

I. US nuclear forces

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As of January 2015, the United States maintained a stockpile of approximately 4760 nuclear warheads.¹ This included approximately 2080 deployed nuclear warheads, consisting of roughly 1900 strategic and 180 non-strategic warheads (see table 11.2). In addition to this deployed arsenal, about 2680 warheads were held in reserve. Another roughly 2500 retired warheads were scheduled for dismantlement, giving a total inventory of approximately 7260 warheads.

The USA has made slow progress in implementing the 2010 Russian–US Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START).² As of 1 September 2014, the USA was counted as having 1642 strategic warheads attributed to 794 deployed missiles and bombers, a modest increase compared with the count in March 2014.³ The total reduction since the treaty entered into force in February 2011 is 158 strategic warheads and 88 launchers.

Due to the counting rules, however, these numbers do not reflect the actual deployment of strategic warheads and launchers. This is mainly because each bomber is counted as carrying only one weapon, even though the bombers can carry up to 20 nuclear-armed air-launched cruise missiles (ALCMs) each.

Thus far the USA has implemented New START mainly by reducing so-called phantom weapons, that is, launchers that are no longer assigned nuclear weapon missions but are still accountable under the treaty because they continue to carry nuclear-related equipment. This is now changing. The first actual denuclearization of a nuclear launcher—a B-52H bomber—took place in September 2013.⁴ Starting in 2015, the US Navy will begin reducing the number of missile tubes on each of its nuclear-powered ballistic missile submarines (SSBN) from 24 to 20. Later in the decade the US Air Force will reduce its intercontinental ballistic missile (ICBM) force

¹ The US Department of State declared in Apr. 2015 that the US nuclear weapons stockpile included 4717 warheads as of Sep. 2014, a reduction of 87 warheads compared to the level a year earlier. It is estimated here that a small number of additional warheads were retired between Sep. 2014 and Jan. 2015. Kerry, J., US Secretary of State, Remarks at the 2015 Nuclear Nonproliferation Treaty Review Conference, 27 Apr. 2015, <<http://www.state.gov/secretary/remarks/2015/04/241175.htm>>.

² For a summary and other details of New START see annex A, section III, in this volume.

³ US Department of State, 'New START Treaty aggregate numbers of strategic offensive arms', Fact Sheet, 1 Oct. 2014, <<http://www.state.gov/t/avc/rls/232359.htm>>.

⁴ McCasland, J., 'First B-52H becomes New START compliant ground trainer', Barksdale Air Force Base, News release, 20 Sep. 2013, <www.barksdale.af.mil/news/story_print.asp?id=123364035>.

Table 11.2. US nuclear forces, January 2015

Type	Designation	No. deployed ^a	Year first deployed	Range (km) ^b	Warheads x yield	No. of warheads
Deployed strategic forces						-1 900
<i>Bombers^c</i>		89/60				300
B-52H	Stratofortress	78/44	1961	16 000	ALCM 5–150 kt ^d	200
B-2A	Spirit	11/16	1994	11 000	B61-7, -11, B83-1 bombs ^e	100
<i>ICBMs</i>		447/450				450
LGM-30G	Minuteman III ^f					
	Mk-12A	200	1979	13 000	1 x 335 kt	200
	Mk-21 SERV	250	2006	13 000	1 x 300 kt	250
<i>SSBNs/SLBMs^g</i>		260/288				1 152
UGM-133A	Trident II (D5) ^h					
	Mk-4	..	1992	>7 400	4 x 100 kt	168
	Mk-4A	..	2008	>7 400	4 x 100 kt	600
	Mk-5	..	1990	>7 400	4 x 475 kt	384
Deployed non-strategic forces						-180
B61-3, -4 bombs		..	1979	..	0.3–170 kt	-180 ⁱ
Total deployed warheads						-2 080
Reserve warheads						-2 680
Total military stockpile						-4 760
Retired awaiting dismantlement						-2 500
Total inventory						-7 260^j

.. = not available or not applicable; ALCM = air-launched cruise missile; ICBM = inter-continental ballistic missile; kt = kiloton; SERV = security-enhanced re-entry vehicle; SLBM = submarine-launched ballistic missile; SLCM = sea-launched cruise missile; SSBN = nuclear-powered ballistic missile submarine.

