

British American Security Information Council



The real cost behind
Trident Replacement
and the Carriers



by Professor Paul Dunne,
Dr Samuel Perlo-Freeman and Paul Ingram
October 2007



British American Security Information Council

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The real cost behind Trident Replacement and the Carriers

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Inside front cover photo: San Diego Aircraft Carrier Museum.

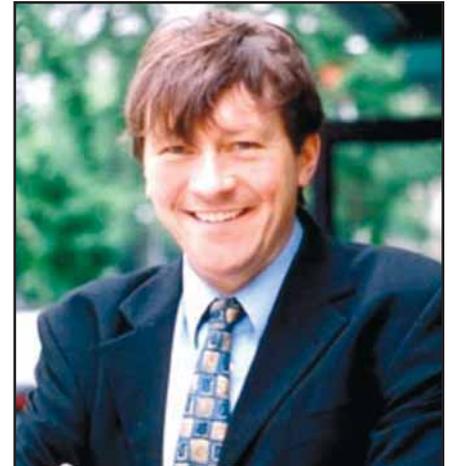
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Foreword

Dr Ian Davis, BASIC Co-Executive Director

On the face of it the decisions have already been made. The government received formal endorsement from Parliament to start the process of replacing Britain's Trident submarine fleet (the Vanguard class) on 14 March 2007. Four months later, on 25 July the Ministry of Defence released a statement that it had reached a settlement with the Treasury for its future budget, and that the CVF carrier programme now had funding to move towards the next stage in its development. The Westminster village may now have turned its gaze elsewhere, but significant questions remain that mean both projects in future years may yet be in question.



With regard to Trident, the government's White Paper, and Ministers several times during the debate, assured MPs that this decision would not bind future governments or parliaments, and that further decisions would be needed over the warhead replacement, and over the details of any replacement.

Two key factors may yet reverse the decisions. The first is that domestic or international circumstances may change. There may be a shift in public opinion strongly away from a nuclear posture, the Scottish Parliament may make operations more complex, or international momentum towards disarmament may gather pace. The government has explicitly recognised this, and has said that it would be open to a future parliament or government to change the policy. Similarly, a future government may reconsider Britain's supporting role in US global force projection; Britain's procurement choices currently emphasise long-range military platforms, including fighter aircraft, nuclear submarines and aircraft carriers for such an end.

After the failure of the invasion of Iraq to achieve long-term objectives there has been a renaissance in efforts to use 'soft power' to meet new international security challenges. A fundamental security review may point towards different investment choices.

The second factor is that the costs are likely to escalate, and a future government may be forced to quietly downgrade or drop either or both programmes under financial pressure. This report focuses on this second point, an issue referred to in the Trident debate in March, but sidelined by government assurances that the spend would not affect conventional defence capabilities.

In estimating the equivalent annual cost of the two projects, and in highlighting the opportunity costs, this report gives a flavour of the sacrifices sidestepped in the debate earlier this year. It is a companion piece to the research report that BASIC released in January this year, *Oceans of Work*.

This earlier report put the case for diverting resources away from nuclear submarine manufacture to a 'national needs' programme of civil R&D and manufacture, including major investment in off-shore renewable energy, both for security of supply and to help tackle the growing international threat for climate change.

These issues have not gone away; indeed the pressures are likely to increase as the price tag rises, Britain's Armed Forces are further stretched and the realities of climate chaos begin to bite.

Decisions on the Comprehensive Spending Review may have been settled, but with an inevitable procurement crunch expected within the next decade, the debate about the best use of security spending could yet be fierce.

A future government may be forced to quietly downgrade or drop either or both programmes under financial pressure

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USS Midway Aircraft Carrier

Executive Summary

Context

1. The British Parliament voted on 14 March 2007 to support the Government's decision to proceed with preparations to replace the existing Vanguard-class Trident submarines with a new class of submarine capable of deploying modified Trident D5 missiles. Government Ministers made it clear at the time not only that there were other decisions that could come to Parliament in future years (such as the replacement of the warheads), but that this decision may be revisited by a future Parliament prior to the submarine construction stage.
2. The Comprehensive Spending Review (CSR) is due for announcement imminently. The government has already announced on 25 July that the defence budget will be rising by 1.5% in real terms over the next three years, but the detailed budget will only be published with the CSR. This will include initial decisions over the budgets for detailed feasibility studies and development of submarine designs prior to construction. In these early years spending will be relatively low, running to several hundreds of millions a year. There will be several years, perhaps up to 2014 or beyond, when decisions to delay the timetable, or cancel the project altogether, would be possible prior to major investment being made.
3. While there was a debate earlier in 2007 over the cost of Trident replacement (government estimates were between £15bn and £20bn capital), the Government dodged any debate over the opportunity costs, claiming that conventional defence procurement would not suffer. This claim was repeated on the announcement of the defence settlement in July. There had been no prior commitment from the Treasury to increased funding for the Defence Budget to cover the costs of Trident replacement.
4. The Government is also planning to procure two new aircraft carriers, along with up to 150 F35 Joint Combat Aircraft (JCA), representing a major increase in Britain's global power projection capability. The carriers' planned in-service dates have now been put back to 2014-2016. However, as final 'Main Gate' approval is now three-four years late and still pending, even this new timetable must be considered uncertain. There are also reports that the MoD has delayed the service entry of the JCA to 2017.¹ The defence settlement announced on 25 July 2007 included money in the defence budget to cover the initial costs of construction for the carriers, so we may now see rapid progress towards Main Gate.²

...cancelling the [Trident and aircraft carrier] programmes would allow the Government to take 1.2 pence off the basic rate of income tax or pay the capital and running costs of around 200 new hospitals...

Economic Findings

5. We have estimated the total cost of Trident over the lifetime of the project to 2042 to be £78bn. Using the Treasury's Green Book recommended real discount rate for evaluating future costs and benefits of 3.5% gives a Net Present Value (NPV) for a Trident replacement programme, including acquisition and operations / maintenance costs, of £39bn in 2006 prices.
6. To get a better idea of the opportunity cost of Trident replacement, it is instructive to calculate an "equivalent annual cost" for each year of operation for the system, associated with this NPV figure; that is, how much would have to be spent each year over the service life of Trident replacement to generate the same Net Present Value? This allows us to consider what alternative spending stream could be afforded if Trident were not to be replaced. It amounts to £3.9bn a year.
7. Based on the carriers and their aircraft beginning to enter service in 2014, as planned by the government, and assuming that production expenditure peaks from around 2010, we calculate an estimated NPV for the carrier programme 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 £5bn per annum. This amounts to over 40% of the whole defence equipment budget.

	Net Present Value	Equiv. Annual Cost
Trident	£39bn	£3.9bn
Carriers	£19bn	£1.1bn
Total	£57bn	£5.0bn

8. The increases in public spending seen in recent years are now likely to be drawn in, with competition between demands on the public purse greatly increasing. Defence spending is already under considerable pressure, with talk of overstretch even by senior serving officers. There is no avoiding the conclusion that spending on Trident and the carriers is an opportunity cost, and there is likely to be heated debate over its efficacy.
9. If the plans for Trident replacement and the carriers were cut from the budget there would be no significant negative impact on the economy. Ineed, model-based studies and historical experience of defence cut-backs in the 1990s demonstrate that economic performance would be improved if military spending were allocated to other forms of government expenditure.



A child points at the USS John C. Stennis aircraft carrier

10. If the two programmes were to be cancelled the study concludes that savings of over £3.9bn 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 £5bn for every year of the joint service life of those systems means that cancelling the programmes would allow the Government to:

- Take 1.2 pence off the basic rate of income tax; or
- Pay the capital and running costs of around 200 new hospitals; or
- Pay the capital and running costs of around 1,000 new secondary schools in moderate / high cost areas, with 1,000 pupils each; or
- Pay £10-11 per week real increase in the basic state pension.



12. Also, there is clear evidence of a more general procurement crisis becoming apparent, with the long term defence equipment programme facing a serious funding gap. A recent article placed this funding gap at £11.6bn between 2011 and 2020, even before the cost of Trident is factored in.

