



# Extreme circumstances

**The UK's new nuclear  
warhead in context  
Executive summary**

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# in context

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*Front cover image:  
Timelapse of MIRV re-entry paths from a 1986 Peacekeeper missile test.  
Credit: US DOD.*

# Executive summary

## Introduction

The UK Government's programme to build a new nuclear warhead is the latest stage in the Ministry of Defence plan to replace all three parts of the UK's nuclear weapon system: the submarine, missile and warhead. The new warhead will be deployed on the UK's Trident missiles which are leased from the United States (US). It will be a 'parallel' programme to the new US W93 Trident warhead currently being developed.

The UK is unique amongst the nine nuclear-armed states in fielding a single nuclear weapons system, using only submarine-launched missiles with no ground or air-launched weapons. It has the smallest nuclear weapons stockpile amongst the five nuclear-armed states recognised by the 1968 Nuclear Non-Proliferation Treaty (NPT). As a party to that treaty the UK is committed to eliminating its nuclear weapons. In March 2021 the government abandoned plans to reduce the UK's warhead stockpile limit to 180 and instead announced an increase to 260, a reversal of trends established towards the end of the Cold War.

This report investigates the current status of the UK's Replacement Warhead Programme to try and understand why it is going ahead, what strategic thinking underlies the decision, and what can be inferred about its likely characteristics from all available sources. Much of the key source material is comprised of US public documents about the W93 and related programmes.

## UK Replacement Warhead Programme

The new warhead programme was announced in February 2020. It entered its 'readiness phase' in the financial year 2019-20, and the government spent £214m on the project up to the end of financial year 2020-21. The project is currently at a stage analogous to the early stages of the W93 programme and is yet to settle on a single chosen design. The government has not provided an official cost estimate and timetable for the project, but the warhead is likely to come into service some time in the late 2030s or early 2040s.

In September 2020 the government announced that the Atomic Weapons Establishment (AWE), where the UK's nuclear warheads are designed and produced, was being brought back into public ownership.

This was partly due to the poor performance under the previous contract in terms of value for money, regulatory compliance and programme delivery, but the government's desire to exercise greater control over AWE as the warhead project commenced was also a major factor.

## W93 and Mk7

The US W93 programme was revealed by the Trump administration in February 2020. The warhead will be housed within the Mk7 aeroshell, which is designed to protect the warhead as it re-enters earth's atmosphere. The Mk7 has a separate budget, and is run as a separate, but closely related, project alongside the W93.

In Fiscal Year 2021 the project entered an initial phase where a range of potential warhead designs are evaluated against various desired attributes, characteristics and constraints. After this it will transition into a second phase where the warhead concepts will be reviewed and developed into a series of design options that will eventually be winnowed down to a single proposed design. The current planning estimate cost for the W93 is \$13.4bn to \$15.5bn, equivalent to between £10.9bn and £12.6bn. This figure is expected to change as the design matures.

The two factors that appear to have played a significant role in the decision to build the W93 are an ambition to revitalise the US nuclear weapons industrial base, and the desire for an additional type of submarine-launched warhead in case of a technical problem in one of the two current designs.

Active US-UK cooperation on this new generation of nuclear weapons pre-dates the February 2020 announcements of the W93 and UK replacement warhead. Since 2016 the two countries have

been working together on the Joint Technology Demonstrator (JTD) project, developing demonstration warhead systems that could potentially be deployed in a number of future warheads.

### **The UK's 2021 Integrated Review**

The most significant change to the UK's nuclear posture in the 2021 Integrated Review (IR) of Security, Defence, Development and Foreign Policy was a reversal of a decades-long trend of reductions in the UK nuclear stockpile. The stockpile ceiling had planned to be reduced from 225 to 180 by the mid 2020s, but was instead increased to 260. The IR also reversed the policy of providing information about the numbers of operational warheads and the number of deployed warheads and submarines.

These changes will allow the number of deployed warheads to increase with no accountability or democratic challenge. There are two broad goals that this could be intended to achieve: either to increase the overall number of warheads that would be used in a full nuclear strike, or to increase the range of different strike options available by fielding missiles carrying different numbers of warheads. Some missiles could also potentially be carrying a lower-yield version of the warhead.

The most likely explanation for this decision is a change in what the government determines to be 'credible' in terms of its nuclear capabilities. While the process of devising the IR will have involved detailed and careful analysis, that does not mean the final decision, taken by the Prime Minister, would have been characterised by careful deliberation. Suggestions that the decision was driven by a desire for the UK to be more assertive about its nuclear weapons possession are more convincing than the justifications given in the IR.

Analysis of convoys carrying nuclear warheads from AWE to Scotland, where the UK's nuclear-armed submarines are based, suggest that warhead numbers were reduced by around 12 between 2010 and 2015,

then returned to their 2010 levels around 2017 or 2018, with substantial increases in warhead numbers in 2019 and 2020. The possibility that the stockpile rose above the government's self-imposed stockpile limit of 225 during 2020 cannot be ruled out. These increases call into question public assurances that the previous reductions were irreversible.

The UK appears to be in breach of several of its commitments under the NPT, including commitments to unilaterally reduce its nuclear arsenal, to increase transparency and that reductions would be irreversible.

### **UK Replacement Warhead characteristics**

The UK Replacement Warhead is very unlikely to differ substantially from the design of the US W93 warhead. The UK warhead will depend on US-made components and will need to have an identical weight distribution and shape to the W93. The UK could incur substantial additional costs to produce a warhead that would be considered less reliable, due to the difficulties in providing assurance that all the components would work as intended throughout the life of the warhead.

