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Abstract

The United States has an estimated 4,650 nuclear warheads available for delivery by more than 800 ballistic missiles and aircraft. Approximately 2,700 retired but still intact warheads await dismantlement, for a total inventory of roughly 7,400 warheads. The stockpile includes an estimated 2,130 operational warheads, about 1,150 on submarine launched ballistic missiles and 470 on intercontinental ballistic missiles. Roughly 300 strategic warheads are located at bomber bases in the United States, and nearly 200 nonstrategic warheads are deployed in Europe. Another 2,530 warheads are in storage. To comply with New START, the United States is expected to eliminate land based missile silos, reduce the number of launch tubes on its missile submarines, and limit its inventory of nuclear capable bombers in coming years. Coinciding with a revised nuclear weapons strategy, the Obama administration is also planning an upgrade of all nuclear weapons systems. The three decade long plan would cost more than \$200 billion in the first decade alone.

Keywords

interoperable warhead, New START, Presidential Policy Directive 24, US nuclear arsenal, US nuclear forces, warhead modernization

The US Defense Department maintains a stockpile of an estimated 4,650 nuclear warheads for delivery by more than 800 ballistic missiles and aircraft. The stockpile did not decline significantly over the last year, but has shrunk by roughly 460 warheads compared with May 2010, when the United States announced that the Defense Department's stockpile contained 5,113 warheads.

The current stockpile includes an estimated 2,130 operational warheads, of which approximately 1,620 strategic warheads are deployed on ballistic missiles 1,150 on submarine launched ballistic missiles (SLBMs) and 470 on intercontinental ballistic missiles (ICBMs);

roughly 300 strategic warheads are located at bomber bases in the United States; and nearly 200 nonstrategic warheads are deployed in Europe (see Table 1). The remaining 2,530 warheads are in storage as a so called hedge against technical or geopolitical surprises.

In addition to the warheads in the US stockpile, approximately 2,700 retired, but still intact warheads are in storage and await dismantlement, for a total inventory of roughly 7,400 warheads.

Implementing New START

As of September 1, 2013, the United States nuclear arsenal was counted under the

Table 1. The US nuclear arsenal, 2014

Type/Designation	No.	Year deployed	Warhead x yield (kilotons)	Deployed
ICBMs				
LGM-30G Minuteman III				
Mk-12A	200	1979	1-3 W78 x 335 (MIRV)	220
Mk-21/SERV	250	2006 ¹	1 W87 x 300	250
Total	450			470
SLBMs				
UGM-133A Trident II D5				
Mk-4	288 ²	1992	4 W76 x 100 (MIRV)	268
Mk-4A		2008	4 W76-1 x 100 (MIRV)	500
Mk-5		1990	4 W88 x 455 (MIRV)	384
Total	288			1,152
Bombers				
B-52H Stratofortress	93/44 ³	1961	ALCM/W80-1 x 5-150	200
B-2A Spirit	20/16	1994	B61-7/-11, B83-1	100
Total	113/60			300⁴
Nonstrategic forces				
B61-3, -4 bombs	n/a	1979	0.3–170	~200 ⁵
Total				~200
Total deployed				~2,120⁶
Reserve				~2,530
Total stockpile				~4,650
Awaiting dismantlement				~2,700
Total inventory				~7,400

¹The W87 was initially deployed on the MX/Peacekeeper in 1986.

²Two additional submarines with 48 missile tubes (total) are normally in overhaul and not available for deployment. Their 48 missiles, with 288 warheads, are considered part of the responsive force of reserve warheads. Sometimes more than two submarines are in overhaul.

³The first figure is the aircraft inventory, including those used for training, testing, and backup; the second is the primary mission aircraft inventory—the number of operational aircraft assigned for nuclear or conventional missions.

⁴The pool of bombs and cruise missiles allows for multiple loading possibilities depending on the mission. The Air Force has 528 ALCMs, of which 200 are deployed at Minot AFB. Although B-52Hs can also carry B61-7 and B83-1, gravity bombs are only planned for delivery by the B-2s.

⁵These are deployed in Europe. Another 300 bombs are in storage in the United States, for a total inventory of 500 nonstrategic bombs.

⁶The US government does not count spares as operational warheads. We have included them in the reserve.

ALCM: air-launched cruise missile

ICBM: intercontinental ballistic missile

LGM: silo-launched ground-attack missile

MIRV: multiple independently targetable reentry vehicle

SERV: security-enhanced reentry vehicle

SLBM: submarine-launched ballistic missile

SLCM: sea-launched cruise missile

UGM: underwater-launched ground attack missile.

