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U.S. nuclear forces, 2003

Key events that affected U.S. nuclear forces over the past year included the signing of the Strategic Offensive Reductions Treaty (the "Moscow Treaty") by Presidents George W. Bush and Vladimir Putin of Russia in May, and the U.S. withdrawal from the Anti-Ballistic Missile (ABM) Treaty in June, 2002. Steps were also taken to begin implementing the Nuclear Posture Review (NPR).

Intercontinental ballistic missiles (ICBMs). Initial deactivation of the 50-missile MX/Peacekeeper ICBM force began on October 2, 2002, when W87 warheads were removed from a missile in the S-07 Launch Facility at F. E. Warren Air Force Base (AFB) in Wyoming. One missile will be withdrawn approximately every three weeks. All will be deactivated over three years at a cost of \$600 million. According to the air force, the missiles will remain on alert until they are deactivated.

The NPR calls for the MX silos to be retained, rather than destroyed as specified in the SALT and START treaties. MX missiles will be kept for potential use as space launch vehicles, target vehicles, or for redeployment. We estimate that 200 W87 warheads will arm Minuteman III missiles, and the balance will be placed in the "responsive force" of reserve warheads. Some W87s may be used to arm Trident II D5s in the future.

The Minuteman III force remains unchanged compared to last year, with 500 missiles deployed at three air force bases: 200 missiles at Malmstrom AFB in Montana; 150 at Minot AFB in North Dakota; and 150 at F. E. Warren AFB. (There are 107 missiles kept for spares, operational testing and evaluation, aging, and surveillance.) The Minuteman missiles at Malmstrom and Minot carry three warheads each; those at F. E. Warren have one W62 warhead each. All 500 missiles will be downloaded to single-warhead configuration by 2007.

The Minuteman III missile force continues to be modernized under a \$6 billion, six-part plan to improve the weapon's accuracy and reliability and to extend its service life beyond 2020. In spite of this extensive modernization, the air force may begin studies on a Minuteman IV next year.

ICBMs are maintained at very high alert rates (above 98 percent) and can be launched on short notice to provide "prompt strike capability."

Submarines. The NPR validated the Trident submarine-launched ballistic missile (SLBM) system as the backbone of the offensive nuclear strike force. As of mid-2003, there were 16 operational *Ohio*-class nuclear-powered ballistic missile submarines (SSBNs), two fewer than a year ago. Eventually the number will be reduced to 14. The navy has extended the service life of the Trident from 30 to 44 years. The oldest submarine will retire in 2029; the Pentagon is studying two options for a new SSBN to be introduced the same year. One option is a variant of the *Virginia*-class nuclear-powered attack submarine (SSN); the other is a dedicated SSBN based on either a new design or a Trident derivative. The new project would begin in 2016.

The 16 SSBNs carry 384 SLBMs with as many as 2,880 warheads—about half the operational warheads in the strategic arsenal. Tridents carry one of two types of SLBMs, the Trident I C4 and the newer, more accurate, and longer-range Trident II D5. So far 12 subs have been upgraded to carry D5s: eight in the Atlantic, and four in the Pacific. After the remaining Pacific-based subs are retrofitted to carry D5s, the D5 will arm all U.S. SSBNs. The first D5-equipped sub in the Pacific, the *Alaska*, completed its 19-month refit in November 2001 and test-launched its first D5 missile on March 16, 2002. The *Alaska* was certified for strategic service in early May 2002, and after loading its complement of Trident II D5s, deployed to Bangor, Washington, in July 2002. The *Nevada*, which completed conversion in summer 2002, was scheduled to test-launch its first D5 early this year. The last two Tridents slated for retrofit are the *Henry M. Jackson* in 2005, and the *Alabama* in 2006.

The navy is balancing its 14-sub fleet between the Atlantic and Pacific oceans by moving two SSBNs from Kings Bay, Georgia, to Bangor, Washington. The first of these, the D5-armed *Pennsylvania*, arrived in Bangor on October 17, 2002. The *Kentucky* followed on November 22, 2002. The navy initially indicated that the fleet would be split evenly, with seven subs in the Atlantic and seven in the Pacific. It now appears, however, that there will be eight boats in the Atlantic and six in the Pacific. There are now four Trident II D5-equipped SSBNs based in the Pacific (*Alaska*, *Nevada*, *Pennsylvania*, and *Kentucky*), with 96 missiles. During their transit, neither the *Pennsylvania* nor the *Kentucky* used the Panama Canal, the normal route for SSBNs moving between the two oceans, but sailed around South America. The extended voyage may have been a safety precaution because they carried D5s.

As a result of the retrofitting program, the Strategic Weapons Facility at Bangor has been upgraded and certified to handle and store D5 missiles with both Mk-4/W76 and Mk-5/W88 warheads. More than \$430 million is earmarked for fleet ballistic missile ordnance support equipment through 2005.

