

### III. British nuclear forces

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As of January 2021, the United Kingdom's nuclear weapon inventory consisted of approximately 225 warheads (see table 10.4).<sup>1</sup> In its 2015 Strategic Defence and Security Review (SDSR), the British Government reaffirmed its intention to cut the size of the nuclear arsenal. By that time, the number of operationally available nuclear warheads had already been reduced from fewer than 160 to no more than 120, and the overall size of the nuclear weapon inventory, including non-deployed warheads, was intended to decrease from no more than 225 in 2010 to no more than 180 by the mid 2020s.<sup>2</sup> These plans changed following the Integrated Review of Security, Defence, Development and Foreign Policy undertaken in 2020 and published in early 2021, which increased the ceiling for the nuclear weapon inventory to 260.<sup>3</sup>

The January 2021 estimate of 225 warheads is based on publicly available information on the British nuclear arsenal, conversations with officials, and assumptions about the scope of the planned reduction. The authors consider the British Government to have been more transparent about its nuclear activities than many other nuclear-armed states—for example by having declared the size of its nuclear 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.

#### **The role of nuclear weapons in British military doctrine**

The UK remains 'deliberately ambiguous' about the precise conditions under which it would use nuclear weapons; however, the British Government has stated that such weapons would only be used under 'extreme circumstances of self-defence, including the defence of our NATO Allies'.<sup>4</sup>

The UK is the only nuclear-armed state that operates a single nuclear weapon type: the British 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

<sup>1</sup> This is a revision of SIPRI's estimate of 215 warheads in *SIPRI Yearbook 2020*.

<sup>2</sup> British Government, *National Security Strategy and Strategic Defence and Security Review 2015: A Secure and Prosperous United Kingdom*, Cm 9161 (HM Stationery Office: London, Nov. 2015), para. 4.66.

<sup>3</sup> 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). These changes will be discussed in the next edition of the SIPRI Yearbook.

<sup>4</sup> British Government (note 2), para. 4.68.

missiles (SLBMs).<sup>5</sup> In a posture known as Continuous At-Sea Deterrence (CASD), which began in 1969, one British SSBN is on patrol at all times.<sup>6</sup> While the second and third SSBNs 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.

### **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.<sup>7</sup> The 2015 SDSR stated the government's intention to replace the Vanguard-class submarines with four new SSBNs.<sup>8</sup> In 2016 the House of Commons, the lower house of the British Parliament, approved a motion supporting the government's decision with cross-party support.<sup>9</sup>

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.<sup>10</sup> The UK is participating in the United States Navy's programme to extend the service life of the Trident II D5 missile (the life-extended version is known as D5LE) to the early 2060s (see section I).<sup>11</sup>

The warhead carried on the Trident II D5 is called the Holbrook. Its nuclear explosive package is thought to be a modified version of the USA's W76 warhead and is contained in the US-produced Mk4 re-entry body. The Atomic Weapons Establishment, the research facility responsible for the design and manufacture of the UK's warheads, is currently upgrading the Holbrook to accommodate the US-produced Mk4A re-entry body, in collaboration with US nuclear laboratories.<sup>12</sup>

In February 2020 the British Government announced its intention to replace the Holbrook with a new warhead.<sup>13</sup> The announcement had been pre-empted by the commander of US Strategic Command, Admiral

<sup>5</sup> Mills, C., *Replacing the UK's Strategic Nuclear Deterrent: Progress of the Dreadnought Class*, Briefing Paper no. CBP-8010 (House of Commons Library: London, 17 July 2020), p. 7.

<sup>6</sup> British Ministry of Defence, 'Continuous at sea deterrent 50: What you need to know', 3 May 2019.

<sup>7</sup> Mills (note 5), p. 7.

<sup>8</sup> British Government (note 2), para. 4.73.

<sup>9</sup> British House of Commons, 'UK's nuclear deterrent', *Hansard*, col. 559, vol. 613 (18 July 2016).

<sup>10</sup> British Government (note 2), para. 4.65.

<sup>11</sup> Mills (note 5), p. 7.

<sup>12</sup> British Ministry of Defence, 'The United Kingdom's future nuclear deterrent: 2020 update to Parliament', 17 Dec. 2020; and Kristensen, H. M., 'British submarines to receive upgraded US nuclear warhead', Federation of American Scientists (FAS) Strategic Security Blog, 1 Apr. 2011.

<sup>13</sup> Wallace, B., British Secretary of State for Defence, 'Nuclear deterrent', Written Statement HCWS125, British Parliament, 25 Feb. 2020.

**Table 10.4.** British nuclear forces, January 2021

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 <sup>a</sup>				120
Trident II D5	48 <sup>b</sup>	1994	>10 000 <sup>c</sup>	1–8 x 100 kt <sup>d</sup>	120
<b>Total operationally available warheads</b>					<b>120<sup>e</sup></b>
Other stored warheads					105 <sup>f</sup>
<b>Total inventory</b>					<b>225<sup>g</sup></b>

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

<sup>a</sup> 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.

<sup>b</sup> 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.

<sup>c</sup> 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.

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

<sup>e</sup> Of the 120 operationally available warheads, 40 are deployed on the single SSBN that is at sea at any given time.

<sup>f</sup> Of the estimated 105 warheads that are not operationally available, it is thought that about half are spares and the other half are undergoing upgrade from the Mk4 to the Mk4A.