^a The first figure in the 'No. deployed' column is the number counted as 'deployed' under the New START Treaty. The second figure is the number assigned for nuclear missions.

^b Aircraft range is for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

^c The total inventory of B-52H and B-2A bombers is 93 and 20, respectively.

^d The B-52H can also carry B61-7 and B83-1 gravity bombs but is currently only planned for delivery of ALCMs. The total ALCM inventory has been reduced to 528. New START only attributes one weapon to each aircraft and does not count weapons stored at bomber bases.

^e Strategic gravity bombs are only planned for delivery by the B-2A bomber.

^f Downloading of the Minuteman III was completed in June 2014 but the capability to re-MIRV the missiles if necessary is retained.

^g Of the 14 SSBNs, 2 or more are normally undergoing overhaul at any given time. These are not assigned weapons.

^h Although each D5 missile was counted under New START as carrying 8 warheads and has been flight-tested with 14, the US Navy is thought to have downloaded each missile to an average of 4–5 warheads.

ⁱ Since 2001 the number of B61 bombs deployed in Europe has been unilaterally reduced by almost two-thirds, from 480 to c. 180. Additional warheads are held in reserve.

^j In addition to these c. 7200 intact warheads, there are c. 20 000 plutonium pits stored at the Pantex Plant, Texas, and perhaps 5000 uranium secondaries stored at the Y-12 facility at Oak Ridge, Tennessee.

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

from 450 to 400 missiles. It will also remove nuclear capability from all but 60 of its bombers.⁵

Nuclear modernization

Over the next decade, the USA plans to spend as much as \$350 billion on modernizing and maintaining its nuclear forces.⁶ This includes designing a new class of SSBN, a new long-range bomber with nuclear capability and a new ALCM; studying options for the next-generation land-based ICBM; deploying a new nuclear-capable tactical fighter aircraft; completing full-scale production of one nuclear warhead and beginning modernization work on two others; modernizing nuclear command and control facilities; and building new nuclear weapon production and simulation facilities.

The nuclear warheads intended for this arsenal are scheduled to undergo extensive life-extension and modernization programmes over several decades. Full-scale production of approximately 1200 W76-1 warheads for the Trident II (designated D5) submarine-launched ballistic missile (SLBM) is under way. It is scheduled for completion in 2019 at a total cost of approximately \$3.7 billion.⁷ Production of the B61-12, a guided nuclear gravity bomb, is scheduled to be completed by 2025 at a cost of approximately \$10 billion.⁸ Production of the W80-4 warhead—a modified version of the W80-1, intended for the new Long-Range Standoff (LRSO) ALCM—will cost another \$7–8 billion up to 2033 (see below). Including the cost of

⁵ US Department of Defense, 'Report on plan to implement the nuclear force reductions, limitations, and verification and transparency measures contained in the New START Treaty specified in Section 1042 of the National Defense Authorization Act for Fiscal Year 2012', Apr. 2014, <<http://www.defense.gov/documents/New-START-Implementation-Report.pdf>>.

⁶ US Congressional Budget Office, *Projected Costs of U.S. Nuclear Forces, 2014 to 2023* (US Congress: Washington, DC, Dec. 2013), table 1.

⁷ US Department of Energy (DOE), National Nuclear Security Administration, *Fiscal Year 2015 Stockpile Stewardship and Management Plan*, Report to Congress (DOE: Washington, DC, Apr. 2014), pp. 8–13.

⁸ US Department of Energy (note 7), pp. 8–12; and US Air Force, *Department of Defense, Fiscal Year 2015 Budget Estimates: Research, Development, Test & Evaluation—Air Force*, vol. 2 (US Air Force: Washington, DC, Mar. 2014), p. 626.

the new cruise missile to carry the warhead, the LRSO programme may ultimately cost \$20 billion.⁹

The National Nuclear Security Administration (NNSA) has also presented a plan for a new family of so-called interoperable (previously called ‘common or adaptable’) warheads that can be used on both ICBMs and SLBMs.¹⁰ The plan, known as the 3+2 plan because it would reduce the number of warhead types in the stockpile to three warheads for ballistic missiles and two warheads for bombers, has been challenged by Congress because of the uncertainty over technical requirements and risks that could affect warhead reliability.¹¹ The first of these new warheads would be the Interoperable Warhead 1 (IW1). Built with components from the W78, W88, and possibly W87 warheads, it could cost \$10–15 billion. A simpler life-extension of existing warhead designs could provide reliable warheads at a fraction of the cost.

