U.S. Strategic Nuclear Forces: Background, Developments, and Issues

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Summary

During the Cold War, the U.S. nuclear arsenal contained many types of delivery vehicles for nuclear weapons. The longer range systems, which included long-range missiles based on U.S. territory, long-range missiles based on submarines, and heavy bombers that could threaten Soviet targets from their bases in the United States, are known as strategic nuclear delivery vehicles. At the end of the Cold War, in 1991, the United States deployed more than 10,000 warheads on these delivery vehicles. That number has declined to less than 6,000 warheads today, and is slated, under the 2002 Moscow Treaty, to decline to 2,200 warheads by the year 2012. The United States and Russia are discussing a potential new treaty that will further reduce U.S. forces to between 1,500 and 1,675 deployed warheads.

At the present time, the U.S. land-based ballistic missile force (ICBMs) consists of 450 Minuteman III ICBMs, each deployed with between one and three warheads, for a total of 1,200 warheads. The Air Force has deactivated all 50 of the 10-warhead Peacekeeper ICBMs; it plans to eventually deploy Peacekeeper warheads on some of the Minuteman ICBMs. It has also recently deactivated 50 Minuteman III missiles. The Air Force is also modernizing the Minuteman missiles, replacing and upgrading their rocket motors, guidance systems, and other components. The Air Force had expected to begin replacing the Minuteman missiles around 2018, but has decided, instead, to continue to modernize and maintain the existing missiles.

The U.S. ballistic missile submarine fleet currently consists of 14 Trident submarines; each carries 24 Trident II (D-5) missiles. The Navy has converted 4 of the original 18 Trident submarines to carry non-nuclear cruise missiles. The remaining submarines currently carry around 2,000 warheads in total, a number that will likely decline as the United States implements the Moscow Treaty. The Navy has shifted the basing of the submarines, so that nine are deployed in the Pacific Ocean and five are in the Atlantic, to better cover targets in and around Asia. It also has undertaken efforts to extend the life of the missiles and warheads so that they and the submarines can remain in the fleet past 2020.

The U.S. fleet of heavy bombers currently includes 20 B-2 bombers and 94 B-52 bombers. The B-1 bomber no longer is equipped for nuclear missions. The 2006 QDR recommended that the Air Force reduce the B-52 fleet to 56 aircraft; Congress rejected that recommendation, but will allow the fleet to decline to 76 aircraft. The Air Force has also begun to retire the nuclear-armed cruise missiles carried by B-52 bombers, leaving only about half the B-52 fleet equipped to carry nuclear weapons.

Congress has reviewed the Bush Administration's plans for U.S. strategic nuclear forces during the annual authorization and appropriations process. It has reviewed a number of questions about the future size of that force. For example, some have questioned why the United States must retain 2,200 strategic nuclear warheads. Congress may also question the Administration's plans for reductions in the Minuteman force and B-52 fleet. This report will be updated as needed.

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Introduction

During the Cold War, the U.S. nuclear arsenal contained many types of delivery vehicles for nuclear weapons, including short-range missiles and artillery for use on the battlefield, medium-range missiles and aircraft that could strike targets beyond the theater of battle, short- and medium-range systems based on surface ships, long-range missiles based on U.S. territory and submarines, and heavy bombers that could threaten Soviet targets from their bases in the United States. The short- and medium-range systems are considered non-strategic nuclear weapons and have been referred to as battlefield, tactical, and theater nuclear weapons.[1] The long-range missiles and heavy bombers are known as strategic nuclear delivery vehicles.

In 1990, as the Cold War was drawing to a close and the Soviet Union was entering its final year, the United States had more than 12,000 nuclear warheads deployed on 1,875 strategic nuclear delivery vehicles.[2] As of January 1, 2009, according to the counting rules in the Strategic Arms Reduction Treaty (START), the United States had reduced to 5,576 nuclear warheads on 1,198 strategic nuclear delivery vehicles.[3] According to the State Department, the United States had reduced its number of operationally deployed warheads, a number that excludes many warheads that count under START, to 2,871 by the end of December 2007.[4] Under the terms of the 2002 Strategic Offensive Reduction Treaty (known as the Moscow Treaty) between the United States and Russia, this number is to decline to no more than 2,200 operationally deployed strategic nuclear warheads by the end of 2012; some press reports indicate that the United States has already reached that level.[5]

Although these numbers do not count the same categories of nuclear weapons, they indicate that the number of deployed warheads on U.S. strategic nuclear forces will decline significantly in the two decades following the end of the Cold War. Yet, nuclear weapons continue to play a key role in U.S. national security strategy, and the United States does not, at this time, plan to either eliminate its nuclear weapons or abandon the strategy of nuclear deterrence that has served as a core concept in U.S. national security strategy for more than 50 years.[6] During the 2008 election campaign, then candidate Obama stated that he supported the goal of working to eliminate all

[1] For a detailed review of U.S. nonstrategic nuclear weapons see, CRS Report RL32572, *Nonstrategic Nuclear Weapons*, by Amy F. Woolf.

[2] Natural Resources Defense Council. Table of U.S. Strategic Offensive Force Loadings. Archive of Nuclear Data. http://www.nrdc.org/nuclear/nudb/datab1.asp The same source indicates that the Soviet Union, in 1990, had just over 11,000 warheads on 2,332 strategic nuclear delivery vehicles.

[3] Russia, by the same accounting, had 3,909 warheads on 814 delivery vehicles. See U.S. Department of State, Bureau of Verification, Compliance and Inspection. Fact Sheet. START Aggregate Numbers of Strategic Offensive Weapons. April 1, 2009. Washington, DC.

[4] The State Department did not provide an unclassified estimate for Russia's current force of operationally deployed warheads. See, U.S. Department of State, Bureau of Verification, Compliance, and Inspection. 2008 Annual Report on Implementation of the Moscow Treaty. May 13, 2008. p. 2.

[5] The START Treaty counts more than just "operationally deployed" warheads, as its data base includes warheads that would count on retired missiles until the launchers for those missiles are destroyed. The United States has maintained some ICBM and SLBM launchers after retiring the missiles, so the warheads attributed to these launchers still count.

[6] The Bush Administration emphasized this point in early 2002, when presenting the results of the 2001 Nuclear Posture Review (NPR). Douglas Feith, the Undersecretary of Defense for Policy, stated that nuclear weapons "continue to be essential to our security, and that of our friends and allies." See U.S. Senate. Committee on Armed Services. Statement of the Honorable Douglas J. Feith, Undersecretary of Defense For Policy. February 14, 2002.

nuclear weapons, but he also stated that "America will not disarm unilaterally," and that "as long as nuclear weapons exist, I will retain a strong, safe, secure, and reliable nuclear deterrent.... "[7]

The Bush Administration, after completing the 2002 Nuclear Posture Review (NPR) indicated that the United States would reduce its forces to 2,200 operationally deployed warheads, the number and concept codified in the Moscow Treaty, but it did not identify the specific combination of delivery vehicles or warhead loadings that the United States would maintain to reach the specified number. Subsequent Pentagon studies, including the Strategic Capabilities Assessment in 2005 and the 2006 Quadrennial Defense Review (QDR), offered further guidance on strategic nuclear force structure. As the United States reduces its deployed forces to meet the mandates of the Moscow Treaty, it is likely also to pursue programs that will allow it to modernize and adjust its strategic forces so that they remain capable in the years that follow. A number of factors could influence decisions about these programs, including budget, political, and strategic considerations, along with standard capabilities assessments.

This report reviews the ongoing programs that will affect the expected size and shape of the U.S. strategic nuclear force structure. It begins with an overview of this force structure during the Cold War, and summarizes the reductions and changes that have occurred since 1991. It then offers details about each category of delivery vehicle—land-based intercontinental ballistic missiles (ICBMs), submarine launched ballistic missiles (SLBMs) and heavy bombers—focusing on their current deployments and ongoing and planned modernization programs. The report concludes with a discussion of issues related to decisions about the future size and shape of the U.S. strategic nuclear force.

Background: The Strategic Triad

Force Structure and Size During the Cold War

Since the early 1960s the United States has maintained a "triad" of strategic nuclear delivery vehicles,[8] The United States first developed these three types of nuclear delivery vehicles, in large part, because each of the military services wanted to play a role in the U.S. nuclear arsenal. However, during the 1960s and 1970s, analysts developed a more reasoned rationale for the nuclear "triad." They argued that these different basing modes had complementary strengths and weaknesses. They would enhance deterrence and discourage a Soviet first strike because they complicated Soviet attack planning and ensured the survivability of a significant portion of the U.S. force in the event of a Soviet first strike.[9] The different characteristics might also strengthen

[7] "Arms Control Today 2008 Presidential Q&A: Democratic Candidate Barack Obama," *Arms Control Today*, September 24, 20008.

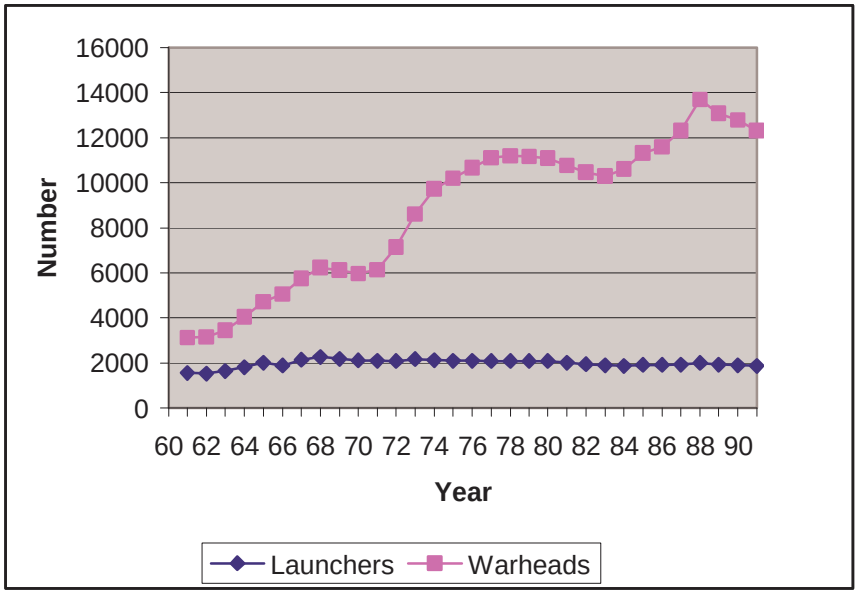
[8] When announcing the results of the Nuclear Posture Review in 2002, the Bush Administration identified a "new triad" of weapons systems and capabilities. This conceptual framework differs from the "old" triad in that it outlines how a broad set of capabilities that contribute to U.S. security, as opposed to the "old triad," which described a mix of specific weapons systems. In the "new triad," nuclear weapons and precision-guided conventional weapons combine as "offensive strike" forces. Missile defenses represent the second leg of the triad, and a "responsive infrastructure" serves the third leg. For more details see CRS Report RL31623, *U.S. Nuclear Weapons: Changes in Policy and Force Structure*, by Amy F. Woolf.

