How Could Britain Operate a Scaled Down Deterrent?

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Abstract

This paper evaluates options that could enable the UK to either reduce costs or numbers of in-service warheads. First the current deterrent is described in terms of system, supporting infrastructure and the associated costs. Second, five options are described (reduction in stockpile, virtual stockpile, operating fewer submarines, alternative platform and/or delivery vehicle, and shared infrastructure) and then evaluated against their ability to reduce costs or numbers of warheads. The evaluation leads to the conclusion that each option tends to scale down either costs *or* numbers and that each option carries different risks to the UK's deterrence policy (as well as technical and implementation risks). Without insight into the relative priorities of the deterrence policy elements, and assuming that the risks of each option are acceptable, leads to the conclusion that moving to a virtual stockpile (option 2) has the potential to maximize benefits by scaling down both costs and warhead numbers.

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Introduction

During 2009, the future of the UK's Trident based nuclear deterrent was much debated. In June 2009, after the global financial crisis had created havoc in the public finances and serious questions were being asked about the affordability of public spending, Nick Clegg, a Liberal Democrat leader, asked how Britain could operate a scaled down deterrent.[2] This paper aims to provide an answer to this question.

Interpreting 'Scaled Down'

The term 'scaled down' could be interpreted in a variety of ways. At the time that this question was raised, the UK's public finances had been under increasing scrutiny and pressure:

> "We have to be realistic and candid about what we can and can't afford as a nation."
>
> - Nick Clegg, June 17, 2009[1]

In addition, moves towards reducing stockpiles were continuing to be a focus:

> "We can't lecture to non-nuclear states if we don't fulfil our obligations under the Nuclear Non-Proliferation Treaty to cut back on our weapons."
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> - Lord Robertson, June 30, 2008 [3]

> "If it is possible to reduce the number of UK warheads further, consistent with our national deterrence requirements and with the progress of multilateral discussions, Britain will be ready to do so."
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> - Gordon Brown, March 18, 2009[4]

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[2] Murray Wardrop, "Trident nuclear deterrent should be scrapped, says Nick Clegg", *Telegraph*, June 17, 2009. <http://www.telegraph.co.uk/news/newstopics/politics/defence/5554410/Trident-nuclear-deterrent-should-be-scrapped-says-Nick-Clegg.html>

[3] Aislinn Simpson, "Global nuclear stockpiles 'must be reduced to prevent terrorist attacks'", *Telegraph*, June 30, 2008. <http://www.telegraph.co.uk/news/uknews/2222273/Global-nuclear-stockpiles-must-be-reduced-to-prevent-terrorist-attacks.html>

[4] James Kirkup, "Britain prepared to cut nuclear arsenal as part of arms deal", *Telegraph*, March 18, 2009. <http://www.telegraph.co.uk/news/5007215/Britain-prepared-to-cut-nuclear-arsenal-as-part-of-arms-deal.html>

This paper interprets 'scaled down' to mean a reduction in costs, or size of the stockpile, rather than scaling down the physical size, explosive power, or any other interpretation.

The UK's Current Deterrent

This section outlines the key elements of the UK's nuclear deterrence policy. It describes the key elements of the system (including infrastructure) required to deliver the policy objectives and outlines the costs of maintaining the entire deterrent system.

The key elements of the UK's nuclear deterrence policy are:

- Operation of a credible *minimum deterrent* that is *continuously available* and *invulnerable* to detection, to prevent nuclear blackmail and acts of aggression against our vital interests.
- Deterring *state,* or *state-sponsored aggressors*;
- Neither a first-use, nor a non first-use policy (an assured 1st or 2nd strike capability is required).
- Having a deterrent that is *available to NATO* while the UK retains *independent use*
- A nuclear deterrence policy of ambiguity.

These policy elements are delivered by a system comprised of a single platform (submarine), single delivery vehicle (Trident D5 ballistic missile) and nuclear warhead.

The UK maintains 4 submarines dedicated to the deterrent. At any given time, one submarine is continuously patrolling at sea, one is being refitted, one is in training and one is preparing to go on patrol. Under the 1963 Polaris Sales Agreement (amended for Trident in 1982), the UK has the use of 58 Trident D5 missiles from a US missile pool. These missiles are loaded & unloaded (and

serviced) at US facilities in King's Bay, Georgia. The UK currently has fewer that 160 operationally available warheads[5].