13. Reallocating the expenditure within the defence budget away from the two 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.

Broadening Security

14. These purchases will dominate defence procurement in the forthcoming decade, represent a major escalation of the trend in the UK's post-Cold War defence posture towards offensive power projection and pre-emptive strikes alongside the US. It could lock Britain into a highly militaristic course for decades to come, and compromise on spending for genuine defence purposes, both in traditional military spend, and more importantly in preparations to tackle critical security threats in the 21st century, such as climate change.

15. Trident replacement and the carrier programme represent a backward-looking vision of security. The 1998 Strategic Defence Review was a lost opportunity to consider the UK's role in the new security environment, failing to consider real alternatives, such as "Non-Offensive Defence" and marginalising 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.

16. A comprehensive security approach would recognise the importance of human and environmental security, as complementary concepts to military security. If the government's own conflict prevention and resolution Public Service Agreement were to be taken seriously as a determining factor for defence allocations we may yet move in the right direction. This objective is promoted in the US by the Institute for Policy Studies through their annual Unified Security Budget, an exercise that the UK could build upon.³

17. Areas that could benefit from greater spending as part of a comprehensive security approach include reducing carbon emissions and oil dependency, peacekeeping and conflict prevention, overseas development aid, and nuclear non-proliferation. As an example of the type of programmes that could be funded with the money saved from Trident replacement and the carriers, we present a hypothetical annual budget for the next 25 years, consisting of:

- £500m per year to tackle 'overstretch' in the army
- £900m to fund an additional major peace support operation
- £218m to increase R&D for renewable technology to the level of nuclear energy R&D at its height
- £800m capital and fiscal support for renewable energy implementation
- £654m on measures to reduce oil dependency in transport
- £134m for a non-military conflict-prevention programme for Sudan
- £215m for a 5% increase in overseas development assistance.
- £60m increase in the Global Partnership fund for non-proliferation

1

Introduction

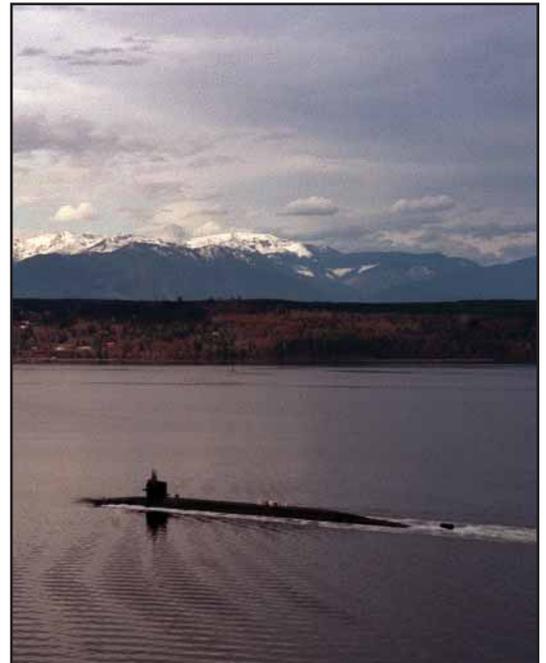
In December 2006, the Government published its White Paper, *The Future of the United Kingdom's Nuclear Deterrent* which stated its intention of procuring a replacement for Britain's Trident nuclear weapons system ("Trident replacement").⁴ A Parliamentary debate and vote on March 14, 2007, endorsed this decision.

The justification for the UK's nuclear capability was framed in terms of 'deterrence', that is maintaining the capability to enact an ultimate retaliation against an unspecified threat to the nation. While the government itself states that there is no direct military threat to Western Europe and it does not expect any short-term re-emergence of such a threat, it pointed to the uncertainty of the future, the possible emergence of such a threat, and the need for a new Trident system as an insurance policy.⁵ It was less than forthcoming in describing actual scenarios where an independent nuclear deterrent would be necessary to deter any threats to Britain that would not be deterred by the United States or NATO.

The reality is that Britain's nuclear forces are not only being extended far into the future, they are also being made increasingly 'usable'. Britain's warheads have a variable yield, said to be between 1kiloton (kt) and 100kt (the bomb that destroyed Hiroshima was 15kt). Modifications to the Trident missile outlined in the White Paper will allow a ground-burst capability (with greater potential for hitting hardened targets) and the possibility of much greater accuracy with improved design and when additional GPS guidance systems are available.

The justification for the UK's nuclear capability was framed in terms of 'deterrence'... and the need for a new Trident system as an insurance policy.

The capability enables the UK to pre-emptively and stealthily deliver overwhelming destruction within an hour of launch half way across the planet at pin-point accuracy. What is more, the UK's ambiguous nuclear doctrine allows for 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.⁶ 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 power-projection strategy is to secure our 'vital interests': preventing a new threat to Western Europe, overseas investment, overseas trade, and overseas resources - especially oil.⁷



A Trident nuclear-armed submarine heading out to sea from its base on the Clyde

Nuclear deterrence requires opponents to believe that the government is willing to seriously contemplate use of its arsenal at the critical moment. Its potency degrades over time with the non-use of those nuclear weapons - people may lose faith in the government's resolve to threaten use. This effect is countered by reducing the nuclear threshold - an action that is dangerous and ultimately destabilising (continual threshold reduction will lead sooner or later to the use of nuclear weapons).

The Government is also planning to procure two new aircraft carriers, along with up to 150 F35 Joint Combat Aircraft. 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.⁸ Such capability is unnecessary for national defence or peace support operations, being more appropriate for all-out attacks on nation states.⁹

The Trident upgrade, and the new carriers with their aircraft, will dominate defence spending in the next two decades, and represent a cornerstone in the UK's post-Cold War military posture towards assertive power projection and pre-emptive strikes alongside the US, consistent with the 2003 Defence White Paper, *Delivering Security in a Changing World*¹⁰.

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, either in the economy more generally or in addressing 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 these two procurement decisions, followed in section 3 by an estimate of the cost of Trident replacement and the carriers, using official and publicly available information. This also includes computations of the net present value of the projects.



Carriers are generally designed for all-out attacks on nation states. The direct utility of aircraft carriers in the War on Terror is questionable

In section 4 an analysis of the likely impact of cancelling the procurement is undertaken, followed by an analysis of the more general opportunity cost in section 5. The opportunity costs associated with energy, climate and peacekeeping insecurities are then addressed in section 6. A hypothetical budget that allocates the Trident replacement and carrier money to these other security areas is then presented. Finally section 7 presents some conclusions.

A word of caution is appropriate here. The figures used are based upon official estimates provided by the MoD. The lead-time for these costs, over decades rather than years, mean that there is a high risk that these costs will escalate. The record of control in public procurement, especially defence projects, is not good, despite the best efforts that have been made to control spiralling costs. This is more likely when there is a domestic monopoly supplier with particularly strong political connections, as is the case with the prime contractors in these cases. It would be courageous indeed for any politician or civil servant to attempt to guarantee that the estimated costs to the taxpayer in this report will be achieved.

The Trident upgrade, and the new carriers with their aircraft, will dominate defence spending in the next two decades, and represent a cornerstone in the UK's post-Cold War military posture towards assertive power projection and pre-emptive strikes alongside the US.

2

The defence policy context

Current UK defence policy is based on the 1998 Strategic Defence Review (SDR), 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 Defence White Paper, which continued and indeed accelerated many of the trends in the SDR. The renewal and upgrade of Trident needs to be seen in the context of an assertive and expeditionary defence posture developed under the Labour government. It goes way beyond a simple insurance policy to cover any potential future nuclear aggression against the UK homeland, the official rationale for Trident replacement. Combined with the carrier decision and other procurement plans for major weapon platforms such as the new Astute-class attack submarines and Type 45 Destroyers at sea, the Future Rapid Effects System for land warfare and Trident presents a critical back-up threat capability towards any state that might resist UK military action abroad.

