

I. United States nuclear forces

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As of January 2024 the United States maintained a military stockpile of approximately 3708 nuclear warheads, the same number as the previous year. Approximately 1770 of these—consisting of about 1670 strategic and roughly 100 non-strategic (tactical) warheads—were deployed on ballistic missiles and at bomber bases. In addition, about 1938 warheads were held in reserve and around 1336 retired warheads were awaiting dismantlement (200 fewer than the previous year’s estimate), giving a total inventory of approximately 5044 nuclear warheads (see table 7.2, end of section).

The estimates presented here are based on publicly available information regarding the US nuclear arsenal and assessments by the authors.¹ While in 2021 the USA briefly restored a policy of declassifying the size of its nuclear stockpile and the annual number of dismantled warheads, the information was not released in 2022 or 2023.²

The US stockpile is expected to continue to decline slightly over the next decade as nuclear modernization programmes consolidate some nuclear weapon types. The US Department of Energy (DOE) reported in April 2023 that it had been ‘on pace to complete the dismantlement of all warheads retired before FY [fiscal year] 2009 by the end of FY 2022’ but that the Covid-19 pandemic had ‘delayed the dismantlement of a small number of these retired warheads until after FY 2022’.³ As for warheads retired during and after FY 2009, the DOE reported in November 2023 that ‘Warheads awaiting dismantlement constitute a significant fraction of the total warhead population’, and that the DOE planned to ‘remove additional retired weapons from . . . [US Department of Defense (DOD)] facilities’ and ‘dismantle several [retired] weapons systems’.⁴

This section details the USA’s holdings of nuclear weapons, both strategic (including those delivered by air, land and sea) and non-strategic. Before doing so, it first considers the USA’s compliance with its bilateral arms control obligations, outlines the role played by nuclear weapons in the USA’s military doctrine and describes the country’s warhead-production capacity.

¹ Kristensen, H. M. and Korda, M., ‘Estimating world nuclear forces: An overview and assessment of sources’, SIPRI Commentary, 14 June 2021.

² US Department of State, ‘Transparency in the US nuclear weapons stockpile’, Fact sheet, 5 Oct. 2023; and Kristensen, H. M., ‘While advocating nuclear transparency abroad, Biden administration limits it at home’, FAS Strategic Security Blog, Federation of American Scientists, 31 July 2023.

³ US Department of Energy (DOE), National Nuclear Security Administration (NNSA), *Fiscal Year 2023 Stockpile Stewardship and Management Plan*, Report to Congress (DOE: Washington, DC, Apr. 2023), p. 2-12. US fiscal years end on 30 Sep. of the named year.

⁴ US Department of Energy (DOE), National Nuclear Security Administration (NNSA), *Fiscal Year 2024 Stockpile Stewardship and Management Plan*, Report to Congress (DOE: Washington, DC, Nov. 2023, pp. 2-12, G-6).

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US compliance with New START

During 2023 the USA appeared to continue to be in compliance with the limits on deployed strategic nuclear forces prescribed by the 2010 Russian–US Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START).⁵ Under the treaty, the Russian Federation and the USA are obligated to exchange data on their nuclear forces twice a year. Although Russia stopped publishing and sharing treaty data in early 2023 (see section II of this chapter), the USA initially disclosed its numbers in May 2023 by publicly declaring that it had 1419 warheads attributed to 662 deployed ballistic missiles and heavy bombers as of 1 March 2023.⁶ The USA stated that it had voluntarily released the numbers ‘In the interest of transparency and the US commitment to responsible nuclear conduct’.⁷ However, the USA did not disclose its aggregate numbers for September 2023; in January 2024 it instead republished the numbers for March 2023.⁸

In addition to no longer publicly volunteering its New START aggregate data, the USA announced four countermeasures in June 2023 in response to Russia’s violation of the treaty. The USA (a) will not provide biannual force data; (b) will not provide notifications (e.g. on the location and status of deployed missiles and launchers); (c) will not facilitate Russian inspections on US territory; and (d) will not provide telemetry information on test launches of US intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs). The US Department of State said the countermeasures were in line with international law as they aimed to induce Russia to return to compliance.⁹

Just as with Russia, many of the USA’s strategic delivery systems carry fewer warheads than their maximum capacity in order to meet the limits of New START. While New START has so far constrained US nuclear warhead loadings, the National Defense Authorization Act (NDAA) for FY 2024 directed the US Air Force (USAF) to ‘develop a plan to decrease the amount of time required to upload additional warheads to the intercontinental ballistic missile force in the event Presidential direction is given to exercise such a plan’.¹⁰ In addition, a report by the bipartisan US Congressional Commission on Strategic Posture published in October 2023, while not part of official US

⁵ For a summary and other details of New START see annex A, section III, in this volume. On related developments in 2023 see chapter 8, section I, in this volume.

⁶ US Department of State, Bureau of Arms Control, Verification and Compliance, ‘US New START Treaty aggregate numbers of strategic offensive arms’, Fact sheet, 12 May 2023, p. 2.

⁷ US Department of State (note 6).