[9] U.S. Department of Defense. *Annual Report to Congress, Fiscal Year 1989*, by Frank Carlucci, Secretary of Defense. February 18, 1988. Washington, 1988. p. 54.

the credibility of U.S. targeting strategy. For example, ICBMs eventually had the accuracy and prompt responsiveness needed to attack hardened targets such as Soviet command posts and ICBM silos, SLBMs had the survivability needed to complicate Soviet efforts to launch a disarming first strike and to retaliate if such an attack were attempted,[10] and heavy bombers could be dispersed quickly and launched to enhance their survivability, and they could be recalled to their bases if a crisis did not escalate into conflict.

According to unclassified estimates, the number of delivery vehicles (ICBMs, SLBMs, and nuclear-capable bombers) in the U.S. force structure grew steadily through the mid-1960s, with the greatest number of delivery vehicles, 2,268, deployed in 1967.[11] The number then held relatively steady through 1990, at between 1,875 and 2,200 ICBMs, SLBMs, and heavy bombers. The number of warheads carried on these delivery vehicles increased sharply through 1975, then, after a brief pause, again rose sharply in the early 1980s, peaking at around 13,600 warheads in 1987. **Figure 1** displays the increases in delivery vehicles and warheads between 1960, when the United States first began to deploy ICBMs, and 1990, the year before the United States and Soviet Union signed the Strategic Arms Reduction Treaty (START).

Figure 1. U.S. Strategic Nuclear Weapons: 1960-1990



Source: Natural Resources Defense Council, Archive of Nuclear Data.

The sharp increase in warheads in the early 1970s reflects the deployment of ICBMs and SLBMs with multiple warheads, known as MIRVs (multiple independent reentry vehicles). In particular, the United States began to deploy the Minuteman III ICBM, with 3 warheads on each missile, in 1970, and the Poseidon SLBM, which could carry 10 warheads on each missile, in 1971.[12] The

[10] In the early 1990s, SLBMs also acquired the accuracy needed to attack many hardened sites in the former Soviet Union.

[11] Natural Resources Defense Council. Table of U.S. Strategic Offensive Force Loadings. Archive of Nuclear Data. http://www.nrdc.org/nuclear/nudb/datab1.asp

[12] GlobalSecurity.org LGM Minuteman III History and Poseidon C-3 History. http://www.globalsecurity.org/wmd/systems/lgm-30_3-hist.htm and http://www.globalsecurity.org/wmd/systems/c-3.htm

increase in warheads in the mid-1980s reflects the deployment of the Peacekeeper (MX) ICBM, which carried 10 warheads on each missile.

In 1990, before it concluded the START Treaty, the United States deployed a total of around 12,304 warheads on its ICBMs, SLBMs, and heavy bombers. The ICBM force consisted of single-warhead Minuteman II missiles, 3-warhead Minuteman III missiles, and 10-warhead Peacekeeper (MX) missiles, for a total force of 2,450 warheads on 1,000 missiles. The submarine force included Poseidon submarines with Poseidon C-3 and Trident I (C-4) missiles, and the newer Trident submarines with Trident I, and some Trident II (D-5) missiles. The total force consisted of 5,216 warheads on around 600 missiles.[13] The bomber force centered on 94 B-52H bombers and 96 B-1 bombers, along with many of the older B-52G bombers and 2 of the brand new (at the time) B-2 bombers. This force of 260 bombers could carry over 4,648 weapons.

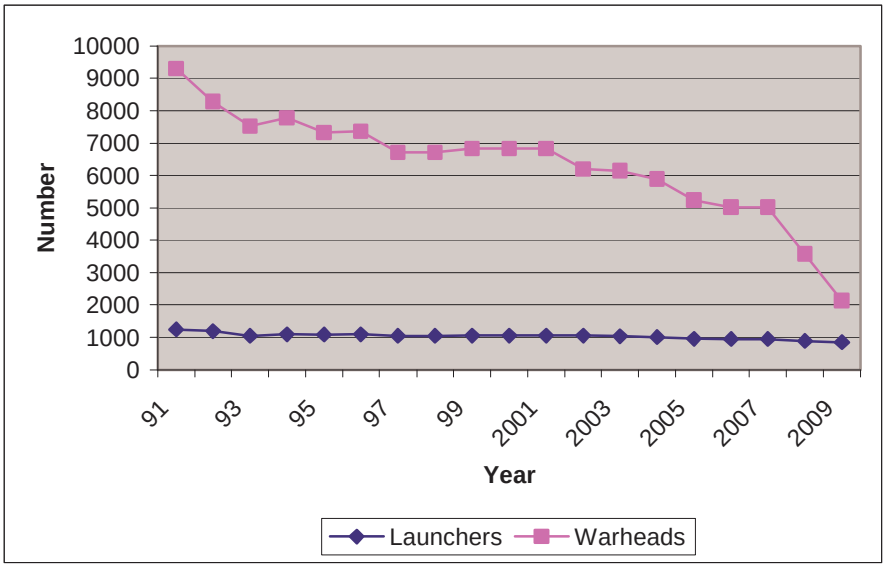
Force Structure and Size After the Cold War

During the 1990s, the United States reduced the numbers and types of weapons in its strategic nuclear arsenal, both as a part of its modernization process and in response to the limits in the 1991 START Treaty. The United States continued to maintain a triad of strategic nuclear forces, however, with warheads deployed on ICBMs, SLBMs, and bombers. According to the Department of Defense, this mix of forces not only offered the United States a range of capabilities and flexibility in nuclear planning and complicated an adversary's attack planning, but also hedged against unexpected problems in any single delivery system. This latter issue became more of a concern in this time period, as the United States retired many of the different types of warheads and missiles that it had deployed over the years, reducing the redundancy in its force.

The 1991 START Treaty limited the United States to a maximum of 6,000 total warheads, and 4,900 warheads on ballistic missiles, deployed on up to 1,600 strategic offensive delivery vehicles. However, the Treaty did not count the actual number of warheads deployed on each type of ballistic missile or bomber. Instead, it used "counting rules" to determine how many warheads would count against the Treaty's limits. For ICBMs and SLBMs, this number usually equaled the actual number of warheads deployed on the missile. Bombers, however, used a different system. Bombers that were not equipped to carry air-launched cruise missiles (the B-1 and B-2 bombers) counted as one warhead; bombers equipped to carry air-launched cruise missiles (B-52 bombers) could carry 20 missiles, but would only count as 10 warheads against the Treaty limits. These rules have led to differing estimates of then numbers of warheads on U.S. strategic nuclear forces during the 1990s; some estimates count only those warheads that count against the Treaty while others count all the warheads that could be carried by the deployed delivery systems.

[13] The older Poseidon submarines were in the process of being retired, and the number of missiles and warheads in the submarine fleet dropped quickly in the early 1990s, to around 2,688 warheads on 336 missiles by 1993. See Natural Resources Defense Council. Table of U.S. Strategic Offensive Force Loadings. Archive of Nuclear Data. http://www.nrdc.org/nuclear/nudb/datab1.asp

Figure 2. U.S. Strategic Nuclear Forces: 1990-2009



Source: Natural Resources Defense Council, Archive of Nuclear Data.

According to the data from the Natural Resources Defense Council, the United States reduced its nuclear weapons from 9,300 warheads on 1,239 delivery vehicles in 1991 to 6,196 warheads on 1,064 delivery vehicles when it completed the implementation of START in 2001. By 2008, the United States had reduced its forces to approximately 3,500 warheads on around 900 delivery vehicles. According to the State Department, as of May 2009, the United States has 2,126 operationally deployed warheads on its strategic offensive nuclear forces.[14] These numbers appear in **Figure 2**.

During the 1990s, the United States continued to add to its Trident fleet, reaching a total of 18 submarines. It retired all of its remaining Poseidon submarines and all of the single-warhead Minuteman II missiles. It continued to deploy B-2 bombers, reaching a total of 21, and removed some of the older B-52G bombers from the nuclear fleet. Consequently, in 2001, its warheads were deployed on 18 Trident submarines with 24 missiles on each submarine and 6 or 8 warheads on each missile; 500 Minuteman III ICBMs, with one or 3 warheads on each missile; 50 Peacekeeper (MX) missiles, with 10 warheads on each missile; 94 B-52H bombers, with up to 20 cruise missiles on each bomber; and 21 B-2 bombers with up to 16 bombs on each aircraft.

The United States and Russia signed a second START Treaty in early 1993. Under this Treaty, the United States would have had to reduce its strategic offensive nuclear weapons to between 3,000 and 3,500 accountable warheads. In 1994, the Department of Defense decided that, to meet this limit, it would deploy a force of 500 Minuteman III ICBMs with one warhead on each missile, 14 Trident submarines with 24 missiles on each submarine and 5 warheads on each missile, 76 B-52 bombers, and 21 B-2 bombers. The Air Force would eliminate 50 Peacekeeper ICBMs and reorient the B-1 bombers to non-nuclear missions; the Navy would retire 4 Trident submarines (it later decided to convert these submarines to carry conventional weapons). This Treaty never entered into force and Congress prevented the Clinton Administration from reducing U.S. forces

[14] U.S. Department of State, Bureau of Verification, Compliance, and Implementation, *The Legacy of START and Related U.S. Policies*, Fact Sheet, Washington, D.C., July 16, 2009, http://www.state.gov/t/vci/rls/126119.htm.

unilaterally to START II limits. Nevertheless, the Navy and Air Force continued to plan for the forces described above, and eventually implemented those changes. **Table 1** displays the forces the United States had deployed in 2001, after completing the START I reductions. It also includes those that it would have deployed under START II, in accordance the with 1994 decisions.

Table 1. U.S. Strategic Nuclear Forces Under START I and START II

	Deployed under START I (2001)		Planned for START II	
System	**Launchers**	**Accountable Warheads[a]**	**Launchers**	**Accountable Warheads**
Minuteman III ICBMs	500	1,200	500	500
Peacekeeper ICBMs	50	500	0	0
Trident I Missiles	168	1,008	0	0
Trident II Missiles	264	2,112	336	1,680
B-52 H Bombers (ALCM)	97	970	76	940
B-52 H Bombers (non-ALCM)	47	47	0	0
B-1 Bombers[b]	90	90	0	0
B-2 Bombers	20	20	21	336
Total	1,237	5,948	933	3,456

a. Under START I, bombers that are not equipped to carry ALCMs count as one warhead, even if they can carry up 16 nuclear bombs; bombers that are equipped to carry ALCMs count as 10 warheads, even if they can carry up to 20 ALCMs.

b. Although they still count under START I, B-1 bombers are no longer equipped for nuclear missions.

Future Force Structure and Size

The Bush Administration stated in late 2001 that the United States would reduce its strategic nuclear forces to 1,700-2,200 "operationally deployed warheads" over the next decade.[15] This goal was codified in the 2002 Moscow Treaty. According to the Administration, operationally deployed warheads are those deployed on missiles and stored near bombers on a day-to-day basis. They are the warheads that would be available immediately, or in a matter of days, to meet "immediate and unexpected contingencies."[16] The Administration also indicated that the United States would retain a triad of ICBMs, SLBMs, and heavy bombers for the foreseeable future. It did not, however, offer a rationale for this traditional "triad," although the points raised in the past about the differing and complementary capabilities of the systems probably still pertain. Admiral James Ellis, the former Commander of the U.S. Strategic Command (STRATCOM) highlighted this when he noted in a 2005 interview, that the ICBM force provides responsiveness, the SLBM force provides survivability, and bombers provide flexibility and recall capability.[17]

[15] President Bush announced the U.S. intention to reduce its forces on November 13, 2001, during a summit with Russia's President Vladimir Putin. The United States and Russia codified these reductions in a Treaty signed in May 2002. See CRS Report RL31448, *Nuclear Arms Control: The Strategic Offensive Reductions Treaty*, by Amy F. Woolf.