While the SDR acknowledged that there was no longer a direct or potential military threat to the UK mainland or Western Europe, it nonetheless outlined a whole range of new threats, including organised crime, terrorism, drugs, regional conflict and instability, dangerous regimes (possibly with access to weapons of mass destruction) and environmental degradation, which could require a proactive military response. New technology could create potential new vulnerabilities; future threats were likely to be 'asymmetric' in nature. The UK's vital interests continued to focus on peace and stability in Europe, but 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 renewal and upgrade of Trident needs to be seen in the context of an assertive and expeditionary defence posture developed under the Labour government.

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 world.¹¹

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 strategic threat, possible future threats necessitated the retention of the nuclear deterrent, though with fewer missiles and warheads than originally planned when Trident was ordered. The possibility of this changing through arms control negotiations was not dismissed, but unilateral nuclear disarmament was.

The SDR also foresaw a desire 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.¹² No conflict involving war fighting or simultaneous deployment was considered likely to last more than six months.¹³ While an increase in Britain's regular armed forces was not seen as necessary, changes in structure were anticipated, in order to improve flexibility and readiness for deployment. This was expected to comprise:

- a restructured and trained army able to sustain deployed operations;
- reoriented naval forces undertaking rapid deployment operations, with amphibious forces assisting the Rapid Reaction Forces; and
- new equipment, with larger aircraft carriers needed for deterrence and coercion.¹⁴

New investment was expected, but would be combined with savings through rationalisation, increases in efficiency, smart procurement and cuts in cold war related programmes.¹⁵

The awareness of the strategic environment changed abruptly with the terrorist attack on the World Trade Centre on the 11 September 2001 (9/11), and a 'New Chapter' was produced for the SDR in July 2002.¹⁶ The use of terrorism for strategic effect was seen as novel. The move towards expeditionary operations was to be strengthened 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 operations.¹⁷ 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 terrorist groups may be small, dispersed, hard to locate, monitor and target (for example, sometimes hiding in mountainous terrain and on other occasions intermingled with civilians) and use asymmetric techniques, Network-Enabled Capability (NEC) was seen as vital.¹⁸ Similarly, speed and precision were considered crucial, as were the integration of new technologies, such as unmanned aerial vehicles (UAVs), the BOWMAN communications system, a Future Rapid Effects System on land and faster and more adaptable ships. This was all considered to require clearer command and control structures, with rapid reaction forces for emergencies, and air defence and maritime integrity.¹⁹

The 2003 Defence White Paper 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. Large scale operations - against state adversaries - would only be undertaken as part of a US-led coalition. Thus, interoperability with US forces, 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. 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 2003.²⁰ This capability is largely if not entirely irrelevant for combating terrorist groups, or for contributing to peace support operations. Rather, it is more suited to large-scale 'shock and awe' operations against nation states, on the scale of the invasion of Iraq or greater.

Programmes such as the Future Rapid Effects System (FRES), a 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 systems²¹ 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.



HMS Invincible, one of Britain's current fleet of three much smaller aircraft carriers to the the new CVF.



*USS Midway
Aircraft Carrier,
now a museum in
San Diego, USA.*

Clearly, the process of the SDR, the New Chapter and the 2003 Defence White Paper represent a comprehensive reconsideration of UK security policy. 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 now a massive rearmament programme is being planned. The UK failed to consider the possibility of non offensive defence or the transformation of NATO, an organisation developed for the Cold War and still largely wedded to an outdated 1999 Strategic Concept.²² This review process also left untouched a continuing commitment to nuclear weapons and so to a Trident replacement, which when combined with the aircraft carrier programme and other offensive weapons acquisitions, represents an unquestioning emphasis on power-projection capability, including long-range offensive air capability.²³

The UK defence posture can be summed up as having the capability to mount full-scale military interventions alongside the United States, against nations considered a threat against vital interests. It continues the alignment of UK foreign policy with US interests. As the late Air Marshal Garden and General Ramsbotham argued, the UK can only ever provide a small contingent as part of a US-led operation, and this concentration on high-intensity war-fighting, and dedication to supporting the United States comes at the expense of UK forces' ability to carry out other, arguably more desirable missions, including conflict prevention and post-conflict reconstruction.²⁴

The Trident replacement and carrier programme represents not only a backward-looking vision of security based on military power, but one based on offensive rather than defensive use of that power.

At the same time the House of Commons Defence Committee has been expressing concern about “overstretch” of British forces in the wake of the Iraq invasion.²⁵ 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. When concurrent deployments are undertaken there is a shortfall. The Committee has also criticised MoD for failing to invest rapidly in new technologies, and questioned whether increased equipment expenditures would merely make good previous budget shortfalls. The UK defence posture, and its equipment budget, is already highly ambitious given the constraints of the defence budget, even without the additional burden brought on by Trident and the carriers.

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 offensive rather than defensive use of that 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, and contributions towards common security through peace-keeping and peace enforcement operations in conjunction with other like-minded countries, under the auspices of the UN or the EU. Subsequent developments have taken this even further, and represent a dangerous resurgence of militarism. While this comes as no surprise, it represents a dangerous lost opportunity for Britain to ditch the last vestiges of imperial ambition and lead Europe from five decades of division and Cold War stalemate into a new cooperative security regime.

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.

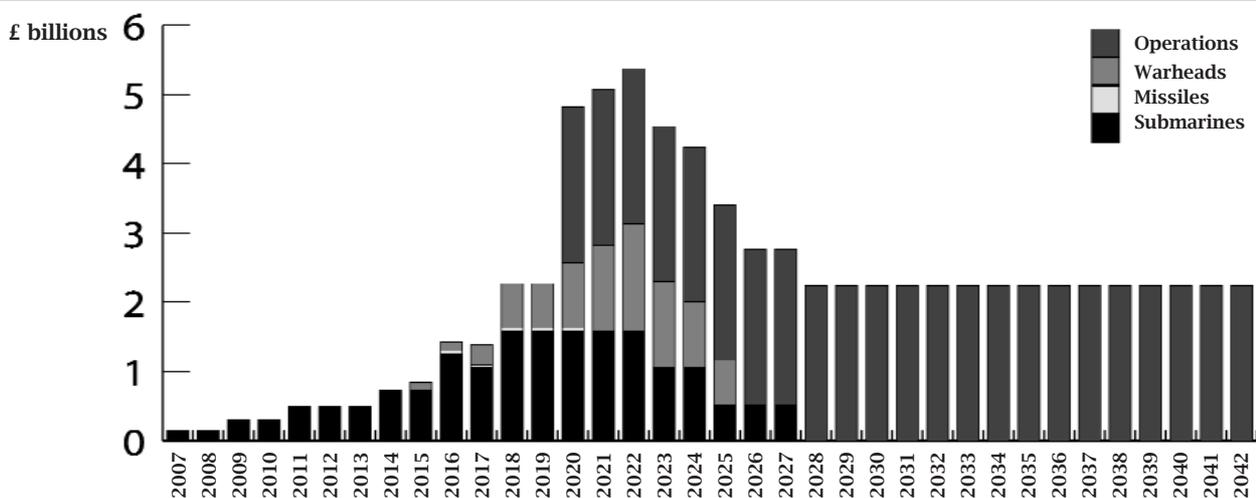
Costs of Trident

The Government's White Paper on Trident replacement envisages a new generation of SSBN ballistic nuclear submarines replacing the Vanguard-class submarines carrying upgraded Trident II D5 missiles. These will probably be armed with a new generation of warhead produced by the Atomic Weapons Establishment (AWE) at Aldermaston. As expected, the submarine replacement option was preferred over alternative land, air or surface vessel-based systems (too vulnerable), a wholly independent system (far more expensive), or submarine-based cruise missiles (less capable). An SSBN-based system makes it easier to make cost projections based on historical examples.

The replacement to Trident will consist of three elements: submarines, warheads, and missiles. The government has decided to design a new class of submarine, to deploy the Trident D5 missile. AWE is confident that it can keep the current warhead design (based on the US W76) going until at least the mid to late 2020s with relatively minor upgrades.