⁸ US Department of State, Bureau of Arms Control, Deterrence, and Stability, ‘2023 report to Congress on implementation of the New START treaty’, 31 Jan. 2024, p. 4.

⁹ US Department of State, Bureau of Arms Control, Deterrence, and Stability, ‘US countermeasures in response to Russia’s violation of the New START treaty’, Fact sheet, 1 June 2023.

¹⁰ National Defense Authorization Act for Fiscal Year 2024, US Public Law 118-31, signed into law on 22 Dec. 2023, HR 2670, pp. 466–67.

policy, recommended that the USA should urgently prepare to ‘upload some or all’ of the country’s reserve warheads.¹¹

The role of nuclear weapons in US military doctrine

The 2022 Nuclear Posture Review (NPR) released by the administration of President Joe Biden affirmed three overall roles for US nuclear weapons: ‘Deter strategic attacks; Assure Allies and partners; and Achieve US objectives if deterrence fails.’¹² It noted that ‘The United States would only consider the use of nuclear weapons in extreme circumstances to defend the vital interests of the United States or its Allies and partners’; however, it did not elaborate on what specifically constitutes ‘vital interests’, nor did it define the phrase ‘Allies and partners’.¹³ The 2022 NPR also appeared to scale back somewhat the language about the role that nuclear weapons could play against non-nuclear strategic attacks, a role the 2018 NPR issued by the administration of President Donald J. Trump had sought to broaden.¹⁴

The overall roles of US nuclear weapons outlined in the 2022 NPR are in line with long-held policies, but the force structure required to serve those roles appears to be changing. The administration of President Barack Obama (2009–17) initiated a general nuclear weapon modernization programme, which the Trump administration (2017–21) sought to expand by adding new low-yield and tactical nuclear weapons (see below).¹⁵ While the 2022 NPR rejected some of this expansion, the Biden administration came under increasing pressure in 2023 to modify US posture to counterbalance Russian and Chinese nuclear developments. For example, in October 2023 the Congressional Strategic Posture Commission recommended a wide range of urgent modifications to US strategic and regional nuclear forces.¹⁶

¹¹ Congressional Commission on the Strategic Posture of the United States, *America’s Strategic Posture: Final Report of the Congressional Commission on the Strategic Posture of the United States* (Institute for Defense Analyses, IDA: Alexandria, VA, 2023), p. 48.

¹² US Department of Defense (DOD), *2022 National Defense Strategy of the United States of America* (DOD: Washington, DC, Oct. 2022), *2022 Nuclear Posture Review*, p. 7.

¹³ US Department of Defense (note 12), p. 9.

¹⁴ US Department of Defense (note 12), p. 7; and US Department of Defense (DOD), *Nuclear Posture Review 2018* (DOD: Washington, DC, Feb. 2018). On the 2018 NPR see Kristensen, H. M., ‘US nuclear forces’, *SIPRI Yearbook 2019*. Note that the NPRs are public documents but the detailed requirements for the role of nuclear weapons are described in a number of White House and US DOD documents that remain classified.

¹⁵ For further detail see Kristensen, H. M. and Korda, M., ‘United States nuclear forces’, *SIPRI Yearbook 2023*, pp. 252–53.

¹⁶ Congressional Commission on the Strategic Posture of the United States (note 11), p. 48.

Warhead production

Since the end of the cold war, the USA has relied on refurbishment of existing warhead types to maintain the nuclear arsenal. The National Nuclear Security Administration (NNSA) delivered more than 200 refurbished nuclear weapons to the US military in 2023.¹⁷ In more recent years, the USA has moved towards a more ambitious plan focused on producing new or significantly modified warheads. Because the plan depends heavily on the ability to produce new pits—the plutonium core of a nuclear weapon—the NNSA aimed to increase pit production capacity from around 10 per year to up to 30 pits in 2026 and at least 80 pits per year by 2030.¹⁸ However, the NNSA acknowledged in 2022 that this timeline was unrealistic.¹⁹ As a result, some of the nuclear weapon programmes described below will probably face delays or new delivery systems could be initially deployed with existing warheads.²⁰

Strategic nuclear forces

US offensive strategic nuclear forces include heavy bombers, land-based ICBMs and nuclear-powered ballistic missile submarines (SSBNs). These forces, together known as the triad, changed little during 2023. SIPRI estimates that a total of 3508 nuclear warheads were assigned to the strategic triad, of which an estimated 1670 warheads were deployed on ballistic missiles and at heavy bomber bases.

Aircraft and air-delivered weapons

As of January 2024 the USAF heavy bomber fleet included B-1Bs, B-2As and B-52Hs. Of these, 66 (20 B-2As and 46 B-52Hs) were nuclear-capable, but not all are operationally deployed at any given time. The B-2A can deliver gravity bombs (B61-7, B61-11, B61-12 and B83-1) and the B-52H can deliver the AGM-86B/W80-1 nuclear air-launched cruise missile (ALCM). SIPRI estimates that approximately 788 warheads were assigned to strategic bombers, of which about 300 are deployed at bomber bases and ready for delivery on relatively short notice. The USA is modernizing its nuclear bomber force by upgrading nuclear command-and-control capabilities on existing bombers, developing improved nuclear weapons (the B61-12 gravity bomb and the new

¹⁷ US National Nuclear Security Administration (NNSA), '2023: Year in review: Making our vision a reality', Feb. 2024.