There are no interoperable warheads in the current stockpile. Introducing them under the 3+2 plan would contradict the 2010 US Nuclear Posture Review (NPR) which commits the USA ‘not [to] develop new nuclear warheads’. The NPR states that the USA will instead consider the ‘full range’ of life-extension programme options, including ‘refurbishment of existing warheads, reuse of nuclear components from different warheads, and replacement of nuclear components’.¹² This is intended to prevent a need to resume nuclear explosive testing and enable adherence to the 1996 Comprehensive Nuclear-Test-Ban Treaty (CTBT).¹³ The NPR also states that any life-extension programme ‘will not support . . . new military capabilities’.¹⁴ However, this would depend on how ‘new’ military capabilities are defined, since the addition of new or improved features outside the nuclear explosive package can also increase a weapon’s military capabilities. The USA is expected to use new fuses and guided tail kits to increase the accuracy of its nuclear weapons in order to permit a lowering of the yield in modified warheads linked to improved performance margins.

⁹ Wolfsthal, J. B., Lewis, J. and Quint, M., *The Trillion Dollar Nuclear Triad* (Monterey Institute of International Studies, James Martin Center for Nonproliferation Studies: Monterey, CA, Jan. 2014), p. 11.

¹⁰ For a description of the 3+2 plan see US Department of Energy (note 7), pp. 1-2–1-4.

¹¹ Arms Control Association, ‘NNSA’s ‘3+2’ nuclear warhead plan does not add up’, Issue briefs, vol. 5, no. 6, May 2014, <<https://www.armscontrol.org/issuebriefs/NNSAs-3%202-Nuclear-Warhead-Plan-Does-Not-Add-Up>>.

¹² US Department of Defense (DOD), *Nuclear Posture Review Report* (DOD: Washington, DC, Apr. 2010), p. xiv.

¹³ The USA has signed but not yet ratified the Comprehensive Nuclear-Test-Ban Treaty (CTBT). For a summary and other details of the CTBT see annex A, section I, in this volume.

¹⁴ US Department of Defense (note 12), p. xiv.

Nuclear planning

Following the release in June 2013 of Presidential Policy Directive 24 (PPD-24) on the nuclear weapons employment strategy of the United States, the US Department of Defense and the military services began upgrading the Nuclear Weapons Employment Policy (NUWEP) and the Nuclear Supplement to the Joint Strategic Capabilities Plan (JSCMP-N).¹⁵ These documents identify the objectives of and resources required for US Strategic Command (STRATCOM) and the geographic combatant commanders to update the strategic war plan (Operations Plan 8010-12) and various regional war plans.

To practice execution of these plans and validate command and control procedures, several nuclear strike exercises were conducted during 2014. STRATCOM's annual Global Lightning exercise, held in mid-May 2014, involved heavy bombers, ICBMs, SSBNs, and space and cyber capabilities from the various commands and military services.¹⁶ Global Lightning coincided with Air Force Global Strike Command's Constant Vigilance nuclear deterrence and long-range strike exercise, which deployed B-2 and B-52H bombers. The exercise occurred shortly after Russia's annexation of Crimea, which intensified the crisis in Ukraine.¹⁷ However, the Air Force stated that the exercises had long been planned and the timing was 'unrelated to any real-world events'.¹⁸

Large-scale nuclear exercises followed in the second half of 2014. These included Valiant Shield 14 in September, which stretched from Goose Bay in Canada to Guam. The exercise involved: (a) B-2s and B-52s deploying to Andersen Air Force Base (AFB) on Guam; (b) B-52s deploying to Goose Bay in Canada; (c) a test launch of a Minuteman III ICBM from the US west coast into the Pacific; and (d) a B-52 test-launching an air-launched cruise missile in Utah. Valiant Shield 14 was followed in October by Global Thunder 15, a nuclear readiness exercise which included rapid launch of B-2s from Whiteman AFB and B-52s from Minot AFB and Barksdale AFB. The STRATCOM-led exercise also involved coordination with the North American Aerospace Defense Command (NORAD) and Canada's Joint Operations Command. According to STRATCOM, 'the scenario integrated, in just eight days, nearly every conceivable strategic threat to our nation and called upon all the USSTRATCOM capabilities that would be provided

¹⁵ US Department of Defense, 'Report on nuclear employment strategy of the United States, specified in Section 491 of 10 U.S.C.', [12 June 2013], <<http://www.defense.gov/pubs/>>. For background discussion of the report see Kristensen, H. M. 'US nuclear forces', *SIPRI Yearbook 2014*.

