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Replacing the UK's nuclear deterrent: the long-awaited warhead decision

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Since 2006 work has been underway on several programmes that will maintain the UK's nuclear deterrent beyond the life of the current system. Much of the focus in that time has been on the delivery of the new Dreadnought class submarines, which are expected to enter service in the early 2030s. However, a decision on replacing the UK's Mk4/A nuclear warhead has also been long-awaited and work on possible options has been ongoing. After an initial deferral in 2010, a decision was widely expected to be taken as part of the Government's forthcoming [Integrated Defence and Security Review](#).

In February 2020, however, a US official disclosed the existence of a UK replacement warhead programme, which the Government subsequently confirmed in a Statement to the House. That revelation prompted widespread criticism that a decision appeared to have been taken without an official Government announcement or appropriate Parliamentary scrutiny. Questions over the independence of the UK's nuclear deterrent have once again risen to the fore.

The UK's Mk4/A nuclear warhead

The Mk4 nuclear warhead is designed, manufactured and maintained by the Atomic Weapons Establishment (AWE) in Berkshire. Public information about it is scarce but it is thought to be based on the American W76 warhead design and has a yield of around 100 kilotons. Certain non-nuclear components for the warhead are procured from the US on cost effectiveness grounds.¹ It entered service in 1994 to coincide with the introduction of the Trident system.

The Nuclear Warhead Capability Sustainment Programme (NWCSP)

In 2005 the AWE began the Nuclear Warhead Capability Sustainment Programme (NWCSP). Over a period of 20 years, and at an estimated cost of £20 billion, the NWCSP aims to sustain key nuclear skills and technological capability and deliver improved infrastructure, in order to manage the current nuclear stockpile and underpin a future replacement programme.

Explainer: Composition of the UK's nuclear deterrent

The UK is the only nuclear weapon state that operates a single deterrent capability: the submarine-launched Trident system. It has three main elements:

- Four Vanguard-class submarines (SSBN)
- Trident II D5 missile, which is held in a communal pool with the US
- The Mk4/A nuclear warhead deployed on the Trident II D5.

¹ Collaboration with the US is conducted under the [1958 UK-USA Mutual Defence Agreement](#) and the [Polaris sales agreement](#) 1963, as amended for Trident ([Treaty Series 086/1980](#)) and ([Treaty Series 008/1983](#)).

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As part of the NWCSP AWE is currently refurbishing the UK warhead to replace obsolete components and incorporate the US-designed Mk4A arming, fusing and firing system. In June 2016 the MOD highlighted that this refurbishment did not equate to a new warhead and “does not change the destructive power of the weapon”.²

The UK-French Teutates project on nuclear stockpile stewardship also forms part of the NWCSP.³

The projects being undertaken through the NWCSP are funded as part of the annual in-service costs of the nuclear deterrent,⁴ which currently stand at six per cent of the defence budget. In 2020/21 that equated to £2.5 billion.⁵

Timeline of decision making on the nuclear warhead

A 2006 Government White Paper, [The Future of the United Kingdom's Nuclear Deterrent](#), committed to retaining the UK's existing nuclear capability beyond the life of the current system, by replacing the Vanguard class submarines (SSBN) and participating in the US service-life extension programme for the Trident II D5 missile. It did not commit to a replacement programme for the nuclear warhead at that time.

As the existing nuclear warhead design was expected to last into the 2020s, the Paper suggested that such decisions would not be required until the 2010 Parliament. The Government did state, however, that:

In order to inform these decisions, we will undertake a detailed review of the optimum life of the existing warhead stockpile and analyse the range of replacement options that might be available. This will include a number of activities to be undertaken with the United States...⁶

SDSR 2010 – deferral of a warhead decision

The 2010 Strategic Defence and Security Review (SDSR) made a number of changes to the size of the UK's nuclear arsenal and its deployed capability. It also updated several assumptions in the 2006 White Paper about the nuclear deterrent replacement programme.