¹⁸ US National Nuclear Security Administration (NNSA), 'Plutonium pit production', Fact sheet, Apr. 2019; and US Government Accountability Office (GAO), *Nuclear Weapons: NNSA Should Further Develop Cost, Schedule, and Risk Information for the W87-1 Warhead Program*, Report no. GAO-20-73 (GAO: Washington, DC, Sep. 2020), pp. 7–8, 14–15.

¹⁹ For further detail see Kristensen and Korda (note 15), pp. 253–54.

²⁰ US Air Force (USAF), *Report on Development of Ground-Based Strategic Deterrent Weapon*, Report to eight congressional committees (USAF: [Washington, DC,] May 2020), p. 4.

AGM-181 Long-Range Standoff, LRSO, cruise missile), and building a new heavy bomber (the B-21 Raider).

The first six B-21s are expected to enter service in 2027; the aircraft will gradually replace the B-1B and B-2 bombers.²¹ The B-21 made its first flight in November 2023.²² It is expected that the USAF will procure at least 100 (possibly as many as 145) of the new bombers, with the latest service costs estimated at approximately \$203 billion for the entire 30-year operational programme, at an estimated production cost of \$550 million per aircraft; however, several critical cost details remain classified.²³ To accommodate the incoming B-21s, the number of US bomber bases with nuclear capability is expected to increase from two as of January 2024 to five by the early 2030s.²⁴ Commercial satellite imagery indicates that a new weapons generation facility is under construction at Barksdale Air Force Base in Louisiana, which will reinstate its former nuclear storage capability upon completion.²⁵

The B-21 appears to have a slightly smaller weapon load than the B-2. It will be capable of delivering four types of nuclear weapon: the B61-12 and B61-13 guided nuclear gravity bombs; the B61-11 nuclear earth-penetrator; and the AGM-181 LRSO ALCM, which is in development. The AGM-181 LRSO will replace the AGM-86B ALCM in the early 2030s and will carry the W80-4 nuclear warhead, a modified version of the W80-1 warhead that is used on the AGM-86B. In March 2023 the NNSA authorized the production engineering phase for the W80-4, with the first production unit scheduled to be ready by FY 2027 (September 2027), instead of FY 2025 as originally planned.²⁶ Production is scheduled to be completed in FY 2031.²⁷

The B61-12 was previously viewed as a replacement for all other gravity bombs in the stockpile, including the B61-7, B61-11 and B83-1 used for strategic bombers. However, in October 2023 the Biden administration announced plans to develop a new modification of the B61 gravity bomb, the B61-13, possibly as part of an effort to gain Congressional approval to retire the

²¹ Tirpak, J. A., 'B-21 Raider first flight now postponed to 2023', *Air and Space Forces Magazine*, 20 May 2022; and US Air Force, 'B-21 bomber to be unveiled Dec. 2', 20 Oct. 2022.

²² Stone, M. and Swanson, D., 'US Air Force's new B-21 Raider "flying wing" bomber takes first flight', Reuters, 11 Nov. 2023.

²³ Capaccio, A., 'Under-wraps B-21 bomber is seen costing \$203 billion into 2050s', Bloomberg, 17 Nov. 2021; Tirpak, J. A., 'A new bomber vision', *Air Force Magazine*, 1 June 2020; and Stone and Swanson (note 22).

²⁴ Dawkins, J. C., Commander, 8th Air Force and Joint-Global Strike Operations Center, Barksdale Air Force Base, 'B21 General Dawkins intro', YouTube, 19 Mar. 2020, 01:35; and Kristensen, H. M., 'USAF plans to expand nuclear bomber bases', FAS Strategic Security Blog, Federation of American Scientists, 17 Nov. 2020.

²⁵ Knight, M., 'Construction of new nuclear weapons facility at Barksdale AFB', FAS Strategic Security Blog, Federation of American Scientists, 20 Feb. 2024.

²⁶ US National Nuclear Security Administration (NNSA), 'W80-4 life extension program enters phase 6.4, production engineering', 1 May 2023.

²⁷ Leone, D., 'Two-year delay for first LRSO warhead, but NNSA says will still deliver on-time to Air Force', *Defense Daily*, 4 Aug. 2022.