¹⁶ US Strategic Command, 'Successful end to US Strategic Command Exercise Global Lightning 14', News release, 16 May 2014, <http://www.stratcom.mil/news/2014/497/Successful_end_to_US_Strategic_Command_Exercise_Global_Lightning_14/printable/>.

¹⁷ For further discussion of the crisis in Ukraine see chapter 3 in this volume.

¹⁸ US Air Force, 509th Bomb Wing, 'Constant Vigilance confirms global deterrence capabilities', News release, 6 June 2014, <http://www.whiteman.af.mil/news/story_print.asp?id=123413645>.

to geographic combatant commanders in a real-world crisis: space, cyber, intelligence, surveillance and reconnaissance, global strike, and ballistic missile defense capabilities, among them'.¹⁹

In addition to these large-scale national-level exercises, smaller exercises included rapid-launch exercises and long-range deployments of heavy bombers in April and June. In response to Russia's annexation of Crimea and military activities in eastern Ukraine and its increased air operations in Europe and elsewhere, two B-2s and three B-52Hs were deployed to the United Kingdom and practised long-range strike scenarios in Central Europe and Northern Africa.²⁰ The deployment was part of Operation Atlantic Resolve, an effort by US European Command (EUCOM) to 'develop a unified response plan to revanchist Russia', and 'forged a link between STRATCOM Bomber Assurance and Deterrence missions to NATO [North Atlantic Treaty Organization] regional exercises'.²¹

Bombers

The US Air Force currently operates a fleet of 20 B-2 and 93 B-52H bombers, of which 18 B-2s and 76 B-52Hs are nuclear-capable. Approximately 60 bombers (16 B-2s and 44 B-52Hs) are thought to be assigned nuclear missions under the nuclear war plans.²² They are organized in eight bomb squadrons in five bomb wings at three bases: Minot AFB in North Dakota, Barksdale AFB in Louisiana and Whiteman AFB in Missouri. These include two new squadrons, the B-2 equipped 110th Bomb Squadron at Whiteman AFB and the B-52H equipped 343rd Bomb Squadron at Barksdale AFB, which were certified for nuclear missions in 2013.

Each B-2 can carry up to 16 nuclear bombs (B61-7, B61-11 and B83-1 gravity bombs) and each B-52H can carry up to 20 ALCMs. An estimated 1000 nuclear weapons, including 528 ALCMs, are assigned to the bombers. Only 200–300 weapons are deployed at the bomber bases under normal circumstance. The remaining 700–800 weapons are in central storage at Kirtland AFB.

¹⁹ US Strategic Command, 'Global Strike forces participate in USSTRATCOM command, control exercise', News release, 29 Oct. 2014, <<http://www.afgsc.af.mil/news/story.asp?id=123429750>>.

²⁰ US Air Force, Second Expeditionary Group, Air Force Global Strike Command, 'Global Strike bombers complete their deployment', News release, 20 June 2014, <http://www.usafe.af.mil/news/story_print.asp?id=123415178>.

²¹ Breedlove, P. (Gen.), Commander, US Forces Europe, Statement before the US House of Representatives, Armed Services Committee, 25 Feb. 2015, pp. 10, 24, <<http://eucom.mil/media-library/document/31979/u-s-european-command-posture-statement-2015>>.

²² New START counted 109 nuclear bombers as of 1 Mar. 2013, including 89 deployed, an anomaly caused by counting so-called phantom bombers that are no longer nuclear tasked but still carry some equipment that makes them accountable under the treaty. There are no longer any B-1Bs or B-52Gs with nuclear equipment. US Department of State, 'New START Treaty aggregate numbers of strategic offensive arms', Fact Sheet, 1 July 2014, <<http://www.state.gov/t/avc/rls/228652.htm>>.