As a result of the work being done on the optimum life of the existing warhead stockpile, the SDSR changed the earlier assumption that a replacement warhead would be required in the 2020s. It concluded that “a replacement warhead is not required until at least the late 2030s” and as such “decisions on replacing the warhead will not therefore be required in this Parliament”. To drive value for money within the broader nuclear deterrent replacement programme, the decision was expected to defer £500m of spending from the next 10 years.⁷

SDSR 2015

The 2015 SDSR confirmed that work to determine the optimum life of the existing warhead stockpile and on the range of replacement options, continued. However, it also alluded to the possibility of retaining the current warhead in service longer than previously anticipated:

² [Defence in the media](#), 8 June 2016

³ Library briefing paper, SN04079, [The French Nuclear Deterrent](#), examines the Teutates project and the 2010 UK-French nuclear treaty in greater detail.

⁴ HL328, Trident submarines, 6 June 2016 and HC deb 11 November 2010, c450W

⁵ The costs of the nuclear deterrent are examined in greater detail in [Library Briefing CBP8166, The costs of the UK's strategic nuclear deterrent](#)

⁶ The Future of the United Kingdom's Nuclear Deterrent, CM 6994, December 2006, para 7-4

⁷ [Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review](#), Cm 7948, October 2010, para 3.12

A replacement warhead is not required until at least the late 2030s, *possibly later* [author's emphasis]. Given lead times, however, a decision on replacing the warhead may be required in this Parliament or early in the next. In the meantime, we continue to invest significantly in the Atomic Weapons Establishment to maintain the facilities and skills necessary to assure the safety and security of the current stockpile, and to sustain the ability to develop a replacement warhead when we need to do so.⁸

Those lead times had already been examined as part of the 2013 [Trident Alternatives Review](#). A panel of experts expressed the view that it would take 17 years to design, develop, certify and manufacture a new nuclear warhead.⁹ That timeframe was subsequently reiterated by the Ministry of Defence in its [2014 Update to Parliament](#).

As a result of SDSR15, a decision on a replacement warhead was therefore earmarked for around the end of the decade. In its [2017 Update to Parliament](#) the MOD subsequently stated that “a decision on replacing the warhead will be required in this Parliament [before the end of May 2022] and work continues on developing replacement options”.

When asked about a decision on the replacement warhead during a debate in the House in April 2019, the Minister replied that:

work continues to transition. We continue to refine the options and the technical solutions that will inform the final Government decision, bearing in mind that the replacement is not really required until the late 2030s or possibly even later.¹⁰

In December 2019 the MOD published its [2019 Update to Parliament](#). That report merely stated that “work also continues to develop the evidence to support a government decision when replacing the warhead”.¹¹

Work on replacement options

As outlined above, work on sustaining the UK's nuclear stockpile and replacement options has been underway since 2005 through the AWE's Nuclear Warhead Capability Sustainment Programme (NWCSP).

Investment at the AWE has continued, including in projects to reduce technical, cost and schedule risks to support any future replacement programme.¹²

The UK has also been undertaking work with the United States, through the UK-US Joint Technology Demonstrator (JTD) project examining warhead safety, security and advanced manufacturing technologies. In its 2016 Update to Parliament the MOD sought to reiterate that the JTD was not a new warhead programme but intended to:

help sustain skills and develop the capabilities, processes and technology needed to inform potential options being considered in future, and to reduce future technical, cost and schedule risks.¹³

⁸ [National Security Strategy and Strategic Defence and Security Review 2015](#), Cm9161, November 2015, para.4.72

⁹ Executive Summary, para 18. The long lead time is largely based around the length of time required to certify a new nuclear warhead, in the absence of live nuclear testing. The UK signed the Comprehensive Test Ban Treaty in 1996 and ratified it in 1998. Although the treaty has yet to enter into force the UK is committed to its principles.

