "Over a Barrel: Reducing Transport's Oil Dependency", Institute for European Environmental Policy, April 2006.

Appendix 1: Non Offensive defence

It is clear that at present procurement to meet new needs is above what is available and suggests a particular security stance that was developed in the SDR and shows considerable continuity. As mentioned an alternative that was dismissed was ‘non-offensive’ defence (NOD). Traditional NOD is directed towards preventing successful invasion by another nation; but this threat does not exist for the UK and is not likely to re-emerge in the foreseeable future. Thus the UKs defensive capability would only need to be limited, but there are security threats that can be identified that might be argued to require, in some cases, a military response, including terrorist groups, weak or failed states, regional conflict that threatens to spill over, etc., and these are likely to be far afield. Missions might range from peace-keeping through peace support/stabilisation up to peace-enforcement (forcibly separating combatants – e.g. the Sierra Leone mission, which most observers would regard as successful). At first sight these might seem to require offensive capability, but the NOD approach would suggest a force projection capability as part of *collective security* arrangements, where no individual nation possessing offensive capabilities, but different nations contribute elements to a collective task force. (Moller, 1996).¹⁰⁵ The CVF programme is not appropriate to dealing with peace support operations etc, which might require transport aircraft, but not that sort of scale of offensive air capability. Schofield (2002) provides a careful analysis of the UKs security needs and how they can be met through NOD and a reduced defence budget.

Appendix 2: Net Present Value and Equivalent Annual Cost

Net Present Value (NPV) calculations are based on the principle of ‘discounting’, namely that costs and benefits in the future should be ‘discounted’, i.e. reduced in value, compared with costs and benefits now, as it is assumed that immediate benefits are more highly valued than those in the future. This can also be measured by the interest rates that may be earned or must be paid. The Treasury Green Book recommends using a figure of 3.5% per year as the appropriate discount rate for evaluating public projects with future costs and benefits. That is, paying £100 now should be treated as equivalent to paying £103.50 in one year’s time, or £107.12 in two years time (due to compounding), etc. The NPV figure answers the question “How much spending now as a lump sum would be equivalent to the total spending over the life-cycle of the project. Another way of seeing it is, if we were to put a sum of money into the bank now, at 3.5% interest rate, how much would we have to put away to be able to pay the various costs of the project at the time they are incurred.

The Equivalent Annual Cost (EAC) figures are based on calculating a constant annual expenditure, over the service-life of the project, that gives the same NPV as the project itself, that is over the period when the ‘benefits’ of these programmes would be obtained. So it is answering the question “What alternative benefits could we be getting if we were not spending the money on the project that would have the same NPV?” Alternatively, if we were to put the NPV in the bank at 3.5% interest (which we know is just enough to

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pay for the life-cycle costs of the programme being considered), how much could we draw out for every year that the weapons would be in service?

It may be noted that the NPV figures calculated are considerably *less* than the raw total for the life-cycle costs of the project. This is because a lot of the spending takes place far into the future, and so has a low NPV due to compound discounting. On the other hand, the EAC figures are considerably *higher* than the figure obtained by dividing the life-cycle costs of the programme in question by the number of years in service. This is because the procurement expenditure takes place some years before the programme comes into service, and so is equivalent in NPV terms to a greater sum spent at the time the programme is in service. Because a large sum is expended before any benefits are enjoyed, a larger benefit is required to justify it.

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Table X: Net Present Value calculation for Trident Replacement. All costs are in constant 2006 £b.

Year	Event	Year of programme	Subs + other stuff	Missiles	Warheads	operations/maintenance	Total	PDV
2007		1	0.1474				0.1474	0.142415
2008		2	0.1475				0.1475	0.137693
2009		3	0.295				0.295	0.266073
2010		4	0.595				0.595	0.518508
2011		5	0.595				0.595	0.500974
2012		6	0.885				0.885	0.719948
2013		7	0.885				0.885	0.695602
2014		8	0.995				0.995	0.755614
2015		9	1		0.12		1.12	0.821779
2016		10	1.15	0.05	0.12		1.32	0.935773
2017		11	1.2	0.05	0.28		1.53	1.047967
2018		12	1.4	0.05	0.64		2.09	1.383127
2019	Upgraded Missiles	13	1.4	0.05	0.64		2.09	1.336355
2020	1st new sub in service	14	1.2	0.05	0.95	2.24	4.44	2.742951
2021		15	1.15		1.25	2.24	4.64	2.769572
2022	2nd sub in service	16	1		1.56	2.24	4.8	2.768188
2023		17	0.995		1.25	2.24	4.485	2.499059
2024	3rd sub in service	18	0.885		0.95	2.24	4.075	2.193822
2025	New warheads	19	0.595		0.64	2.24	3.475	1.807541
2026	4th sub in service	20	0.595			2.24	2.835	1.424774
2027		21	0.595			2.24	2.835	1.376594
2028		22				2.24	2.24	1.050897
2029		23				2.24	2.24	1.01536
2030		24				2.24	2.24	0.981024
2031		25				2.24	2.24	0.947849
2032		26				2.24	2.24	0.915796
2033		27				2.24	2.24	0.884827
2034		28				2.24	2.24	0.854906
2035		29				2.24	2.24	0.825996
2036		30				2.24	2.24	0.798064
2037		31				2.24	2.24	0.771076

