III. British nuclear forces

HANS M. KRISTENSEN AND MATT KORDA*

As of January 2023 the United Kingdom's nuclear weapon stockpile consisted of approximately 225 warheads (see table 7.4)—an unchanged estimate from the previous year. SIPRI assesses that around 120 of these are operationally available for delivery by Trident II D5 submarine-launched ballistic missiles (SLBMs), with about 40 being carried on a nuclear-powered ballistic missile submarine (SSBN) that is on patrol at all times. The UK is expected to increase the number of warheads it possesses in the coming years.

These estimates are based on open-source information on the British nuclear arsenal and conversations with British officials. The UK has generally been more transparent about its nuclear activities than many other nuclear-armed states. However, it has never declassified the history of its stockpile or the actual number of warheads it possesses, and in 2021 it declared that it will no longer publicly disclose figures for the country's operational stockpile, deployed warheads or deployed missiles.[1]

This section briefly outlines the role played by nuclear weapons in the UK's military doctrine and then describes its sea-based missiles and its nuclear weapon modernization programme.

The role of nuclear weapons in British military doctrine

The British government has stated that it remains 'deliberately ambiguous about precisely when, how and at what scale [it] would contemplate the use of nuclear weapons'.[2] However, British policy also states that the UK 'would consider using . . . nuclear weapons only in extreme circumstances of self-defence, including the defence of [North Atlantic Treaty Organization (NATO)] Allies'.[3]

Like the United States, the UK operates its submarines with detargeted missiles, although it would take only moments to load the targeting coordinates. Unlike US SSBNs, which can launch in minutes, the UK says that its submarines 'are at several days' notice to fire'.[4]

[1] British Government, *Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy*, CP403 (Her Majesty's Stationery Office: London, Mar. 2021), pp. 76–77. On the challenges of collecting information on world nuclear forces more generally see Kristensen, H. M. and Korda, M., 'Estimating world nuclear forces: An overview and assessment of sources', SIPRI Commentary, 14 June 2021.

[2] 10th NPT review conference, National report of the United Kingdom, NPT/CONF.2020/33, 5 Nov. 2021, para. 13. On the review conference see also 'The 10th review conference of the Non-Proliferation Treaty', chapter 8, section II, in this volume.

[3] British Government (note 1), p. 76.

[4] British Ministry of Defence, 'The UK's nuclear deterrent: What you need to know', 17 Feb. 2022.

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Sea-based missiles

The UK is the only nuclear-armed state that operates a single type of nuclear weapon: the country's nuclear deterrent is entirely sea-based. The UK possesses four Vanguard-class SSBNs, based at Faslane on the west coast of Scotland, each of which can carry up to 16 Trident II D5 submarine-launched ballistic missiles.[5] In a posture known as continuous at-sea deterrence (CASD), which began in 1969, one British SSBN carrying approximately 40 warheads is on patrol at all times.[6] The second and third SSBNs remain in port but could be put to sea in a crisis. The fourth is in overhaul at any given time and is unable to deploy.

In its Integrated Review of Security, Defence, Development and Foreign Policy, published in March 2021, the British government announced a significant increase to the upper limit of its nuclear weapon stockpile, to a maximum of 260 warheads.[7] Until then, it was assumed that the UK's nuclear weapon stockpile had been gradually decreasing towards a goal of 180 warheads by the mid 2020s, as described in the UK's strategic defence and security reviews (SDSRs) of 2010 and 2015.[8] British officials clarified in 2021 that the target of 180 warheads stated in the SDSRs 'was indeed a goal, but it was never reached'.[9] Instead, in its statement submitted to the 10th review conference of the 1968 Treaty on the Non-Proliferation of Nuclear Weapons, held in 2022, the British government stated that the new and higher number of 260 warheads 'is a ceiling, not a target, and it is not our current stockpile number'.[10]

Replacement of the submarines

The UK's four Vanguard-class SSBNs entered service between December 1994 and February 2001, each with an expected service life of 25 years.[11] The

[5] Mills, C., *Replacing the UK's Strategic Nuclear Deterrent: Progress of the Dreadnought Class*, Research Briefing no. 8010 (House of Commons Library: London, 28 Sep. 2022), p. 9.

[6] British Ministry of Defence, 'UK's nuclear deterrent (CASD)', 17 Mar. 2021.

[7] British Government (note 1), p. 76. For further detail see Kristensen, H. M. and Korda, M., 'British nuclear forces', *SIPRI Yearbook 2022*, pp. 371–72.