¹⁰ HC Deb 10 April 2019, c418

¹¹ p.4

¹² A number of infrastructure projects are underway at AWE, including Project MENSA, which is a new nuclear warhead assembly and disassembly facility at the AWE site in Burghfield. The project is expected to be completed in 2023, six years late and more than £1 billion over its original forecast cost estimate. The project is examined in greater detail by the NAO in its January 2020 report, [Managing infrastructure projects on nuclear-regulated sites](#), HC19, Session 2019-20

¹³ Ministry of Defence, *The United Kingdom's Future Nuclear Deterrent: 2016 Update to Parliament*, December 2016

Confirmation of a replacement warhead programme

In February 2020 the US Commander of United States Strategic Command, Admiral Charles Richard, revealed during an evidence session of the Senate Armed Services Committee that work on its new W93 warhead was being conducted in parallel with a UK programme for a new replacement warhead:

The Nuclear Weapons Council has established a requirement for the W93/Mk7 warhead. This warhead will provide USSTRATCOM and the Navy a means to address evolving ballistic missile warhead modernization requirements, improve operational effectiveness, and mitigate technical, operational, and programmatic risk in the sea-leg of the triad.

This effort will also support a parallel Replacement Warhead Program in the United Kingdom whose nuclear deterrent plays an absolutely vital role in NATO's overall defense posture. Without a coordinated, joint effort to develop and field the W93/MK7 as a system, the bulk of our day-to-day deterrent force will be at increased risk in the early 2040s due to aging legacy systems.¹⁴

The revelation came less than two months after the MOD's 2019 Annual Report to Parliament had stated that "work continued" on the evidence to support a Government decision on a replacement warhead.

The US disclosure prompted widespread criticism that a decision appeared to have been taken without an official Government announcement and appropriate Parliamentary scrutiny. On 25 February 2020 the Secretary of State for Defence, Ben Wallace, subsequently made a Written Statement to the House confirming the existence of a replacement warhead programme:

In 2007 the Government, endorsed by a parliamentary vote, began a programme to maintain the UK's nuclear deterrent beyond the early 2030s. The 2015 strategic defence and security review (Cm 9161) confirmed the UK's commitment to an independent minimum credible deterrent, reaffirmed in 2016 when the House voted overwhelmingly to maintain the continuous at sea deterrence posture. Our independent nuclear deterrent is essential to defend the UK and our NATO allies against the most extreme threats to our national security and way of life. The Government's 2019 manifesto pledged: "We will maintain our Trident nuclear deterrent, which guarantees our security". To ensure the Government maintain an effective deterrent throughout the commission of the Dreadnought class ballistic missile submarine we are replacing our existing nuclear warhead to respond to future threats and the security environment.

As set out in our annual updates to Parliament on the future of the UK's nuclear deterrent the Ministry of Defence's Defence Nuclear Organisation is working with the Atomic Weapons Establishment: to build the highly skilled teams and put in place the facilities and capabilities needed to deliver the replacement warhead; while also sustaining the current warhead until it is withdrawn from service. We will continue to work closely with the US to ensure our warhead remains compatible with the Trident strategic weapon system.

Delivery of the replacement warhead will be subject to the Government's major programme approvals and oversight. My Department will continue to provide updates through the annual report to Parliament on the United Kingdom's future nuclear deterrent.¹⁵

In its [2020 Annual Report to Parliament](#) the MOD confirmed that the UK will "procure the Mark 7 aeroshell and some other non-nuclear components" for the replacement warhead.

¹⁴ Senate Committee on Armed Services, [Statement of Charles A. Richard, Commander United States Strategic Command](#), 13 February 2020

¹⁵ HCWS125, [Nuclear Deterrent](#), 25 February 2020

Interdependence with the US

It had already been suggested by some commentators that the timing of a decision on the warhead would be closely linked to progress by the US on its own nuclear warhead programme.¹⁶

Indeed, the level of UK collaboration with the US has once again brought to the fore longstanding concerns over the independence of the UK's nuclear deterrent. David Cullen, Director of the Nuclear Information Service, has commented:

The UK's reliance on US knowledge and assistance for their nuclear weapons programme means they will find it almost impossible to diverge from any development path the US decides to take.¹⁷

This view has subsequently raised questions over the implications for the UK were the new Biden administration to change direction on the W93 programme. While the programme received Congressional approval in December 2020, the new administration is currently reviewing the entire \$1.2 trillion nuclear modernisation programme. President Biden has in the past expressed the view that US nuclear spending is excessive and cuts to the overall programme, or delays to a number of individual projects, are considered likely.¹⁸ Whether the W93 warhead programme will be in the firing line is uncertain.