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2038		32				2.24	2.24	0.745001
2039		33				2.24	2.24	0.719808
2040		34				2.24	2.24	0.695466
2041		35				2.24	2.24	0.671948
2042	Missiles leave service	36				2.24	2.24	0.649225
							NPV	39.37157
							Equivalent annual cost	4.189381

Notes:

1. This table demonstrates the Net Present Value calculation for Trident Replacement used in this paper.
2. "Other" costs refers to weapons systems and shore construction. The relative shares of the components of Trident replacement are based on the shares of the cost of Trident from the 1986 UK Defence Estimates.
3. It is assumed that all cost elements double compared to Trident, except the missiles, as it is assumed the UK participates in the US Service Life Extension Programme for Trident. Thus it is assumed that this cost element is no more than for the original Trident procurement.
4. It is assumed that submarine procurement begins, at least in initial exploratory stages, in 2007. Work on a replacement warhead is assumed to begin in the mid 2010s to come into service in the mid 2020s. This may be a generous assumption, as some work on upgrading the existing warhead may entail additional costs beforehand. It is assumed that the upgrade for the Trident II D5 missiles is paid for in the five years leading up to their introduction in 2020, along with the new subs.

Appendix 3: Determining the Economic Effects of Cancelling the Programmes

Cutting military spending in a country where most of the expenditure is on manpower can lead to unemployment, while even in developed economies there are likely to be localised impacts of cuts. Particular areas and communities will be effected the closure of defence establishments. In the case of production facilities the factories made have been located in out of the way areas for security reasons and hence it would be difficult to attract the type of civil industry that would suit the highly trained workforce that is overrepresented in defence production.

Theoretically, any evaluation of the impact of military spending on growth is contingent on the theoretical perspective used, but as theories differ it becomes an empirical question¹⁰⁶. When we move to empirical analyses, it is necessary to determine the level of abstraction at which the analysis is to be presented and to operationalise the theory to form an applied model. This leads to a variety of empirical work from applied econometric to more focussed institutional case study analyses. When statistical analysis is undertaken, it is generally based on the Keynesian or neoclassical approaches, as these are most amenable to the creation of formal models, though some studies adopt a more ad hoc approach. The studies differ in terms of the country coverage, the use of time-series versus cross-section data, the time period covered and the empirical methods used (see Dunne, 1996).

In general the literature has identified a number of channels by which military spending and production can influence the economy one way or another. It can take skilled labour away from civil production, but on the other hand can enhance training of the workforce, particularly in developing economies where the military may provide valuable skills. It can take the best capital equipment from civil industry to produce a high-technology enclave, but there may well be positive externalities of the development of the military sector on the civil sector. It can lead to damaging wars, but may maintain peace and lead to economic benefits from more prosperous allies. It can stimulate demand in a stagnant economy and lead to growth, but may create bottlenecks in a constrained economy. Finally, it may slow down development through the fostering of a militaristic ideology, but on the other hand nationalist attitudes may increase effort and output, and the military force and ideology may be used to control the workforce. Clearly whether these effects end up being positive or negative overall is an empirical question and the result is likely to differ across countries (Dunne, 1996).

Following the ad hoc approach of Benoit's original study, which found a positive effect of military spending on growth in developing countries, an impressive literature has been built up using econometric analysis of single-equation reduced-form equations and simultaneous equation models, which model both direct and indirect effects (Smith, 2000). In addition, macroeconometric models have been used to simulate the likely impact of changes in military spending at country and international level (Gleditsch et al, 1996).

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Overall, the results of the empirical work have tended to show an insignificant or negative impact of military spending on economic growth in developing countries and a clearer negative impact in developed economies, through military spending being at the expense of investment rather than consumption. What is clear is that we would not expect particular economic problems from relatively large changes in military expenditure, especially if we have policies to aid industrial adjustment in place. The end of the cold war saw very large reduction in military spending and no obvious negative impact on the UK's growing economy¹⁰⁷.

To get a more detailed idea of the likely effects of cutting the two projects on the UK economy this appendix now reviews some empirical studies on the economic effects of military spending using models of the economy.

Barker, Dunne and Smith (1991) used the Cambridge Growth Project inter-industry model of the UK economy to investigate the impact of cutting military spending by one half by the end of the century. This implied an 8-9% per annum cut in military expenditures, of a similar order to (though somewhat lower than) the reduction in defence spending that would result from removing the Trident replacement programme if it was included in the budget. In our case we only cut once and then maintain that cut, though from a lower level.

We estimate the annual cost of Trident replacement around £4.2 bn per year, using 2004-5 as a base year, this would be the equivalent of 14% of total defence spending (total defence spending = £38.4 bn in 2004-5, provisional outturn) for the year when Trident replacement kicks in¹⁰⁸. We have the first year results for the Barker et al study, which we can increase proportionately to give us the likely impact of removing the Trident replacement spend

% changes	Compensated		Uncompensated		
	Year 1		Year 1		
	Barker et al	Trident	Barker et al	Trident	
Decrease milex	-9.00	-14.00	-9.00	-14.00	
Consumers Expend	-0.22	-0.34	-0.31	-0.48	
Govt Cons	-0.21	-0.33	-1.87	-2.91	
Invest	0.25	0.39	-0.30	-0.47	
Exports	-0.02	-0.03	-0.01	-0.02	
Imports	0.09	0.14	-0.50	-0.78	
GDP	0.10	0.16	-0.45	-0.70	
B/P	-0.04	-0.06	0.16	0.25	
PSBR	-0.08	-0.12	-0.16	-0.25	
Unemployment	-0.05	-0.08	-0.06	-0.09	

This suggests that GDP will decline by 0.7% in the first year if the money saved from Trident replacement is not allocated to other forms of expenditure –which is what we mean by uncompensated. If these were allocated to other forms of government spending then we would expect GDP to increase by 0.16%. These are not large amounts. We also know that in the longer run the impact of such cuts will be less pronounced and that the compensated scenario will give a positive benefit of the cuts in military spending.