[16] U.S. Senate. Committee on Armed Services. Statement of the Honorable Douglas J. Feith, Undersecretary of Defense For Policy. February 14, 2002.

[17] Hebert, Adam. The Future Missile Force. *Air Force Magazine*. October 2005.

The Bush Administration did not specify how it would reduce the U.S. arsenal from around 6,000 warheads to the lower level of 2,200 operationally deployed warheads, although it did identify some force structure changes that would account for part of the reductions. Specifically, after Congress removed its restrictions,[18] the United States would eliminate the 50 Peacekeeper ICBMs, reducing by 500 the total number of operationally deployed ICBM warheads. It would also continue with plans to remove 4 Trident submarines from service, and convert those ships to carry non-nuclear guided missiles. These submarines would have counted as 476 warheads under the START Treaty's rules. These changes reduced U.S. forces to around 5,000 warheads on 950 delivery vehicles in 2006; this reduction appears in **Figure 2**. The Bush Administration also noted that two of the Trident submarines remaining in the fleet would be in overhaul at any given time. The warheads that could be carried on those submarines would not count against the Moscow Treaty limits because they would not be "operationally deployed." This would further reduce the U.S. deployed force by 200-400 warheads.

The Bush Administration, through the 2005 Strategic Capabilities Assessment and 2006 Quadrennial Defense Review, announced additional changes in U.S. ICBMs, SLBMs, and bomber forces; these include the elimination of 50 Minuteman III missiles and several hundred air-launched cruise missiles. (These are discussed in more detail below.) These changes appear to be sufficient to reduce the number of operationally deployed warheads enough to meet the Treaty limit of 2,200 warheads, as the United States announced, in early 2009, that it has met this limit. Reaching this level, however, also depends on the number of warheads are carried by each of the remaining Trident and Minuteman.[19]

Unlike START, the Moscow Treaty does not contain definitions or counting rules that help determine the number of treaty-accountable warheads. It also does not contain any monitoring provisions that would assist the nations in verifying compliance with the Treaty. Further, neither side has to declare how many warheads are deployed on any particular type of delivery vehicle. Theoretically, each missile could carry a different number of warheads without either side having to reveal the individual loadings, or even the loadings attributed to any given portion of the force. Each simply has to declare the total number of warheads that it has designated as "operationally deployed" and that it, therefore, counts under the Treaty limits.

Table 2 identifies an illustrative force structure that the United States might deploy under the Moscow Treaty, and compares it with U.S. operational strategic nuclear forces in 2008. This structure is consistent with the statements and adjustments the Administration has made, to date, but does not postulate any further reductions in the number of delivery vehicles. The table also displays a range for the number of warheads that could be carried by each "leg" of the triad, even though, as was just noted, this estimate remains highly speculative.

[18] Beginning in FY1996, and continuing through the end of the Clinton Administration, Congress had prohibited the use of any DOD funds for the elimination of strategic nuclear delivery vehicles, below START I levels, until START II entered into force. See, for example, the FY1998 Defense Authorization Act (P.L. 105-85, Sec. 1302). Congress lifted this restriction in the FY2002 Defense Authorization Act (P.L. 107-107, Sec. 1031).

[19] "U.S. Meets Moscow Nuclear Reduction Commitment Three Years Early," *Global Security Newswire*, February 11, 2009.

Table 2. U.S. Strategic Nuclear Forces 2008 and Illustrative Strategic Nuclear Forces Under the Moscow Treaty

System	Forces in 2008		Possible forces in 2012	
	Launchers	Accountable Warheads	Launchers	Operational Warheads[a]
Minuteman III ICBMs	450	1,200	450	450-600
Trident II Missiles	336	2,688	288[b]	1,152
B-52H Bombers	95	950	76[c]	300-550
B-2 Bombers	21	336	20[d]	200-350
Total	952	5,174	834	~ 2,200

Source: U.S. Department of State, Fact Sheet; CRS Estimates

a. These estimates are highly speculative, but reflect reports of possible changes in deployed forces.

b. The launcher total for Trident submarines counts only 12 vessels, excluding the 2 submarines in overhaul.

c. Congress rejected the Air Force plan for the B-52 fleet, and, in the FY2007 Defense Authorization Act, mandated that the Air Force retain 75 B-52 bombers through 2018. Secretary of Defense Gates endorsed a fleet of 76 B-52 bombers in April 2009.

d. The number of B-2 bombers has declined by one, after a B-2 crashed on take-off from Guam on late February 2008.

Strategic Nuclear Delivery Vehicles: Ongoing Plans and Programs

Intercontinental Ballistic Missiles (ICBMs)

Peacekeeper (MX)

In the late 1980s, the United States deployed 50 Peacekeeper ICBMs, each with 10 warheads, at silos that had held Minuteman missiles at F.E. Warren Air Force Base in Wyoming. The 1993 START II Treaty would have banned multiple warhead ICBMs, so the United States would have had to eliminate these missiles while implementing the Treaty. Therefore, the Pentagon began planning for their elimination, and the Air Force added funds to its budget for this purpose in 1994. However, beginning in FY1998, Congress prohibited the Clinton Administration from spending any money on the deactivation or retirement of these missiles until START II entered into force. The Bush Administration requested $14 million in FY2002 to begin the missiles' retirement; Congress lifted the restriction and authorized the funding. The Air Force began to deactivate the missiles in October 2002, and completed the process, having removed all the missiles from their silos, in September 2005. The MK21 reentry vehicles and W87 warheads from these missiles have been placed in storage. As is noted below, the Air Force plans to redeploy some of these warheads and reentry vehicles on Minuteman III missiles, under the Safety Enhanced Reentry Vehicle (SERV) program.

Under the terms of START, the United States would have had to eliminate the Peacekeeper missile silos to remove the warheads on the missiles from accountability under the Treaty limits.

However, the Air Force has chosen to retain the silos. Therefore, the warheads that were deployed on the Peacekeeper missiles would still count under START, even though the missiles are no longer operational. To reduce the number of warheads "attributed" to these missiles, the Air Force has declared that the silos that had held the Peacekeeper missiles have been converted back to Minuteman missile silos. It has also declared that each silo should count as if the Minuteman missile in the silo carried only one warhead. Consequently, the silos that formerly held Peacekeeper missiles now count, on the START data base, as 50 warheads, instead of 500 warheads.[20] The United States does not, however, count any of these warheads under the limits in the Moscow Treaty.

Minuteman III

The U.S. force of Minuteman III ICBMs has declined recently from 500 to 450 missiles. These missile are located at three Air Force bases—F.E. Warren AFB in Wyoming, Malmstrom AFB in Montana, and Minot AFB in North Dakota. Each base houses 150 missiles.

Missile Plans

In the 2006 Quadrennial Defense Review (QDR), the Pentagon indicated that it planned to "reduce the number of deployed Minuteman III ballistic missiles from 500 to 450, beginning in Fiscal Year 2007."[21] The QDR did not indicate which base was likely to lose a squadron of missiles, although, in testimony before the Senate Armed Services Committee, General James E. Cartwright, the Commander of U.S. Strategic Command (STRATCOM), indicated that the missiles would likely come from Malmstrom because that would leave each base with an equal number of 150 ICBMs.[22] The Air Force deactivated the missiles in Malmstrom's 564th Missile Squadron, which was known as the "odd squad."[23] This designation reflected that these missiles were built and installed by General Electric, while all other Minuteman missiles were built by Boeing, and that these missiles used a different communications and launch control system than all the other Minuteman missiles. According to Air Force Space Command, the drawdown began on July 1, 2007. All of the reentry vehicles were removed from the missiles in early 2008, the missiles were all removed from their silos by the end of July 2008, and the squadron was deactivated by the end of August.[24]

In testimony before the Senate Armed Services Committee, General Cartwright stated that the Air Force had decided to retire these missiles so that they could serve as test assets for the remaining force. He noted that the Air Force had to "keep a robust test program all the way through the life of the program."[25] With the test assets available before this decision, the test program would begin to run short around 2017 or 2018. The added test assets would support the program through

[20] U.S. Department of State, *START Aggregate Numbers of Strategic Offensive Arms*, Fact Sheet, Washington, D.C., April 1, 2009.

[21] U.S. Department of Defense. Report of the 2006 Quadrennial Defense Review. Washington, February 2006. p. 50.

[22] U.S. Senate, Committee on Armed Services, Hearing on Global Strike Plans and Programs. Testimony of James E. Cartwright, Commander U.S. Strategic Command. March 29, 2006.

[23] Johnson, Peter. Growth Worries Base Boosters. *Great Falls Tribune.* January 19, 2006.

[24] Global Security Newswire. U.S. Deactivates 50 Strategic Missiles. August 4, 2008.

[25] U.S. Senate, Committee on Armed Services, Hearing on Global Strike Plans and Programs. Testimony of James E. Cartwright, Commander U.S. Strategic Command. March 29, 2006.

2025 or longer. This time line, however, raises questions about why the Air Force pressed to begin retiring the missiles in FY2007, 10 years before it runs out of test assets. Some have speculated that the elimination of the 50 missiles was intended to reduce the long term operations and maintenance costs for the fleet, particularly since the 564th Squadron used different ground control technologies and training systems than the remainder of the fleet. This option was not likely, however, to produce budgetary savings in the near-term as the added cost of deactivating the missiles could exceed the reductions in operations and maintenance expenses.[26] In addition, to use these missiles as test assets, the Air Force will include them in the modernization programs described below. This would further limit the budgetary savings. At the same time, the Air Force plans to retain the silos at Malmstrom, and will not destroy or eliminate them.

Retiring these missiles might also allow the Air Force to reduce the number of officers needed to operate the Minuteman fleet and to transfer these officers to different positions, although, again, the numbers are likely to be small. Nevertheless, by retiring these missiles, both STRATCOM and the Air Force can participate in the ongoing effort to transform the Pentagon in response to post-Cold War threats. These missiles may still have a role to play in U.S. national security strategy, but they may not be needed in the numbers that were required when the United States faced the Soviet threat.