New Strategic Arms Reduction Treaty (New START) with 1,688 strategic war heads attributed to 809 deployed missiles and bombers an increase of 34 war heads and 17 launchers compared with the previous count in March 2013. The increase is an anomaly, however, reflecting fluctuations in launchers in overhaul

rather than an actual increase of strategic forces. Since the treaty entered into force in February 2011, the United States has reduced a total of 146 strategic warheads and 90 launchers counted under the treaty (Kristensen, 2013a).

To meet the treaty limit on non deployed launchers, the Air Force plans

to eliminate 104 empty ICBM silos. This includes 50 silos at Malmstrom Air Force Base in Montana, which until 2008 housed the 50 Minuteman III missiles of the 564th Missile Squadron; 50 silos at F. E. Warren Air Force Base in Wyoming, which was until 2005 used by MX/Peacekeeper ICBMs of the 400th Missile Squadron; and one MX/Peacekeeper and three Minuteman III test launch silos at Vandenberg Air Force Base in California. The 50 silos at Malmstrom will be destroyed in 2013–2014, the 50 silos at Warren in 2015–2016, and the four test launch silos at Vandenberg in 2017.

The next step will be the reduction of missile tubes from 24 to 20 on each US nuclear missile submarine in 2015–2016. The third and final step will be the denuclearization of excess bombers to reduce the accountable inventory to 60.

Nuclear weapons employment guidance

The Obama administration's long awaited nuclear weapons employment guidance was announced in June 2013 after more than two years of internal deliberations. The administration published a nine page report and a fact sheet that described the employment guidance known as Presidential Policy Directive 24 setting four overall principles for the role of US nuclear forces.

Under the directive, the fundamental role of US nuclear weapons remains to deter nuclear attack on the United States and its allies and partners. The United States will only consider the use of nuclear weapons in extreme circumstances to defend the vital interests of the United States or its allies and partners. The United States will maintain a credible nuclear deterrent capable of

convincing any potential adversary of the adverse consequences of attacking the United States or its allies and partners. And US policy seeks to achieve a credible deterrent with the lowest possible number of nuclear weapons, consistent with its current and future security requirements (Defense Department, 2013).

These planning principles are based on the 2010 Nuclear Posture Review, and the guidance report describes an employment strategy that contains a mix of constraints on and reaffirmations of nuclear planning.

In terms of constraining nuclear plans, the guidance document declares that the United States can safely pursue up to a one third reduction in deployed nuclear weapons from the level established in New START in negotiated cuts with Russia; directs the Defense Department to focus planning only on those objectives and missions that are necessary for deterrence; and tells the department to examine further options to reduce the role Launch Under Attack plays in US planning. The guidance also directs the Defense Department to take concrete steps toward reducing the role of nuclear weapons in US national security by increasing planning for non nuclear strike options and assessing what objectives and effects could be achieved through them; declares that the United States will not use or threaten to use nuclear weapons against states that are party to the Nuclear Non Proliferation Treaty and in compliance with their non nuclear obligations;¹ declares that the United States will not intentionally target civilian populations or civilian objects; reiterates the intention to work toward the goal of making deterrence of nuclear weapons the sole purpose of US

nuclear weapons; and outlines a more efficient strategy for hedging against unanticipated risks with fewer non deployed nuclear weapons (Defense Department, 2013; White House, 2013).

The reaffirmations contained in the guidance document in some cases simply confirm that long held principles for nuclear war planning still are in force. In other cases, however, the reaffirmations appear to contradict the constraints asserted in the same document. Among other things, the document declares that the new guidance is consistent with the fundamentals of deterrence that have long undergirded US nuclear weapons policy, and that the United States will retain a nuclear triad so it can credibly threaten “a wide range” of nuclear responses if deterrence should fail; these responses could include nuclear attacks against adversaries armed with chemical, biological, and conventional weapons. The guidance also states that the United States will maintain significant counterforce capabilities against potential adversaries and rejects countervalue or minimum deterrence as the basis for US nuclear strategy. It also directs the Defense Department to retain the ability to Launch Under Attack; declares that the new employment strategy does not direct any changes to currently deployed nuclear forces; decides to continue to keep a reserve of non deployed war heads to increase the deployed force if needed; calls for retaining the ability to forward deploy nuclear weapons with heavy bombers and dual capable fighter aircraft in support of extended deterrence; says that the United States should continue a forward based nuclear posture in Europe; and declares that non nuclear strike options are not a substitute

for nuclear weapons (Defense Department, 2013; White House, 2013).