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Barker et al with their continuous reduction in defence spending find that without reallocating the savings is a reduction of about 200,000 defence jobs and almost a 4% reduction in GDP. When this expenditure is reallocated to the other categories of expenditure in proportion to their share of the total before the change, 600,000 jobs are generated, giving a net increase of 400,000 jobs and a net increase of almost 2% of GDP. We can be sure that our longer run effect would show similar patterns but much less pronounced. Of course this is an old study and the structure of the economy has changed since it was undertaken, but it still provides a useful benchmarks and a useful way of thinking consistently as to what the likely impact will be¹⁰⁹.

Bai et al (1996) provide a similar analysis of the macro effects of cuts in military spending, though they only consider this leading to a cut in overall government spending. They also consider the problem of specifying how the government might respond to the reduced spending, lowering interest rates in response to lower inflation, or lowering taxes in response to lower public borrowing. Their results are consistent with the other studies in terms of their evaluation of the likely economic consequences.

In the Barker et al study estimates are made of the likely industrial impact and suggests where there may be problems. Underlying the simulations is an implicit assumption that the defence contractors are able to adjust without government assistance and that the defence workers with their particular skills will be able to gain employment in the jobs created by the increase in expenditure in other parts of the public sector, and those created in the private sector by multiplier effects. Their simulation has continuous cuts in defence spending making it a much more profound change than the one we envisage. There is certainly no expectation that the cuts we envisage will lead to economic problems.

Cancelling the Trident replacement and the carriers does have some specific implications. It all comes out of equipment budget rather than across the board as in the simulation so it might have a larger industrial effect and possibly a larger multiplier effect. It will certainly have a smaller impact on employment, as it does not necessarily mean cuts in personnel and civil servants. The jobs lost will be the more qualified and relatively highly paid workers and this may have benefits for civil industry. It is also unlikely to have implications for arms trade. Certainly defence production has more import content than it had when this work was done and the role of Thales as partner with BAE Systems would not have happened then, but production is planned to take place in the UK. Thus the older study is likely to overestimate the impact of the cuts if anything. This will increase our confidence in suggesting that cutting the amount spent on Trident from the defence budget will not cause particular economic problems and if that money is reallocated into other forms of government spending it has the potential to improve things. What used to be called the 'peace dividend' is still possible.

In a more recent study Chalmers et al (2002) considered the economic costs and benefits of UK defence exports and provided estimates of the economic impact of a 50% reduction of arms exports. This report produced by two Ministry of Defence economists and two academics. This estimates that such a reduction would lead to a net financial loss to the Exchequer of between around £40m and £100m a year on a continuing basis. It would also involve a one off cost of adjustment of between £0.9m and £1.4bn. Including

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possible terms of trade effects increases this to between £2 and £2.5bn, the bulk of which falls in the first couple of years¹¹⁰.

They estimate that 49,000 jobs would be lost as a result of the reduction in exports, but that these would be offset by the creation of 67,000 new jobs in non-defence employment as the economy adjusts. There would actually be a medium-term increase in employment. It should also be pointed out that the short-term costs can be minimized and long-term benefits maximized, by government efforts to re-train redundant defence workers and support demand and investment in affected regions.

While undertaken for a different reason the results provide a useful benchmark for judging the impact of reducing expenditure on the carriers and Trident, giving us very much the worst case scenario. In the case of reduced exports the exchequer loses money as well as the companies losing demand for their products. In this case the industry still loses demand, but cancelling the carriers would give a net increase to the exchequer of 1.1bn per year and cancelling Trident replacement 4.2bn when it kicks in. There is, therefore, the opportunity to reallocate these expenditures and no reason why there need be an increase in the real rate of interest and the terms of trade.

Based on the Chalmers results we can envisage results of the nature of those below.

Table 3 – summary of economic effects

Scenario	Cut in exports	Annual cost to govt. (Chalmers)	Adjustment cost	Initial job loss	Eventual new jobs
Chalmers et. al.	50%	£40-100m	£2-2.5bn	49,000	67,000
Carriers	n/a	0	-£1.1bn	20,000	30,000
Trident	n/a	0	-£4.2bn	65,000	105,000

Notes: Annual cost (Chalmers) refers to the annual cost to the exchequer estimated by Chalmers of a 50% cut in arms exports, applied pro-rata. The one-off economic adjustment cost, and the initial job losses and eventual job gains, are based on Chalmers et. al. (2002), again applied pro-rata.

There is an initial cut in employment, but eventually new jobs are created in the economy that more than compensate. These effects will start when the cuts in defence spending kick in, as shown in Figure 1. There would be differences between cutting exports in general and cancelling Trident and the carriers, especially given that the UK has never exported nuclear submarines. There will also be more localised impacts, for example on the town of Barrow, and whole production and other facilities may need to be closed down. However, as mentioned there will be money available to the exchequer to spend on policies to assist the structural adjustments required.