B83-1.²⁸ The B61-13 will reportedly use the warhead from the outgoing B61-7s—and will thus have the same maximum yield of 360 kilotons—but will be modified with new safety and control features as well as a guided tail-kit for improved accuracy and to facilitate broad area targeting.²⁹ According to the US DOD, the B61-13 will not increase the size of the US stockpile because the number of B61-12s to be produced (approximately 480) ‘will be lowered by the same amount as the number of B61-13s produced’.³⁰

Land-based missiles

As of January 2024 the USA deployed 400 LGM-30G Minuteman III ICBMs in 400 silos across three missile wings.³¹ Another 50 empty silos are kept in a state of readiness for reloading with stored missiles if necessary. SIPRI estimates that 800 warheads were assigned to the ICBM force, of which 400 were deployed on the missiles. Each Minuteman III ICBM is armed with either a 335-kt W78/Mk12A or a 300-kt W87-0/Mk21 warhead. ICBMs carrying the W87-0 can only be loaded with one warhead, while those carrying the W78 can be uploaded with up to two more warheads for a maximum of three multiple independently targetable re-entry vehicles (MIRVs).³² In recent years, there has been growing internal pressure on the US government—which intensified in 2023—to re-MIRV some of the USA’s deployed ICBMs.³³

The USAF has scheduled its next-generation ICBM to begin replacing the Minuteman III in 2028, with full replacement by 2036, although delays to this schedule are expected.³⁴ The first flight test of this new ICBM—the LGM-35A Sentinel—was initially planned for 2023; however, technological and staffing issues have caused delays, pushing the first flight test and first full functional test back to FY 2024 and FY 2025, respectively.³⁵ In 2023 commercial satellite imagery revealed ongoing construction at an ICBM test launch silo at Vandenberg Air Force Base in California, one of more than 600 facilities that

²⁸ Kristensen, H. and Korda, M., ‘Biden administration decides to build a new nuclear bomb to get rid of an old bomb’, FAS Strategic Security Blog, Federation of American Scientists, 27 Oct. 2023.

²⁹ US Department of Defense, ‘Department of Defense announces pursuit of B61 gravity bomb variant’, Press release, 27 Oct. 2023.

³⁰ US Department of Defense, ‘Fact sheet on B61 variant development’, Fact sheet, 27 Oct. 2023.

³¹ US Air Force, ‘LGM-30G Minuteman III’, Fact sheet, accessed 15 Mar. 2024.

³² On the warheads and yields see also Kristensen, H. M. and Korda, M., ‘United States nuclear forces’, *SIPRI Yearbook 2021*, p. 341.

³³ Kristensen, H. M. et al., ‘Strategic Posture Commission report calls for broad nuclear buildup’, FAS Strategic Security Blog, Federation of American Scientists, 12 Oct. 2023.

³⁴ Richard, C. A., Commander, US Strategic Command, Statement before the US Senate, Armed Services Committee, 13 Feb. 2020, p. 9. On the Sentinel see also Kristensen and Korda (note 32), p. 341.

³⁵ ‘LGM-35A Sentinel intercontinental ballistic missile, USA’, Airforce Technology, 29 July 2022; and US Government Accountability Office (GAO), *Weapon Systems Annual Assessment*, Report no. GAO-23-106059 (GAO: Washington, DC, June 2023).

will require an upgrade as part of the Sentinel programme.³⁶ Complications related to these infrastructure upgrades have contributed to the delays and cost overruns faced by the programme: the USAF announced in January 2024 that the Sentinel deployment will be delayed by up to two years and cost an estimated 37 per cent more than originally expected.³⁷ The scale of the cost overrun triggered legislation (the 1982 Nunn–McCurdy Act) that potentially could result in the termination of the programme. To avoid this, the US Secretary of Defense must investigate the cause of the overrun, put in place mitigating measures and re-certify the programme as essential to national security.³⁸

Each Sentinel will be able to carry up to two warheads, with the USAF planning to produce a significantly modified warhead based on the same design as the W87-0, known as the W87-1. The cost of the W87-1 warhead-modernization programme has been estimated at between \$11.9 billion and \$15.9 billion in ‘then-year’ dollars (i.e. the values account for inflation), but this excludes the considerable costs of producing the plutonium pits for the warhead.³⁹ The programme formally entered the development engineering phase in May 2023, with completion of the first production unit expected sometime in FY 2031 or FY 2032 (although the original plan was for FY 2030).⁴⁰ However, production of the W87-1 in time to meet the Sentinel’s planned deployment schedule depended on the NNSA’s projected production rate of at least 80 plutonium pits per year by 2030 (see above). The NNSA’s acknowledgement that this objective was unrealistic means that the Sentinel will initially be deployed with the existing W87-0 warheads.⁴¹

The Sentinel is also expected to carry a new type of re-entry vehicle (known as the Next Generation Re-entry Vehicle, NGRV). The USAF’s budget for FY 2024 includes funding for ‘early acquisition activities’ for the NGRV. To accommodate the delays affecting production of the W87-1 warhead, the NGRV will be capable of carrying both current and future warheads.⁴²

Sea-based missiles

The US Navy operates a fleet of 14 Ohio-class SSBNs, of which 12 are normally considered to be operational with the remaining 2 typically undergoing

³⁶ US Government Accountability Office (note 35); and authors’ assessment based on analysis of satellite imagery.

³⁷ Tirpak, J. A., ‘New ICBM has “critical” cost and schedule overruns, needs SecDef certification to continue’, *Air and Space Forces Magazine*, 18 Jan. 2024.

³⁸ Knight, M., ‘“Critical” overrun of Sentinel ICBM program demands government transparency’, FAS Strategic Security Blog, Federation of American Scientists, 2 Feb. 2024.