Congress questioned the Administration's rationale for this plan to retire 50 Minuteman missiles. In the FY2007 Defense Authorization Act (H.R. 5122, Sec. 139), Congress stated that DOD could not spend any money to begin the withdrawal of these missiles from the active force until the Secretary of Defense submitted a report that addressed a number of issues, including (1) a detailed justification for the proposal to reduce the force from 500 to 450 missiles; (2) a detailed analysis of the strategic ramifications of continuing to equip a portion of the force with multiple independent warheads rather than single warheads; (3) an assessment of the test assets and spares required to maintain a force of 500 missiles and a force of 450 missiles through 2030; (4) an assessment of whether halting upgrades to the missiles withdrawn from the deployed force would compromise their ability to serve as test assets; and (5) a description of the plan for extending the life of the Minuteman III missile force beyond FY2030. The Secretary of Defense submitted this report to Congress in late March 2007. In testimony before the Senate Armed Services Committee, Subcommittee on Strategic Forces, on March 28, 2007, General Cartwright noted that the Air Force was prepared to begin reducing the number of deployed Minuteman III missiles in April 2007.[27]

Warhead Plans

Each Minuteman III was initially deployed with 3 warheads, for a total of 1,500 warheads across the force. In 2001, to meet the START limit of 6,000 warheads, the United States removed 2 warheads from each of the 150 Minuteman missiles at F.E. Warren AFB,[28] reducing the Minuteman III force to 1,200 total warheads. In the process, the Air Force also removed and destroyed the "bulkhead," the platform on the reentry vehicle, so that, in accordance with START rules, these missiles can no longer carry 3 warheads.

[26] Private communication.

[27] U.S. Congress. Senate. Armed Services Committee, Subcommittee on Strategic Forces. Fiscal Year 2008 Strategic Forces Program Budget. Hearing. March 28, 2007.

[28] See Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

Under START II, the United States would have had to download all the Minuteman III missiles to one warhead each. Although the Bush Administration initially endorsed the plan to download all Minuteman ICBMs, this plan has apparently changed. In an interview with *Air Force Magazine* in October 2003, General Robert Smolen indicated that the Air Force would maintain the ability to deploy these 500 missiles with up to 800 warheads.[29] Although some analysts interpreted this statement to mean that the Minuteman ICBMs would carry 800 warheads on a day-to-day basis, it seems more likely that this was a reference to the Air Force intent to maintain the ability to reload warheads, and reconstitute the force, if circumstances changed.[30] The 2001 NPR had indicated that the United States would maintain the flexibility to do this. However, in testimony before the Senate Armed Services Committee, General Cartwright also indicated that some Minuteman missiles might carry more than one warhead. Specifically, when discussing the reduction from 500 to 450 missiles, he said, "this is not a reduction in the number of warheads deployed. They will just merely be re-distributed on the missiles."[31] Major General Deppe confirmed that the Air Force would retain some Minuteman III missiles with more than one warhead when he noted, in a speech in mid-April 2007, that the remaining 450 Minuteman III missiles could be deployed with one, two, or three warheads.[32]

The Air Force may alert its plans for warheads on the Minuteman force, in the coming years, if the United States and Russia reach an agreement on further reductions in their strategic offensive forces. During their summit in July 2009, Presidents Obama and Medvedev agreed that the new Treaty would likely limit each side to between 1,500 and 1,675 operationally deployed warheads. DOD has offered no details about how the United States would reduce its forces from the current level of about 2,126 warheads, but some of these warheads could come from the Minuteman fleet if the Air Force decides to deploy all Minuteman missiles with only one warhead.

Several factors are likely to affect the decision on the final number of warheads carried on Minuteman missiles. First, as was noted above, 150 Minuteman missiles have been "downloaded" to a single warhead under START rules, and, therefore can no longer carry additional warheads. That leaves, at most, 300 missiles that could carry 2 or 3 warheads. Second, the Air Force is planning to deploy its Minuteman missiles with the MK21 reentry vehicles removed from Peacekeeper ICBMs under the SERV program. Some of the modified missiles will carry a single W-87 warhead, but the Air Force has not indicated how many missiles will be limited to this single warhead configuration.[33] As a result, only a portion of the Minuteman fleet will still be able to carry more than one warhead.

Minuteman Modernization Programs

The Air Force has pursued several programs that are designed to improve the accuracy and reliability of the Minuteman fleet and to extend the missiles' service lives. According to some

[29] Hebert, Adam. The Future Missile Force. *Air Force Magazine*. October 2005.

[30] See, for example, Jeffrey Lewis. STRATCOM Hearts MIRV. ArmsControlWonk.com, January 30, 2006.

[31] See, U.S. Senate, Committee on Armed Services, Hearing on Global Strike Plans and Programs. Testimony of James E. Cartwright, Commander U.S. Strategic Command. March 29, 2006.

[32] Sirak, Michael. Air Force Prepared To Draaw Down Minuteman III Fleet by 50 Missiles. Defense Daily. April 17, 2007.

[33] Sirak, Michael. Minuteman Fleet has Life Beyond 2020, Says Senior Air Force Space Official. Defense Daily. June 14, 2006.

estimates, this effort could eventually cost $6-7 billion.[34] This section describes several of the key programs in this effort.

Propulsion Replacement Program (PRP)

The program began in 1998 and has been replacing the propellant, the solid rocket fuel, in the Minuteman motors to extend the life of the rocket motors. A consortium led by Northrup Grumman poured the new fuel into the first and second stages and remanufactured the third stages of the missiles. According to the Air Force, as of early August, 2007, 325 missiles, or 72% of the fleet, had completed the PRP program; this number increased to around 80% by mid-2008. The Air Force purchased the final 56 booster sets, for a total of 601, with its funding in FY2008. Funding in FY2009 supported the assembly of the remaining boosters. The Air Force expects to complete the PRP program by 2013.[35] In the FY2007 Defense Authorization Act (P.L. 109-364) and the FY2007 Defense Appropriations Act (P.L. 109-289), the 109th Congress indicated that it would not support efforts to end this program early. However, in its budget request for FY2010, the Air Force indicated that FY2009 was the last year for funding for the program.

Guidance Replacement Program (GRP)

The Guidance Replacement Program has extended the service life of the Minuteman missiles' guidance set, and improved the maintainability and reliability of guidance sets. It replaced aging parts with more modern and reliable technologies, while maintaining the accuracy of the missiles.[36] Flight testing for the new system began in 1998, and, at the time, it exceeded its operational requirements. Production began in 2000, and the Air Force purchased 652 of the new guidance units. Press reports indicate that the system had some problems with accuracy during its testing program.[37] The Air Force eventually identified and corrected the problems in 2002 and 2003. According to the Air Force, 425 Minuteman III missiles were upgraded with the new guidance packages as of early August, 2007. The Air Force had been taking delivery of 5-7 new guidance units each month, for a total of 652 units. Boeing reported that it had delivered the final guidance set in early February 2009. The Air Force has indicated that this program has achieved full operational capability, and it does not plan to request any additional funding for FY2010.

Propulsion System Rocket Engine Program (PSRE)

According to the Air Force, the Propulsion System Rocket Engine (PSRE) program is designed to rebuild and replace Minuteman post-boost propulsion system components that were produced in the 1970s. The Air Force has been replacing, rather than repairing this system because original replacement parts, materials and components are no longer available. This program is designed to reduce the life-cycle costs of the Minuteman missiles and maintain their reliability through 2020.

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[34] Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

[35] Sirak, Michael. Minuteman Fleet has Life Beyond 2020, Says Senior Air Force Space Official. Defense Daily. June 14, 2006.

[36] LGM Minuteman III Modernization. Globalsecurity.org

[37] Donnelly, John M. Air Force Defends Spending Half A Billion on Iffy ICBMs. *Defense Week*. September 10, 2001. p. 1.

Through FY2009, the Air Force had purchased 435 units for this program, at a cost of $73 million. It has requested an additional 14.8 million to purchase another 96 units in FY2010.

Rapid Execution and Combat Targeting (REACT) Service Life Extension Program

The REACT targeting system was first installed in Minuteman launch control centers in the mid-1990s. This technology allowed for a significant reduction in the amount of time it would take to re-target the missiles, automated routine functions to reduce the workload for the crews, and replaced obsolete equipment.[38] In 2006, the Air Force began to deploy a modernized version of this system to extend its service life and to update the command and control capability of the launch control centers. This program will allow for more rapid retargeting of ICBMs, a capability identified in the Nuclear Posture Review as essential to the future nuclear force The Air Force completed this effort in late 2006.

Safety Enhanced Reentry Vehicle (SERV)

As was noted above, under the SERV program, the Air Force plans to deploy MK21/W-87 reentry vehicles removed from Peacekeeper ICBMs on the Minuteman missiles, replacing the older MK12/W62 and MK12A/W78 reentry vehicles. To do this, the Air Force must modify the software, change the mounting on the missile, and change the support equipment. According to Air Force Space Command, the SERV program conducted three flight tests in 2005 and cancelled a fourth test because the first three were so successful.[39] The Air Force installed 20 of the kits for the new reentry vehicles on the Minuteman missiles at F.E. Warren Air Force Base in 2006. The process began at Malmstrom in July 2007 and at Minot in July 2008. As of early August 2007, 47 missiles had been modified. The Air Force purchase an additional 111 modification kits in FY2009, for a total of 570 kits. This was the last year that it planned to request funding for the program. It plans to complete the installation process by 2012.

Future Programs

The Air Force began to explore its options for a new missile to replace the Minuteman III in 2002, with the intent to begin deploying a new missile in 2018. It reportedly produced a "mission needs statement" at that time, and then began an Analysis of Alternatives (AOA) in 2004.[40] In June 2006, Lt. General Frank Klotz indicated that, after completing the AOA, Space Command had decided to recommend "an evolutionary approach to the replacement of the Minuteman III capability,"[41] which would continue to modernize the components of the existing missiles rather than begin from scratch to develop and produce new missiles. He indicated that Space Command supported this approach because it would be less costly than designing a new system "from scratch." With this plan in place, the Air Force now plans to maintain the Minuteman fleet through 2025 or beyond.

[38] LGM Minuteman III Modernization. Globalsecurity.org

[39] Lt. Gen. Frank G. Klotz, Vice Commander, Air Force Space Command. Transcript of Speech to the National Defense University Breakfast. June 13, 2006.

[40] Selinger, Mark. Minuteman Replacement Study Expected to Begin Soon. Aerospace Daily and Defense Report. June 25, 2004.

[41] Lt. Gen. Frank G. Klotz, Vice Commander, Air Force Space Command. Transcript of Speech to the National Defense University Breakfast. June 13, 2006.

This approach could ensure the long-term future of the ICBM fleet. A more expensive "new" program could face cost-cutting pressures in both the Pentagon and Congress. In addition, budget limits could lead to pressures to reduce the number of missiles, leading to a further contraction of the ICBM fleet. On the other hand, some might argue that a new ICBM program would demonstrate a stronger long-term commitment by the Air Force to its ICBM fleet. It might appear easier to withdraw funding and support from the ICBM fleet if the Air Force decides to modernize, maintain, and extend the existing missiles, rather than to pursue new, and possibly more capable, technologies.

Submarine Launched Ballistic Missiles

The U.S. fleet of ballistic missile submarines consists of 14 Trident submarines, each equipped to carry 24 Trident missiles. The fleet currently carries a total of around 1,200 warheads.

By the early 1990s, the United States had completed the deployment of 18 Trident ballistic missile submarines (SSBNs). Each of these submarines was equipped to carry 24 Trident missiles, and each missile could carry up to 8 warheads (either W-76 warheads or the larger W-88 warheads on the Trident II missile). The Navy initially deployed 8 of these submarines at Bangor, Washington, and all 8 were equipped with the older Trident I missile. It then deployed 10 submarines, all equipped with the Trident II missile, at Kings Bay, Georgia. During the 1994 Nuclear Posture Review, the Clinton Administration decided that the United States would reduce the size of its Trident fleet to 14 submarines, and that four of the older submarines would be "backfit" to carry the Trident II missile.