Unless the difficult decision is taken for the two designs to diverge, the Replacement Warhead is likely to follow the W93 in having an explosive yield somewhere between the two current US strategic Trident warheads: the 100kt W76-1 and the 455kt W88. The yield is unlikely to be as high as the W88 due to the increase in the accuracy of the system since that warhead was designed. This report argues that the new UK warhead can be expected to have a yield that is significantly higher than the current warhead, which is based on the US W76-1 warhead and believed to have a similar explosive yield.

Evidence presented in this report also suggests a lower-yield capability will be available from the new warhead. Part of the initial production run for the new UK warhead could even be adapted to explode with this lower yield. It is also likely the design process

will anticipate the warhead being hosted on missiles carrying different numbers of warheads, allowing for a range of strike sizes.

The UK replacement warhead will be based on existing US warhead designs that have been tested, although it may incorporate elements from more than one design. Some of the warhead's components will be based on those already used in existing US nuclear weapons. The UK warhead will be housed in the Mk7 re-entry body, supplied by the US, and is almost certain to incorporate technologies being developed under the JTD project to increase safety and security.

The warhead will be designed to work with the current Trident missile stock. The missile has been upgraded once and is now planned to undergo a second life-extension upgrade. It is very likely that the future capabilities of the missile will be taken into account during the warhead design process.

### **Conclusions**

Although both the W93 and UK Replacement Warhead are yet to reach the stage of selecting a final design, key decisions are happening now, in a political context where the security doctrines of each country are willing to countenance a widened role for nuclear weapons. The impact of this may prove to be long-lasting, as the warheads are likely to remain in service well into the second half of the 21st century.

This report makes the case that the W93 and the UK Replacement Warhead should be seen as being driven by political considerations, rather than technical factors. The major factor in the decision to go ahead with the warheads is the internal pressure to sustain infrastructure and capabilities within the nuclear weapon programmes in both the US and UK. This is a clear demonstration of the limitations of a model of disarmament whereby nuclear-armed states make incremental reductions in their arsenals at a pace determined by their political convenience.

The need for negotiated disarmament agreements to reduce international tensions is greater than at any time since the end of the Cold War. Recent developments have diminished the prospects for international cooperation, but the stark reality of the alternatives means that the nuclear-armed states have to find the political will to advance towards their shared objective of a world without nuclear weapons. That goal is as relevant and urgent as it has ever been.

From being the NPT nuclear-weapon state that could claim to be the closest towards achieving disarmament, the UK is developing a new weapon that will likely have a larger explosive yield, and is now increasing warhead numbers and broadening the circumstances in which it would countenance a role for nuclear weapons in its security doctrine. While the internal processes that lead to these decisions will have involved detailed deliberation, the final decision by the Prime Minister appears to have been guided by a desire for the UK to be less 'apologetic' about its continued possession of nuclear weapons.

The increase in the UK's warhead stockpile and the probable increase in capabilities from the UK Replacement Warhead are likely to further weaken the NPT treaty regime which is already struggling with a loss of credibility, and with accusations of bad faith levelled at the nuclear weapon states. As the programmes are at an early stage in development, these harms can be avoided with sufficient political will and leadership. Specifically, the UK should declare that the new warhead will not involve any upgrade to its offensive capabilities.

The moves away from transparency and accountability in the UK militate against this outcome. The political will to make progress on disarmament is unlikely to emerge without more scrutiny of the nuclear weapons programme, which should be provided by parliament. The UK would also need to exercise influence over the US to ensure that the parallel W93 and Replacement Warhead Programmes do not jeopardise the UK's disarmament commitments. The slim chances of success do not absolve the UK of its disarmament obligations

## **Recommendations**

1. If the UK Replacement Warhead Programme goes ahead, despite the known drawbacks, the Government should make a public statement to the effect that the programme will not result in any change to the UK's nuclear capabilities, and any changes to the warhead design will be solely focussed on:
  - a) Improvements to safety and surety.
  - b) Ease of verifiable dismantlement, using lessons learned in the UK's disarmament verification research.
  - c) Easy replacement and life-extension of components, in order to eliminate any technical pressures for subsequent warhead designs while the UK remains a nuclear weapons state.
2. The UK government should release a detailed justification for the recent increase to its warhead stockpile cap, in order to allow public debate about the merits of the change.
3. This justification should include a statement about the status of any lower-yield capability on the UK's current warhead and a timetable for the permanent phase-out of this capability, in keeping with its commitments to the 2000 and 2010 NPT Review Conferences.
4. The UK should abandon its doctrine of strategic ambiguity. It has the potential to confuse decision-making in a crisis and any strategic benefit it might provide is outweighed by the harms done to democratic scrutiny, accountability and strategic stability.
5. The UK government should immediately make public the size of its operational warhead stockpile, as well as the maximum number of missiles and warheads carried on each submarine. It should commit to updating parliament on any changes to these numbers.
6. The UK's nuclear weapons programme, particularly the Dreadnought submarine programme and the Replacement Warhead Programme, should be subject to detailed parliamentary scrutiny to ensure the best possible management of the public funds being spent. A central element of this scrutiny should be annual inquiries and reports by the Defence Select Committee, as was the case during construction of the first generation of Trident submarines and warheads through the 1980s and early 1990s.

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