³⁹ US Department of Energy (note 4), pp. 8-27, 8-32.

⁴⁰ US Department of Energy (note 4), pp. 1-6, 2-10, 2-11, 8-6.

⁴¹ For further detail see Kristensen and Korda (note 15), pp. 253–54.

⁴² US Department of Defense (DOD), *Department of Defense Fiscal Year (FY) 2024 Budget Estimates*, Justification Book, vol. 3 of 4, Research, Development, Test and Evaluation, Air Force (DOD: Washington, DC, Mar. 2023).

maintenance at any given time. Eight of the SSBNs are based at Naval Base Kitsap in Washington state, on the Pacific Ocean, and six at Naval Submarine Base Kings Bay in Georgia, on the Atlantic. The last mid-life refuelling was completed in March 2022, meaning that all 14 boats are now potentially deployable until 2027, when the first Ohio-class submarine is expected to retire.⁴³

Each Ohio-class SSBN was built to carry up to 24 Trident II SLBMs, but to meet the New START limit on deployed launchers, 4 of the 24 initial missile tubes on each submarine were deactivated so that the 12 SSBNs that are usually operational can carry no more than 240 missiles.⁴⁴ At any given time 8–10 SSBNs are normally at sea, of which 4–5 are on alert in their designated patrol areas and ready to fire their missiles within 15 minutes of receiving the launch order. The US SSBN fleet conducts about 30 deterrence patrols per year.⁴⁵

The Trident II D5 SLBMs carry two basic warhead types: the 455-kt W88 and the W76. The latter exists in two versions: the 90-kt W76-1 and the low-yield W76-2.⁴⁶ The NNSA has begun modernizing the ageing W88 warhead. The first production unit of the W88 Alt 370 was completed on 1 July 2021 and the warhead was formally accepted into the stockpile in 2023.⁴⁷ Each SLBM can carry up to eight warheads but normally carries an average of four or five. SIPRI estimates that around 1920 warheads were assigned to the SSBN fleet as of January 2024, of which approximately 970 were deployed on SLBMs.⁴⁸

The low-yield W76-2, which was first deployed in late 2019 and is operational on SSBNs in both the Atlantic and the Pacific, is a modification of the W76-1 and is estimated to have an explosive yield of 8 kt.⁴⁹ The 2022 NPR left open the possibility that the W76-2 warhead might be retired as the B61-12 and the LRSO's low-yield capabilities are fielded over the coming decade.⁵⁰

Since 2017 the US Navy has been replacing its Trident II D5 SLBMs with an enhanced version, known as the D5LE (LE for 'life extension'), which is equipped with the new Mk6 guidance system. The upgrade is scheduled for

⁴³ Puget Sound Naval Shipyard and Intermediate Maintenance Facility, 'Louisiana back underway: Project team completes the final engineering refueling overhaul for an Ohio-class ballistic missile submarine', US Navy, Naval Sea Systems Command, 8 Mar. 2023.

⁴⁴ US Navy Office of Information, 'Fleet ballistic missile submarines—SSBN', Fact file, 25 May 2021.

⁴⁵ See e.g. Kristensen, H., 'US SSBN patrols steady, but mysterious reduction in Pacific in 2017', FAS Strategic Security Blog, Federation of American Scientists, 24 May 2018.

⁴⁶ The older W76-0 version has been, or remains in the process of being, retired. On these warheads see Kristensen and Korda (note 32), p. 341.

⁴⁷ US National Nuclear Security Administration (NNSA), 'NNSA completes first production unit of W88 Alteration 370', 13 July 2021; and US Department of Energy (note 4), p. 2-1.

⁴⁸ US Department of State (note 6).

⁴⁹ Arkin, W. M. and Kristensen, H. M., 'US deploys new low-yield nuclear submarine warhead', FAS Strategic Security Blog, Federation of American Scientists, 29 Jan. 2020; US Department of Defense, 'Statement on the fielding of the W76-2 low-yield submarine launched ballistic missile warhead', Press release, 4 Feb. 2020; and US military officials, Private communication with authors, 2019–20.

⁵⁰ US Department of Defense (note 12), p. 20.

completion in 2025.⁵¹ It will arm Ohio-class SSBNs for the remainder of their service lives (up to 2042) and will also be deployed on the United Kingdom's Trident submarines (see section III).