Based on the new employment guidance, the Office of the Secretary of Defense will update the Nuclear Weapons Employment Policy, and the Office of the Chairman of the Joint Chiefs of Staff will update the nuclear supplement to the Joint Strategic Capabilities Plan. These documents will in turn guide Strategic Command’s revision of the strategic nuclear war plan (Kristensen, 2013b). Some changes will be implemented quickly, while others (such as increasing the role of non nuclear forces) could take years to achieve.

Nuclear modernization plan

Coinciding with the revised nuclear weapons employment strategy, the Obama administration is planning an extensive upgrade of all nuclear weapons systems: missiles, bombers, submarines, fighters, warheads, and the supporting complex and factories. The plan extends three decades into the future and costs more than \$200 billion in the first decade and hundreds of billions of dollars more in the next two decades.

The plan envisions the production of significantly modified nuclear weapons, including the addition of a guided tail kit to the B61 bomb to increase its accuracy, broaden strike options against underground targets, and reduce radioactive fallout. The new B61 bomb (B61 12) is already being designed and is expected to cost around \$10 billion for 400 to 500 bombs the most expensive nuclear bomb project ever.

The plan also envisions building a family of so called interoperable war heads that could be used on both land and sea based missiles. Little is known

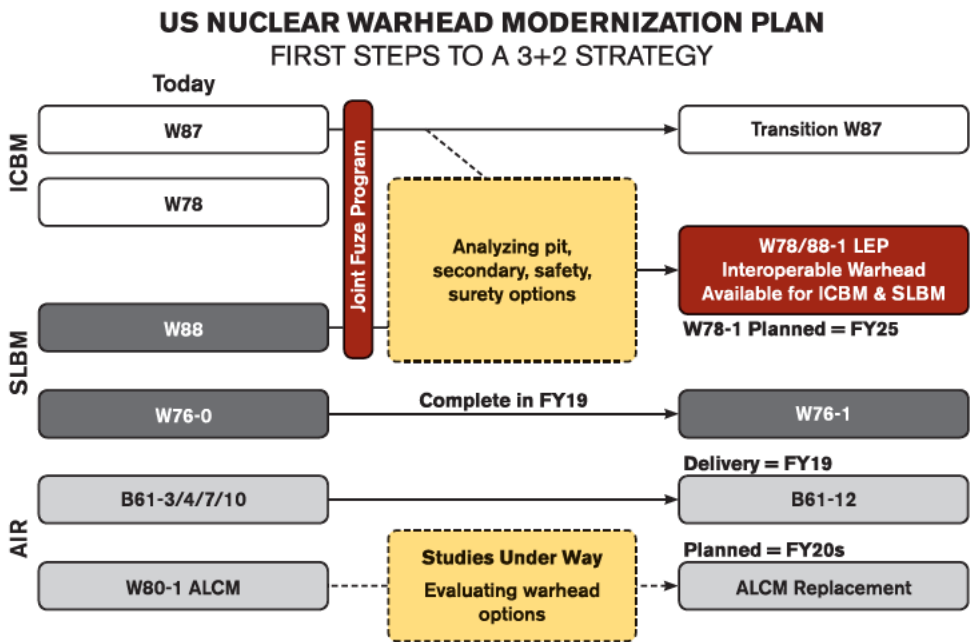
about the precise configuration of these warheads, but even though they would incorporate components from previously tested warhead designs, each could differ significantly from warheads currently in the stockpile and potentially increase uncertainty about warhead performance. Each interoperable warhead will be extremely expensive, with IW1 projected at \$14.7 billion. The plan is known as the 3 + 2 plan because it envisions the entire future stockpile containing three warhead types for intercontinental ballistic missiles (ICBMs) and submarine launched ballistic missiles (SLBMs) and two warheads for bombers, compared with seven warhead types today (see Figure 1). The high cost

will likely result in significant modification, even cancelation, of the 3+2 plan.