In evidence to the Defence Select Committee in December 2020, the MOD's Permanent Secretary, Sir Stephen Lovegrove, acknowledged this issue:

Martin Docherty-Hughes: There is noise from Washington that the President-elect and their team may pull the W93 warhead programme. What contingency does the UK Government make if that is the case? If the President-elect were to make that decision, is there any contingency for that? [...]

Sir Stephen Lovegrove: I have to say, that is not a message that we have been receiving from American colleagues in the last few weeks and months. Clearly, if there is a close alignment between the naval warheads—the W93 and a replacement warhead—there would, no doubt, be very significant implications were that to be the case. They would be difficult to analyse at this range because they would be at a different stage in the development.

As Mr Pate has said, we are perfectly well set up, whatever happens, for the next four years, which is as far as we can go with the money that we have in the programme.¹⁹

¹⁶ See for example, Tom Plant "[The trouble with Trident](#)", February 2019

¹⁷ "Pentagon reveals deal with Britain to replace Trident", The Guardian, 22 February 2020

¹⁸ US nuclear weapons modernisation is examined in [Nuclear weapons at a glance: United States](#), House of Commons Library, December 2020

¹⁹ Defence Select Committee, Oral evidence: MOD annual report and accounts, HC1051, 8 December 2020, Q.30

Compliance with the UK's international legal obligations

There is a longstanding argument that replacement of the UK's nuclear deterrent is not compliant with the UK's international legal obligations under the Nuclear Non-Proliferation Treaty (NPT).

David Cullen has argued that the warhead announcement "would take us in the opposite direction". Hans Kristensen of the Federation of American Scientists shares this view:

Britain and the US have come a long way from being leaders in reducing the role of nuclear weapons and contemplating the possible road toward potential disarmament to re-embracing nuclear weapons for the long haul. They are obviously not alone in this, with Russia, China and France doing their own work. So, overall, this is a serious challenge for the international non-proliferation regime.²⁰

Successive British Governments have, however, argued that the NPT contains no prohibition on updating existing weapons systems and gives no explicit timeframe for nuclear disarmament.

In March 2020 the MOD reaffirmed its view that work on the replacement warhead "will continue to be fully compliant with our obligations under the Treaty on the Non-Proliferation of Nuclear Weapons".²¹

Renationalisation of AWE

In November 2020 the MOD [announced](#) that the Atomic Weapons Establishment would be brought back under direct Government ownership and control.

AWE will now transition from a Government-owned, contractor-operated (GoCo) arrangement to a Non-Departmental Public Body wholly owned by the MOD. The current contract will be terminated on 30 June 2021 with no penalty costs incurred by the Government.²²

Under the new model AWE will continue to draw on specialist private sector support and play a key role in managing capital projects and contracts. The MOD acknowledges that "this approach is recognised as best practice in other major complex programmes".²³

In evidence to the Defence Committee in December 2020 Sir Stephen Lovegrove provided more detail on the MOD's decision:

We think that this arrangement simplifies and strengthens the Department's oversight of a very important part of the nuclear enterprise. It will allow us to move more quickly into an important phase in the development of the warhead. We have a new warhead that we will have to start building before too long and which needs to be in the design stage, so we need to move quickly. This arrangement will allow us to have a clearer understanding of what is going on at the site. We will be putting more people on to the board. We will be capable of channelling the savings that we make as a result of no longer having to pay the plc into investment in the site, its improved productivity and the safety of its workforce.²⁴

Article VI of the NPT

"Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control."

²⁰ "Pentagon reveals deal with Britain to replace Trident", The Guardian, 22 February 2020

²¹ PQ24309, Nuclear weapons: USA, 11 March 2020

²² The original GoCo arrangement with AWE plc (a consortium comprising Serco, Lockheed Martin and Jacobs) was a 25-year contract, which will now be cut short to 20 years.