A new class of at least 12 SSBNs (the Columbia class) is under construction to replace the Ohio class. The lead boat in the new class, the USS *District of Columbia*, is scheduled to start patrols in 2031.⁵² Each Columbia-class SSBN will carry 16 missiles, initially the D5LE, but from 2039 these will be replaced with an upgraded SLBM, the D5LE2.⁵³

To arm the D5LE2, the NNSA has begun early design development of a new nuclear warhead, known as the W93. This will be the first new warhead design fielded by the USA since the end of the cold war. The W93 warhead will be housed in a new Mk7 re-entry body (aeroshell) that will also be deployed on the UK's new Dreadnought-class submarines (see section III). The W93 appears intended to initially supplement, rather than replace, the W76-1 and the W88. Another new warhead is planned to replace those warheads. The completion of the first production unit of the W93 is tentatively scheduled for 2034–36.⁵⁴

Non-strategic nuclear forces

As of January 2024 the USA had one basic type of non-strategic weapon in its nuclear arsenal—the B61 gravity bomb, with three versions assigned to non-strategic forces: the B61-3, the B61-4 and the new B61-12, which is scheduled to replace the two older versions by 2026.⁵⁵

SIPRI estimates that there were 200 B61 bombs in the stockpile, of which approximately 100 (all B61-3/-4 versions) were deployed in Europe for potential use by US and allied combat aircraft. The bombs, which are controlled by the US Air Force, are deployed at six airbases in five North Atlantic Treaty Organization (NATO) member states: Kleine Brogel in Belgium; Büchel in Germany; Aviano and Ghedi in Italy; Volkel in the Netherlands; and İncirlik in Türkiye.⁵⁶ The remaining (c. 100) B61 bombs are thought

⁵¹ Wolfe, J., Director of US Strategic Systems Programs, 'US nuclear weapons policy, programs, and strategy in review of the defense authorization request for fiscal year 2020 and the Future Years Defense Program', Statement before the US Senate, Armed Services Committee, Subcommittee on Strategic Forces, 1 May 2019, p. 4.

⁵² Wolfe (note 51), p. 8.

⁵³ Wolfe, J., Director of US Strategic Systems Programs, 'FY2021 budget request for nuclear forces and atomic energy defense activities', Statement before the US House of Representatives, Armed Services Committee, Subcommittee on Strategic Forces, 3 Mar. 2020, p. 5.

⁵⁴ US Department of Energy (note 3), p. 2-10.

⁵⁵ Another version of the B61, the B61-10, was retired in Sep. 2016. US Department of Energy (DOE), National Nuclear Security Administration (NNSA), *Fiscal Year 2018 Stockpile Stewardship and Management Plan*, Report to Congress (DOE: Washington, DC, Nov. 2017), figures 1.1–1.7, p. 1-13.

⁵⁶ For detailed overviews of the dual-capable aircraft programmes of the USA and its NATO allies see Kristensen (note 14), pp. 299–300; and Andreasen, S. et al., *Building a Safe, Secure, and Credible NATO Nuclear Posture* (Nuclear Threat Initiative: Washington, DC, Jan. 2018).

to be stored at Kirtland Air Force Base in New Mexico for potential use by US aircraft, possibly including in East Asia.⁵⁷ USA-based combat aircraft assigned this mission include F-15Es of the 366th Fighter Wing at Mountain Home Air Force Base in Idaho.⁵⁸

There was growing evidence in 2022 and 2023 to suggest that the USA is upgrading the nuclear storage vaults and related infrastructure at the British Royal Air Force (RAF) Lakenheath airbase in the UK, in order to facilitate the potential contingency storage of nuclear weapons at the base.⁵⁹ These upgrades are taking place in the broader context of a plan to modernize up to 180 nuclear storage vaults across Europe, which probably include all active vaults as well as dozens of vaults in caretaker status at other bases.⁶⁰

Full-scale production of the B61-12 began in late 2022 and the first bombs were formally accepted into the US military stockpile in 2023, with the entire replacement process scheduled to be completed by 2026.⁶¹ Once deployment to the bases in Europe begins, the B61-3 and B61-4 bombs currently deployed at those bases will gradually be returned to the USA and dismantled. Unlike the older versions, the B61-12 is equipped with a guided tail-kit that enables the B61-12 to hit targets more accurately, meaning that it can use lower yields and thus generate less radioactive fallout.⁶²

Operations continued in 2023 to integrate the incoming B61-12 on seven types of aircraft operated by the USA or its NATO allies: the B-2A, the new B-21, the F-15E, the F-16C/D, the F-16MLU, the F-35A and the PA-200 (Tornado).⁶³ In October 2023 the F-35A achieved technical certification to carry the B61-12, clearing the way for USAF units in Europe to complete their nuclear surety certifications before later receiving the new bombs.⁶⁴ The F-35A will replace all Belgian, Dutch and US F-16s and German and Italian Tornado aircraft in the nuclear strike role.

⁵⁷ US Department of Defense, *Nuclear Posture Review 2018* (note 14), p. 48.

⁵⁸ Heflin, L., '53rd Wing WSEP incorporates NucWSEP, enhances readiness for real world operations', Press release, Air Combat Command, 9 Sep. 2021.

⁵⁹ Kristensen, H. M., 'Lakenheath air base added to nuclear weapons storage site upgrades', FAS Strategic Security Blog, Federation of American Scientists, 11 Apr. 2022; Korda, M. and Kristensen, H. M., 'Increasing evidence that the US Air Force's nuclear mission may be returning to UK soil', FAS Strategic Security Blog, Federation of American Scientists, 28 Aug. 2023; and Diver, T., 'US to station nuclear weapons in UK to counter threat from Russia', *Daily Telegraph*, 26 Jan. 2024.

