

III. British nuclear forces

HANS M. KRISTENSEN AND MATT KORDA

As of January 2022, the United Kingdom's nuclear weapon inventory consisted of approximately 225 warheads (see table 10.4)—an unchanged estimate from the previous year. This estimate is based on publicly available information on the British nuclear arsenal and conversations with British officials. The authors consider the British government to have generally been more transparent about its nuclear activities than many other nuclear-armed states—for example, by having declared the size of its nuclear weapon inventory in 2010 and the number of warheads it intends to keep in the future. However, the UK has never declassified the history of its inventory or the actual number of warheads it possesses, and in 2021 declared that it will no longer publicly disclose figures for the country's operational stockpile, deployed warheads or deployed missile numbers.¹

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 . . . NATO [North Atlantic Treaty Organization] Allies'.³

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 nuclear-powered ballistic missile submarines (SSBNs) that carry Trident II D5 submarine-launched ballistic missiles (SLBMs).⁴ 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.⁵ While the second and third SSBNs

¹ British Government, *Global Britain in a Competitive Age: Integrated Review of Security, Defence, Development and Foreign Policy*, CP 403 (HM 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 Topical Backgrounder, 14 June 2021.

² British Government, *National Report of the United Kingdom of Great Britain and Northern Ireland, pursuant to Actions 5, 20 and 21 of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) Review Conference 2010 for the 10th NPT Review Conference* (British Ministry of Defence: London, Nov. 2021), p. 9.

³ British Government (note 1), p. 76.

⁴ Mills, C., *Replacing the UK's Strategic Nuclear Deterrent: Progress of the Dreadnought Class*, Briefing Paper no. CBP-8010 (House of Commons Library: London, 2 Mar. 2021), p. 7.

⁵ British Ministry of Defence, 'UK's nuclear deterrent (CASD)', 17 Mar. 2021.

Table 10.4. British nuclear forces, January 2022

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
<i>Sea-based missiles (SLBMs)</i>	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 inventory					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 four SSBNs, one is in overhaul at any given time.

^b The three 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, approximately 40 are deployed on the single SSBN that is at sea at any given time.

^f This figure includes c. 45 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 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 inventory appears to have remained at approximately 225 warheads throughout the decade 2010–20. The integrated review of security, defence, development and foreign policy undertaken in 2020 and published in early 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.

remain in port and could be put to sea in a crisis, the fourth would probably be unable to deploy because it would be in the midst of extensive overhaul and maintenance.

The UK operates its submarines at a 'reduced alert' level with detargeted missiles, meaning that it could take days—rather than minutes—to fire nuclear missiles in a crisis.⁶ This distinguishes British nuclear policy from that of countries such as Russia or the United States, which are postured to launch nuclear missiles at a moment's notice and could be prompted to launch without first receiving a wholly accurate confirmation of an adversarial

⁶ British Ministry of Defence, 'The UK's nuclear deterrent: What you need to know', 17 Feb. 2022.

first strike. In order to command its submarines in the event of a degraded command and control environment, the British government uses a system of pre-written ‘letters of last resort’ to issue possible retaliatory orders: on a prime minister’s first day in office, after being briefed on the precise damage that a Trident missile could cause, the prime minister is expected to offer preplanned instructions regarding the UK’s response in the event of a nuclear crisis.⁷

Revisions to British nuclear policy

For approximately 15 years, the British government had been in the process of reducing the number of operationally available warheads and the size of its overall nuclear stockpile, until a sudden policy shift occurred in 2021.

In 2006 the British Ministry of Defence (MOD) announced that the country would be ‘reducing the number of operationally available warheads from fewer than 200 to fewer than 160’.⁸ By May 2010, the MOD had also reduced the country’s overall nuclear stockpile from approximately 240 to 245 warheads in 2006 to no more than 225 warheads.⁹

In October 2010 the British government’s strategic defence and security review (SDSR) announced additional plans for reductions: the number of warheads carried by each submarine would be reduced from 48 to 40 and the number of operational missiles on each submarine would also be reduced; the number of operationally available nuclear warheads would be reduced from fewer than 160 to no more than 120; and the overall nuclear stockpile would be reduced from no more than 225 warheads to no more than 180.¹⁰ The 2015 SDSR reaffirmed these planned reductions and announced that the number of operationally available nuclear warheads had already been reduced from fewer than 160 to no more than 120, and that all Vanguard-class SSBNs ‘now carr[ied] 40 nuclear warheads and no more than eight operational missiles’ (see below).¹¹

Despite these reductions and the government’s stated intentions about gradually further reducing the overall nuclear stockpile, from 2010 until 2021 the size of the UK’s stockpile remained constant at approximately

⁷ Norton-Taylor, R., ‘Theresa May’s first job: Decide on UK’s nuclear response’, *The Guardian*, 12 July 2016.