The Bush Administration's 2001 Nuclear Posture Review endorsed the plan to "backfit" 4 of the Trident submarines so that all would carry Trident II missiles. It also indicated that, instead of retiring the remaining 4 submarines, the Navy would convert them to carry conventional weapons, and designated them "guided missile" submarines (SSGNs). Consequently, the U.S. ballistic missile submarine (SSBN) force currently consists of 14 Trident submarines, with 7 based at Bangor, Washington, 5 based at Kings Bay, Georgia, and 2 in overhaul as they are equipped to carry Trident II missiles. This section describes many of the plans and programs that are changing this force.

The SSGN Program

The Navy has completed the process of converting 4 Trident submarines (the USS Ohio, USS Michigan, USS Florida, and USS Georgia) to carry conventional cruise missiles and other conventional weapons. Reports indicate that the conversion process took approximately $1 billion and two years for each of the 4 submarines. The SSGNs can each carry 154 Tomahawk cruise missiles, along with up to 100 special forces troops and their mini-submarines.[42]

The first two submarines scheduled for this conversion were removed from the nuclear fleet in early 2003. They were slated to receive their engineering overhaul, then to begin the conversion process in 2004.[43] The first to complete the process, the USS Ohio returned to service as an

[42]Connolly, Allison. For Four Subs, Its Good-bye Ballistic Missiles, Hello SEALs. Norfolk Virginia Pilot. December 18, 2004.

[43] Ohio Class SSGN Tactical Trident. GlobalSecurity.org http://www.globalsecurity.org/military/systems/ship/ssgn-726.htm

SSGN in January 2006[44] and achieved operational status on November 1, 2007. According to the Navy, the Georgia was scheduled for deployment in March 2008, and the other submarines were scheduled to reach that status later in the year.[45] According to Admiral Stephen Johnson, the Director of the Navy's Strategic Submarine Program (SSP), all four of the submarines had returned to service by mid-2008, and two were forward-deployed on routine patrols.

The Backfit Program

As was noted above, both the 1994 and 2001 Nuclear Posture Reviews confirmed that the Navy would "backfit" four Trident submarines so that they could carry the newer Trident II (D-5) missile. This process would not only allow the Navy to replace the aging C-4 missiles, it would also equip the fleet with a missile that has improved accuracy and a larger payload. With its greater range, it would allow the submarines to operate in a larger area and cover a greater range of targets. These characteristics were valued when the system was designed and the United States sought to enhance its ability to deter the Soviet Union. The Bush Administration believes that the range, payload, and flexibility of the Trident submarines and D-5 missiles remain relevant in an era when the United States may seek to deter or defeat a wider range of adversaries.

Four of the eight Trident submarines based in Bangor, Washington (USS Alaska, USS Nevada, USS Henry M. Jackson and USS Alabama) were a part of the backfit program. The Alaska and Nevada both began the process in 2001; the Alaska completed its backfit and rejoined the fleet in March 2002 and the Nevada did the same in August 2002. During the process, the submarines underwent a pre-planned engineered refueling overhaul, which accomplishes a number of maintenance objectives, including refueling of the reactor; repairing and upgrading some equipment, replacing obsolete equipments, repairing or upgrading the ballistic missile systems, and other minor alterations.[46] The submarines also are fit with the Trident II missiles and the operating systems that are unique to these missiles. According to the Navy, both of these efforts came in ahead of schedule and under budget. The Henry M. Jackson and Alabama were scheduled to compete their engineering overhaul and backfit in FY2006 and to reenter the fleet in 2007 and 2008.

The last of the Trident I (C-4) missiles was removed from the fleet in October 2004, when the USS Alabama off-loaded its missiles and began the overhaul and backfit process. All the Trident submarines currently in the U.S. fleet now carry the Trident II missile.[47]

Basing Changes

When the Navy first decided, in the mid-1990s, to maintain a Trident fleet with 14 submarines, it planned to "balance" the fleet by deploying 7 Trident submarines at each of the two Trident bases.

[44] First Trident Submarine Converted. Associated Press. January 10, 2006.

[45] U.S. Congress. Senate. Armed Services Committee, Subcommittee on Strategic Forces. Fiscal Year 2008 Strategic Forces Program Budget. Hearing. Prepared statement of Mr. Brian R. Green, Deputy Assistant Secretary of Defense, Strategic Capabilities, p. 6. March 28, 2007. See also, Guided Missile Submarine Ohio Ready for Deployment. Inside the Navy, November 5, 2007.

[46] SSBN-726 Ohio-Class FBM Submarines, GlobalSecurity.org, http://www.globalsecurity.org/wmd/systems/ssbn-726-recent.htm

[47] Morris, Jefferson. Older Trident Missiles to be Phased out by Fall, Admiral Says. Aerospace Daily and Defense Report. June 17, 2005.

The Navy would have transferred 3 submarines from Kings Bay to Bangor, after 4 of the submarines from Bangor were removed from the ballistic missile fleet, for a balance of 7 submarines at each base. However, these plans changed after the Bush Administration's Nuclear Posture Review. The Navy has transferred 5 submarines to Bangor, "balancing" the fleet by basing 9 submarines at Bangor and 5 submarines at Kings Bay. Because two submarines would be in overhaul at any given time, this basing plan means that 7 submarines would be operational at Bangor and 5 would be operational at Kings Bay.

According to unclassified reports, the Navy began moving Trident submarines from Kings Bay to Bangor in 2002, and transferred the fifth submarine in September 2005.[48] This change in basing pattern apparently reflects changes in the international security environment, with fewer targets within range of submarines operating in the Atlantic, and a greater number of targets within range of submarines operating in the Pacific. In particular, the shift allows the United States to improve its coverage of targets in China and North Korea.[49] Further, as the United States modifies its nuclear targeting objectives, and, particularly, if it deploys conventional warheads on Trident submarines, it could alter the patrol routes for the submarines operating in both oceans, so that a greater number of emerging targets would be within range of the submarines in a short amount of time.

Warhead Issues

The Trident I (C-4) and Trident II (D-5) missiles can be equipped to carry up to 8 warheads each. Under the terms of the START Treaty, the United States can remove warheads from Trident missiles, and reduce the number listed in the data base, a process known as downloading, to comply with the Treaty's limit of 6,000 warheads. The United States took advantage of this provision as it reduced its forces under START, reducing to 6 warheads per missile on the 8 Trident submarines based at Bangor, Washington.[50]

The Navy has also reduced the number of warheads on the other Trident submarines, so that it can reduce its forces to the 2,200 deployed warheads permitted under the Moscow Treaty. The United States did not have to reach this limit until 2012, but, according to some reports, it has already reached that level. As it has done so, however, the United States has not had to indicate how many warheads are deployed on each missile; it can simply have to declare a total number of operationally deployed warheads on all of its strategic nuclear delivery vehicles. To meet the limit however, it is likely to deploy an average of 4 warheads on each Trident II missile.

Modernization Plans and Programs

The Navy initially planned to keep Trident submarines in service for 30 years, but has now extended that time period to 42 years. This extension reflects the judgment that ballistic missiles submarines would have operated with less demanding missions than attack submarines, and could, therefore, be expected to have a much longer operating life than the expected 30 year life

[48] Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

[49] Ibid.

[50] Even though 4 of these submarines are being converted to SSGNs, they still count under the START Treaty because they still have SLBM launch tubes. Each of those tubes count as 6 warheads. See U.S. Department of State. Bureau of Verification, Compliance, and Implementation. START Aggregate Number of Strategic Offensive Arms. April 1, 2006.

of attack submarines. Therefore, since 1998, the Navy has assumed that each Trident submarine would have an expected operating lifetime of at least 42 years, with two 20-year operating cycles separated by a two-year refueling overhaul.[51] The Navy has also pursued a number of programs to ensure that it has enough missiles to support this extended life for the submarines.

Trident Missile Production

The Navy purchased 461 Trident II (D-5) missiles through FY2009. After finalizing the plan to deploy all 14 Trident submarines with D-5 missiles, the Navy extended Trident production through 2013, and now expects to purchase 561 Trident missiles, at a rate of 12-24 missiles per year.[52] The Navy expects to maintain a fleet of 12 operational Trident submarines, with 24 missiles on each submarine, but it would need more than the 288 missiles that would fill these submarines. Around 50 of the missiles would be available for use by Great Britain in its Trident submarines. The remainder would support the missile's test program throughout the life of the Trident system. The Navy requested $220 million towards the purchase of Trident missiles in FY2007, $211.5 million in FY2008, $186.3 million in FY2009, and $162.4 million in FY2010.

Trident Missile Life Extension

The Navy has also begun a life extension program for the Trident II missiles, so that they will remain capable and reliable throughout the 45-year life of the Trident submarines. The Navy requested nearly $700 million to support this program in FY2007, $457.7 million in FY2008, $487.4 million in FY2009 and $524.5 in FY2010. According to the Navy, this funding will sustain efforts to redesign the guidance system and missile electronics to extend the life of the missiles.[53] The Navy expects the refurbished missiles to reach their IOC in 2013.

W76 Warhead Life Extension

The overwhelming majority of Trident missiles are deployed with the MK4/W76 warhead, which, according to unclassified estimates, has a yield of 100 kilotons.[54] It is nearing the end of its service life and is currently undergoing a life extension program that is designed to enhance its capabilities. According to some reports, the Navy had initially planned to apply this program to around 25% of the W76 warheads, but has increased that plan to cover more than 60% of the stockpile.

Several questions have come up during the life extension program. For example, some weapons experts have questioned whether the warhead's design is reliable enough to ensure that the warheads will explode at its intended yield.[55] In addition, in June 2006, an inspector general's report from the Department of Energy questioned the management practices at the National

[51] SSBN Ohio-Class FBM Submarines. GlobalSecurity.org,

[52] Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

[53] U.S. Department of Defense. Department of the Navy. Fiscal Year 2007Budget Estimate Submission. Justification of Estimates. February 2006. p. 13.

[54] Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

[55] Fleck, John. Flaws Seen in Sub-Launched Nuclear Warhead. Albuquerque Journal. July 8, 2004.

Nuclear Security Administration (NNSA), which is responsible for the life extension program, arguing that management problems had led to delays and created cost overruns in the program. This raised questions about whether NNSA would be able to meet the September 2007 delivery date for the warhead,[56] and, when combined with other technical issues delayed the delivery of the first W-76 warhead until August 2008. The Navy accepted the first refurbished warhead into the stockpile in February 2009.[57] NNSA had planned to eventually phase out the life extension program, and use the new Reliable Replacement Warhead program to develop a replacement for the W-76 warhead,[58] but Congress has not funded the studies supporting the development of the RRW.