The Air Force is planning a new bomber, known as the Long-Range Strike Bomber (LRS-B) or simply the next-generation bomber, to begin replacing existing bombers from the mid-2020s. Procurement of 80–100 aircraft is envisaged, some of which are planned to be nuclear-capable, at a cost of well over \$55 billion.²³

The LRS-B will be equipped to deliver the new B61-12 precision-guided bomb, which will eventually replace all other gravity bombs, and the LRSO cruise missile, which will replace the ALCM by around 2027. The Nuclear Weapons Council in 2014 selected the W80-1 warhead to arm the LRSO. Under the plan, the W80-1 would undergo a life-extension programme to extend its service life to the middle of this century. The life-extended warhead would be known as the W80-4 and include components and technologies developed for the B61-12 programme.²⁴ The number of LRSOs planned has not been announced but is thought to be around 400–500 missiles.

Nuclear-capable heavy B-2 and B-52H bombers continued rotational deployments to Andersen AFB in Guam, an extended deterrence mission which began in 2004.²⁵ Since 2012, nuclear-capable B-52H bombers have also started to deploy to Darwin Air Base in Australia as part of their Pacific rotational deployments pursuant to a 2011 Australian–US agreement to increase the US military presence in Northern Australia.

Land-based ballistic missiles

The US Air Force operates a force of 450 silo-based Minuteman III ICBMs divided evenly among three wings, at F. E. Warren AFB in Wyoming, Minot AFB in North Dakota and Malmstrom AFB in Montana. Each wing has three squadrons, each with 50 missiles controlled by five Launch Control Centres. According to New START data, 447 Minuteman IIIs were operational as of 1 September 2014 and an additional 251 missiles were in storage.²⁶

Each Minuteman missile carries either the 335-kiloton W78 warhead or the 300-kt W87 warhead. Downloading of the ICBM force was completed on 16 June 2014, when the last remaining Minuteman III with multiple warheads at Malmstrom AFB was downloaded to single warhead

²³ Gertler, J., 'Budget highlights: Air Force Long Range Strike Bomber', US Congress, Congressional Research Service, 2 July 2014, <<http://fas.org/sgp/crs/weapons/IN10095.html>>.

²⁴ For background on the W80-4 and the LRSO programme see Kristensen, H. M., 'W80-1 warhead selected for new nuclear cruise missile', FAS Strategic Security Blog, Federation of American Scientists, 10 Oct. 2014, <http://fas.org/blogs/security/2014/10/w80-1_lrs0/>.

²⁵ US Air Force, Air Force Global Strike Command, 'AFGSC provides deterrence for the modern era', News release, 26 Sep. 2014, <<http://www.afgsc.af.mil/news/story.asp?id=123426299>>.

²⁶ There were also 56 retired Peacekeeper (MX) missiles in storage at Hill AFB in Utah. US Department of State (note 3).

configuration.²⁷ Although the US military refers to this process as ‘de-MIRVing’ (meaning that the missiles no longer carry multiple independently targetable re-entry vehicles (MIRVs)), the Minuteman force will retain a MIRV capability as an option, with hundreds of M78 warheads kept in storage that could be reloaded on the missiles.²⁸

The USA plans to reduce its ICBM force to 400 deployed missiles under New START to meet the treaty’s limit of no more than 700 deployed nuclear missiles and heavy bombers by 2018. Rather than eliminating one squadron of 50 missiles, however, the US Air Force plans to spread the reduction across all three bases. Moreover, the 50 empty silos will not be destroyed but retained for potential reloading of missiles. The ‘cut’ ICBMs will not be destroyed but kept in storage. The New START Implementation Report lists the same inventory of Minuteman IIIs in 2014 and 2018: 454 deployed and non-deployed missiles.²⁹

A multibillion-dollar, decade-long modernization programme to extend the service life of the Minuteman III to 2030 is scheduled for completion in 2015. Although the USA is officially not deploying a new ICBM, the upgraded Minuteman IIIs ‘are basically new missiles except for the shell’.³⁰