This equipment is supported by 5 main sites across the UK, employing over 20,100 people as summarized in the table below:

Site	**Activity**	**Staff**[6]
AWE, Aldermaston & Burghfield	Warhead research, design, assembly, disassembly	4,000
Rolls Royce Submarines, Derby	Submarine propulsion design & build	900
BAE Systems Barow-in-Furness	Submarine design & build	3,500
Babcock Marine Devonport	Submarine refit & disposal	5,200
HM Naval Base & RNAD(C) Faslane & Coulport	Submarine operations & loading	6,500

Costs

Before looking at the lifecycle costs of the current deterrent, it is worth understanding that costs associated with the deterrent are relatively fixed in nature, i.e. they do not change *with the scale of output* (i.e. number of warheads). For the purposes of this paper, the static costs have been organized into 3 main groups:

1. Maintaining Infrastructure and Capabilities

These are the costs that are incurred to ensure that land, buildings, equipment, and individual skills and knowledge are maintained to an appropriate standard to prevent the assets from deteriorating. These costs include the capability to research and design warheads, submarines and submarine propulsion systems, as well as the maintenance of all facilities and equipment within the sites. These capability costs are entirely independent of the number of warheads or submarines.

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[5]Ministry of Defence (MoD) and Foreign & Commonwealth Office (FCO), *The Future of the United Kingdom's Nuclear Deterrent*. Presented to Parliament by The Secretary of State for Defence and The Secretary of State for Foreign and Commonwealth Affairs, by Command of Her Majesty. Command 6994, December 2006 (Norwich: The Stationery Office [TSO]), 17.

[6] Ministry of Defence (MoD) and Foreign & Commonwealth Office (FCO), "Supporting the Trident System, Fact Sheet 6". <http://www.mod.uk/NR/rdonlyres/D1ABB5B1-D3E6-419F-A886-2E4A7B38C010/0/Cm6994_Factsheet6.pdf>

2. Operational Costs

These are the costs associated with day-to-day operations of the deterrent system including submarine base operations, missile and warhead loading (HM Naval Base Clyde & RNAD Coulport), submarine refit (Babcock Marine, Devonport) and warhead surveillance / in-service support (AWE). These costs are largely independent of submarine and warhead numbers.

3. Procurement Costs

These are the estimated acquisition costs for a replacement system and would typically include platform (e.g. submarine) design and build, warhead design and build, and missile design and build costs. These costs are more dependent on the scale of deterrent. However, as the white paper noted, the costs of procuring 4 submarines would not be substantially more than 3 since most of the costs would be incurred in establishing the infrastructure and capabilities to build the first 3 boats.

Looking at the costs from a lifecycle perspective, and breaking the lifecycle into 4 key stages the costs can be summarized as shown in the following table.

Lifecycle stage	**Approximate Annualized Cost**	**Description**
Capability Development	£0.9 bn	Forecast £2.65bn[7] covering Nuclear Weapons Capability Sustainment Programme (NWCSP) funding for 3 years
Product Development	£1bn	£15 – 20bn[8] (at 06-07 prices) over approximately 15 year estimated product development period for 4 submarine option
In-service maintenance	£1.2 – £1.7bn	Historically between 3% and 4.5% of the UK defence budget Future forecast is 5 – 6% of defence budget[9]
Disposal	Not known	Estimated to be approximately £9.7bn. £837m of which is for decommissioning of submarines up to and including vanguard-class[10]

[7] National Audit Office, *Ministry of Defence, The United Kingdom's Future Nuclear Deterrent Capability*, November 2008 (London: The Stationery Office [TSO]), 27.
[8] Ibid., 25.
[9] Claire Taylor, and Tim Youngs, *The Future of British Nuclear Deterrent*, November 3, 2006, House of Commons Library Research Paper 06/53, 16.
[10] HCDC, *The Future of the UK's Strategic nuclear Deterrent: the White Paper.* Ninth Report of Session 2006-07. HC 225-1 March 2007. (London: the Stationary Office Limited, 2007), 54.

Currently the costs are a combination of capability development and in-service maintenance. From the data, it is difficult to ascertain the degree of double counting as some NWCSP funding is included in the increased in-service maintenance costs over recent years. Therefore, current annual costs are likely to be in the range of £1.2bn to £2.6bn.

Options

Keeping in mind the key elements of the UK deterrence policy, 5 main options to operate a scaled down deterrent have been identified and are briefly described before being analyzed in terms of their ability to provide a scaled down solution.

Option 1: Reduce stockpile numbers
This option assumes a straightforward reduction in operationally available warheads, with all other things (e.g. platform and missile types and numbers) remaining the same.

Option 2: A virtual stockpile
This option assumes that there are no operationally available warheads. Instead, components are stored and ready for assembly and would be available for operational use in days or weeks[11]. Since there are no warheads, this option assumes there is no need to operate continuously at sea and therefore requires fewer submarines. It assumes that a similar number of warheads could be assembled from the stored components as currently available.

Option 3: Operate fewer submarines
This option assumes the same stockpile size, but with fewer than 4 submarines operating continuous at sea deterrence (CASD).