Land-based ballistic missiles

The US Air Force operates a force of 450 silo based Minuteman III ICBMs split evenly across three wings: the 90th Missile Wing at F. E. Warren Air Force Base; the 91st Missile Wing at Minot Air Force Base in North Dakota; and the 341st Wing at Malmstrom Air Force Base. Each wing has three squadrons, each with 50 missiles controlled by five launch control centers. Under New START, the Air Force plans to reduce the ICBM force to 400 missiles, probably by retiring one of three missile squadrons at one of the

Figure 1. The first phase of the US nuclear warhead modernization plan, known as 3 + 2



The B83-1 strategic bomb, which will be retired, is not shown in the plan.

ALCM: air-launched cruise missile
ICBM: intercontinental ballistic missile
SLBM: submarine-launched ballistic missile

Source: Department of Defense. Annotations: Hans M. Kristensen, Federation of American Scientists, 2013

three bases, leaving two bases with 150 missiles each and one with 100 missiles.

Each missile carries either the 335 kiloton W78 warhead or the 300 kiloton W87 warhead. A few missiles still carry multiple warheads but are being down loaded in order for the United States to meet the limits of New START. Despite the download, the ICBM force will retain a re MIRVing capability that could increase warhead loading if directed.

The Air Force is in the final phase of a multibillion dollar, decade long modernization program to extend the service life of the Minuteman III to 2030. Although the United States has not officially announced deployment of a new ICBM, the upgraded Minuteman IIIs “are basically new missiles except for the shell” (Pampe, 2012). The total modernization program will be completed in 2015.

In mid 2014, the Air Force is scheduled to complete an analysis of alternatives for replacing the Minuteman III missiles. Options being studied range from extending the existing missile to beyond 2030 to more exotic options, such as a mobile ICBM to increase survivability. Three Minuteman IIIs were test launched in 2013.

Nuclear-powered ballistic missile submarines

The US Navy operates 14 Ohio class ballistic missile submarines (eight based in the Pacific and six in the Atlantic), all equipped with Trident II D5 SLBMs. Normally 12 of the subs are considered operational, with a 13th and 14th boat in overhaul at any given time. The aggregate New START data show that normally fewer than 12 of these submarines are fully equipped with missiles. Of the 14

boats, 10 or 11 are normally capable of deploying with their missiles.

The deployed submarines carry approximately 1,150 warheads or an average of 4.8 warheads per missile. In practice, each missile probably has three, four, or five warheads, depending upon the requirement of the war plan. Loading with fewer warheads increases a missile’s range.

Three versions of two basic warhead types are deployed on the SLBMs: the 100 kiloton W76 0, the 100 kiloton W76 1, and the 455 kiloton W88. The W76 1 is a refurbished version of the W76 0, with the same yield but with an added safety device, a dual strong link detonation control. Moreover, a new arming, fuzing, and firing unit provides improved targeting capabilities. Full scale production of an estimated 1,200 W76 1s is under way at the Pantex plant in Texas. So far, roughly 500 W76 1s have replaced W76 0s on Trident II SLBMs, and production is scheduled to continue through 2019. W76 1s are also being supplied to Britain’s missile submarines (Kristensen, 2011a).

US submarine nuclear deterrent patrols have decreased significantly over the past decade from 64 patrols in 1999 to 28 in 2011. As a result, each sub now conducts an average of 2.5 patrols per year compared with 3.5 patrols a decade ago. The average duration of a patrol is 70 days, with a few lasting more than 100 days. More than 60 percent of the patrols take place in the Pacific Ocean, reflecting nuclear war planning against China, North Korea, and eastern Russia.

At any given time, eight or nine of the 12 operational nuclear missile submarines are at sea. Four or five of the at sea boats are on “hard alert,” which means they are in designated patrol areas within range of the targets specified in

their assigned target package in accordance with the strategic war plan. The other three or four subs at sea are in transit to or from their patrol areas, and the remaining boats are in port, some with their missiles removed.

Starting in 2015, the number of missile tubes on each Ohio class boat will be reduced by four, from 24 to 20. The reduction is intended to reduce the number of deployed SLBMs to no more than 240 at any given time, to meet the 2018 limit on deployed strategic delivery vehicles set by New START.

The Navy has ambitious modernization plans to replace the Ohio class subs with a new design, a submarine that is 2,000 tons larger than the Ohio class submarine, but with 16 missile tubes instead of the current 24—four fewer than the 20 planned under New START. Twelve replacement boats (tentatively known as SSBNX) are planned, a reduction of two compared with the current fleet of 14, at an estimated cost of approximately \$100 billion. Construction of the first new submarine is scheduled for 2021, with deployment on deterrent patrol starting in 2031.