<sup>g</sup> The British Government declared in 2010 that its inventory would not exceed 225 warheads. It is estimated here that the inventory remained at that number in Jan. 2021, a revision of SIPRI's estimate of 215 warheads in *SIPRI Yearbook 2020*. A planned reduction to an inventory of 180 warheads by the mid 2020s was ended by the Integrated Review of Security, Defence, Development and Foreign Policy undertaken in 2020 and published in early 2021. The review 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.

Charles A. Richard, who reported during testimony to the US Senate that the US W93/Mk7 programme 'will also support a parallel Replacement Warhead Program in the United Kingdom'.<sup>14</sup> In April 2020 Ben Wallace, the British Secretary of State for Defence, sent an unprecedented letter to members of the US Congress, lobbying them in support of the W93 warhead programme and claiming that it is 'critical . . . to the long-term viability of the UK's nuclear deterrent'.<sup>15</sup> This letter and the surprise announcement of the W93 decision have sparked fresh concerns that the UK's nuclear

<sup>14</sup> Richard, C. A., Commander, US Strategic Command, Statement, US Senate, Armed Services Committee, 13 Feb. 2020, p. 13.

<sup>15</sup> Borger, J., 'UK lobbies US to support controversial new nuclear warheads', *The Guardian*, 1 Aug. 2020.

deterrent lacks the appropriate independence and parliamentary scrutiny.<sup>16</sup> The British Ministry of Defence (MOD) acknowledged in 2020 that ‘It is not exactly the same warhead, but . . . there is a very close connection, in design terms and production terms.’<sup>17</sup>

The new Dreadnought-class submarines will have 12 launch tubes—a reduction from the 16 carried by the Vanguard class (see below). Technical problems resulted in a delay in the delivery of the missile launch tubes; however, as of January 2021 six tubes—half 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.<sup>18</sup>

The cost of the Dreadnought programme has been a source of concern and controversy since its inception. In 2015 the MOD estimated the total cost of the programme to be £31 billion (\$47.4 billion). It set aside a contingency of £10 billion (\$15.3 billion) to cover possible increases, and approximately £800 million of that fund had been allocated by mid 2020.<sup>19</sup> In 2018 the National Audit Office (NAO) reported that the MOD was facing an ‘affordability gap’ of £2.9 billion (\$3.9 billion) in its military nuclear programmes between 2018 and 2028.<sup>20</sup> In its annual update to the parliament in December 2020, the MOD reported that a total of £8.5 billion (\$11.8 billion) had been spent on the programme’s concept, assessment and delivery phases—an increase of £1.6 billion (\$2.2 billion) from the previous financial year.<sup>21</sup>

In 2020 the NAO and the Commons Public Accounts Committee reported that three key nuclear-regulated infrastructure projects in the UK’s nuclear weapon programme would be delayed by 1.7–6.3 years, with costs increasing by over £1.3 billion (\$1.7 billion) to a forecasted total of £2.5 billion (\$3.2 billion).<sup>22</sup> According to these reports, the delays were largely caused by poor management and premature construction. This suggests that the UK’s relative inexperience in building new warheads could lead to further delays and cost overruns.

<sup>16</sup> Mills, C., ‘Replacing the UK’s strategic nuclear deterrent: The long-awaited warhead decision’, Briefing Paper no. CBP-8941, House of Commons Library, 19 June 2020, p. 1.

<sup>17</sup> Lovegrove, S., Permanent Secretary, Ministry of Defence, Statement, British House of Commons, Defence Committee, 8 Dec. 2020, Q31.

<sup>18</sup> British Ministry of Defence (note 12).

<sup>19</sup> Mills (note 5), pp. 18–19.

<sup>20</sup> British National Audit Office (NAO), *The Defence Nuclear Enterprise: A Landscape Review*, Report by the Comptroller and Auditor General, HC 1003, Session 2017–19 (NAO: London, 22 May 2018). Spending on military nuclear programmes was estimated to account for c. 14% of the total 2018/19 Ministry of Defence budget, and it could rise to 18% or 19% during the peak of recapitalization.

<sup>21</sup> British Ministry of Defence (note 12).

<sup>22</sup> British National Audit Office, *Managing Infrastructure Projects on Nuclear-regulated Sites*, Report by the Comptroller and Auditor General, HC 19, Session 2019–20 (NAO: London, 10 Jan. 2020), pp. 5–6; and British House of Commons, Committee of Public Accounts, *Defence Nuclear Infrastructure*, 2nd report of session 2019–21, HC 86 (House of Commons: London, 13 May 2020).

### Sea-based missiles

The Vanguard-class SSBNs can each be armed with up to 16 Trident II D5 SLBMs. Of the four SSBNs, three (with a total of 48 missile tubes) are considered to be operational at any given time, while the fourth SSBN is in overhaul. 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.<sup>23</sup> Under limits set out in the 2010 SDSR and reaffirmed by the 2015 SDSR, when on patrol, the submarines are armed with no more than 8 operational missiles with a total of 40 nuclear warheads.<sup>24</sup> The missiles are kept in a ‘detargeted’ mode, meaning that target data would need to be loaded into the guidance system before launch. They also have a reduced alert status: several days’ notice would be required to fire the missiles.<sup>25</sup>

<sup>23</sup> Allison, G., ‘No, America doesn’t control Britain’s nuclear weapons’, UK Defence Journal, 20 July 2017.

<sup>24</sup> British Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, Cm 7948 (HM Stationery Office: London, Oct. 2010), pp. 5, 38; and British Government (note 2), para. 4.66.

<sup>25</sup> British Government (note 2), para. 4.78.