After that, a new warhead may be needed fairly early on in the life of the new boats; a decision on this is likely in around ten years and so will almost certainly affect 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 will participate in this, at an additional cost of some £250m.²⁷ The SLEP will extend the life of Trident missiles to 2042, when the last US Ohio-class ballistic missile submarine is due to leave service.²⁸ By then the United States will have replaced the Ohio-class submarines and the D5 missiles with entirely new systems, plans for which are as yet unknown. In an exchange of letters in early December 2006 the US President gave to Tony Blair an assurance that the replacement missile would be compatible with the D5 Trident missile. However, it would be heroic in the extreme for a British government to rely upon such an assurance constraining the choices of a future President several offices down the line. Britain may end up needing to replace the Trident replacement, and have it fully operational soon after 2042, in order to deploy the new US missiles. Money spent on Trident replacement may therefore only purchase 23 years of capability (some of those early and later years operating in tandem with other systems). Research and later production of any further replacement may have to begin as early as 2025.

Spending Profile for Trident Replacement 2007 - 2042



Capital Costs: £26bn

The original complete Trident system (excluding the missiles) cost roughly £13bn in today's prices.²⁹ The Government's White Paper estimated the procurement costs of Trident replacement at £15-20bn, little more than the original system, adjusted for general inflation. This is a highly provisional figure with little detail given, and is likely to be a significant underestimate.³⁰ Defence economists estimate military inflation for new technology to run on average at 10% per year.³¹ The continuing tendency for cost overruns in major public projects, especially defence projects (Astute-class submarine an obvious example),³² are not encouraging.

Alternatively, a rule of thumb based on past experience with similar generational replacements would suggest that new weapons systems tend to cost around twice as much as their predecessors.³³ For example, the acquisition cost to the United States 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.³⁴ The US 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 years.³⁵ Double the Vanguard-class would give a cost of £26bn in 2006 prices, including the cost of an eventual replacement for the warheads, but not including the missiles.



*A computer model of the planned aircraft carriers
Graphic: UK Ministry of Defence*

Running Costs: £2.24bn/year, £53bn over 23 years

On top of the acquisition costs there are also the operational and maintenance costs, which the 2006 White Paper estimates at up to 6% of the current Defence budget or £1.8 billion per year.³⁶ This is a considerable increase on previous public figures for Trident itself, due to a recent comprehensive review of the costs, and increased spending at AWE. 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 incidental costs (£60m, including an allowance for major refits over the 30-year life span), giving £440m per year in 2006 prices.³⁷ 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.

Total costs: £78bn

NPV: £39bn EAC: £3.9bn

Over 23 years, this gives a total cost (for procurement and operations) of £77.8bn, which is indeed close to estimates produced by other recent studies, though over a shorter period. To get the Net Present Value (NPV) 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 2.³⁸

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 five 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 2020s.³⁹ Using the Treasury's recommended real discount rate for evaluating future costs and benefits of 3.5% gives a NPV for a Trident replacement programme, including acquisition and operations/maintenance costs, of roughly £39bn in 2006 prices, with 2006 also the base year for the NPV calculation.⁴⁰

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. The NPV over 22 years gives an Equivalent Annual Cost (EAC) of around £3.9bn per year, which is over thirteen percent of the defence budget.

Cost of the Aircraft Carriers and Fighters

The UK is also 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 Strike Fighter (JSF) also known in the UK as the Joint Combat Aircraft (JCA). In total, up to 150 aircraft are to be procured to operate from sea and land bases.⁴¹ 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 Gate approval for the carriers was given in December 1998,⁴² with Main Gate approval originally intended for 2003-04, but the Assessment Phase was extended in 2004.⁴³ The Government's announcement in the House of Commons on July 25th 2007 confirming the allocation of money for the carriers was followed by a statement from the MoD that Main Gate had now been ‘agreed’, though the carriers were still in the Assessment Phase (expected to complete in October 2007).⁴⁴ Originally, the Assessment Phase was forecast to cost £118m, but this figure has increased to £300m.⁴⁵ The intended in-service dates for the carriers were originally 2012 and 2015, but this has now been put back to 2014 and 2016.⁴⁶

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.

BAE Systems, along with Rolls Royce, is also participating in the development and manufacture of the JCA. The UK's role in the current Development and Demonstration phase has already received 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.⁴⁷ The JCA was initially intended to enter service in 2012, but this has now slipped to 2014. The third component of the Carrier Strike Capability, the MASC is also running late, reaching Initial Gate in 2005, with best guess for in service of 2015-2018.⁴⁸

The total life-cycle costs of the three ‘core projects’ was forecast by the MOD to be £31bn, of which £12bn is procurement costs.⁴⁹ As the procurement cost for the carriers has now increased from £3bn to £3.8bn, we will use a figure of £32bn. Given the increase in costs already and the continuing tendency for cost overruns in the MOD, especially for such large-scale projects, however, it would not be at all surprising if the final figure were considerably higher.

In January 2003 Procurement Minister Lord Bach estimated the additional life-time cost of the carriers as £6.4bn, though it is unclear how this figure was arrived at, and difficult to know how to comment upon its voracity.⁵⁰

For the aircraft, estimates suggest an acquisition cost at £7-10bn, depending on the number procured.⁵¹ The Maritime Airborne Surveillance and Control Programme was initially expected to cost £700m-£1bn.⁵²

Using the £32bn figure, and 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 £18.4bn, and an Equivalent Annual Cost of around £1.1bn.

Combining this with the cost of Trident gives a total NPV for these two projects, the core of Britain's force projection capabilities, of £58bn and an equivalent annual cost of around £5bn per annum.

4

Disarmament and conversion: the opportunity

Economic costs of disarmament

During the Cold War there was considerable but largely inconclusive debate over the economic impact of military spending. It appeared that increased military expenditure could have a negative effect on growth, through its impact on investment. Reductions in military spending could produce a peace dividend if the expenditures were reallocated to other forms of expenditure.⁵³ The significant variation in global military spending throughout the 1990s (a fall) and since 2000 (a rise to approach Cold War peak) has not appeared to have had any noticeable impact on the global economy.

To consider this further some model based studies are reported in Appendix 2, which also deals with the dynamics of the changes and the possibility of reallocating the defence savings to other government spending. These suggest that with military spending allocated to other forms of government expenditure it is likely that economic performance would be improved.

To get some idea of the likely impact from cancelling the two programmes it is useful to consider future scenarios. Using the Treasury's forecast for GDP and the GDP deflator,⁵⁴ from 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 three 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:

- Annual cost of the aircraft carriers in today's prices is £1.1bn (see EAC calculation in previous section) - cancellation would enable 4% of the defence budget to be reallocated each year.⁵⁵
- Annual cost of Trident replacement in today's prices is £3.9bn - cancellation would enable 13% of the defence budget to be annually reallocated each year after 2010.⁵⁶

If this reallocation happens outside the defence budget, we get the results in the graph on the left. This charts as a baseline scenario a relatively high rate of growth in defence spending, such as would be needed to accommodate a Trident replacement and the carriers along with some other programmes (though even with this increase there are likely to be forced cuts to current procurement plans, see next section).

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 not far below its mid 1980s Cold War peak. Notice the sustained decline in defence spending after the Cold War was of a much greater scale than any possible impacts from the cancellation of the Trident replacement.

Defence spending scenarios



Using the total annual savings figure from cancelling both projects of £5bn we can estimate the opportunity cost. Firstly, 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 1.2p off the basic rate of income tax;⁵⁷ or
- Pay the capital and running costs of around 200 new hospitals;⁵⁸ or
- Pay the capital and running costs of around 1,000 new secondary schools in moderate / high cost areas, with 1,000 pupils each;⁵⁹ or
- Pay £10.50 per week real increase in the basic state pension.⁶⁰

The studies reviewed in Appendix 2 have suggested that reallocating expenditure from the defence budget to civil areas, such as health and education as suggested above, would have a net positive effect on the economy. They have higher multiplier effects, direct benefits to increasing capacity in the economy (education leads to higher skilled workforce, health spending to a healthier workforce) and higher employment (the defence industry has a high capital intensity, particularly 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 regional investment programmes using some of the saved expenditure.⁶¹

Within the defence budget itself there is clear evidence of a more general procurement crisis. The major rearmament programme planned for 2011-2020 includes the carriers and the JCA, future tranches of 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.⁶²

This shortfall arises even without considering the cost of Trident replacement. But the Trident replacement and carrier programmes dwarf the other major procurement projects apart from The Eurofighter Typhoon.⁶³ This means that a commitment to the programmes is likely to introduce some very hard choices for the Government. If the commitment to a nuclear deterrent is maintained beyond the Initial Gate decision expected in 2009, for example, it is likely that acquisitions of conventional platforms will have to be scaled-back. 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, or around 133% of money spent on the *Building for the Future* objective (including R&D and new equipment).