[11] Logically, even if one wanted to move further along the 'virtual deterrent continuum' towards having a deterrent built on a 'dormant capability', the first step is having a deterrent based on disassembled warheads, therefore only this form of a virtual deterrent has been considered.

Option 4: Alternative platform and/or delivery vehicle

This option, as discussed in the white paper,[12] assumes a move to a non submarine based platform. It assumes the same stockpile size is available through a land, ship or air based platform using a cruise or ballistic missile delivery system as appropriate.

Option 5: Shared infrastructure

This option assumes the same stockpile size, platform and delivery system, but assumes less UK exclusive infrastructure is required as arrangements are in place to share infrastructure and equipment. These sharing arrangements could include any combination of submarine purchase rather than design & build, sharing submarine propulsion design, sharing submarine operational facilities and warhead research facilities.

It must be noted that all of these options are not without difficulties. How large is a 'minimum deterrent?' Is a virtual deterrent an effective deterrent? Does a set of components that could be assembled and operational within days or weeks constitute a 'continuously available deterrent?' If CASD was not operated, how would the UK manage the escalation effects associated with assembly of warheads or launching of submarines? How would the security aspects of shared infrastructure be overcome? This paper doesn't provide answers to these questions, but assumes that these difficulties can be overcome and that these options are all fundamentally viable.

Option Appraisal

The following table provides a comparison of the options using the current deterrent as a baseline and criteria to assess the effectiveness of each option to scale down costs or numbers.

[12] Ministry of Defence (MoD) and Foreign & Commonwealth Office (FCO), *The Future of the United Kingdom's Nuclear Deterrent*. Presented to Parliament by The Secretary of State for Defence and The Secretary of State for Foreign and Commonwealth Affairs, by Command of Her Majesty. Command 6994, December 2006 (Norwich: The Stationery Office [TSO]).

Options / Criteria	Reduce Stockpile	Virtual stockpile	Fewer Submarines	Alternative platform	Shared infrastructure
Reduces stockpile[13]	Yes	Yes	No	No	No
Reduces Costs					
• Infrastructure costs	⇔	⇔	⇔	⇑⇑	⇓⇓
• In-service costs	⇔	⇓	⇓	⇑	⇓⇓
• Disposal costs	⇔	⇔	⇓	⇑	⇓⇓
• Procurement costs[14]	⇔	⇓	⇓	⇑	⇓⇓
Overall lifecycle cost reduction	No	⇓	⇓⇓	⇑⇑	⇓⇓⇓
Politically Acceptable	Yes	Yes	Yes	No	No

Note: Direction and number of arrows provides an indicative measure of the scale of change (if any) in costs.

The simplest way to reduce operationally available warheads is to take warheads out of service (option 1). However, in terms of costs, reducing the stockpile is unlikely to have a significant impact. Having fewer warheads to 'look after' and 'service' requires the same infrastructure, personnel with skills, and would require a similar level of stockpile surveillance activity. Therefore, infrastructure and in-service costs would be unlikely to change significantly. In terms of disposal costs, the reduction is stockpile numbers effectively brings forward a proportion of the total stockpile disposal costs, which are assumed to remain unchanged overall.

Politically, a reduction in stockpile would be a very favourable. Many would see it as a positive move towards disarmament and a signal to other nuclear weapon states to take similar action. However, Britain already operates a minimum deterrent and any reduction in stockpile could impact the effectiveness of the deterrent against major states. Further discussion of this issue is beyond the scope of this paper.

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[13] i.e. Would each option *automatically* lead to a reduction of the stockpile (operationally available warheads)?

[14] These costs assume that a replacement system is/would be needed in the future and represent the costs of procuring a replacement system based on each option.

Moving to a virtual stockpile (option 2) is also likely to be politically favourable as it would reduce the number of operationally available warheads and very likely reduce lifecycle costs. The key assumption with this option is that there is no need to operate Continuous At Sea Deterrence (since there are no assembled warheads to have on board). Therefore, there are likely to be fewer submarines in the fleet with reduced associated operating / in service costs (less refuelling, refitting and general maintenance). Similar infrastructure is likely to be needed to maintain the components and similar eventual disposal costs. Procuring a new system, based on a virtual deterrent would result in a cost saving due to having fewer submarines to procure and build. Although as discussed in the white paper, the cost savings of procuring less than three rather than four submarines are not as much as might be expected.[15]

Moving to a deterrent operating with fewer submarines (option 3) would not automatically lead to a reduction in operationally available warheads as either each submarine could simply carry more warheads, or a larger reserve stock could be held on shore. The former option has the challenge of being an increase in operational 'fire-power' and having a large store of warheads (effectively a current boat-load in store) seems of limited value. Therefore, it could be concluded that this option if implemented, may be most likely to be implemented along with option 1. In terms of costs, having fewer submarines only would incur the same infrastructure and capability maintenance costs, but in-service, procurement and the eventual submarine disposal costs would all be reduced. Although a politically a favourable option, operating fewer submarines is likely to come up against strong resistance from naval base stakeholders and having fewer than 4 submarines is likely to put CASD operations at risk.