Conventional Trident Modification

In the report of the 2006 Quadrennial Defense Review, the Pentagon called for the deployment of conventional warheads on a portion of its Trident SLBMs.[59] According to DOD's plan, the Navy would deploy two Trident missiles on each submarine with conventional warheads and deploy 4 warheads deployed on each of these missiles, for a total force of 96 conventional warheads. This would provide the United States with the capability to launch conventional warheads against targets around the world in less than an hour, a capability that does not now exist unless U.S. forces are forward-based in the region where the targets might be. This is a part of STRATCOM's plan for the Prompt Global Strike mission. The Navy requested $127 million for FY2007 to begin this program, but Congress did not authorize or appropriate the funding in the FY2007 Defense Authorization or Defense Appropriations bills, instead questioning the need for and intentions of the program, while raising concerns about the possibility that other nations might misinterpret the launch of a conventional Trident missile.

The Navy requested $175 million for this program in FY2008. The House Armed Services Committee, in its version of the FY2008 Defense Authorization Bill (H.R. 1585, H.Rept. 110-146), approved the request for $126.4 million for continued research and development on the reentry vehicle, and authorized $16 million for procurement, but reduced the budget request by $33 million, withholding all funds for long-lead procurement. The Senate Armed Services Committee, in its version of the FY2008 Defense Authorization Bill (S. 1547, S.Rept. 110-77), recommended that no funding be provided specifically for the CTM program, and that all the funding for the CTM and other "prompt global strike" programs, a total of $208 million be pooled to support a "coordinated look at a variety of kinetic non-nuclear concepts is necessary to address the feasibility of a prompt global strike." In the final version of the Defense Authorization Bill for FY2008 (H.Rept. 110-477), the Conference Committee adopted that Senate's approach, combining the funding in a single account. But, as the Defense Appropriations Bill had done, the Conference Report on the Defense Authorization Bill limited this funding to $100 million. In FY2009, the funding remains in a single account, and Congress continued to reject separate funding for the CTM program.

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[56] Costa, Keith J. IG: Project Weaknesses put W-76 Warhead Refurbishment Plan at Risk. InsideDefense.Com June 8, 2006.

[57] National Nuclear Security Administration, *Refurbished W76 Warhead Enters U.S. Nuclear Stockpile*, Washington, D.C., February 23, 2009, http://www.nnsa.energy.gov/news/2286.htm.

[58] U.S. Congress. Senate. Armed Services Committee, Subcommittee on Strategic Forces. Fiscal Year 2008 Strategic Forces Program Budget. Hearing. March 28, 2007.

[59] For details, see, CRS Report RL33067, *Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress*, by Amy F. Woolf.

Future Programs

The Navy has initiated studies into options for a replacement for the Trident submarine. According to Admiral Stephen Johnson, the Navy would have to begin construction of its new submarine by 2019 so that it could begin to enter the fleet in 2025, before the Tridents begin to retire in 2027. Congress approved the Navy's request for $10 million in the FY2009 budget to begin conceptual design work on this replacement for the Trident. In his April 6, 2009 presentation that outlined the plans for the next defense budget, Secretary of Defense Robert [60]Gates announced that the Navy would formally begin the replacement program for the Trident submarines in FY2010.[61] As a result, the Navy's budget request for FY2010 includes $560 million for "Advanced Submarine System Development" to design, and prepare for construction, of a replacement for the Trident.

Although the Navy has not finalized its design for the new submarine, it will probably be based on the Virginia-class attack submarines, because, as Admiral Johnson has said, leveraging the "success of the Virginia-class SSN program" will help hold down costs. Its also likely that the missile compartment will carry only 16, rather than 24, ballistic missiles, if the Nuclear Posture Review reduces the number of weapons and targets associated with the submarine fleet. According to Admiral Johnson, the number of submarines in the fleet is derived from the number that must be at sea to provide a "survivable deterrent." Since this number is not likely to decline, a decline in the number of warheads is likely to come through a decline in the number of missiles on each submarine.

Bombers

B-1 Bomber

The Air Force began to deploy the B-1 bomber in the mid-1980s and eventually deployed a fleet of 96 aircraft. After several crashes, the Air Force was left with 92 bombers in 2001. It has sought to retire 30 of the aircraft, leaving a force of 62 bombers, but has met resistance from Congress. The B-1 served exclusively as a nuclear delivery vehicle through 1991, carrying short-range attack missiles and gravity bombs. Because these bombers were not equipped to carry nuclear-armed air-launched cruise missiles, each counts as a single delivery vehicle and a single warhead under START. In 1993, the Air Force began to convert the B-1 bombers to carry conventional weapons. This process was completed in 1997 and the B-1 bomber is no longer equipped to carry nuclear weapons, although it still counts against the START limits. Neither the bomber nor its weapons count against the limits in the Moscow Treaty. The bomber has contributed to U.S. conventional operations in Afghanistan and Iraq.

[60] RADM Stephen Johnson, Director, Navy Strategic Programs Office. Speech at the NDU/NDIA Seminar Series, June 23, 2009.

[61] U.S. Department of Defense, *Briefing by Defense Secretary Robert Gates and Marine Corps Gen. James Cartwright, Vice Chairman of the Joint Chiefs of Staff*, Washington, D.C., April 6, 2009, http://insidedefense.com/secure/data_extra/html3/dplus2009_0893_3.htm.

B-2 Bomber

The Air Force has 20 B-2 bombers, based at Whiteman AFB in Missouri.[62] The B-2 bomber can carry both B-61 and B-83 nuclear bombs, but is not equipped to carry cruise missiles. It can also carry conventional weapons, and has participated in U.S. military campaigns from Bosnia to Iraq. It is designed as a "low observable" aircraft, and was intended to improve the U.S. ability to penetrate Soviet air defenses.

Weapons

According to unclassified estimates, the United States has around 550 B-61 and B-83 bombs.[63] The B61-11, a modification developed in the 1990s, has a hardened, modified case so that it can penetrate some hardened targets, although probably not those encased in steel and concrete. The B-83 bomb is a high yield weapon, that is also designed to destroy hardened targets, such as ICBM silos. The National Nuclear Security Administration reported that it had completed its life extension program for two versions of the B-61 bomb in early 2009.

B-52 Bomber

The Air Force maintains 93 B-52H aircraft at two bases, Barksdale, Louisiana and Minot, North Dakota.[64] The Air Force began to retire the first of 18 B-52 bombers scheduled for retirement at the end of July 2008.[65] The B-52 bomber, which first entered service in 1961, is equipped to carry nuclear or conventional air-launched cruise missiles and nuclear-armed advanced cruise missiles. The B-52 bombers can also deliver a wide range of conventional arms.

The Air Force has proposed cutting the B-52 fleet on many occasions in the last 10-15 years. For example, when the United States identified the force structure that it would deploy under the START Treaty, it indicated that it would only seek to retain 76 B-52 bombers. Congress, however, rejected the Clinton Administration's proposal, and the United States retained the full fleet of 94 aircraft.

The 2006 Quadrennial Defense Review called for a significant change to the B-52 fleet, reducing it from 94 to 56 aircraft. The budget request for FY2007 indicated that the Air Force planned to retire 18 bombers in FY2007 and 20 in FY2008. At the same time, the QDR called for continuing improvements to the B-1, B-2, and B-52 bombers' conventional capabilities using the funds that were saved by the retirement of the 38 aircraft. The Air Force has argued that it can reduce the number of deployed bombers, without reducing the overall capabilities of the bomber fleet, because these new weapons have "raised the efficiency" of the bomber platform. At hearings before the Senate Armed Services Committee, General James E. Cartwright, the Commander of STRATCOM, noted that "the next generation weapons that we're fielding, these air-launched cruise missiles, the joint direct attack munitions, et cetera, are much more efficient than they were

[62] A B-2 bomber crashed on take-off from Anderson Air Force Base on Guam in late February 2008, reducing the number of deployed bombers from 21 to 20.

[63] Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

[64] A B-52 bomber crashed off the coast of Guam in July 2008.

[65] U.S. Air Force, Minot Air Force Base, Office of Public Affairs. B-52H Reaches Retirement. July 30, 2008.

in the past."[66] General Cartwright also indicated that, in spite of the reduced size of the fleet, the Air Force would continue to deploy B-52 bombers at two bases.

During the FY2007 budget cycle, Congress rejected the Pentagon's proposals for at least part of the B-52 fleet. The House, in its version of the FY2007 Defense Authorization Bill, prohibited the Air Force from retiring any of the B-52 aircraft, and mandated that it maintain at least 44 "combat coded" aircraft until the Air Force began to replace the B-52 with a new bomber of equal or greater capability. It stated, as a part of its rationale for this rejection, that it appeared the reduction was based on the reduced need for nuclear-capable bombers and did not take into consideration a growing need for long-range conventional strike capabilities.[67] The Senate agreed to permit the Air Force to retire 18 B-52 aircraft, but stated that it expected no further reduction in the size of the force, noting that a further reductions might "prevent our ability to strike the required conventional target set during times of war."[68] The Conference Committee (H.R. 5122, Sec. 131) combined these two provisions, allowing the retirement of no more than 18 aircraft after the submission of a report, and mandating that the Air Force retain at least 44 "combat coded" aircraft. These restrictions are to remain in place until 2018, or until a new long-range strike aircraft "with equal or greater capability than the B-52H model aircraft" attained initial operational capability, if that occurred first. Congress also stated that no funds could be spent to retire any B-52 aircraft until the Secretary of the Air Force submitted a report to Congress that described the Air Force plan for the modernization of the B-52, B-1, and B-2 bomber fleets; how many bombers would be assigned two nuclear and conventional missions if the United States had to execute "two overlapping 'swift defeat' campaigns;" a justification of the cost and projected savings of any reductions to the B-52H bomber aircraft fleet; the life expectancy of each bomber aircraft to remain in the bomber force structure and the capabilities of the bomber force structure that would be replaced by a new bomber aircraft.

The Air Force indicated that the report on the bomber fleet would be ready in the fall of 2007. Further, in testimony before the Armed Services Committee, the Air Force indicated that it still planned to reduce the B-52 fleet to 56 aircraft, with 32 combat coded aircraft included in the fleet. But, in recognition of the congressional mandate, it was seeking a way to maintain 44 combat coded aircraft, the minimum set by Congress, within the smaller fleet of 56 aircraft. It also stated that it planned to store the 20 aircraft it wanted to retire in FY2008 on ramps at Barksdale Air Force Base; the aircraft would be kept in serviceable condition, but would not receive any capabilities upgrades.[69] Congress once again rejected this proposal. In the FY2008 Defense Authorization Bill (H.R. 1585, Sec. 137), Congress mandated that the Air Force maintain a fleet of 74 B-52 bombers, with no less than 63 in the Primary Aircraft inventory and 11 backup aircraft. Two additional aircraft would be designated as "attrition reserve." The Conference Committee indicated that the Members agreed that a fleet of fewer than 76 aircraft would be insufficient to meet long-range strike requirements.

[66] U.S. Senate, Committee on Armed Services, Hearing on Global Strike Plans and Programs. Testimony of James E. Cartwright, Commander U.S. Strategic Command. March 29, 2006.

[67] U.S. Congress. House. Committee on Armed Services. National Defense Authorization Act for Fiscal Year 2007. H.Rept. 109-452. May 5, 2006. p. 103.