[8] British Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, Cm 7948 (Her Majesty's Stationery Office: London, Oct. 2010), p. 38; and British Government, *National Security Strategy and Strategic Defence and Security Review 2015: A Secure and Prosperous United Kingdom*, Cm 9161 (Her Majesty's Stationery Office: London, 2015), p. 34. See also Kristensen, H. M. and Korda, M., 'United Kingdom nuclear weapons, 2021', Nuclear notebook, *Bulletin of the Atomic Scientists*, vol. 77, no. 3 (May 2021).

[9] Liddle, A. (@AidanLiddle), British permanent representative to the Conference on Disarmament, Twitter, 16 Mar. 2021, <https://twitter.com/aidanliddle/status/1371912132141445120>. This information was also later confirmed by other officials. British officials, Interviews with the authors, May 2021.

[10] 10th NPT review conference, NPT/CONF.2020/33 (note 2), para. 22.

[11] Mills (note 5), p. 10.

Table 7.4. British nuclear forces, January 2023

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)	Warheads x yield	No. of warheads
Sea-based missiles (SLBMs)	*4/64*[a]				*120*
Trident II D5	48[b]	1994	>10 000[c]	1–8 x 100 kt[d]	120
Total operationally available warheads					120[e]
Other stored warheads					105[f]
Total stockpile					**225**[g]

kt = kiloton; SLBM = submarine-launched ballistic missile.

[a] The first figure is the total number of nuclear-powered ballistic missile submarines (SSBNs) in the British fleet; the second is the maximum number of missiles that they can carry. However, the total number of missiles carried is lower (see note b). Of the 4 SSBNs, 1 is in overhaul at any given time.

[b] The 3 operational SSBNs can carry a total of 48 Trident SLBMs. The United Kingdom has purchased the right to 58 missiles from a pool shared with the United States Navy.

[c] The Trident II D5 missiles on British SSBNs are identical to the Trident II D5 missiles on US Navy SSBNs, which have demonstrated a range of more than 10 000 km in test flights.

[d] The British warhead is called the Holbrook, a modified version of the USA's W76 warhead, with a potential lower-yield option.

[e] Of the 120 operationally available warheads, c. 40 are deployed on the single SSBN that is at sea at any given time, with the remaining warheads assigned to the 2 other deployable SSBNs.

[f] This figure includes retired warheads that have not yet been dismantled. It seems likely that they will be reconstituted to become part of the UK's total stockpile over the coming years (see note g). Many of the stored warheads that have not been retired are thought to be undergoing upgrade from the Mk4 re-entry body to the Mk4A.

[g] The British government declared in 2010 that its inventory would not exceed 225 warheads, and that the UK would reduce the number of warheads in its overall nuclear stockpile to no more than 180. Despite these stated intentions, the UK's nuclear stockpile appears to have remained at *c.* 225 warheads. The UK's Integrated Review of Security, Defence, Development and Foreign Policy, published in 2021, introduced a new ceiling of 260 warheads.

Sources: British Ministry of Defence, white papers, press releases and website; British House of Commons, *Hansard*, various issues; *Bulletin of the Atomic Scientists*, 'Nuclear notebook', various issues; and authors' estimates.

2015 SDSR stated the government's intention to replace the Vanguard-class submarines with four new SSBNs, known as the Dreadnought class.[12]

The new submarines were originally expected to begin entering service by 2028, but this has been delayed until the early 2030s. The service life of the Vanguard-class SSBNs has been commensurately extended to an overall lifespan of about 37–38 years.[13] The work to upgrade the ageing SSBNs has been subject to delays and budget overruns. For example, the UK's lead SSBN, HMS *Vanguard*, completed its refit and rejoined the fleet in July 2022,

[12] British government, Cm 9161 (note 8), para. 4.73.
[13] Mills (note 5), p. 10.

about three years later than expected. The cost of the *Vanguard* upgrade rose from an initial projection of about £200 million (US$307 million) in 2015 to more than £500 million ($688 million) in 2021.[14]

The delay meant that the UK's three other SSBNs had to extend their deterrence patrols. The length of time at sea for British nuclear submarines has reportedly increased from about 60–70 days in the 1970s to over 140 days in recent years, with some reports suggesting that a new record for the Royal Navy of 157 days was set in 2022.[15] These extended patrols were potentially factors contributing to several operating errors, accidents and personnel issues (including low morale and allegations of drug and sexual abuse) that have dogged the UK's nuclear forces over the past five years.[16] Furthermore, a January 2023 inspection revealed that the work on the HMS *Vanguard* was of a poor standard—contractors apparently used superglue to repair critical parts surrounding the nuclear reactor's cooling pipes—and nuclear safety issues prevented the SSBN from going out on deterrence patrol.[17]