The four oldest SSBNs (*Ohio*, *Michigan*, *Florida*, and *Georgia*) are being converted into cruise missile submarines (SSGNs) under a \$3.8 billion program. Of the 24 launch tubes on each sub, 22 will be fitted with canisters that hold seven Tomahawk cruise missiles, for a total of 154 per boat. The two remaining launch tubes will house pressurized chambers for Special Operations Forces. The *Ohio* and *Florida* each offloaded their 24 Trident I C4 missiles in October 2002, coinciding with the 2003 Single Integrated Operational Plan (SIOP) taking effect. The *Michigan* and *Georgia* will leave strategic service in October 2003, coinciding with the implementation of the 2004 SIOP. To speed conversion and give defense contracts in multiple states, the navy plans to convert the subs at Puget Sound Naval Shipyard in Washington and at Norfolk Naval Shipyard in Virginia.

The first SSGN (*Ohio*) is scheduled to be delivered in late 2006, and to have initial operational capability in 2007. All four should be operational in 2008. Each will have deployment cycles similar to that of SSBNs with dual crews: Every other turnover will be at a forward-deployed site to maximize deployment time. Indeed, because of the similarities between SSGNs and SSBNs, friends and foes will be unable to tell initially whether a missile launch involves a conventional Tomahawk cruise missile or a nuclear-armed Trident. The approximately 576 W76 operational warheads removed from the converted subs will become part of the responsive force of reserve warheads.

Procurement of Trident II D5s continues at a rate of 12 missiles per year. Through 2001, a total of 396 D5s had been purchased. Production has been extended through 2013, and the number to be bought increased from the initially planned 390 to 568, at an additional cost of \$12.2 billion. The total cost of the program is now \$37.5 billion—or \$66 million per missile. To make D5s operational through 2042 (the service life of *Ohio*-class SSBNs), existing missiles will be upgraded to a new variant called the D5-A. For 2003, \$416 million is budgeted for that modernization. Of the 568 D5s, 336 will arm 14 SSBNs (including two subs that will be in overhaul at any given time). The rest will be available for flight tests.

In April 2002, a D5 experienced a test launch failure for the first time in 96 consecutive launches since December 1989. Compared to the performance of the C4 missiles, the D5s have been extraordinarily successful. The D5 is the most reliable strategic nuclear missile ever built. Despite this, the Pentagon says the current flight test level (set by Strategic Command) is the "minimum acceptable to meet weapon system reliability requirements."

Although the C4 is being retired in 2005, flight tests continue. In December 2001, less than a year before it was removed from the SIOP, the *Ohio* launched two salvos, four missiles on December 9 and three on December 18. A total of 570 C4s were produced from 1976–1986; 225 of them were used in launch tests.

The navy plans to resume SLBM flight-testing in the Pacific in 2005, after the Pacific Missile Range reaches initial operational capability for D5 test launches. The last SLBM test launch in the Pacific was in July 1993; since then, Pacific-based subs have sailed to the Atlantic Test Range off Florida to test-launch their missiles.

The SLBMs carry two types of reentry vehicles (RVs) and warheads: the Mk-4 with the W76 warhead, or the Mk-5 with the W88 warhead. The Mk-4/W76 combination is the more common, with almost 2,500 warheads deployed on 14 submarines. Lockheed Martin's Missile and Space Operations has made more than 5,000 Mk-4 reentry body assembly kits for the U.S. and British navies since 1976. A life extension program is under way for the W76; the first production unit is scheduled for delivery in 2007.

The Mk-5 carries the W88, the most powerful missile warhead in the U.S. arsenal. An estimated 400 of these warheads were built before production ceased in 1989. Small-scale production of W88 plutonium pits goes on at the TA-55 facility at Los Alamos National Laboratory. The first "war reserve" pits are scheduled to enter the stockpile in 2007.

The Trident II D5 is the first SLBM with a hard-target kill capability, an accomplishment reportedly achieved with an Mk-6 guidance system that the navy says "significantly exceeded the program's very aggressive accuracy goals." The navy brags that the C4 can deliver each of its warheads within the base paths of a baseball diamond, but that the D5 can hit home plate. Armed with high-yield Mk-5/W88 warheads, the D5 can "hold at risk, with increased survivability, almost the entire spectrum of strategic targets of any adversary." The Pacific D5 deployment is taking place in conjunction with the phase-out of the MX/Peacekeeper. The D5s will take over coverage of certain targets previously assigned to the MX. If more high-yield warheads are needed, some of the 300-kiloton W87 MX warheads could be removed from the reserve to replace the 100-kiloton W76 warheads.