[68] U.S. Congress Senate. National Defense Authorization Act for Fiscal Year 2007. S.Rept. 109-254. May 9, 2006. p. 94.

[69] U.S. Congress. Senate. Armed Services Committee, Subcommittee on Strategic Forces. Hearing on the Fiscal Year 2008 Strategic Forces Program Budget. Statement of Major General Roger Burg. March 28, 2007. p. 8.

The growing interest in long-range strike capabilities, and the continuing addition of precision conventional weapons to these aircraft, demonstrates that the Pentagon and STRATCOM view the U.S. bomber fleet as essential to U.S. conventional weapons capabilities. Further, the need for long-range strike capabilities, rather than an interest in maintaining the nuclear role for bombers,[70] appeared to be driving decisions about the size and structure of the bomber fleet. There are some indications that, during the discussions on the 2006 QDR, some in the Pentagon argued that the all the B-52 bombers should be removed from the nuclear mission. Moreover, in November 2008, Secretary of the Air Force Michael Donley noted that the role that the bombers play in nuclear deterrence could be reduced in the future, if the U.S. and Russia negotiate further reductions in their nuclear arsenals.

This focus began to shift, however, in 2008. Several recent studies have noted that a lack of attention paid in the Air Force and, more broadly, in DOD, to the bombers' nuclear mission seems to be one of the factors that led to the episode in August 2007, when a B-52 bombers flew from Minot to Barksdale with six cruise missiles that carried live nuclear warheads. [71] The Air Force is pursuing a number of organizational and procedural changes to increase its focus on the nuclear mission and "reinvigorate" its nuclear enterprise. For example, it plans to "stand-up" a B-52 bomber squadron that will focus specifically on the nuclear mission.[72] This new unit would add 10 bombers to the 12 already deployed at Minot. While all the B-52 bomber crews and aircraft will retain their nuclear roles, this added squadron will participate in a greater number of nuclear exercises and training missions. The aircraft in the squadron will rotate from other missions, but will remain designated as the nuclear squadron for full year. The Air Force hopes this construct will improve not only the operational proficiency of the crews, but also their morale and their confidence in the value of the nuclear mission. The Air Force expects the new squadron to begin its operations late in 2009 or early in 2010. With this change, Secretary of Defense Gates stated, in April 2009, that the Air Force now planned to retain 76 B-52 bombers.

Weapons

The B-52 bomber is equipped to carry both the Air-Launched cruise missile (ALCM) and Advanced Cruise Missile (ACM). The ACM reportedly has a modified design with a lower radar cross-section, making it more "stealthy" than the ALCM. According to Air Force figures, the United States has 1,142 ALCMs and 394 ACMs.[73] Although these weapons represent a majority of the weapons that U.S. bombers could carry on nuclear missions, the Department of Defense recently decided to retire many of these missiles. In his statement to the Senate Armed Services Committee's Subcommittee on Strategic Forces, Major General Roger Burg indicated that this study had concluded, and the Secretary of Defense had directed, that the Air Force retire all the Advanced Cruise Missiles, although some could be converted to carry conventional warheads, and reduce the ALCM fleet to 528 cruise missiles. The excess ALCMs will also be eliminated, and the remaining missiles would be consolidated at Minot Air Force Base. With all the ALCMs

[70] Carlo Munoz, "Donley: Role of Nuclear Bomber Fleet Could Be Curtailed," *Inside the Air Force*, November 14, 2008.

[71] For a detailed review of this incident see, Warrick, Joby and Walter Pincus. The Saga of a Bent Spear. *Washington Post*. September 23, 2007.

[72] Marcus Weisgerber, "USAF To Activate Rotational Nuclear Bomber Squadron Next Month," *Inside Defense*, September 26, 2008.

[73] The Air Force also has 289 ALCMs that have been converted to carry conventional warheads (CALCMs). See Michael Sirak. DOD Studies Future Role of Nuclear-Armed Cruise Missiles. Defense Daily, March 30, 2006.

consolidated at Minot Air Force Base, the bombers at Barksdale may no longer be included in the nuclear mission.

Both the ALCM and ACM were set to undergo life-extension programs so that they could remain in service through 2030.[74] Both cruise missiles also carry the W-80 warhead, which was scheduled to for a life-extension program. However, the Department of Defense no longer plans to support the W-80 refurbishment program.[75] These program changes, taken together, raise serious questions about the future of nuclear-armed cruise missiles and nuclear-capable bombers in the U.S. strategic force. The Air Force now plans to begin an Analysis of Alternatives, in FY2010, for a future "long-range stand-off vehicle" that might replace the existing ALCM.

This reduction in the ALCM fleet and elimination of the ACM fleet will help the United States meet its obligation under the Moscow Treaty to reduce to 2,200 operationally deployed nuclear warheads by the end of 2012. Under the START II Treaty, the United States would have had to count the total number of nuclear weapons the B-2 and B-52 bombers were equipped to carry under its allocation of permitted warheads. These warheads would have counted even if the bombers were equipped to perform conventional missions, unless the bombers were altered so that they could no longer carry nuclear weapons. Under the Moscow Treaty, however, the United States will only count as "operationally deployed" those nuclear weapons stored at bomber bases, excluding a small number of spare warheads. It does not intend to alter any bombers so that they cannot carry nuclear weapons. Consequently, the number of bomber weapons could decrease in the future, even without changes to the numbers of deployed bombers, as the United States retires weapons or removes them from storage areas at Barksdale Air Force Base.

Future Bomber Plans

The Air Force has begun to plan for the development of a new strategic bomber, with its possible introduction into the fleet in around 2018. According to former Air Force Secretary Michael Wynne, the service was seeking a bomber with not only stealth capabilities and long range, but also one with "persistence," one that can "stay airborne and on call for very long periods."[76] The start of the study on a new bomber, known as an Analysis of Alternatives (AOA) had been delayed by a dispute over whether the study should stand alone or be merged with another AOA on prompt global strike (PGS). While a future bomber could be a part of the PGS mission, other systems, such as hypersonic technologies and missiles, would also be a part of the effort to strike anywhere around the world at long range. General Cartwright, the former head of STRATCOM, reportedly supported a plan to merge the two efforts, so that the considerations of capabilities for a new bomber would be measured along side other systems, both to balance the force and avoid redundancy across the force.[77] On the other hand, the former Air Force Chief of Staff, General T. Michael Moseley, reportedly preferred to keep the two studies separate. He argued that a bomber with long-range strike capabilities must have "persistent, survivable, and penetrating capabilities"

[74] Robert S. Norris and Hans M. Kristensen. U.S. Nuclear Forces, 2006. Bulletin of the Atomic Scientists. January/February 2006.

[75] According to S.Rept. 109-274, Energy and Water Appropriations Bill 2007, the Nuclear Weapons Council and Department of Defense no longer support the W80 Life Extension activities. As a result, both the House (H.R. 5427) and Senate Appropriations Bills eliminate funding for this effort.

[76] Christie, Rebecca. Air Force To Step Up New Bomber Search in Next Budget. *Wall Street Journal*. June 29, 2006.

[77] Grossman, Elaine M. Cartwright Wants to See Strike Studies Await "Discovery" Process. InsideDefense.Com. April 6, 2006.

while a platform with PGS capabilities could be "standoff weapon that is very, very fast."[78] This position reportedly prevailed, with the Air Force deciding, in May 2006, to keep the two studies separate.[79]

This dispute reveals wide-ranging differences, within the Air Force and Pentagon, about the goals for and capabilities that should be sought in a new bomber program.[80] The dispute focuses, however, on conventional capabilities; it seems to be almost a foregone conclusion that nuclear capabilities, or the need for a bomber leg of the nuclear triad, will not drive the discussion or analysis.

In early May 2007, the Air Force indicated that it had decided that the next generation bomber would be manned and subsonic, although it would incorporate some stealth characteristics.[81] It decided that it would not pursue supersonic capabilities, or an unmanned option, to contain costs and maintain the capabilities of the future aircraft. In October 2008, Air Force Secretary Michael Donley indicated that the new bomber would also be capable of carrying nuclear weapons.[82]

However, on April 6, 2009, in a briefing describing the FY2010 defense budget, Secretary of Defense Robert Gates stated that the Air force would not "pursue a development program for a follow-on Air Force bomber until we have a better understanding of the need, the requirement and the technology."[83] Specifically, he suspended the program until DOD completes the QDR and Nuclear Posture Review. Lt. Gen. Robert Elder, the commander of the 8th Air Force, stated that he supported the decision to delay the bomber program, and noted that the ongoing U.S.-Russian negotiations to replace the 1991 START Treaty might also affect the capabilities planned for the next generation bomber.[84] The Air Force, however, still supports the development of a new bomber and will, reportedly, make its case towards this end in the QDR and NPR.

Issues for Congress

This report focuses on the numbers and types of weapons in the U.S. strategic nuclear force structure. It does not address the broader question of why the United States chooses to deploy these numbers and types of weapons, or more generally, the role that U.S. nuclear weapons play in U.S. national security strategy. This question is addressed in other CRS reports.[85] However, as

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[78] Bennet, John T. Internal Squabbles Holding Up Bomber Study, USAF Official Says. InsideDefense.com. April 21, 2006.

[79] Matishak, Martin. Long-Range, Prompt Global Strike Studies Will Remain Separate. InsideDefense.com. June 16, 2006.

[80] For more details on the proposed bomber, see CRS Report RL34406, *The Next Generation Bomber: Background, Oversight Issues, and Options for Congress*, by Anthony Murch.

[81] Sirak, Michael. Air Force Identifies Manned, Subsonic Bomber as Most Promising 2018 Option. Defense Today. May 2, 2007.

[82] Carlo Munoz, "Donley: Next Generation Bomber Will Be Nuclear Capable by 2018," *Inside the Air Force*, October 31, 2008.

[83] [83] U.S. Department of Defense, *Briefing by Defense Secretary Robert Gates and Marine Corps Gen. James Cartwright, Vice Chairman of the Joint Chiefs of Staff*, Washington, D.C., April 6, 2009, http://insidedefense.com/secure/data_extra/html3/dplus2009_0893_3.htm.

[84] John Reed, "Elder: Bomber Decision Delay Likely Linked to Upcoming Strategic Arms Talks," *Inside Defense*, April 21, 2009.

[85] See, for example, CRS Report RL31623, *U.S. Nuclear Weapons: Changes in Policy and Force Structure*, by Amy F. (continued...)

the Obama Administration reviews and possibly revises the plans for U.S. nuclear force structure, Congress could address broader questions about the relationship between these forces and the role of nuclear weapons.