Total Military R&D Expenditure in 2003-2004 was £2.74bn, so Trident replacement alone would consume over 150% of this amount.⁶⁴ 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. If from a separate budget, as the government has suggested, then this means either a diversion of resources from social and other productive expenditure, or an additional call on the taxpayer.

Cancelling the programmes would allow the Government to:

- *take 1.2p off the basic rate of tax, or*
- *pay capital and running costs of 200 new hospitals, or*
- *pay capital and running costs of 1000 large new secondary schools, or*
- *pay £10.50 per week real increase in the state pension*

6

Real security: Responding to energy, climate and peacekeeping

Some of the greatest security challenges facing the UK are those of climate change, the related problem of energy security and the problems caused by weak and failing states. Terrorism, organised crime and narcotics flows, and the spread of sensitive WMD technologies are closely linked to these challenges and are likely to be exacerbated by them if not addressed. This has been acknowledged by government ministers, but resources currently devoted to finding solutions are currently very limited, as can be seen from some of the examples below. A genuine comprehensive or cooperative security strategy would prioritise spending in these areas.⁶⁵

Oil, energy and climate change

Global warming will increase flooding and coastal erosion, quite literally threatening the “territorial integrity” of the United Kingdom. Abroad, climate change is increasing 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.

The British government has long recognised tackling climate change as one of the fundamental problems facing both the UK and humanity in general.⁶⁶ 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.⁶⁷

One specific area of under-funding is renewable energy-related R&D. Spending in 2002-03 was only £12.2m, a figure criticised in 2004 as inadequate by the House of Lords.

A related security issue is Britain's increasing level of dependency on oil imports. North Sea oil production has peaked in 2000, and the UK will become a net importer of oil well before 2020 when Trident replacement is set to come into service.⁶⁸ With inevitably rising oil prices this will not only be an economic burden, but also a strategic one reflecting an increasing dependence on a highly unstable Middle East region.⁶⁹

In 2002-03 the UK government spent no more than around £200m on carbon reduction technologies.⁷⁰ This compares very unfavourably with other major economies such as France, Germany, Japan and the United States. Statements by ministers repeatedly underline the devastating consequences that could follow from unchecked climate change, and the government has a long-term target of reducing carbon emissions by 60% by 2050. The UK 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.⁷¹

One specific area of under-funding is renewable energy-related R&D. Spending in 2002-03 was only £12.2m, a figure criticised in 2004 as inadequate by the House of Lords.⁷² The New Economics Foundation recommended raising this figure to at least the level of peak nuclear energy R&D (£164m in 1989-90).⁷³ In today's prices this would be roughly £230m, and so would mean increasing renewables R&D by a factor of ten to 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.⁷⁴

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.⁷⁵ This could include the target to produce 25% of the UK's energy needs from renewables by 2025, and 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.⁷⁶

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.⁷⁷ Suggested policies include investment in R&D and the development of laws, tax incentives and penalties to encourage greater fuel efficiency in vehicles, the use of alternative fuels and more fuel-efficient modes of transport, and changes to driving habits. Some of these policies would involve costs, but others could be fiscally neutral, and ultimately reductions in oil demand would present major savings for the UK economy.⁷⁸

Most of these schemes have not been costed for the UK. The Stern Review recommends that global deployment support should rise by a factor of 2-5 times, from its current level of \$34bn. A US output-subsidy scheme for renewable energy gives some idea of the likely cost of such policies.⁷⁹ The US 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 increase.⁸⁰ If the renewables share reaches 10% by 2010, the annual cost would then be roughly £460m, and if 20% by 2020 the cost would be £1.1bn.⁸¹ Other measures could include subsidies for capital schemes, especially in the early years, to boost renewable capacity.

£800m annual spend 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.



Flooded pub 'overlooking' the River Severn

The area of transport policy is one which is highly relevant both towards tackling climate change and reducing the UK's oil dependence. 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.⁸² The following transport measures could be funded for around £655m per year:⁸³

- 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).



Women collect firewood in a drought-stricken region of India. Photo: International Federation of Red Cross and Red Crescent Societies (IFRC).

Peacekeeping and peace making

The British government has for some years been aware of the importance of weak and failing states for the security of western countries.⁸⁴ They can become havens for terrorism and organised crime, create spill-over effects into neighbours, weaken effective global governance (where in many cases success depends on the 'weakest link'), and threaten 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 state collapse rather than seeking to deal with the consequences.⁸⁵

A recent study led by Malcolm Chalmers⁸⁶ at the University of Bradford considers a range of conflict-prevention packages - from diplomatic support to robust peace-enforcement missions - and compares 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 the conflict prevention packages. In all the cases considered (Afghanistan, Rwanda and Former Yugoslavia retrospectively, 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. So it is clearly 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 increased resources to conflict prevention perhaps at the expense of some resources currently earmarked for war-fighting.

*A robust long-term
peacekeeping mission with
5-15,000 troops... would have
reduced the probably of renewed
conflict [in Darfur] by 65% at a
cost of \$300-600m per year.*

Conflict prevention measures can be both military and non-military. The military measures tackle the immediate threats of conflict. 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. 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.⁸⁷

The main contribution the UK makes to this is through its international development budget, which has been rising, with the objective of reaching the UN target of 0.7% GDP by 2013 (in 2006 it had reached £4.3bn, around 0.36% GDP).⁸⁸ A step-rise of 5% per annum would cost £215m per year and would enable the UN target to be reached 1-2 years earlier. It goes without saying that it is more than just the bottom-line that determines the effectiveness of this spending, but extra money, spent wisely, could reap significant dividends.

One of the case-studies for the Chalmers study looked at a possible package for Sudan.⁸⁹ They predicted before the outbreak of the Darfur conflict that the peace deal was shaky and highly likely to revert to conflict without strong support from the international community. They considered a robust long-term peacekeeping mission with 5-15,000 troops (depending on the progress of events). They estimate that such an operation would have reduced the probability of renewed conflict by 65%, at a cost of \$300-600m per year (around £170-340m). Maintaining an overseas operation requires backup forces 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 cost of £900m per year.⁹⁰

Given the UK's ongoing commitments in Iraq and Afghanistan, it is widely recognised that the army is experiencing 'overstretch'.⁹¹ Shortages are particularly acute amongst certain "key enablers" such as medics, logistic specialists, and engineers.⁹² Key equipment shortages, in body armour, desert boots and airlift in particular, have received media coverage.

Expansion in conflict prevention activities would demand greater investment in such key enablers and basic equipment, that are called upon in all operations. It would also require some out of area capability, including amphibious capability.⁹³ £500m per year would go some way to tackling some of these shortfalls.

The UK has two interdepartmental Conflict Prevention Pools (CPPs), funding activities that include:

- 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.⁹⁴

In 2004-05, the Africa CPP received £60m of annual funding, and the Global CPP received £74m. An example of the type of effort that could be funded is the more limited, non-military conflict prevention package proposed by the Chalmers study for Sudan, which they estimated would have reduced the probability of renewed conflict by 50%, and would cost \$141m a year (2004 prices), or around £80m in 2006 prices.⁹⁵

A doubling of the total CPP budget, at a cost of £134m per year could make a very positive initial impact on conflict and instability worldwide.