Part of the upgrade involves refurbishing the arming, fusing and firing (AF&F) component on the Mk12A and Mk21 security enhanced re-entry vehicles (SERV). The publicly stated purpose of the upgrade is to extend the service life but it also involves modifying the fuses to improve the targeting capability of the warheads. This reportedly improves the ‘burst height compensation’ to take advantage of enhancements to the Minuteman III guidance system.³¹ This will improve the accuracy and target kill-capability of the warheads against hardened nuclear forces and will potentially also allow for a reduction of the explosive yield of the warheads. The fuses were upgraded in 2010–12.³²

The US Air Force is also studying options for the next-generation ICBM, known as the Ground Based Strategic Deterrent (GBSD), which will replace the Minuteman III from 2030. An analysis-of-alternatives study completed in July 2014 determined that the preferred alternative would be a ‘hybrid’ design concept, partly based on the current Minuteman III

²⁷ US Air Force, Air Force Global Strike Command, ‘Malmstrom Air Force Base completes final MMIII reconfiguration’, News release. 19 June 2014, <http://www.afgsc.af.mil/news/story_print.asp?id=123414908>.

²⁸ Minuteman III missiles configured for the Mk21 (SERV) re-entry vehicles with the larger W87 warhead cannot carry multiple warheads.

²⁹ US Department of Defense (note 5), p. 3.

³⁰ Pampe, C., ‘Life extension programs send missiles into the future’, US Air Force Global Strike Command, 24 Oct. 2012, <<http://www.afgsc.af.mil/news/story.asp?id=123323606>>.

³¹ Postol, T., ‘How the Obama Administration learned to stop worrying and love the bomb’, *The Nation*, 10 Dec. 2014.

³² US Air Force, 377th Air Base Wing, ‘Sustainment efforts hitting their stride’, News release, 5 Aug. 2011, <http://www.kirtland.af.mil/news/story_print.asp?id=123266882>.

design, silos, and command and control, but also incorporating modified features such as new rocket motors and a guidance system that will be more accurate than the current Minuteman III. One option would be to allow the missiles to be pulled out of their silos and dispersed on trucks or by rail, an approach that would substantially increase the cost.³³ According to the head of Air Force Global Strike Command, Brigadier General Fred Stoss, the new missile is not a follow-on missile but a 'systematic approach to recapitalizing the existing Minuteman III missile over the long term'.³⁴

Only one Minuteman III flight test was conducted in 2014, three fewer than in 2013. The missile was randomly selected from a silo at Minot AFB and launched from Vandenberg AFB in California on 23 September 2014.³⁵ In addition to the live Minuteman III test, several simulated launches, known as Simulated Electronic Launch-Minuteman (SELM), were conducted at the ICBM bases. Each SELM, which may include several launch facilities, involves simulating the receipt of a launch order and launching missiles in 'a variety of new scenarios' against 'certain modern threats'.³⁶

Ballistic missile submarines

The US Navy's 14 Ohio class SSBNs (8 based in the Pacific and 6 in the Atlantic) can each carry 24 Trident II (D5) SLBMs. Normally, 12 of the SSBNs are considered operational, with the 13th and 14th boat being overhauled at any given time. According to the unclassified New START aggregate data, the 12 operational SSBNs are not all routinely equipped with full missile loadings. As of 1 September 2014, for example, 260 missiles were counted as deployed—28 fewer than the capacity of the 12 boats.³⁷ Starting in 2015, the number of missile tubes on each Ohio class SSBN will be reduced from 24 to 20. The purpose is to reduce the number of SLBMs that can be deployed at any given time to no more than 240 in order to meet the limit on deployed strategic delivery vehicles set by New START for 2018.

The warhead loading of the deployed SLBMs is not specified in the New START aggregate data. In practice the missiles probably carry 3–6 warheads, depending on the requirements of the particular strike package assigned under the war plans. Some may even carry a single warhead. Loading with fewer warheads increases the range of the missile. As of

³³ Grossman, E., 'Key targeting tech for future US nuclear missile has gone unfunded', NextGov.com, 19 Aug. 2014, <<http://www.nextgov.com/defense/2014/08/key-targeting-tech-future-us-nuclear-missile-has-gone-unfunded/91790/>>.