The plan is that during the first decade of its service life, this new class of submarine will be armed with a life extended version of the current Trident II D5 SLBM. This upgraded missile, the D5LE, has a guidance system designed to “provide flexibility to support new missions” (Draper Laboratory, 2006: 8) and make the missile “more accurate” (Naval Surface Warfare Center Crane Division, 2008: 14); it will also be backfitted onto existing Ohio class subs for the remainder of their service life, starting in the Pacific in October 2017. The D5LE will also be deployed on Britain’s missile submarines.

The US submarine force conducted eight SLBM test launches in 2013. In

April, following completion of its reactor refueling overhaul, the Pennsylvania launched four missiles including the second flight test of the D5LE guidance package. And in September, another submarine launched two salvos of two missiles in the Atlantic Ocean.

Strategic bombers

The Air Force operates a fleet of 20 B 2 and 93 B 52H bombers at three bases. Of those, 18 B 2s and 76 B 52Hs are nuclear capable. An estimated 60 bombers (16 B 2s and 44 B 52Hs) are assigned nuclear weapons under the strategic nuclear war plan.

Each dedicated B 2 can carry up to 16 nuclear bombs (B61 7, B61 11, and B83 1). The dedicated B 52Hs are assigned air launched cruise missiles (ALCMs) but are no longer assigned gravity bombs. From the 2020s, the B 2 is scheduled to receive the planned B61 12 precision guided nuclear bomb, a program currently estimated to cost in excess of \$10 billion. It is estimated that approximately 1,000 nuclear weapons, including 528 ALCMs, are assigned to the bombers. Most of these weapons are in central storage at Kirtland Air Force Base in New Mexico and Nellis Air Force Base in Nevada, but a small number (we estimate 200 to 300) are stored at Minot Air Force Base and Whiteman Air Force Base in Missouri; nuclear weapons are no longer stored at Barksdale AFB in Louisiana (*Air Force Magazine*, 2011; Ferrell, 2012). The weapons are not deployed on the bombers under normal circumstances but could be loaded on short notice.

From the mid 2020s, the Air Force plans to begin replacing B 52 and B 1 (and later also B 2) bombers with a new long range bomber. Procurement of 80

to 100 aircraft is envisioned; some of the new bombers are planned to be nuclear capable, at a total cost of well over \$55 billion. The new bomber will be equipped to deliver the planned B61 12 precision guided bomb, as well as a new nuclear ALCM that is currently known as the Long Range Stand Off (LRSO) missile. The current ALCM is scheduled to remain operational through the 2020s. The administration has promised that it will not produce “new” nuclear war heads, so the LRSO could either use a life extended version of the ALCM’s W80 1 warhead or a life extended version of the retired W84 warhead that once armed the Ground Launched Cruise Missile. The LRSO warhead could cost as much as \$12 billion, with billions more needed to produce the missile itself.

Nonstrategic nuclear weapons

The US inventory of nonstrategic nuclear weapons includes approximately 500 warheads, all B61 gravity bombs. Nearly 200 of the bombs are deployed in Europe at six bases in five NATO countries: Belgium, Germany, Italy, the Netherlands, and Turkey. The Belgian, Dutch, and Turkish air forces (with F 16s) and German and Italian air forces (with PA 200 Tornado aircraft) are assigned nuclear strike missions with the US nuclear weapons (Kristensen and Norris, 2011). The weapons in Europe no longer serve a military purpose and are not tasked with providing the ultimate security guarantee to NATO, a mission that is assigned to strategic weapons.

Although the May 2012 NATO Summit in Chicago approved the Deterrence and Defense Posture Review conclusion that the existing “nuclear force posture

currently meets the criteria for an effective deterrence and defense posture” (North Atlantic Treaty Organization, 2012: paragraph 8), NATO has approved modernization in Europe through the addition of a guided tail kit to the B61 bomb to increase its accuracy, and the deployment of the stealthy F 35A Lightning II Joint Strike Fighter in Europe. Italy, the Netherlands, and Turkey have decided to buy the F 35A, and it is under consideration in Belgium. The modified bomb, known as the B61 12, will also be carried on other fighter aircraft (F 15E, F 16, and PA 200 Tornado) as well as strategic bombers (B 2 and the new long range bomber), potentially complicating future arms control agreements (Kristensen, 2011b, 2012).

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Note

1. This policy has, in various modifications, been in force since the 1970s.

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