Cooperative Threat Reduction

Preventing the spread of nuclear, chemical and biological weapons material worldwide is universally recognised as a global and urgent matter. One of the most important aspects of this is the Cooperative Threat Reduction programme involving the US, Russia and other developed 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 Global Partnership against the Spread of Weapons and Materials of Mass Destruction at or soon after the G8 summit in Kanansakis, Canada, in 2002, pledging to spend \$20bn between them over 10 years.⁹⁶

The Global Partnership is critical to global security, but the UK's \$750m commitment, whilst valuable, is less than Germany's or Italy's, and makes up less than 4% of the total \$20bn commitment.⁹⁷ There are also fears that even if the full \$20bn were spent there would still be significant shortfalls. In June 2006 the House of Commons Foreign Affairs Committee expressed concern at the slow progress in disposal of chemical and biological materials, and in a general danger of a loss of momentum.⁹⁸ At present, the UK's annual contribution is just £30m-£40m per year. Raising this sum by £60m would put the UK on a par with Germany as the largest contributor after the United States and Russia, and would go some way towards restoring essential momentum to the whole project. It would make the UK a leader in counter-proliferation, as opposed to a leader in proliferation as Trident replacement will be seen around the world.

BASIC will be publishing a more detailed examination of these issues and the need for further investment later this month.

A 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 US 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.⁹⁹ The UK government would greatly benefit from conducting a similar exercise. The table below presents an illustrative package of policies that could be undertaken in place of Trident replacement and the carrier programme.

As the proposed areas of spending are annual sums, they are compared to the equivalent annual cost of both programmes combined over their future service periods calculated at £5bn for the duration of their life. However, this assumes that the alternative £5bn 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 need resources devoted to them now. Therefore, we consider instead what alternative spending could be supported over the next 25 years, starting in 2007.

We calculate a figure of £3.5bn as the annual equivalent cost of the programmes treated as if the programmes started today. 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.

In sum, the savings from the Trident replacement and CVF programmes 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. These measures would make a strong positive contribution to UK and global security, and help move towards the government's stated objective of acting as a 'force for good'.¹⁰⁰ They 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 where combined with moves towards Non Offensive Defence structures, this reallocation could be combined with decreased military budgets and increased security.

Hypothetical budget

Total Net Present Value of cost of the programmes	£57bn
Equivalent annual spend over next 25 years	£3.5bn

Military spending

Tackling 'overstretch' in the army	£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
5% increase in ODA	£215m
Increase in Global Partnership contribution	£60m
Subtotal for broader security spending	£2,081m
Total	£3,481m

This report has considered the issues and costs involved in the UK's decision to upgrade its Trident nuclear weapons programme and to procure two new aircraft carriers. The programmes represent a vision of security based on the offensive use of military power. The 1998 Strategic Defence Review which underpins current government defence policy, a conservative stance that failed to consider real alternatives, such as non-offensive defence,¹⁰¹ combined with contributions towards common security through peace-keeping and peace enforcement operations. 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 £5bn per annum. Cutting the two programmes and reducing the defence budget need not create economic problems; localised issues could be dealt with by regional assistance. 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.



Vesta's wind-turbine factory in Campbeltown, Scotland, is a good example of responsible investment helping local and international efforts for a peaceful and sustainable future. September 2004
© Greenpeace / Kate Davison

Aside from the usual reallocations of government spending to the general categories used in the UK national accounts, this 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:

- 1.2p off the basic rate of income tax; or
- the capital and running costs of around 200 new hospitals; or
- the capital and running costs of around 1,000 new secondary schools in moderate / high cost areas, with 1,000 pupils each; or
- a real increase in the basic state pension of £10.50 per week.

However, there is a pressing need to deal with broader threats, particularly to environmental and energy security. This demands much greater support to research on renewable energy sources for example, an initiative that 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. Allocating funds to development assistance initiatives and to conflict prevention activities would be an important contributor to improved international security and welfare.

If these types of measures were combined with moves towards non-offensive defence,¹⁰² 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.

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Appendix 1:

Net Present Value and Equivalent Annual Cost

Net Present Value (NPV) calculations are based on the principle of ‘discounting’ future costs and benefits. This can also be measured by the real interest rates that may be earned or must be paid on money borrowed to pay for investment. The Treasury Green Book recommends using a figure of 3.5% per year real 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 plus inflation in one year’s time, or £107.12 plus inflation in two years time (due to compounding). 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% real 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 real expenditure, over the service-life of the project, that gives the same NPV as the project itself 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% real interest (which we know is just enough to 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.

Notes to the table on next page:

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.

Net Present Value calculation for Trident Replacement

PDV = Present Discounted Value - the current value in 2006 of the spending in that year.

All costs are in constant 2006 £bn

Year	Event	Year	Subs & other stuff	Missiles	Warheads	Operations /maintain	Total	PDV
2007		1	0.15				0.15	0.144928
2008		2	0.15				0.15	0.140027
2009		3	0.3				0.3	0.270583
2010		4	0.3				0.3	0.261433
2011		5	0.5				0.5	0.420987
2012		6	0.5				0.5	0.40675
2013		7	0.5				0.5	0.392995
2014		8	0.725				0.725	0.550573
2015		9	0.725		0.12		0.845	0.620003
2016		10	1.25	0.05	0.12		1.42	1.006665
2017		11	1.05	0.05	0.28		1.38	0.945225
2018		12	1.575	0.05	0.64		2.265	1.498939
2019	Upgraded Missiles	13	1.575	0.05	0.64		2.265	1.44825
2020	1st sub in service	14	1.575	0.05	0.95	2.24	4.815	2.974619
2021		15	1.575		1.25	2.24	5.065	3.023251
2022	2nd sub in service	16	1.575		1.56	2.24	5.375	3.099794
2023		17	1.05		1.25	2.24	4.54	2.529705
2024	3rd sub in service	18	1.05		0.95	2.24	4.24	2.282651
2025	New warheads	19	0.525		0.64	2.24	3.405	1.77113
2026	4th sub in service	20	0.525			2.24	2.765	1.389595
2027		21	0.525			2.24	2.765	1.342604
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
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		36				2.24	2.24	0.649225
							NPV	39.04795
							EAC	3.909582

Appendix 2:

Determining the economic effects of cancellation

There is a heated theoretical discussion around the impacts of reduced military expenditure on a country's economy.¹⁰³ Statistical analyses have generally been based upon the Keynesian or neoclassical approaches. 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.¹⁰⁴

Military spending and production can influence the economy in a variety of ways. It can take skilled labour away from civil production, but can enhance training of the workforce. It can take the best capital equipment, but can have positive spin-offs. It can lead to damaging wars, but may maintain peace and lead to economic benefit from trade with more prosperous allies. It can stimulate demand, but may create bottlenecks in a constrained economy. It may slow down development by fostering a militaristic ideology, but nationalist attitudes may increase output, and the military force and ideology may be used to control the workforce.

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. In addition, macroeconometric models have been used to simulate the likely impact of changes in military spending at country and international level.¹⁰⁵ This empirical work has shown a clear negative impact from increased defence spending on economic growth in developed economies, largely from the crowding out of investment.

We review now some empirical studies on the economic effects of changes to military spending using models of the economy. Barker, Dunne and Smith used the Cambridge Growth Project inter-industry model of the UK economy to investigate the impact of a 50% cut in military spending over eight years (8-9% per annum), a similar order to savings from the cancellation we are considering. Though a little outdated, it still provides a useful benchmark for economy-wide consequences.¹⁰⁶

We estimate the annual cost of Trident replacement around £4.2bn per year, equivalent of 13.7% of the current defence cash budget.¹⁰⁷ 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.

The economic impacts of removing spend on Trident replacement

% changes	Compensated		Uncompensated	
	Year 1 Barker	Year 1 Trident	Year 1 Barker	Year 1 Trident
Decrease millex	-9.00	-13.00	-9.00	-13.00
Consumer expen	-0.22	-0.32	-0.31	-0.45
Govt Cons	-0.21	-0.31	-1.87	-2.70
Invest	+0.25	+0.36	-0.30	-0.43
Exports	-0.02	-0.03	-0.01	-0.01
Imports	+0.09	+0.13	-0.50	-0.72
GDP	+0.10	+0.15	-0.45	-0.65
B/P	-0.04	-0.06	+0.16	+0.23
PSBR	-0.08	-0.11	-0.16	-0.23
Unemployment	-0.05	-0.07	-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.