³⁴ Schanz, M. V., 'The future of ICBMs', *Air Force Magazine*, 6 June 2014.

³⁵ US Air Force, Vandenberg Air Force Base, 'Minuteman III launches from Vandenberg', News release, 23 Sep. 2014, <<http://www.vandenberg.af.mil/news/story.asp?id=123425784>>.

³⁶ US Air Force, 90th Missile Wing, 'SELM test comes to a close', News release, 24 Apr. 2014, <http://www.warren.af.mil/news/story_print.asp?id=123408481>.

³⁷ US Department of State (note 3).

September 2014, the 260 deployed SLBMs carried an estimated 1108 warheads, or around 4 or 5 warheads per missile.

Three versions of two basic warhead types are deployed on the SLBMs: the 100-kt W76-0, the 100-kt W76-1 and the 455-kt W88. The W76-1 is a refurbished version of the W76-0. It has the same yield but with dual strong link detonation control added. The Mk4A re-entry body that carries the W76-1 is equipped with a new AF&F unit that has improved targeting capabilities compared with the old Mk4/W76 system. Full-scale production of an estimated 1600 W76-1s is under way at the Pantex Plant in Texas. Production is scheduled to be completed in 2019. The W76-1–Mk4A combination is also being supplied to the UK for use on its SSBNs (see section III below).³⁸

In 2014 the SSBN fleet celebrated its 4000th deterrent patrol since SSBNs were first deployed with nuclear missiles in 1960. The number of deterrent patrols conducted by the SSBN fleet each year has declined by more than 56 per cent, from 64 patrols in 1999 to less than 30 in 2014. More than 60 per cent of the patrols take place in the Pacific Ocean, reflecting nuclear war planning against China, North Korea and eastern Russia.³⁹

Design of the next-generation SSBN to replace the Ohio class is under way. The new submarine, known as SSBNX, will be 2000 tonnes larger than the Ohio class submarine but equipped with 16 instead of 24 missile tubes.⁴⁰ Twelve SSBNXs are planned, a reduction of two boats compared with the current fleet, at an estimated cost of \$92 billion, or \$7.7 billion per submarine.⁴¹ Procurement of the first boat is scheduled for 2021, with deployment on deterrent patrol starting in 2031.

During the first decade of its service life, the SSBNX will be armed with a life-extended version of the current Trident II (D5) SLBM (the D5LE), which has a new guidance system designed to ‘provide flexibility to support new missions’ and make the missile ‘more accurate’.⁴² The D5LE

³⁸ Kristensen, H. M., ‘British submarines to receive upgraded US nuclear warhead’, FAS Strategic Security Blog, Federation of American Scientists, 1 Apr. 2011, <<http://fas.org/blog/security/2011/04/britishw76-1/>>.

³⁹ For analysis of US SSBN patrols see Kristensen, H. M., ‘Declining deterrent patrols indicate too many SSBNs’, FAS Strategic Security Blog, Federation of American Scientists, 30 Apr. 2013, <<http://fas.org/blogs/security/2013/04/ssbnpatrols/>>.

⁴⁰ For overviews of the SSBNX programme see Brougham, W. J., ‘Ohio replacement program’, Presentation to the 2012 Navy Submarine League, 18 Oct. 2012, <<http://news.usni.org/news-analysis/documents/ohio-replacement-program>>; and O’Rourke, R., *Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program: Background and Issues for Congress*, Congressional Research Service (CRS) Report for Congress R41129 (US Congress, CRS: Washington, DC, 10 Dec. 2012).

⁴¹ US Congressional Budget Office, *An Analysis of the Navy’s Fiscal Year 2015 Shipbuilding Plan*, (US Congress: Washington, DC, Dec. 2014), p. 25.

⁴² ‘Keeping Trident ever ready’, Draper Laboratory, *Explorations*, spring 2006, p. 8; and ‘Underwater wonder, submarines: a powerful deterrent’, Naval Surface Warfare Center, Crane Division, *Warfighter Solutions*, Fall 2008, p. 14.

will also be fitted to existing Ohio SSBNs from 2017 for the remainder of their service life (up to 2042) and be deployed on British SSBNs.

Two Trident II (D5) SLBMs were test-launched in the Atlantic Ocean from the *USS West Virginia* (SSBN-736) in June 2014, following completion of its reactor refuelling overhaul.