²³ HCWS544, Defence update, 2 November 2020

²⁴ Defence Select Committee, Oral evidence: MOD annual report and accounts, HC1051, 8 December 2020, Q.26

Potential costs of the replacement warhead?

The 2015 SDSR revised the estimated costs of replacing the SSBN element of the nuclear deterrent to £31 billion, including inflation over the life of the programme. A £10 billion contingency has also been set aside.

Infrastructure projects related to the Atomic Weapons Establishment,²⁵ and work on the options for replacing the nuclear warhead as part of the NWCSP, are not part of the Dreadnought programme spend. As outlined above, AWE projects, including the NWCSP, are met from the annual in-service costs of the nuclear deterrent.

It remains unclear, however, whether the replacement warhead programme will also be funded through the NWCSP or whether the MOD will attribute individual costs to the programme.²⁶

In answer to a Parliamentary Question in February 2020 the MOD said the programme would be “subject to the Government's major programme approvals and oversight”,²⁷ suggesting that it may be independent of the NWCSP.

On potential costs, MOD officials commented in recent evidence to the Defence Committee:

it is too early, I am afraid, to give estimates on that, given the complexity of the design, the very early stages that we are in, the commercial arrangements and the fact that we are working with our US colleagues on this. So much will depend on the eventual design and those arrangements, but we do have adequate provision for the next four years within the settlement that has just been announced, so we can afford this through that period.²⁸

Role of Parliament

There has been some criticism that the decision on a replacement warhead has been made without appropriate parliamentary scrutiny.

The Government is not legally or constitutionally obliged to seek parliamentary approval on a programme to replace the nuclear warhead and successive Governments have never made a political commitment to do so either.

In its statement on the replacement warhead programme on 25 February 2020, the Government pointed to two previous votes in Parliament which had endorsed the overall programme to replace the UK's nuclear deterrent beyond the 2030s: [a vote in March 2007](#)²⁹ and a subsequent vote in July 2016.³⁰ It was this latter debate and vote that enabled the SSBN replacement programme to move forward into its manufacturing phase, which will see the construction of four new Dreadnought class ballistic missile submarines over the next 15-20 years.

The Government has also confirmed that it will feed into the scrutiny process by continuing to provide updates in its annual report to Parliament.

²⁵ These are examined by the NAO in its latest report, Managing infrastructure projects on nuclear-regulated sites, HC19, Session 2019-20

²⁶ The 2006 White Paper had suggested that the cost of a replacement warhead programme would be £2-3 billion (2006 prices).

²⁷ HCWS125, [Nuclear Deterrent](#), 25 February 2020

²⁸ Defence Select Committee, Oral evidence: MOD annual report and accounts, HC1051, 8 December 2020, Q.29

²⁹ That motion was passed on division by 409 to 161 votes (Division No.78, 2006-07 Session)

³⁰ The motion was passed on division by 472 to 117 votes (Division 46, 18 July 2016). Parliament had also voted in support of the Government's plans to replace the nuclear deterrent in response to SNP-led Opposition Day debates in January 2015 and November 2015.

Box 1: Further Reading

- CBP08010, [Replacing the UK's nuclear deterrent: progress of the Dreadnought class](#)
- CBP08166, [The cost of the UK's strategic nuclear deterrent](#)
- CBP09175, [Integrated Review 2021, Increasing the cap on the UK's nuclear stockpile](#)
- CBP07353, [Replacing the UK's 'Trident' nuclear deterrent](#), July 2016
- Ministry of Defence, [Future of the UK's Nuclear Deterrent: Annual Updates to Parliament](#)
- Matthew Harries, [The UK's new nuclear warhead: issues for Parliament](#), RUSI Commentary, 11 January 2021
- Tom Plant and Matthew Harries, [No Go for GOCO: the UK renationalises its warhead factory](#), RUSI Commentary, 6 November 2020

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