⁸ British Ministry of Defence, *The Future of the United Kingdom’s Nuclear Deterrent*, White Paper, CM 6994 (HM Stationery Office: London, Dec. 2006), p. 8.

⁹ British Ministry of Defence, ‘Response to Freedom of Information Act request made by Rob Edwards: Ref. 25-03-2013-173601-014’, 25 July 2013.

¹⁰ British Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, Cm 7948 (HM Stationery Office: London, 2010), p. 38.

¹¹ Fallon, M., British secretary of state for defence, ‘Statement on nuclear deterrent’, *Hansard*, 20 Jan. 2015, column 4WS; and British Government, *National Security Strategy and Strategic Defence and Security Review 2015: A Secure and Prosperous United Kingdom*, Cm 9161, (HM Stationery Office: London, 2015), p. 34.

225 warheads. While warheads removed from operationally available service throughout this period were placed into storage, they were not dismantled, contrary to what many analysts believed at the time.¹²

In its integrated review of security, defence, development and foreign policy, published in March 2021, the British government revealed a marked shift in policy by announcing a significant increase to the upper limit of its nuclear stockpile, to up to no more than 260 warheads.¹³ British officials clarified that the target of 180 warheads stated in the 2010 and 2015 SDSRs ‘was indeed a goal, but it was never reached, and it has never been our cap’.¹⁴ In addition, in its 2021 national report in advance of the planned 2022 10th review conference of the parties to the 1968 Treaty on the Non-Proliferation of Nuclear Weapons, the British government stated that the 260 number ‘is a ceiling, not a target, and it is not our current stockpile number’.¹⁵

It is unclear what exactly has prompted the UK to reverse decades of gradual disarmament policy. British government officials have offered differing and somewhat vague explanations for the increase in the UK’s overall nuclear stockpile, but following the integrated review’s publication, Ben Wallace, the British secretary of state for defence, explicitly pointed to improvements in Russia’s ballistic missile defence capabilities as one driving factor.¹⁶ It is also possible that raising the limit on its nuclear stockpile could enable the UK to deploy its SSBNs with a full load of Trident missiles and warheads. If the UK intends to increase the size of its nuclear stockpile, this would position the UK with China and Russia as the three members out of the five permanent members of the United Nations Security Council that are increasing the sizes of their nuclear stockpiles.

Nuclear weapon modernization

The UK’s lead SSBN, HMS *Vanguard*, entered service in December 1994, while the last submarine in the class, HMS *Vengeance*, entered service in February 2001 with an expected service life of 25 years.¹⁷ The 2015 SDSR stated the government’s intention to replace the Vanguard-class submarines with four new SSBNs, known as the Dreadnought class.¹⁸

¹² British officials, Interviews with the authors, May 2021.

¹³ British Government (note 1) p. 76.

¹⁴ Aidan Liddle (@AidanLiddle), the UK’s permanent representative to the Conference on Disarmament, ‘That cap was maintained in 2015. 180 was indeed a goal, but it was never reached, and it has never been our cap. And by the way, we’re talking about ceilings, not targets, or indeed our actual numbers’, Twitter, 16 Mar. 2021. This information was also later confirmed by other officials. British officials, Interviews with the authors, May 2021.

¹⁵ British Government (note 2), p. 11.

¹⁶ BBC Politics (@BBCPolitics) ‘#Marr: Do we need 80 new nuclear weapons? Defence Secretary Ben Wallace: “We need a credible nuclear deterrent”’, Twitter, 21 Mar. 2021.

¹⁷ Mills (note 4).

¹⁸ British Government (note 11), para. 4.73.