The missiles and warhead

Given that the UK draws its SLBMs from a common pool shared with the USA, the UK is benefiting from the US Navy's programme to extend the service life of the Trident II D5 missile. The first and second life-extended versions are known as the D5LE and the D5LE2, respectively; the D5LE will function until the early 2060s and the D5LE2 until the mid 2080s (see section I).[18]

The warhead carried on the Trident II D5 is called the Holbrook, which is produced by the UK but based closely on the USA's W76 warhead design. It is being incorporated into the more effective USA-produced Mk4A re-entry body (aeroshell).[19] It is possible that sufficient Mk4A-upgraded warheads had been produced by the end of 2021 to arm the UK's Vanguard-class SSBNs.[20]

[14] British Ministry of Defence, 'British jobs secured through upgrade to nuclear deterrent', 4 Dec. 2015; and Nutt, K., 'Trident submarine refit delay may cost taxpayers £500 million', *The National*, 10 Oct. 2021.

[15] Sabbagh, D. and Edwards, R., 'Safety fears as UK Trident submarines are put to sea for longest-ever patrols', *The Guardian*, 6 Dec. 2022.

[16] Edwards, R., 'Threat to nuclear safety from prolonged Trident patrols', The Ferret, 6 Dec. 2022; and Nicolls, D., 'Royal Navy nuclear-armed submarine forced to abort mission after catching fire', *Daily Telegraph*, 7 Nov. 2022. See also e.g. Lusher, A., 'Nuclear submarine sex and drugs scandal: Nine Trident crew expelled from Navy amid "cocaine" and affairs allegations', *The Independent*, 28 Oct. 2017.

[17] Starkey, J., 'Sub standard: Nuclear security alert after botched attempt to fix Trident submarine with super glue', *The Sun*, 30 Jan. 2023; and Middleton, J., 'Royal Navy orders investigation into nuclear submarine "repaired with glue"', *The Guardian*, 1 Feb. 2023.

[18] Mills (note 5), p. 11.

[19] For detail on how the upgrade improves the weapon's capability see Cullen, D., *Extreme Circumstances: The UK's New Nuclear Warhead in Context* (Nuclear Information Service: Reading, Aug. 2022).

[20] Nukewatch, 'Warhead convoy movements summary 2021', 2021.

In 2020 the British government announced its intention to replace the Holbrook with a new warhead that will use the Mk7 aeroshell being developed for the USA's new W93 warhead (see section I).[21] According to the British Ministry of Defence, the replacement warhead is 'not exactly the same warhead [as the W93] but . . . there is a very close connection, in design terms and production terms'.[22]

Although the future of the W93 programme is being debated in the USA, British officials stated in 2021 that the UK's warhead-replacement programme would move forward regardless of the status of the USA's W93 programme.[23] In both the UK and the USA, the decision to introduce new warheads is thought to stem from strong internal political pressure to enhance nuclear infrastructure and capabilities.[24] The UK has not issued an official cost estimate or timeline for its programme, but it is likely that the new warhead will come into service sometime in the late 2030s or early 2040s.[25]

[21] Wallace, B., British Secretary of State for Defence, 'Nuclear deterrent', Written statement HCWS125, British House of Commons, 25 Feb. 2020; and Wolfe, J., Director of US Strategic Systems Programs, 'FY2022 budget request for nuclear forces and atomic energy defense activities', Statement before the US Senate, Armed Forces Committee, Subcommittee on Strategic Forces, 12 May 2021, pp. 6–7. For further detail see Kristensen, H. M. and Korda, M., 'British nuclear forces', *SIPRI Yearbook 2021*, pp. 360–61.

[22] Lovegrove, S., Permanent Secretary, Ministry of Defence, Statement, British House of Commons, Defence Committee, Oral evidence: MOD annual report and accounts 2019–20, HC 1051, 8 Dec. 2020, Q31.

[23] Mehta, A., 'UK official: American warhead decision won't impact British nuclear plans', *Defense News*, 13 Apr. 2021.

[24] Cullen (note 19), p. 6.

[25] Cullen (note 19), p. 4.