To provide some context, Chalmers et al (2002) point out that the estimated cost of economic adjustment is much less than some other economic adjustments that have taken

place in recent history, such as coal mining. Most of the costs would fall on the workers in the defence industry. There would be some severe local effects, but defence workers are generally highly skilled and are likely to find alternative employment. In the medium term, substantial reduction in defence exports would divert qualified scientists and engineers to other parts of the economy, it may reduce overall R&D activity –if there is no replacement with civil- but unlikely to have any significant effect on the economy. If anything, the effect is likely to be positive.

Overall, these results suggest that the economic costs of reducing defence exports are relatively small and largely one off¹¹. This leads them to conclude that the balance of arguments about defence exports should be based on mainly non-economic considerations¹².

¹ UK MoD, “The Future of the United Kingdom’s Nuclear Deterrent”, Cm6994, December 2006. Specifically, this means a replacement for the *Vanguard*-class nuclear submarines that will act as a new platform for upgraded Trident D5 missiles, armed with new warheads (see section 3). This new system is typically referred to as “Trident replacement”, and we shall also use this phrase as a shorthand although it is not, technically, the Trident missiles that are being replaced.

² “It is now clear that we no longer need to retain a capability against the re-emergence of a direct conventional strategic threat to the United Kingdom or our allies”, UK MoD Defence White Paper “Delivering Security in a Changing World”, December 2003, p11

³ David Edgerton: *New Left Review*,

⁴ MoD, *Delivering Security in a Changing World*, Defence White Paper, December 2003.

⁵ Thus, UK armed forces were expected to be involved in peacetime security missions, including tackling terrorism; security of overseas territories; defence diplomacy, including arms control and education and training of friendly armed forces; peace support and humanitarian operations, from disaster relief to deployments such as IFOR in Bosnia; regional conflicts outside NATO, especially the Near East; collective defence involving NATO.

⁶ This meant a range of war fighting capabilities, supported by technological force multipliers would be required, including information gathering, referred to as *ISTAR* (intelligence, surveillance, target acquisition, reconnaissance), *C3* meaning communications, command and control, and smart weapons (to maximise effect and minimise civilian casualties). Together this is now called *Network-Centric Warfare* or *Network Enabled Warfare*, though this term was not used in the SDR. Forces were also seen as needing to be protected against information warfare and chemical and biological warfare (CBW). At sea, the emphasis was seen as shifting from large scale maritime warfare to littoral operations and force projection, while air power was seen as remaining crucial, with long-range attack aircraft, for overseas operations, and ‘stand-off’ missiles crucial.

⁷ The SDR suggested *Joint Rapid Reaction Forces* (involving all three services) be created to respond powerfully to crises at short notice (with NATO/UN/ad hoc coalition or others). This was to include significant offensive capability and be supported by strategic transport (including roll-on roll-off ships and transport aircraft), joint helicopter command, logistic enhancements, medical support, CBW defence and training in joint operations. Reserves, including the Territorial Army, were seen to have a possible role in supporting overseas deployment, rather than just defence of the homeland. It also suggested that the UK’s forces were suffering from overstretch, with a lack of ‘key enablers’ for multiple operations

⁸ It was argued that the three smaller carriers should be replaced with two larger carriers of the order of 30-40,000 tonnes with 50 aircraft each, from 2012. While naval forces designed for large-scale open ocean warfare were not considered necessary, amphibious landing ships and helicopter carriers were. For the land forces *Challenger 2* Tanks, *Apache* attack helicopters, *longbow* radar, *Hellfire* missiles, new guns and

missile launchers were considered necessary, together with a multi-role armoured vehicle to be developed with France and Germany. The Eurofighter/Typhoon was seen as central for air superiority, with short-range missiles (ASRAAM), with Storm Shadow stand-off missiles to be provided for upgraded Tornado aircraft. In addition, new strategic airlift capacity was seen as important, US C17s in the short-term and the Future Large Aircraft [now A400M] in the long-term. ISTAR capabilities including ASTOR airborne ground surveillance radar, Phoenix UAV, COBRA radar would be needed and the BOWMAN communications system to handle the vast new quantities of information.

⁹ Smart Procurement (now Smart Acquisition). This policy was introduced in 1998 as part of the UK's Strategic Defence Review. Its features include incremental acquisition; integrated project teams (including Industry); partnering with Industry (if competition is not possible); and controlling defence inflation. Hartley: http://www.rmc.ca/academic/poli-econ/idrm/papers/2003-2_e.html

¹⁰ Strategic Defence Review, as above; MoD, "Strategic Defence Review: A New Chapter", HMSO, July 2002

¹¹ Find-and-strike operations require 'high-intensity integrated war-fighting capacity', with rapid intelligence and decision-making capability.

¹² – advanced surveillance technology, speedy (real-time) communications and decision-making, precision weapons to take advantage of 'fleeting opportunities' and reduce collateral.

¹³ Terrorist threats also brought Home Defence back into the frame, with new roles for military reserves

¹⁴ Schofield (2002) provides a useful discussion of this and suggests possible NOD structures for the UK. We discuss NOD in more detail below.

¹⁵ Pre-emptive action being advocated against terrorist groups, to "prevent, deter, coerce, disrupt and destroy" their forces and those of state sponsors.

¹⁶ In a memorandum to the Defence Select Committee in June 2003, the MoD explicitly stated their opinion on out of area operations: "The [SDR] concluded that the ability to deploy offensive air power will be central to future force projection operations, and that aircraft carriers can provide valuable flexibility in a range of operational circumstances.... There is an increasing likelihood of future operations being conducted by forces far from their home bases. In such operations, host-nation support... cannot be guaranteed.