Barker *et al* find that a continuous reduction in defence spending, and a reallocation to other government expenditure leads to a net increase of 400,000 jobs, and a net increase of almost 2% of GDP. Bai *et al* consider instead a resulting cut in overall government spending, lowered interest rates in response to lower inflation, or lowering taxes in response to lower public borrowing. Their results are consistent.¹⁰⁸

Cancelling the replacement of Trident and the carriers is likely to have a smaller impact on employment and the arms trade, as the number of personnel involved is relatively small, and are high-skilled - so that their transfer to the civil sector could have significant benefits. Defence production today has more import content than it had when the original project was published. Thus the older study is likely to overestimate the impact of cuts.

In a more recent study Chalmers *et al* considered the economic costs and benefits of UK defence exports and provided estimates of the economic impact of a 50% reduction of exports. This report was authored by two Ministry of Defence economists and two academics. It 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 possible terms of trade effects increases this to between £2bn and £2.5bn (the authors were divided on whether such terms of trade effects applied), the bulk of which falls in the first couple of years.¹⁰⁹

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.

The results provide a useful benchmark. 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 (the UK does not export nuclear submarines).

Based on the Chalmers *et al* results we can envisage results of the nature of those in the table below.

There is an initial cut in employment, but eventually new jobs are created in the economy that more than compensate, because jobs in the civil economy are generally far less capital intensive. These effects will start when the cuts in defence spending kick in. To provide some context, Chalmers *et al* 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, qualified scientists and engineers would divert to other parts of the economy. If anything, the effect is likely to be positive.¹¹⁰

Overall, these results suggest that the economic costs of reducing spending on Trident are likely to be relatively small and largely one off.¹¹¹ As Chalmers *et al* conclude for defence export reductions, the balance of arguments should be based on non-economic considerations.¹¹² Having said this, the cost to the Exchequer is real and substantial.

Summary of economic effects

Scenario	Cut in exports	Annual cost to govt. (Chalmers)	Adjustment cost	Initial job loss	Eventual new jobs
Chalmers <i>et. al.</i>	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

Note: 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.

Endnotes

- 1 Aviation Week & Space Technology, 11 June 2007
- 2 MoD Defence News Release, 'New Carriers confirmed in Defence Budget increase', 25 July 2007.
- 3 A Unified Security Budget for the United States, FY 2008, April 2007, available at: <http://www.ips-dc.org/reports/070426-unifiedsecuritybudget.pdf>
- 4 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.
- 5 "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
- 6 Paul Rogers, "Big Boats and Bigger Skimmers: Determining Britain's Role in the Long War", International Affairs, 82, 4, 2006, pp651-665.
- 7 UK MoD, Strategic Defence Review, 1998..
- 8 Paul Rogers, op. cit, (2006); and House of Commons Defence Select Committee, "Future Carrier and Joint Combat Aircraft Programmes", Second Report of Session 2005-06, HC554, 13 December 2005.
- 9 MoD, Delivering Security in a Changing World, Defence White Paper, December 2003.
- 10 Ibid.
- 11 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.
- 12 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.
- 13 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.
- 14 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.
- 15 Smart Procurement (now Smart Acquisition). This policy was introduced in 1998 as part of the SDR. 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/policen/idrm/papers/2003-2_e.html
- 16 Strategic Defence Review, as above; MoD, "Strategic Defence Review: A New Chapter", HMSO, July 2002.
- 17 Find-and-strike operations require 'high-intensity integrated war-fighting capacity', with rapid intelligence and decision-making capability.
- 18 Network-Enabled Capabilities refers to networked systems of advanced surveillance technology, speedy (real-time) communications and decision-making, and precision weapons to take advantage of 'fleeting opportunities' and reduce collateral damage.
- 19 Terrorist threats also brought Home Defence back into the frame, with new roles for military reserves.
- 20 <http://en.wikipedia.org/wiki/CVF>
- 21 Computers, Command, Control, Communications, Intelligence, Surveillance, Target Acquisition and Reconnaissance
- 22 Steven Schofield provides a useful discussion of this and suggests possible NOD structures for the UK. See Steven Schofield, "The UK and Non-Offensive defence", Security Studies Network, 2002, www.peaceandprosperity.org.uk. We discuss NOD in more detail below.
- 23 In 2004, former Defence Minister Geoff Hoon described the proposed carriers as the "largest and most powerful warships ever constructed in the United Kingdom". Hansard, 19 July 2004.
- 24 Tim 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."
- 25 House of Commons Defence Committee, "A New Chapter to the Strategic defence Review", Sixth Report of Session 2002-2003, HMSO, 15 May 2003.
- 26 House of Commons, *ibid*.
- 27 MoD Defence White Paper, "The Future of the United Kingdom's Nuclear Deterrent", Cm6994, December 2006.
- 28 House of Commons, Op. Cit (May 2003)..
- 29 House of Commons Hansard, 18 January 2005, col. 29 estimated Trident to have cost £15bn in today's prices, and an estimated 13% of the total cost of the Trident programme was due to the purchase of the missiles, or around £2bn in 2006 prices, House of Commons Papers 399 and Statement on the Defence Estimates 1986, HMSO.
- 30 In January 2005, Defence Procurement Minister Lord Bach gave the acquisition current cost as £14.893 billion, 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 2005-06 and to suggest that £15bn is a reasonable estimate of the cost of the system in 2006 prices.
- 31 Hartley, K. and T. Sandler, The economics of defense, Cambridge University Press, Cambridge, 1995.
- 32 National Audit Office, Major Projects Report 2005.
- 33 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 by Mary Kaldor, "The Baroque Arsenal" 1982., and by David Kirkpatrick, "Trends in the Costs of Weapons Systems and the Consequences", Defence and Peace Economics, 2004, vol. 15, issue 3, pages 259-273.
- 34 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>
- 35 <http://www.fas.org/man/dod-101/sys/ship/nssn.htm>
- 36 Cm6994, p27. The annual defence budget (net cash requirement) is around £30bn.
- 37 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 excessive.

- 38 Following the order of Trident in 1982 significant, though diminishing, sums were paid by the UK for the acquisition until at least 1997 (Hansard 4 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).
- 39 The warhead element consisted of 28% of the cost of Trident, according to HCP 399, Statement on the Defence Estimates 1986.
- 40 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.
- 41 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>)
- 42 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.
- 43 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
- 44 MoD Factsheet: "The Royal Navy's Future Aircraft Carriers", 25th July 2007, <http://www.mod.uk/DefenceInternet/FactSheets/Equipment/Factsheets/FactsheetTheRoyalNavysFutureAircraftCarriers.htm>
- 45 National Audit Office, Ministry of Defence Major Projects Report 2005, HMSO, November 2005.
- 46 "MoD confirms £3.8bn carrier order", BBC News, 25th July 2007, <http://news.bbc.co.uk/1/hi/scotland/6914788.stm>.
- 47 House of Commons Defence Committee, "Future Carrier and Joint Combat Aircraft Programmes", Second Report of Session 2005/06, HC554, 13 December 2005, <http://www.sbac.co.uk/community/news/files/3566/Future%20Carrier%20and%20Joint%20Combat%20Aurcraft%20Programmes.pdf>.
- 48 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>
- 49 HC554, *ibid*, Memo from MoD, Evidence p45.
- 50 <http://navy-matters.beedall.com/cvf1-22.htm>
- 51 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>.
- 52 <http://navy-matters.beedall.com/masc.htm>
- 53 Paul Dunne, "Conversion in Europe: Challenges and Experiences", Chapter 8 in Bjorn Moller and Lev Voronkov (eds) (1996) "Defensive Doctrines and Conversion", Dartmouth, 1996, pp 56-62.
- 54 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.
- 55 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.
- 56 In fact these assume that 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.
- 57 Based on Treasury figures for tax take for higher and basic rate taxpayers in 2004-05.
- 58 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.
- 59 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.
- 60 Actually £8.957.91, based on figures for the over-65 population of the UK from the CIA World Factbook.
- 61 See Dr. Steve Schofield, Oceans of Work, BASIC Research Report 2007.1 January 2007, <http://www.basicint.org/nuclear/beyondtrident/oceans.pdf>
- 62 "Britain Faces Long-Term military procurement Crunch", Douglas Barrie: http://www.aviationweek.com/avnow/news/channel_defense_story.jsp?id=news/aw071706p2.xml
- 63 National Audit Office, Ministry of Defence Major Projects Report 2005, HMSO, November 2005
- 64 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 £33.4bn, 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".
- 65 The idea that security goes beyond military security is a well-established one, and indeed one supported by government ministers and policy documents. In a ground-breaking speech to RUSI, then Foreign Secretary Margaret Beckett highlighted the threat of climate change as being of equal urgency as other 'harder' security threats, demanding focused response. She concluded "The objective... is not to defend a way of life but to change it." RUSI, 10 May 2007. 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, 3 May 2006, <http://www.fpif.org/fpiftxt/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/>
- 66 See for example <http://www.defra.gov.uk/ENVIRONMENT/climatechange/>
- 67 N. Stern, "Stern Review on the Economics of Climate Change", HM Treasury, 30 October 2006, http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
- 68 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 Malcolm Fergusson, Ellie Mackay & Ian Skinner, "Over a Barrel: Reducing Transport's Oil Dependency", Institute for European Environmental Policy (IEEP), April 2006. The forecast is based on figures from the EU General Directorate of Transport and Energy (DG TREN), 2003, quoted therein.
- 69 At the end of 2004, 61.7% of proven oil reserves came from the Middle East. BP Statistical Review, 2005, quoted in IEEP (2006), *ibid*.
- 70 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
- 71 Stern Review, *Op. cit.*, Chapter 16.
- 72 "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.
- 73 "Mirage and Oasis: Energy Choices in an Age of Global Warming", New Economics Foundation, 2005, <http://www.neweconomics.org/gen/uploads/sewoy0355prhbgunpscr51d2w29062005080838.pdf>
- 74 *ibid*.
- 75 *ibid*.