Despite the D5's extraordinary accuracy, development is under way for the next generation guidance system and a new or modified reentry vehicle. This includes development of an Mk-4A reentry vehicle and an upgrade of the current Mk-6 guidance system with new navigation and radiation-hardened technologies. A \$90 million contract was issued in November 2002 (following a \$100 million contract in 2001) to have work completed by September 2005.

In October 2003, the navy will begin deployment of the new SLBM Retargeting System (SRS), after more than a decade in development. The SRS will "provide the increased flexibility and capability required by the Nuclear Posture Review for our offensive strike platform," according to the Pentagon. The system will give Tridents at sea a greater capability to attack both fixed and mobile sites, and enable the subs "to quickly, accurately, and reliably retarget missiles to targets," "allow timely and reliable processing of an increased number of targets," "reduce overall SIOP processing [time]," and "support adaptive planning."

Also under development, the Enhanced Effectiveness (E2) Reentry Body "brings GPS-like accuracy to a strategic weapon that can be launched and delivered to a target quickly after a decision to strike," according to a navy admiral. This "expands the potential targets that are threatened by Trident," and the expected improvement in accuracy means that nuclear as well as conventional warhead options are being considered. The nuclear options are examined in the navy's SLBM Warhead Protection Program, which maintains the capability to develop replacement nuclear warheads for the Mk-5/W88 and the Mk-4/W76.

Bombers. The United States has two types of long-range bombers for nuclear missions: the B-2A Spirit, and the B-52H Stratofortress. Neither is maintained on a day-to-day alert, and both also have conventional missions, as seen in the war in Iraq. The B-52 can deliver cruise missiles, gravity bombs, or a combination of both; the B-2 carries only bombs.

The B-2A bombers are deployed with the 509th Bombardment Wing at Whiteman AFB in Missouri. The B-2A is scheduled for replacement around 2040; a follow-on bomber program began in 1998. The B-2A's nuclear weapons include the B61-7, B61-11 and B83 gravity bombs. Each B-2A can be armed with either B61 or B83 bombs, but cannot mix the two. The B-2A is the only carrier of the B61-11 earth-penetrating nuclear bomb introduced in November 1997.

Modernization of the B-2A continues. The air force has requested \$260 million for 2004 and \$363 million for 2005. This includes the new Air Force Mission Support System (AFMSS), used for planning nuclear and conventional strike sorties. Development problems with the AFMSS in 1997 delayed full nuclear certification of the B-2A, but the problems have been resolved.

The NPR identified an operational need for a more capable nuclear earth-penetrating bomb than the single-yield B61-11. The B-2 is the most likely delivery platform for such a weapon. A "robust nuclear earth penetrator" that uses an existing warhead (probably the B61 or the B83) to make a 5,000-pound penetration weapon is being studied.

There are 94 operationally deployed B-52Hs at two bases: Barksdale AFB in Louisiana, and Minot AFB. The NPR recommended retaining 76 B-52Hs. The bomber will stay in operation until 2040. Like the B-2A, the B-52H has recently been equipped with the AFMSS. Final testing of the Avionics Midlife Improvement, a Stratofortress upgrade, began in December 2002. The upgrade replaces the inertial navigation system, avionics control unit, data transfer system, and all associated hardware and software. According to the air force, the "improvement will ensure the airplane knows where it is at all times and can accurately deliver bombs on target."

The B-52H, called by the air force the "workhorse of nuclear weapons employment," is the only carrier of nuclear cruise missiles. Each B-52H can carry up to 20 air-launched cruise missiles (ALCMs) or advanced cruise missiles (ACMs), with ALCMs carried both internally (up to eight missiles) and externally (up to 12 missiles). The ACM is carried only externally. Approximately 1,140 ALCMs are in the active inventory, but we estimate only 430 are deployed. The remaining weapons are in reserve, with about 200 in long-term, inactive storage. Boeing produced 1,739 ALCMs for the air force from 1982-1986; several hundred have since been converted to conventional cruise missiles. A proposal to convert additional ALCMs to conventional missiles was rejected by the air force in 2002. Air force planning for 2003 envisages an ALCM force of 760 missiles. A \$134 million program to extend the ALCM service life to 2030 is under way. Beginning in 1998, Los Alamos National Laboratory initiated a project to refurbish the W80 warhead, which is used in both ALCMs and ACMs. In January 2001 the project was transferred to Lawrence Livermore National Laboratory; production should begin in 2006.

The ACM has a significantly longer range and greater accuracy than the ALCM. Designed to evade air- and ground-based defenses and strike heavily defended and hardened targets, the ACM also has stealth features to increase its survivability. We estimate there are approximately 430 ACMs in the operational inventory. The ACM service life is being extended to 2030.

Only recently was it revealed that a third strategic bomber, the B-1B, had been maintained as nuclear capable; the air force had described it as "conventional only." When the NPR ordered an end to the B-1B's nuclear capability, the deception came to an end. Of the original 100 B-1Bs, 92 remain. The air force will reduce that number to 66 by October 1. Studies for a new strategic bomber to replace the B-1B, B-2A, and B-52H began in 1998.