¹⁷ In 2004, former Defence Minister Geoff Hoon described them as the "largest and most powerful warships ever constructed in the United Kingdom". Hansard, 19 July 2004.

¹⁸ <http://en.wikipedia.org/wiki/CVF>

¹⁹ Timothy Garden & David Ramsbotham, "About Face: The British Armed Forces – Which Way to Turn", RUSI Journal, April 2004. Of the carriers they write, "Yet no-one appears to be ready to ask the fundamental question of whether such a capability is the most important one for Britain. These carriers will not be able to act in a hostile environment unless they are part of a US force. The Americans are not short of aircraft carriers."

²⁰ House of Commons Defence Committee, "A New Chapter to the Strategic defence Review", Sixth Report of Session 2002-2003, HMSO, 15 May 2003.

²¹ House of Commons Defence Committee, *The Future of the UK's Strategic Nuclear Deterrent: the Strategic Context*, Eighth Report of Session 2005-06, 20 June 2006.

²² *Ibid*, Evidence from Commodore Tim Hare to above report, Ev. p34.

²³ Due to previous design and concept work that had taken place prior to the Trident order in 1980, and raised safety standards etc. since then - "The Future of the United Kingdom's Nuclear Deterrent", *ibid*.

²⁴ Paul Ingram, "Trident: Do we really need to make the decision now?", *BASIC Occasional Papers on International Security Policy*, 25 July 2006, <http://www.basicint.org/pubs/SB060725.htm>.

²⁵ There has been some discussion of converting the design of the *Astute*-class nuclear attack submarines currently under order to a ballistic missile role. It is possible that this would be cheaper than building an entirely new boat, but it is impossible to estimate by how much, if at all. We assume in this report that Trident replacement will involve a new system. It would be up to the government to produce figures for an *Astute*-based option, if that is indeed viable.

²⁶ House of Commons, *ibid*.

²⁷ House of Commons, *ibid*.

²⁸ At an average cost of around \$66m²⁸ per Trident missile, (and a unit cost of \$30m for current production) <http://www.fas.org/nuke/guide/usa/slbn/d-5.htm>

²⁹ House of Commons, *ibid*.

³⁰ MoD, Strategic Defence Review, 1998

³¹ In January 2005, Defence Procurement Minister Lord Bach gave the acquisition current cost as £14.893 billion³¹, an increase broadly in line with inflation. As the change in real terms between 2004 and 2005 was negligible it seems reasonable to suppose this would be true 2005-6 and to suggest that £15bn is a reasonable estimate of the cost of the system in 2006 prices.

³² This point was made by MP Harry Cohen in 1996, noting that the Polaris system cost the UK £5-5.5bn in 1996 prices, while the estimate for Trident costs at that time was £11.7bn – more than double. The generation gap between these systems was a little over 20 years, comparing when the first submarines came into service Hansard, 2 Feb 1996. The issue is discussed in Kaldor, Mary (1982) “The Baroque Arsenal”, . . . Kirkpatrick, David (??) “...” Defence and Peace Economics

³³ In between was the Trident 1 C-4 from 1979, at a cost of \$22.2bn. See P. K. Ghosh, “Economic Dimensions of the Strategic Nuclear Triad”, *Strategic Analysis*, April-June 2002. While figures are not available for the cost of the *Benjamin Franklin*-class ballistic missile submarines that preceded the current US *Ohio*-class, the *Los-Angeles* class nuclear attack submarines (first boat ordered in 1971) cost \$1.1bn per boat in 2000 prices. Federation of American Scientists, <http://www.fas.org/man/dod-101/sys/ship/ssn-688.htm>

³⁴ <http://www.fas.org/man/dod-101/sys/ship/nssn.htm>

³⁵ Cm6994, p26.

³⁶ House of Commons Papers 399 and Statement on the Defence Estimates 1986, HMSO.

³⁷ As noted, the direct replacement option is not likely to be available until 2014. The time from a decision on the Trident system in 1980 to deployment of the first submarine was 14 years; a decision on a Trident replacement would have to be taken by 2010. Thus it is likely that an in-service extension would be ordered before any decision was taken on the direct replacement option. There is no obvious basis for estimating the cost of such a life extension, but as noted above it is not likely to represent a significant cost saving on the direct replacement, although it would be committing the UK to incurring such costs for a shorter period of time.

³⁸ National Audit Office, *Major Projects Report 2005*.

³⁹ Cm6994, p27.

⁴⁰ According to John Ainslie of Scottish CND <http://www.banthebomb.org/archives/magazine/nfs9921.htm>. Defence Secretary George Robertson emphasised that the figures he gave for forces committed to Trident did not represent the cost that could be attributed to Trident, as these forces had other duties as well; however, it would be hard to argue that there is zero marginal cost. Dr. Ainslie assigned the full cost of forces ‘committed’ to Trident, and 30% of the cost of ‘contingent’ forces. This figure is therefore open to debate, but is not outrageous.

⁴¹ Following the order of Trident in 1982 significant, though diminishing, sums were paid by the UK for the acquisition till at least until 1997. Hansard 4th December 1997. Based on the timescales outlined in the Defence Committee report, if there is no service-life extension to the *Vanguard*-class submarines, then initial investment and assessment would need to begin very soon, and full-scale design and construction work following a Main Gate decision round about 2010, with the first boat coming into service in 2020 (and the others presumably in the following 5-6 years, based on the *Vanguards*).