As the white paper concluded, moving to a deterrent based on an alternative platform (option 4) (i.e. aircraft, ship or land based) would firstly incur significant infrastructure set-up costs and secondly, according to estimates, would result in a more costly deterrent for the entire lifecycle,[16] irrespective of the alternative platform. Politically, this would be a difficult as it would most likely be perceived as

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[15] Ministry of Defence (MoD) and Foreign & Commonwealth Office (FCO), *The Future of the United Kingdom's Nuclear Deterrent*. Presented to Parliament by The Secretary of State for Defence and The Secretary of State for Foreign and Commonwealth Affairs, by Command of Her Majesty. Command 6994, December 2006 (Norwich: The Stationery Office [TSO]), 26.
[16] Ibid., 24 & 35-39.

a move in the 'wrong direction,' modernizing and redesigning the deterrent rather than maintaining or reducing it. Additionally, a new platform would require a significant shift in funding away from existing infrastructure, while setting up the new nuclear infrastructure would encounter opposition in the form of the 'Not In My Back Yard' protesters.

The final option, shared infrastructure, would in itself not scale down the number of warheads, but in the long term could have a significant reduction in lifecycle costs. This option assumes that existing infrastructure would not be exclusively operated for the UK's deterrent and that the UK would have access to alternative facilities in other countries – ultimately meaning that some UK facilities may be closed down. Clearly this would significantly reduce infrastructure operating costs, in-service costs and, assuming that arrangements for disposal were made using shared facilities, disposal costs. Procurement costs could also be reduced under this option by buying rather than making submarines or submarine propulsion systems or parts thereof. This option, although financially beneficial, would from a logistical, legal, political and security perspective, be very challenging to implement.

Conclusions & Policy Implications

Each of the options has been shown to either scale down the cost or the size (measured by number of warheads) of the UK's nuclear deterrent. However, each option also carries different risks to the UK's deterrence policy (as well as technical and implementation risks). These risks are briefly discussed below before drawing some conclusions.

Reducing the size of the stockpile is likely to risk the deterrent's perceived effectiveness since an aggressor may take the view that the UK would no longer have sufficient number of warheads to be able to inflict unacceptable damage to their national interests. This 'tipping point' would be at a different stockpile level for each potential aggressor. Therefore, determining the appropriate stockpile size is clearly challenging.

A virtual deterrent in the form of components (option 2) without a rapid response capability may not be perceived as effective against all potential aggressors.

No nation has taken this step. Therefore, there is no precedent on which to judge whether this constitutes a truly effective deterrent.

Operating fewer than 4 submarines (option 3) is generally accepted as putting CASD at greater risk and risks the availability of the deterrent. Without submarines being continuously on patrol, mechanisms would have to be found so that in times of crisis, actions such a launching a submarine would not be seen as escalatory. Equally, having staff trained to the high standards required would be difficult to maintain without continuous at sea patrols

Deterrents that are based on non-submarine platforms (option 4) are generally accepted as being more vulnerable and place the policy of having an assured second strike capability at risk. In addition to this, the generally reduced range of these platforms, compared to submarine launched ballistic missiles, reduces their effectiveness against some locations.

Finally, a UK deterrent that relies on sharing foreign owned infrastructure or allows the UK infrastructure to be shared by another country puts the independence of the UK's deterrent at risk. This may be acceptable if the use (i.e. launching) of the deterrent remains under UK control.

To summarize the key points:

- Reducing warhead numbers alone brings political benefits, but does not significantly reduce costs, and raises questions of whether the deterrent would still be effective.
- Operating fewer submarines results in a small procurement cost saving, significant in-service cost savings, but places CASD at risk.
- A virtual stockpile has cost and political benefits, but raises difficult questions of effectiveness and availability.
- A non-submarine platform incurs high infrastructure development costs and increases through life costs whilst being generally less effective and placing the second strike capability at risk.
- Shared infrastructure is likely in long run to be lowest cost option, but politically difficult and potentially loses independence.

In conclusion, Britain could operate a scaled down deterrent through any of these options other than the alternative platform option if risks to current nuclear deterrent policy were accepted. Without knowledge of the relative importance of the elements of the UK's deterrence policy, and without knowledge of what risks are acceptable, leads to the conclusion that moving to a virtual deterrent has the potential to maximize benefits by scaling down both costs and warhead numbers.