Non-strategic nuclear weapons

The USA has one type of non-strategic (tactical) nuclear weapon in its stockpile—the B61 gravity bomb. The weapon exists in three modifications: the B61-3, B61-4 and B61-10. It is estimated that approximately 500 tactical B61 bombs in all versions remain in the stockpile. A little over 180 of these (versions -3 and -4) are deployed at six bases in five European countries: Aviano (Italy), Büchel (Germany), Ghedi (Italy), Incirlik (Turkey), Kleine Brogel (Belgium) and Volkel (the Netherlands). A small number of the remaining non-strategic weapons stored in the USA are for potential use by US combat aircraft in support of allies outside Europe, including in the Middle East and North East Asia.

The Belgian, Dutch and possibly Turkish air forces (using F-16 combat aircraft) and German and Italian air forces (using PA-200 Tornado combat aircraft) are assigned nuclear strike missions with the US nuclear weapons, but the weapons remain under the control of US Air Force personnel until their use is authorized by the US president and approved by NATO in time of war.

NATO has approved a modernization of the nuclear posture in Europe through deployment at the beginning of the next decade of the B61-12 guided nuclear gravity bomb.⁴³ The B61-12 will use the nuclear explosive package of the B61-4, which has a maximum yield of approximately 50 kt, but will be equipped with a guided tail kit to increase its accuracy and standoff capability. The B61-12 will be able to destroy hardened targets that could not be destroyed with the B61-3 or -4, and will enable strike planners to select lower yields for existing targets to reduce collateral damage. Moreover, several NATO member states that currently have a nuclear strike mission plan to upgrade their fighter-bombers to the US-built F-35A Joint Strike Fighter, which has stealth capabilities. Until the new aircraft is ready, the B61-12 will be fitted on to existing F-15E, F-16

⁴³ On NATO approval of the B61-12 modernization programme see US Government Accountability Office (GAO), *Nuclear Weapons*, GAO-11-387 (GAO: Washington, DC, May 2011), p. 13.

and Tornado aircraft.⁴⁴ The B61-12 and F-35A represent a significant enhancement of the US non-strategic nuclear posture in Europe.⁴⁵

NATO's annual nuclear strike exercise Steadfast Noon was held at Ghedi Air Base in Italy in October 2014. It included aircraft from Belgium, Germany, Italy, the Netherlands, Poland, Turkey and the USA. Unlike the aircraft from the other participating countries, the Polish F-16s are not nuclear-capable but provide non-nuclear support for the nuclear strike package under the Support of Nuclear Operations With Conventional Air Tactics (SNOWCAT) programme, a NATO programme designed to enable member states that do not have nuclear strike missions to provide conventional air support to nuclear missions. In addition to these operations, nuclear-capable F-16s from US Air Force fighter wings conducted periodic deployments to the Baltic States, Poland and Romania.⁴⁶

⁴⁴ Kristensen, H. M., 'B61-12 nuclear bomb integration on NATO aircraft to start in 2015', FAS Strategic Security Blog, Federation of American Scientists, 13 Mar. 2014, <<http://fas.org/blogs/security/2014/03/b61-12integration/>>.

⁴⁵ For analyses of the military implications of the enhanced B61-12 see Kristensen, H. M., 'B61-12 nuclear bomb design features', FAS Strategic Security Blog, Federation of American Scientists, 14 Apr. 2014, <<http://fas.org/blogs/security/2014/04/b61-12features/>>; and Kristensen, H. M., 'B61 LEP: increasing NATO nuclear capability and precision low-yield strikes', FAS Strategic Security Blog, Federation of American Scientists, 15 June 2011, <<http://fas.org/blogs/security/2011/06/b61-12/>>.

⁴⁶ See Kristensen, H. M., 'Polish F-16s in NATO nuclear exercise in Italy', FAS Strategic Security Blog, Federation of American Scientists, 27 Oct. 2014, <<http://fas.org/blogs/security/2014/10/steadfastnoon/>>; and US Air Force, 31st Fighter Wing, 'US, Romanian exercise comes to a close', News release, 19 Apr. 2014, <<http://www.aviano.af.mil/news/story.asp?id=123407948>>.