⁴² Following the order of Trident in 1982 significant, though diminishing, sums were paid by the UK for the acquisition till at least until 1997. Hansard 4th December 1997. Based on the timescales outlined in the Defence Committee report, if there is no service-life extension to the *Vanguard*-class submarines, then initial investment and assessment would need to begin very soon, and full-scale design and construction work following a Main Gate decision round about 2010, with the first boat coming into service in 2020 (and the others presumably in the following 5-6 years, based on the *Vanguards*). The warhead element consisted of 28% of the cost of Trident, according to HCP 399, Statement on the Defence Estimates 1986.

⁴³ These figures are not very sensitive to small-medium changes in assumptions regarding the split of costs between the elements and the loading of these costs.

⁴⁴ Relevant government announcements regarding the CVF programme may be found at “CVF Official Statements”, <http://navy-matters.beedall.com/cvf4.htm>. See also <http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/Maritime/CarrierStrike/>, regarding the JCA (Known as Joint Strike Fighter in the US) Some reports suggest that the UK will only commit to 138 units. (<http://navy-matters.beedall.com/jca1-1.htm>.)

⁴⁵ The “Initial Gate” approval point for a project allows the project to proceed to the Assessment Phase, which considers different alternative procurement possibilities and comes up with a preferred option.

“Main Gate” approval allows the project to move to the Demonstration and Manufacture stages.

⁴⁶ Under the Smart Procurement Initiative (SPI) process, Initial gate occurs at the end of the Concept Stage, before the commencement of the Private Finance Initiative (PFI) procurement process. Main Gate is an exacting approval hurdle, between the Assessment and Demonstration Stages

http://www.ams.mod.uk/ams/content/docs/ils/ils_web/ilsmtg/mg.htm

⁴⁷ “Future Aircraft Carrier project moves to next phase as assembly plans are agreed”, MoD

<http://www.mod.uk/DefenceInternet/DefenceNews/EquipmentAndLogistics/FutureAircraftCarrierProjectMovesToNextPhaseAsAssemblyPlansAreAgreed.htm>

⁴⁸ National Audit Office, *Ministry of Defence Major Projects Report 2005*, HMSO, November 2005

⁴⁹ House of Commons Defence Select Committee, “Future Carrier and Joint Combat Aircraft Programmes”, Second Report of Session 2005/06, HC554, December 13, 2005,

<http://www.sbac.co.uk/community/news/files/3566/Future%20Carrier%20and%20Joint%20Combat%20Aircraft%20Programmes.pdf>

⁵⁰ House of Commons Defence Committee, HC554, *ibid*.

⁵¹ The platform for the electronic systems involved has not been finalised, though it will probably be helicopter-based. Main Gate and In-Service date are uncertain, although the Navy Matters website suggests a Main Gate of 2009 and ISD of 2015-2018. Existing Sea King helicopters may have to be used as an interim platform.<http://navy-matters.beedall.com/masc.htm>

⁵² HC554, *ibid*, Memo from MoD, Evidence p45

⁵³ National Audit Office, *Ministry of Defence Major Projects Report 2005*, HMSO, November 2005

⁵⁴ Further Memorandum by the MoD to Select Committee on Defence, 3 Mar. 2005, <http://navy-matters.beedall.com/cvf4.htm>

⁵⁵ “Future Aircraft Carrier – CVF”, <http://navy-matters.beedall.com/cvf1-22.htm>

⁵⁶ Robert Fox, “£1bn cuts threat to defence industry”, *Thisismoney.co.uk*, 12th June 2006,

http://www.thisismoney.co.uk/news/article.html?in_article_id=409817&in_page_id=2.

⁵⁷ <http://navy-matters.beedall.com/cvf1-22.htm>

⁵⁸ Initial reports also put the cost at up to £10b. See also HoC Defence Committee report HC554 which gives the figure as £7-10bn; given the continuing tendency to cost overruns however, we have taken the high end figure “The UK’s requirement. What is the JCA?”, JSF UK Industry Team,

<http://www.jsf.org.uk/jsfuk.htm>.

⁵⁹ <http://navy-matters.beedall.com/masc.htm>

⁶⁰ SIPRI Yearbook 2006.

⁶¹ The GDP Deflator measures the level of prices across the whole of the economy (as opposed to the usual inflation measure, the Consumer Price Index, which only measures prices for consumers.) The nominal (money) level of GDP must be divided by the GDP Deflator index to obtain a value for real GDP that is adjusted for inflation.

⁶² Of course without aircraft carriers the UK might buy some JSFs to replace its land based Harriers, but for simplicity we do not consider this option here.

⁶³ In fact these assume that a cancellation would save money from the defence budget. There has yet to be a bun-fight over whether the cost of trident replacement will come from the defence budget or the general exchequer. This could make a difference.

⁶⁴ Based on Treasury figures for tax take for higher and basic rate taxpayers in FY0405

⁶⁵ Based on median capital cost of £155 million (Hartley), spread over a 40-year lifespan, together with an average figure of £18.75m running costs, from the £30bn NHS acute care budget spread over 1,600 hospitals. If a typical (median) hospital is higher than average cost, then this figure may need to be reduced, but we may reasonably say over 100.

⁶⁶ Based on capital costs of around £20m – according to government ministers quoted in <http://news.bbc.co.uk/1/hi/education/4952004.stm>, costs vary from £15m for a 900-pupil school in a moderate cost area, to £25-30m for a 1,300 pupil school in a high-cost inner city area, so we have taken a middle value of £20m. According to the Education Formula Spending Share workbook from www.teachernet.gov.uk, average funding per pupil in secondary schools in England and Wales in 2005-06 is £3,754, including both school and LEA administration funding.