⁶⁰ Request for information: Vault modernization program', System for Award Management (SAM.gov), Notice ID FA9422_VMP, 29 Aug. 2023.

⁶¹ Meub, K., 'B61-12 production begins', *Sandia LabNews*, Sandia National Laboratories, 11 Feb. 2022; and US Department of Energy (note 4), p. 2-1.

⁶² Kristensen, H. M. and McKinzie, M., 'Video shows earth-penetrating capability of B61-12 nuclear bomb', FAS Strategic Security Blog, Federation of American Scientists, 14 Jan. 2016.

⁶³ US Air Force (USAF), *Acquisition Annual Report Fiscal Year 2018: Cost-effective Modernization* (USAF: Washington, DC, [n.d.]), p. 24.

⁶⁴ Marrow, M., 'EXCLUSIVE: F-35A officially certified to carry nuclear bomb', *Breaking Defense*, 8 Mar. 2024.

The 2018 NPR implemented by the Trump administration included plans to develop a new nuclear sea-launched cruise missile (SLCM-N) that would form part of the USA's non-strategic nuclear arsenal. The 2022 NPR released by the Biden administration seemingly rejected this plan. However, in 2023 the US Congress challenged the Biden administration's decision by authorizing funding for further research and reinstating the SLCM-N as part of the nuclear modernization programme. Despite strong initial opposition from the Biden administration, the NDAA for FY 2024 authorized \$190 million for the missile and associated warhead, with the aim of reaching operational capability in 2034.⁶⁵ Development of the SLCM-N would violate the US pledge from 1992 not to develop such a weapon and could potentially result in the first significant increase in the size of the US nuclear weapon stockpile since 1996.⁶⁶

⁶⁵ Executive Office of the President, Office of Management and Budget, 'Statement of administration policy: HR 2670—National Defense Authorization Act for Fiscal Year 2024', 10 July 2023; and US National Defense Authorization Act for Fiscal Year 2024 (note 10), pp. 460–62.

⁶⁶ Bush, G. W., US president, 'Address before a joint session of the Congress on the state of the union', 28 Jan. 1992.

Table 7.2. United States nuclear forces, January 2024

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

Type	Designation	No. of launchers	Year first deployed	Range (km) ^a	Warheads x yield	No. of warheads ^b
Strategic nuclear forces		746				3 508^c
<i>Aircraft (bombers)</i>		<i>96/66^d</i>				<i>788^e</i>
B-52H	Stratofortress	76/46	1961	16 000	20 x AGM-86B ALCMs 5–150 kt ^f	500 ^g
B-2A	Spirit	20/20	1994	11 000	16 x B61-7, -11, -12, B83-1 bombs ^h	288
<i>Land-based missiles (ICBMs)</i>		<i>400</i>				<i>800ⁱ</i>
LGM-30G Minuteman III						
	Mk12A	200	1979	13 000	1–3 x W78 335 kt	600 ^j
	Mk21 SERV	200	2006	13 000	1 x W87-0 300 kt	200 ^k
<i>Sea-based missiles (SLBMs)</i>		<i>14/280^l</i>				<i>1 920^m</i>
UGM-133A Trident II D5LE						
	Mk4	..	1992	>12 000	1–8 x W76-0 100 kt	– ⁿ
	Mk4A	..	2008	>12 000	1–8 x W76-1 90 kt	1 511
	Mk4A	..	2019	>12 000	1 x W76-2 ^o 8 kt	25
	Mk5	..	1990	>12 000	1–8 x W88 455 kt	384
Non-strategic nuclear forces						200^p
F-15E	Strike Eagle	..	1988	3 840	5 x B61-3, -4	80
F-35A	Lightning II	..	2023	>2 200	2 x B61-12	..
F-16C/D	Falcon	..	1987	3 200 ^q	2 x B61-3, -4	60
F-16MLU	Falcon ^r	..	1985	3 200	2 x B61-3, -4	30
PA-200	Tornado ^r	..	1983	2 400	2 x B61-3, -4	30
Total stockpile						3 708
Deployed warheads						1 770
Reserve warheads						1 938
Retired warheads awaiting dismantlement						1 336^s
Total inventory						5 044^t

.. = not available or not applicable; – = nil or a negligible value; ALCM = air-launched cruise missile; ICBM = intercontinental ballistic missile; kt = kiloton; SERV = security-enhanced re-entry vehicle; SLBM = submarine-launched ballistic missile.

^a For aircraft, the listed range is for illustrative purposes only; actual mission range will vary according to flight profile, weapon payload and in-flight refuelling.

^b These figures show the total number of warheads estimated to be assigned to nuclear-capable delivery systems. Only some of these warheads have been deployed on missiles and at airbases, as described in the notes below.

^c Of these strategic warheads, c. 1670 were deployed on land- and sea-based ballistic missiles and at bomber bases. The remaining warheads were in central storage. This number differs from the number of deployed strategic warheads counted by the 2010 Russian–US Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START) because the treaty attributes 1 weapon to each deployed bomber, even though bombers do not carry weapons under normal circumstances. Additionally, the treaty does not count weapons stored at bomber bases and, at any given time, some nuclear-powered ballistic missile submarines (SSBNs) are not fully loaded with warheads and are thus not counted under the treaty. The USA no longer publishes aggregate figures for strategic nuclear forces limited by New START.