- 76 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). 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>
- 77 Energy Institute <http://www.schoolscience.co.uk/content/4/chemistry/petroleum/knowl/4/2index.htm?oilcost.html>, quoted in IEEP (2006) and DG TREN (2003), Op Cit.,
- 78 Malcolm Fergusson, Ellie Mackay & Ian Skinner, "Over a Barrel: Reducing Transport's Oil Dependency", Institute for European Environmental Policy, April 2006.
- 79 <http://www.eere.energy.gov/>
- 80 Although if conservation measures are successful this need not be the case.
- 81 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.
- 82 Way to Go Campaign Report, "Paying for better transport", May 2004, http://www.foe.co.uk/resource/reports/paying_for_better_transport.pdf
- 83 Where the capital costs have been spread over ten years using the government's recommended 3.5% discount rate for assessing public capital projects.
- 84 "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.
- 85 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/Servlet?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1007029393906>
- 86 Malcolm Chalmers, "Spending to Save? An Analysis of the Cost Effectiveness of Conflict Prevention", Centre for International Co-operation and Security Working Paper 1, April 2005.
- 87 E.g. Collier, Paul and Anke Hoeffler, 'Aid, policy and peace: Reducing the risks of civil conflict', *Defence and Peace Economics*, Vol. 13 (6), pp. 435-450, 2002.
- 88 DfID website
- 89 Emery Brusset, "Sudan: 2004 - 2018" in Malcolm Chalmers (ed.) "Spending to Save: Prospective Case Studies", Centre for International Co-operation and Security Working Paper 3, April 2005.
- 90 MoD, Delivering Security in a Changing World: Future Capabilities, July 2004.
- 91 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.
- 92 6th Report of the Defence Committee, 2005-06, <http://www.publications.parliament.uk/pa/cm200506/cmselect/cmdfence/822/82205.htm>
- 93 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) Op Cit., 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>
- 94 <http://www.fco.gov.uk/Files/kfile/ACPP%20Information%20Doc%20-%20final.pdf>
- 95 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", Op. Cit.
- 96 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/cmffa/573/573.pdf>.
- 97 FCO, MoD, DTI, Global Partnership, 4th Annual Report, 2006, <http://www.fco.gov.uk/Files/kfile/file36547.pdf>.
- 98 HC573, op cit.
- 99 Miriam Pemberton and Laurence Korb, "A Unified Security Budget for the United States, 2007", *Foreign Policy in Focus*, 3 May 2006, <http://www.fpiif.org/fpiftxt/3253>.
- 100 <http://www.mod.uk/DefenceInternet/AboutDefence/Organisation/DefenceVision/TheDefenceVision.htm>
- 101 See Steven Schofield "The UK and Non-Offensive defence", Security Studies Network, 2002 www.peaceandprosperity.org.uk; Bjorn Moller "Common Security and Non offensive Defense" Lynne Rienner Publishers, Boulder 1992.
- 102 Steven Schofield (2002), *ibid*. It is clear that present procurement plans go beyond existing capabilities and support a doctrine of hard-power force projection. 'Non-offensive' defence (NOD) could be a highly effective alternative. The threat of invasion does not exist for the UK and is not likely to re-emerge in the foreseeable future. Thus the UK's defensive military capability could involve limited operations for counter-terrorism, assisting weak or failed states, or responding to regional conflicts that threaten to spill over. Missions might range from peace-keeping through peace support/stabilisation up to peace-enforcement such as the British intervention in Sierra Leone. The NOD approach would suggest a force projection capability as part of collective security arrangements, with each nation contributing elements to a collective task force (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.) The CVF carrier programme is of a wholly inappropriate scale for these purposes. Schofield (2002) provides a careful analysis of the UK's security needs and how they can be met through NOD and a reduced defence budget.
- 103 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 under-consumptionist arguments suggesting a positive impact of military spending through the prevention of realisation crises to arguments suggesting possible negative impact on the profit rate. See Paul Dunne, "The Political Economy of Military Expenditure: An Introduction" *Cambridge Journal of Economics*, Vol 14, No 4, December 1990, pp395-404.
- 104 Paul Dunne, Op cit (1996).
- 105 Nils Petter Gleditsch, Adne Cappelen, Olav Bjerkholt, Ron Smith and Paul Dunne (eds) "The Peace Dividend", North Holland, 1996.
- 106 Barker, T Dunne P and Smith R, "Measuring the Peace Dividend in the United Kingdom", *Journal of Peace Research*, Vol.28, No.4, November 1991, pp345-358.
- 107 The net cash requirement for Defence was £30.6bn in 2005/6: Defence Statistics 2006, Table 1.1.
- 108 Bai, Hong, Stephen Hall, James Nixon and Ron Smith, "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.
- 109 The net loss to the Exchequer is in contrast to the results of other studies, such as the ORG 'Subsidy Trap' 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.
- 110 Chalmers, M., Davies, N.V., Hartley, K. and Wilkinson, C., "The economic costs and benefits of UK defence exports", *Fiscal Studies*, Vol. 23, No. 3, September 2002, pp 305-342.
- 111 Some studies suggest that this is too high an estimate, given the level of subsidies involved in exports. See for example Dunne and Perlo Freeman "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, 2003. <http://carecon.org.uk/Users/paul/Oxfamreport7.pdf>
- 112 This study would, however, seem to have been ignored by the DTI and MoD in drafting their Defence Industrial Strategy document: http://www.mod.uk/industrial_policy/



The real cost behind Trident Replacement and the Carriers

by Professor Paul Dunne,
Dr Samuel Perlo-Freeman
and Paul Ingram

While spending on public services is having to be tightened, public money is being wasted on new carriers and Trident submarines irrelevant to the security threats facing Britain. *The real cost behind Trident Replacement and the Carriers* calculates the annual cost of the two systems to be at least £5bn over their lifetimes - around 40% of the defence equipment budget. But defence spending in particular, and the public purse in general, is clearly under severe pressure.

“This report outlines the extent of the pain caused by decisions to go ahead with these sacred cow projects. It is not too late for the government to delay or abandon them. The money would be better spent on a ‘comprehensive security’ package, including measures to reduce Britain’s carbon emissions and oil dependency, increased peacekeeping, and conflict prevention, overseas development aid and nuclear non-proliferation. Such targeted spending would provide real security benefits as opposed to feeding grand illusions”.

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