⁶⁷ Actually £8.957.91, based on figures for the over-65 population of the UK from the CIA World Factbook.

⁶⁸ Pensioners do tend to have lower propensity to import (mainly the poorer ones) than other groups, meaning there can be positive economic effects.

⁶⁹ “Britain Faces Long-Term military procurement Crunch”, Douglas Barrie:
http://www.aviationweek.com/avnow/news/channel_defense_story.jsp?id=news/aw071706p2.xml

⁷⁰ Considering the lifecycle costs of the two programmes relative to the overall defence budget. The Trident replacement is £75bn between now and 2042, which gives an average of £3.4bn per year of service (ignoring time discounting considerations); the Carrier Strike programme is around £31bn between now and 2055, which gives an average of £0.8bn per year over 40 years of service. By comparison the total “Defence Output Cost” for 2003/04 was £33.4bn⁷⁰, of which £10bn was for the navy; £8.7bn for the air force; £7bn for the army (all excluding spending on current operations and other military tasks); £3.5bn for current tasks including operations £3.2bn on “Building for the Future”, that is R&D and the equipment programme.

⁷¹ The idea that security goes beyond military security is a well-established one, and indeed one supported by government ministers. The American Foreign Policy in Focus think tank has taken this a step further by proposing a unified security budget for the United States, whereby they seek to rebalance the relative budgetary priorities given to military and non-military security. Miriam Pemberton and Laurence Korb, “A Unified Security Budget for the United States, 2007”, *Foreign Policy in Focus*, May 3 2006, <http://www.fpiif.org/fpif.txt/3253>. Indeed, the US Department of Energy contains a quote from Alexander Karsner, Assistant Secretary for Energy Efficiency and Renewable Energy “Maximizing Energy Efficiency and Renewable Energy is the domestic epicenter in the War on Terror and it is imperative that we maximize the partnerships between the public and private sectors in new and creative ways with a sense of seriousness, national purpose and the urgency the situation merits.” <http://www.eere.energy.gov/>

⁷² See for example <http://www.defra.gov.uk/ENVIRONMENT/climatechange/>

⁷³ N. Stern, “Stern Review on the Economics of Climate Change”, HM Treasury, 30 Oct. 2006, http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

⁷⁴ In 2003, the UK consumed 82.6 million barrels of oil, remaining a net exporter; however, the 15 EU countries before enlargement consumed 604.6m barrels, of which 77% represented net imports. EUROSTAT 2003, quoted in IEEP (2006). The forecast is based on figures from the EU General Directorate of Transport and Energy (DG TREN), 2003, quoted in IEEP (2006).

⁷⁵ At the end of 2004, 61.7% of proven oil reserves came from the Middle East. BP Statistical Review, 2005, quoted in IEEP (2006).

⁷⁶ Including direct research funding, funding through the research councils, grants to the Carbon Trust (which works on low carbon technologies), grants to the Energy Saving Trust, and DTI capital allowances. European Commission, “Non-nuclear Energy Research: a Comparative Study”, vol. 3, 2005, http://ec.europa.eu/research/energy/pdf/synergy_vol3_en.pdf

⁷⁷ Stern Review, *ibid.* Chapter 16

⁷⁸ “We deplore the minimal amounts that the Government have committed to renewable energy related R&D (£12.2 million in 2002-03); the comparable figure for the US is \$250 million for 2004-05. If resources other than wind are to be exploited in the United Kingdom this has to change”. House of Lords, Science and Technology - Fourth Report: Renewable Energy: Practicalities (15 July 2004), para 1.16.

⁷⁹ “Mirage and Oasis: Energy Choices in an Age of Global Warming”, New Economics Foundation, 2005, <http://www.neweconomics.org/gen/uploads/sewyo355prhbgunpscr51d2w29062005080838.pdf>

⁸⁰ *ibid.*

⁸¹ *ibid.*

⁸² The Renewable Energy Manifesto, Feb 2005, [http://www.british-hydro.org/Renewable%20Energy%20Manifesto%20\(Feb%2005\).pdf](http://www.british-hydro.org/Renewable%20Energy%20Manifesto%20(Feb%2005).pdf)

⁸³ More details were provided by the Renewable Energy Association in a parliamentary memorandum, focussing on VAT treatment, enhanced capital allowances, tax breaks for investment in alternative technologies, and output subsidies. Memorandum submitted by the Renewable Energy Association to the

Parliamentary Select Committee on Environmental Audit,

<http://www.publications.parliament.uk/pa/cm200506/cmselect/cmenvaud/882/882we08.htm>

⁸⁴ Energy Institute

<http://www.schoolscience.co.uk/content/4/chemistry/petroleum/knowl/4/2/index.htm?oilcost.html>,

quoted in IEEP (2006) and DG TREN (2003), quoted in IEEP (2006).

⁸⁵ <http://www.eere.energy.gov/>

⁸⁶ Although if conservation measures are successful this need not be the case.

⁸⁷ It is likely that capital allowances and support for emerging technologies might figure more prominently in total costs in the early years, while output subsidies might be scaled down in later years.

⁸⁸ Way to Go Campaign Report, "Paying for better transport", May 2004,

http://www.foe.co.uk/resource/reports/paying_for_better_transport.pdf

⁸⁹ "A Shared Challenge: Promoting Development and Human Security in Weak States", speech by Hilary Benn to the Centre of Global Development, Washington DC, 23 June 2004.