^d The first figure is the total number of bombers in the inventory; the second is the number of bombers that are counted as nuclear-capable under New START. The USA has declared that it will deploy no more than 60 nuclear bombers at any given time but normally only c. 50 are deployed, with the remaining aircraft in overhaul.

^e Of the c. 788 bomber weapons, c. 300 (200 ALCMs and 100 bombs) were deployed at the bomber bases; all the rest were in central storage. Many of the gravity bombs are no longer fully active and are slated for retirement after deployment of the B61-12 is completed in the mid 2020s.

^f The B-52H is no longer configured to carry nuclear gravity bombs.

^g In 2006 the US Department of Defense decided to reduce the number of ALCMs to 528 missiles. Burg, R., Director of Strategic Security in the Air, Space and Information Operations, 'ICBMs, helicopters, cruise missiles, bombers and warheads', Statement before the US Senate, Armed Services Committee, Subcommittee on Strategic Forces, 28. Mar. 2007, p. 7. Since then, the number has probably decreased gradually to c. 500 as some missiles and warheads have probably been expended in destructive tests.

^h Strategic gravity bombs are assigned to B-2A bombers only. The maximum yield of strategic bombs is 360 kt for the B61-7, 400 kt for the B61-11 and 1200 kt for the B83-1. However, all these bombs, except the B61-11, have lower-yield options. Most B83-1s have been moved to the inactive stockpile and B-2As rarely exercise with the bomb. The B61-12 was formally accepted into the stockpile in 2023 and assigned for use by B-2A bombers.

ⁱ Of the 800 ICBM warheads, only 400 were deployed on the missiles. The remaining warheads were in central storage.

^j Only 200 of these W78 warheads were deployed, as each ICBM has had its warhead load reduced to carry a single warhead; all of the remaining warheads were in central storage.

^k SIPRI estimates that another 340 W87 warheads might be in long-term storage outside the stockpile for use in the W87-1 warhead programme to replace the W78.

^l The first figure is the total number of SSBNs in the US fleet; the second is the maximum number of missiles that they can carry. However, although the 14 SSBNs can carry up to 280 missiles, 2 vessels are normally undergoing refuelling overhaul or long-term maintenance at any given time and are not assigned missiles. The remaining 12 SSBNs can carry up to 240 missiles, but 1-2 of these vessels are usually undergoing maintenance at any given time and may not be carrying missiles.

^m Of the 1920 SLBM warheads, c. 970 were deployed on submarines as of Jan. 2024; all the rest were in central storage. Although each D5 missile was counted under the 1991 Strategic Arms Reduction Treaty (START I) as carrying 8 warheads and the missile was initially flight-tested with 14, the US Navy has reduced the warhead load of each missile to an average of 4-5 warheads. D5 missiles equipped with the new low-yield W76-2 are estimated to carry only 1 warhead each.

ⁿ It is assumed here that all W76-0 warheads have been replaced by the W76-1.

^o According to US military officials, the new low-yield W76-2 warhead will normally be deployed on at least 2 of the SSBNs on patrol in the Atlantic and Pacific oceans.

^p Of the 200 non-strategic bombs, c. 100 are thought to be deployed across 6 airbases in 5 North Atlantic Treaty Organization (NATO) member states (Belgium, Germany, Italy, the Netherlands and Türkiye), although the weapons remain in the custody of the US Air Force. The other c. 100 bombs were in central storage in the USA. Older B61 versions will be dismantled once the B61-12 is deployed. The maximum yields of non-strategic bombs are 170 kt for the B61-3 and 50 kt for the B61-4. All have selective lower yields. The B61-10 was retired in 2016.

^q Most sources list an unrefuelled ferry range of 2400 kilometres, but Lockheed Martin, which produces the F-16, lists 3200 km.

^r These dual-capable aircraft are operated at airbases outside the USA by other members of NATO.

^s Up until 2018, the US government published the number of warheads dismantled each year, but the administration of President Donald J. Trump ended this practice. The administration of President Joe Biden temporarily restored transparency, but publication of the 2018, 2019 and 2020 data showed that far fewer warheads had been dismantled than assumed (e.g. only

184 in 2020). Nonetheless, dismantlement of the warheads has continued, leaving an estimated 1336 warheads in the dismantlement queue as of Jan. 2024.

^tIn addition to these intact warheads, more than 20 000 plutonium pits were stored at the Pantex Plant, Texas, and perhaps 4000 uranium secondaries were stored at the Y-12 facility at Oak Ridge, Tennessee.

Sources: US Department of Defense, various budget reports and plans, press releases and documents obtained under the Freedom of Information Act; US Department of Energy, various budget reports and plans; US Air Force, US Navy and US Department of Energy, personal communication with officials; *Bulletin of the Atomic Scientists*, 'Nuclear notebook', various issues; and authors' estimates.