The new Dreadnought-class submarines were originally expected to begin entering into 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 approximately 37 to 38 years.¹⁹ The UK is participating in 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 D5LE and D5LE2, respectively; the D5LE will function until the early 2060s and the D5LE2 until the mid 2080s.²⁰

The warhead carried on the Trident II D5 is called the Holbrook, which is currently being upgraded to accommodate the USA-produced Mk4A re-entry body, in a collaboration between the British MOD's Atomic Weapons Establishment and US nuclear laboratories. British defence officials have suggested that 'the Mk4A programme will not increase the destructive power of the warhead'.²¹ However, the Mk4A is equipped with a new fuze system incorporating new technology that significantly increases the system's ability to conduct nuclear strike missions against hardened targets.²² British defence officials have acknowledged the enhanced capability.²³ According to Nukewatch, a UK-based disarmament group that tracks warhead convoys across the country, it is possible that sufficient Mk4A-upgraded warheads had been produced by the end of 2021 to arm the UK's Vanguard-class SSBNs.²⁴

The British government in 2020 announced its intention to replace the Holbrook with a new warhead, which will use the Mk7 aeroshell to be developed for the new US W93 warhead.²⁵ Although the administration of US President Joe Biden is expected to continue the W93 programme started under the previous administration, British defence officials stated in 2021 that the UK's warhead replacement programme would move forward regardless of the status of the USA's W93 programme.²⁶

¹⁹ Mills (note 4).

²⁰ Mills (note 4).

²¹ British Ministry of Defence, 'Defence in the media: 8 June 2016', Defence in the Media blog, 8 June 2016.

²² Kristensen, H. M., McKinzie, M. and Postol, T., 'How US nuclear force modernization is undermining strategic stability: The burst-height compensating super-fuze', *Bulletin of the Atomic Scientists*, 1 Mar. 2017.

²³ Norton-Taylor, R., 'Trident more effective with US arming device, tests suggest', *The Guardian*, 6 Apr. 2011.

²⁴ Nukewatch, 'Warhead convoy movements summary 2021', 2021.

²⁵ Wallace, B., British secretary of state for defence, 'Nuclear deterrent', Written Statement HCWS125, British Parliament, 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 Subcommittee on Strategic Forces, US Senate Armed Forces Committee, 12 May 2021, pp. 6–7. For further detail see Kristensen, H. M. and Korda, M., 'British nuclear forces', *SIPRI Yearbook 2021*.

²⁶ Mehta, A., 'UK official: American warhead decision won't impact British nuclear plans', *Defense News*, 13 Apr. 2021.

The new Dreadnought-class submarines will have 12 launch tubes—a reduction from the 16 carried by the Vanguard-class (see below). Delivery of the first batch of missile tubes, which are produced in the USA, was initially delayed, but, as of January 2022, all 12 of the tubes required for the first SSBN in the class (HMS *Dreadnought*) had been delivered and were in the process of being integrated into the SSBN's pressure hull.²⁷ The Dreadnought-class is expected to be significantly stealthier than its predecessor, as a result of its hull design and electric-drive propulsion.²⁸

The cost of the Dreadnought programme has been a source of concern and controversy since its inception.²⁹ In its annual update to the parliament in December 2021, the MOD reported that a total of £10.4 billion (\$14.3 billion) had been spent on the programme's concept, assessment and delivery phases as of 31 March 2021—of which £1.9 billion (\$2.6 billion) was spent in financial year 2020/21.³⁰

Sea-based missiles

The current Vanguard-class SSBNs can each be armed with up to 16 Trident II D5 SLBMs. The UK does not own the missiles, but has purchased the right to 58 Trident SLBMs from a pool shared with the US Navy at the US Strategic Weapons Facility in Kings Bay, Georgia.³¹ Previously, under limits set out in the 2010 SDSR and reaffirmed by the 2015 SDSR, when on patrol, the submarines would be armed with no more than 8 operational missiles with a total of 40 nuclear warheads.³² However, after the 2021 integrated review's policy changes, it is possible that these limits are no longer applicable and that the number of deployed missiles and warheads on each submarine could therefore increase.

²⁷ British Ministry of Defence, 'The United Kingdom's future nuclear deterrent: The 2021 update to Parliament', 16 Dec. 2021.

²⁸ Sutton, H. I., 'First submarine to use new stealth technology', *Naval News*, 3 Nov. 2021; O'Rourke, R., *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, Congressional Research Service (CRS) Report R41129 (US Congress, CRS: Washington, DC, 19 Oct. 2021), p. 41; and O'Rourke, R., *Electric-drive Propulsion for US Navy Ships: Background and Issues for Congress*, Congressional Research Service (CRS) Report RL30622 (US Congress, CRS: Washington, DC, 31 July 2000), pp. 11–12.

²⁹ Mills (note 4). See also Kristensen and Korda (note 25), p. 361.

³⁰ British Ministry of Defence (note 27).

³¹ Allison, G., 'No, America doesn't control Britain's nuclear weapons', *UK Defence Journal*, 20 July 2019.

³² Fallon (note 11); and British Government (note 11), p. 34.