Force Size

The Bush Administration argued that, because the United States and Russia are no longer enemies, the United States would not size or structure its nuclear forces simply to deter the "Russian threat." Instead, nuclear weapons will play a broader role in U.S. national security strategy. Specifically, the United States would maintain nuclear weapons to *assure* allies and friends of the U.S. commitment to their security, to *dissuade* potential adversaries from challenging the United States with nuclear weapons or other "asymmetrical threats," to *deter* adversaries by promising an unacceptable amount of damage in response to an adversary's attack, and to *defeat* enemies by holding at risk those targets that could not be destroyed with other types of weapons.[86] Further, the Bush Administration indicated that United States would develop and maintain the capabilities it needs to counter the capabilities of a wider range of adversaries under a wider range of circumstances. It designated these circumstances as immediate contingencies, potential contingencies, and unexpected contingencies.[87]

The 2001 Nuclear Posture review determined that the United States would need to maintain between 1,700 and 2,200 operationally deployed nuclear warheads to achieve the goals outlined above. The Bush Administration also indicated that the United States would maintain in storage many of the warheads removed from deployed forces, and would maintain the capability to restore some of these warheads to the deployed forces to meet unexpected contingencies. This option could increase the size of the U.S. deployed force to more than 3,000 warheads. The Administration indicated that all four of the objectives noted above contribute to the decision on U.S. force size, in contrast with the past when deterrence and defeat of Russia dominated force size decisions.[88]

Some analysts have questioned why the United States must maintain such a large force of nuclear weapons if it is not planning to use its forces against a "Russian threat." They have questioned whether the United States would attack with such a large number of weapons if its own national survival were not at risk, and they note that only Russia currently has the capability to threaten U.S. national survival. They assert that the United States could likely meet any other potential contingency with a far smaller force of nuclear weapons. Therefore, some have asked why, in the

(...continued)

Woolf.

[86] U.S. Department of Defense. Special Briefing on the Nuclear Posture Review. News Transcript. January 9, 2002. These are the same four defense policy goals outlined in the Quadrennial Defense Review for the whole of the U.S. military. See U.S. Department of Defense. Quadrennial Defense Review Report. September 30, 2001. p. 11.

[87] U.S. Department of Defense. Annual Report to the President and Congress. Donald H. Rumsfeld, Secretary of Defense. Washington, 2002. p. 88.

[88] In testimony before the Senate Armed Services Committee, Secretary of Defense Rumsfeld said, "The U.S. nuclear arsenal remains an important part of our deterrence strategy and it helps to dissuade the emergence of potential or would-be peer competitors by underscoring the futility of trying to sprint towards parity with us or, indeed, superiority. I would add that it also assures our friends and allies that indeed our capability is sufficient; and in some instances, nations that have the ability to develop nuclear weapons, because they're our friends and allies, recognize they have no need to do so." See U.S. Senate. Committee on Armed Services. Hearing on The Strategic Offensive Reductions Treaty. July 25, 2002.

absence of a threat from Russia, must the United States maintain a force of 2,200 nuclear warheads. Some have concluded, instead, that the United States could maintain its security with a force of between 500 and 1,000 warheads.[89]

The Bush Administration disputed this view, noting that the United States has other potential adversaries, and, even if these nations do not possess thousands of nuclear warheads, some may expand their nuclear forces or chemical and biological capabilities in the future. And, it asserted that the need to assure allies and dissuade potential adversaries could require a force of significant size, regardless of the number of potential targets a nation might possess. The Obama Administration may alter this assessment. It has just begun its Nuclear Posture Review, and, therefore, has not offered any definition or description of the role of nuclear weapons in U.S. national security policy. Nevertheless, during their meeting in London in early April 2009, President Obama and Russia's President Medvedev pledged to resume negotiations on strategic offensive nuclear weapons and to pursue deeper reductions in their deployed forces. They outlined their goals for this treaty during their summit in Moscow in July 2009, and indicated that they planned to reduce their operational strategic forces to between 1,500 and 1,675 warheads.

Force Structure

When the Bush Administration announced the results of the Nuclear Posture Review, it indicated that the United States would retain a triad of ICBMs, SLBMs, and heavy bombers for the foreseeable future. But it did not offer a rationale for the retention of this traditional "triad." The absence of a rationale makes it difficult to predict possible future trends for any of the three legs of the triad.

As was noted above, most discussions about the bomber force focus on how many bombers, and what types of bomber weapons, the United States needs to bolster its conventional long-range strike capability. There is little, if any, discussion about the role that bombers may play in either nuclear deterrence, or, if deterrence fails, in the launch of U.S. nuclear weapons. It is not surprising that some in the Air Force and Pentagon have questioned the continuing need for nuclear-capable bombers.

It is similarly hard to predict the future size of the ICBM force in the absence of any statements about the unique, or complementary, role that ICBMs may play in the U.S. nuclear deterrent posture in the future. In the past, analysts have argued that single-warhead ICBMs bolster crisis stability, and discourage efforts by an adversary to launch a disarming first strike, because the cost of the strike, as measured by the number of attacking warheads, would exceed the benefits, as measured by the number of warheads destroyed. This, when combined with the high accuracy and prompt responsiveness of ICBM warheads, argued for a substantial fleet of 500 or more ICBM launchers. But one does not hear similar arguments in current discussions. If the goal is simply to retain 500 (or fewer) warheads based on land, then a force of 150-200 Minuteman missiles could be sufficient.

The Trident fleet seems less vulnerable to the absence of a rationale for a triad of strategic delivery vehicles. It is currently carries more than half of the U.S. deployed nuclear warheads, and this percentage will likely hold steady, or even increase, as the United States reduces its

[89] See, for example, Sidney D. Drell and James E. Goodby. What Are Nuclear Weapons For? Recommendations for Restructuring U.S. Strategic Nuclear Forces. Arms Control Association, Updated October 2007.

forces to the levels mandated by the Moscow Treaty. With its ability to remain invulnerable to detection and attack, and with the increasing accuracy and reliability of its missiles and warheads, the Trident fleet will continue to represent the "backbone" of the U.S. nuclear force. Further, in the absence of arguments about the need for complementary capabilities and redundancy, it is possible to imagine that, in the future, the Trident fleet could represent almost the totality of the U.S. nuclear force.

Several officials in the Bush Administration acknowledged that, as the United States reduced its forces to the levels mandated by the Moscow Treaty, the Trident fleet would carry a greater portion of deployed warheads.[90] Further, the United States does not, at this time, plan to alter the basic structure of its Trident fleet; it will continue to deploy its submarines at two bases, with a portion of the fleet deployed in the Atlantic Ocean and a portion deployed in the Pacific Ocean. However, if the United States reduces the size of its nuclear arsenal significantly below the limits in the Moscow Treaty, the United States may find it difficult to retain its "triad" of nuclear delivery vehicles. The limits suggested for the treaty that will replace START are not likely to cut deeply enough to raise questions about the triad, but Presidents Obama and Medvedev have pledged to reduce nuclear weapons in a "step-by-step" process, with additional reductions coming in a future treaty. Most analysts who propose deep reductions, to perhaps 1,000 nuclear warheads, readily acknowledge that these reductions could affect the U.S. triad, and support changes in the U.S. force structure.

Some argue that the United States should retain only the warheads on its Trident submarines. It could convert its bombers to conventional missions and perhaps eliminate its land-based ICBMs. However, the United States might also have to reduce the size of its Trident fleet, from the current 14 submarines to perhaps 8 or 10 submarines, if it reduced to 1,000 warheads. And, with so few submarines, the United States might have to eliminate one of its submarine bases, leaving it with submarines based only in the Atlantic or only in the Pacific Ocean. This change may not be consistent with current submarine operations and employment plans. President Obama and the U.S. military may want to consider the implications of these basing, operational, and policy changes, *before* deciding whether or not to reduce to 1,000 warheads, as opposed to choosing the warhead number first *then* deciding later how to base and operate the remaining nuclear forces.

Safety, Security, and Management Issues

In late August 2007, a B-52 bomber based in Minot, North Dakota, took off on flight to Barksdale Air Force Base in Louisiana. The bomber carried 12 air-launched cruise missiles that were slated for retirement at Barksdale. As a result of a series of errors and missteps in the process of removing the missiles from storage and loading them on the bombers, six of the missiles carried live nuclear warheads, instead of the dummy warheads that were installed on missiles heading for retirement. This episode led to a series of studies and reviews by the Air Force that identified the source of the episode and identified a number of steps the Air Force should take to improve its handling of nuclear weapons.[91]

[90] See, for example, Carlos Munoz, As Stockpile Shrinks, Nuclear Force to Focus More on SLBMs. Inside the Pentagon. January 31, 2008.

[91] See, for example, The Defense Science Board Permanent Task Force on Nuclear Weapons Surety. Report on the Unauthorized Movement of Nuclear Weapons. February 2008.

In early June 2008, Secretary of Defense Robert Gates requested the resignations of the Secretary of the Air Force, Michael Wynne, and the Chief of Staff of the Air Force, General Michael Mosely, from their positions, at least in part, due to concerns about that shortcomings in the Air Force's handling of nuclear weapons "resulted from an erosion of performance standards within the involved commands and a lack of effective Air Force leadership oversight."[92] Secretary Gates appointed a task force, lead by former Secretary of Defense and Energy James Schlesinger, to provide "independent advice on the organizational, procedural and policy improvements necessary to ensure that the highest levels of accountability and control are maintained in the department's stewardship of nuclear weapons, delivery vehicles, sensitive components and basing procedures."[93]

Several of the studies that reviewed this event have concluded that the Air Force leadership has lost its focus on the nuclear mission as the Air Force has diverted resources to more pressing missions related to the ongoing conflicts in Iraq and Afghanistan. As a result the "nuclear enterprise" has been allowed to atrophy, with evident declines in morale, cohesion, and capability.[94] These reports suggest that the United States restore its focus on the nuclear mission and repair long-standing and often-identified deficiencies in manpower and training programs for crews that maintain and service nuclear weapons and operate nuclear-capable bombers. The studies have identified a number of organizational changes to achieve these goals. For example, the Air Force has created a new Global Strike Command, which will be based at Barksdale Air Force Base, that will be responsible for both the ICBM force and the nuclear-capable bombers. This organization began its operations in early 2009. The Air Force has also established a new headquarters office in the Pentagon that will monitor and manage the resources and policies dedicated to the nuclear mission.

Others, however, take away a different lesson. Some have suggested that the evident weaknesses in the Air Force's procedures argue for removing nuclear weapons from the whole of the bomber fleet.[95] Congress may address concerns about these issues, and review possible changes in command structures and security procedures, as it reviews nuclear weapons policies and programs during its next session.

[92] Nuclear Lapses Trigger Ouster of Top U.S. Air ForceOfficials. Global Security Newswire. June 6, 2008.

[93] U.S. Department of Defense. Office of the Assistant Secretary of Defense (Public Affairs). Department of Defense Announces Task Force on Nuclear Weapons Management. June 12, 2008.

[94] See, for example, United States Air Force, *Reinvigorating the Air Force Nuclear Enterprise*, Prepared by the Air Force Nuclear Task Force, Washington, D.C., October 24, 2008, http://www.af.mil/shared/media/document/AFD-081024-073.pdf. See also, Report of the Secretary of Defense Task Force on DOD Nuclear Weapons Management (the Schlesinger Commission), *Phase I: The Air Force's Nuclear Mission*, Washington, D.C. September 2008. http://www.defenselink.mil/pubs/Phase_I_Report_Sept_10.pdf

[95] Kristensen, Hans. Nuclear Safety and the Saga of the Missing Bent Spear. Federation of the American Scientists. February 22, 2008. http://www.fas.org/blog/ssp/2008/02/nuclear_safety_and_the_saga_ab.php

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