Non-strategic nuclear weapons. The United States retains approximately 1,120 non-strategic nuclear weapons: 800 B61 gravity bombs of three modifications; and 320 Tomahawk land-attack cruise missiles (TLAM/Ns), a portion of which are in reserve or inactive. The 2001 NPR did not address non-strategic nuclear weapons.

The 800 operational B61 non-strategic nuclear bombs are for delivery by various U.S. and NATO aircraft, with another 500 in reserve. Most of the bombs are stored at Kirtland AFB in New Mexico

and Nellis AFB in Nevada. A small number are deployed at Seymour Johnson AFB in North Carolina and Cannon AFB in New Mexico. U.S. delivery aircraft include the F-16C/D Fighting Falcon and the F-15E Strike Eagle aircraft. The F-117A Nighthawk may also be nuclear capable. Under air force planning, part of the F-35 Joint Strike Fighter force will have nuclear capability after 2012.

The only U.S. nuclear weapons to remain in forward deployment (besides those on SSBNs) are the approximately 150 B61 bombs at nine airbases in six European NATO countries. NATO aircraft that are assigned nuclear missions include U.S.-supplied F-16s and German and Italian Tornado bombers. Several NATO nations currently assigned strike missions with U.S. nuclear bombs are considering purchase of the F-35. Greece previously hosted B61 bombs at the Araxos Air Base, but the weapons were removed in early 2001, bringing to an end 41 years of U.S. nuclear deployments in Greece.

All of the estimated 320 Tomahawks (with W80-0 warheads) are stored alongside strategic weapons for SSBNs at the Strategic Weapons Facilities in Bangor and Kings Bay. Despite some internal debate about retiring the Tomahawk, the NPR declined to change the weapon's status.

The Tomahawk had its 400th flight test on September 18, 2002, when the *Miami* launched an unarmed missile from the Atlantic off the coast of Florida. It flew west across Florida, over the Gulf of Mexico, turned north, and landed on the Eglin Air Force Test Range after a 722-kilometer flight.

While most U.S. attack submarines were credited with some nuclear capability during the Cold War, most SSNs do not have nuclear missions today. Fewer than half the Pacific fleet's SSNs regularly undergo nuclear certification. The reduced nuclear requirement is further illustrated by the fact that after passing inspections, SSNs are subsequently decertified to save resources for more urgent non-nuclear responsibilities. If necessary, however, Tomahawks can be redeployed in 30 days.

Type	Name	Launchers	Year deployed	Warheads x yield (kiloton)	Warheads active/spares
ICBMs					
LGM-30G	Minuteman III				
	Mk-12	150	1970	1 W62 x 170	150
	Mk-12	50	1970	3 W62 x 170 (MIRV)	150/15
	Mk-12A	300	1979	3 W78 x 335 (MIRV)	900/20
LGM-118A	MX/Peacekeeper	40	1988	10 W87 x 300 (MIRV)	400/50
Total		540			1,600/85
SLBMs					
UGM-96A	Trident I C4	96/4	1979	6 W76 x 100 (MIRV)	576
UGM-133A	Trident II D5	288/12			
	Mk-4		1992	8 W76 x 100 (MIRV)	1,920/156

		Mk-5		1990	B W88 x 475 (MIRV)	384/16
	Total		384/16			2,880/172
Bombers						
	B-52	Stratofortress	94/56*	1961	ALCM/W80-1 x 5-150	430/20
					ACM/W80-1 x 5-150	430/20
	B-2	Spirit	21/16	1994	B61-7, -11, B83-1 bombs	800/45
	Total		115/72			1,660/85
Non-strategic forces						
	Tomahawk SLCM		325	1984	1 W80-0 x 5-150	320
	B61-3, -4, -10 bombs		n/a	1979	0.3-170	800/40
	Total		325			1,120/40
Grand total**						-7,650
<p>ACM: advanced cruise missile; ALCM: air-launched cruise missile; ICBM: intercontinental ballistic missile (range greater than 5,500 kilometers); MIRV: multiple independently targetable reentry vehicles; SLCM: sea-launched cruise missile; SLBM: submarine-launched ballistic missile.</p> <p>* The first figure is the total inventory, including those used for training, testing, and backup; the second figure is the primary mission inventory: the number of operational aircraft assigned for nuclear or conventional missions.</p> <p>** Nearly 3,000 additional intact warheads are retained in reserve or inactive stockpiles.</p>						

Nuclear Notebook is prepared by Robert S. Norris of the Natural Resources Defense Council, Hans M. Kristensen, and Joshua Handler. Inquiries should be directed to NRDC, 1200 New York Avenue, N.W., Suite 400, Washington, D.C., 20005; 202-289-6868.