⁹⁰ As the FCO puts it: "It has long been accepted that prevention is better than cure; that preventing conflict is more cost-effective than responding to a situation after the event."

<http://www.fco.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1007029393906>

⁹¹ Malcolm Chalmers (2004) "Spending to Save? An Analysis of the Cost Effectiveness of Conflict Prevention", Centre for International Co-operation and Security, June.

⁹² DfID website

⁹³ MoD, *Delivering Security in a Changing World: Future Capabilities*, July 2004.

⁹⁴ The army's "harmony guidelines" for troop rotation, which aim for 24-month intervals between 6-month deployments for all soldiers, are systematically violated, with tour intervals of less than 18 months being typical, and as little as 10 months in some cases.

⁹⁵ 6th Report of the Defence Select Committee, 2005-06,

<http://www.publications.parliament.uk/pa/cm200506/cmselect/cmdfence/822/82205.htm>

⁹⁶ The Sierra Leone operation did involve the use of an aircraft carrier. However it would be absurd to suppose that this type of operation would require offensive capability on the scale of the 60,000 tonnes carriers, each with 45 top-of-the-range fighter aircraft. Garden & Ramsbotham (2004) suggest an additional *Ocean*-class helicopter carrier would be suitable for this sort of mission. HMS *Ocean* cost £150m to design and build in the 1990s, or around £200m fully equipped (perhaps around £240m in 2006 prices), a fraction of the cost of the carriers. <http://navy-matters.beedall.com/ocean.htm>

⁹⁷ <http://www.fco.gov.uk/Files/kfile/ACPP%20Information%20Doc%20-%20final.pdf>

⁹⁸ This includes financial support for Disarmament, Demobilisation, Rehabilitation, and Reintegration programmes, security sector reform, judicial reform, and creating a favourable environment for investment and a free press. Emery Brusset, "Prospective Case Studies: Sudan", in Chalmers (2004) "Spending to Save", *ibid.*

⁹⁹ House of Commons Foreign Affairs Committee, *Foreign Policy Aspects of the War Against Terrorism*, HC573, June 2006, <http://www.publications.parliament.uk/pa/cm200506/cmselect/cmfaaff/573/573.pdf>.

¹⁰⁰ FCO, MoD, DTI, *Global Partnership*, 3rd Annual Report, 2005,

<http://www.fco.gov.uk/Files/kfile/Thirdannualreport.pdf>.

¹⁰¹ HC573, *ibid.*

¹⁰² Miriam Pemberton and Laurence Korb, "A Unified Security Budget for the United States, 2007",

Foreign Policy in Focus, May 3 2006, <http://www.fpif.org/fpiftxt/3253>.

¹⁰³

<http://www.mod.uk/DefenceInternet/AboutDefence/Organisation/DefenceVision/TheDefenceVision.htm>

¹⁰⁴ See Steven Schofield (2002) "The UK and Non-Offensive defence", Security Studies Network, www.peaceandprosperity.org.uk; Bjorn Moller (1992) "Common Security and Non offensive Defense" Lynne Rienner Publishers, Boulder. ISBN: [155587259X](http://www.amazon.com/dp/155587259X)

¹⁰⁵ Bjorn Moller, "Common Security and Non-Offensive Defence as Guidelines for Defence Planning and Arms Control?", *International Journal of Peace Studies*, Vol. 1 No. 2, July 1996,

http://www.gmu.edu/academic/ijps/vol1_2/Moeller.htm.

¹⁰⁶ Neoclassical models generally adopt a supply-side perspective with a focus on the trade off between 'guns and butter'. Keynesian models see military spending simply as one component of government

spending and focus on the demand side, although when used in econometric models an aggregate production function does give them a neoclassical flavour. A group of institutional economists focus on the damaging impact of the military industrial complex on the economy. Marxists views range from underconsumptionist arguments suggesting a positive impact of military spending through the prevention of realisation crises to arguments suggesting possible negative impact on the profit rate (Dunne, 1990).

¹⁰⁷ Of course there is the issue of whether policies to plan the relocation the expenditures saved by the cuts in military expenditure to other forms of government spending and investment in new civil technologies, for example to University research, would have provided even greater benefits.

¹⁰⁸ Its not clear that using RAB here is appropriate, cash spend may be a better figure to take, and would give higher percentages, but

¹⁰⁹ The fact that an inter-industry model was used made it a particularly valuable study in capturing the cross economy relations.

¹¹⁰ The net loss to the Exchequer is in contrast to the results of other studies, such as the ORG study, which suggest a net benefit from the ending of subsidies. The difference arises from a number of factors. Compared to the ORG study, for example, Chalmers et al do not count the foregone return on capital from Export Credit Guarantee support, and estimate a higher value to the Ministry of Defence in lower procurement prices resulting from arms exports. The one-off adjustment costs are not considered by other studies.

¹¹¹ Some studies suggest that this is to high an estimate, given the level of subsidies involved in exports. See for example Dunne and Perlo Freeman (2003) "*The Impact of a Responsible Arms Control Policy on the UK Economy*" Report prepared for Oxfam, for their *Control Arms* campaign. Mimeo, School of Economics, University of the West of England. <http://carecon.org.uk/Users/paul/Oxfamreport7.pdf>

¹¹² This study would, however, seem to have been ignored by the DTI in drafting their Defence Industrial Strategy document: http://www.mod.uk/industrial_policy/