Introduction

LARGE SCALE REDUCTIONS in the size of nuclear arsenals have resulted in significant shifts in where the weapons and warheads are stored and deployed. In less than a decade, there has been a five-fold decrease in the number of nuclear weapon storage sites worldwide. Six countries, one United States territory, and 14 former Soviet republics are now free of nuclear weapons.[1] Today, the United States is the only country with nuclear weapons outside of its borders.

Though information on Russian and Chinese nuclear forces remains sparse, and is often contradictory, we estimate that as of the end of 1997 there are some 36,000 nuclear warheads in the arsenals of the five nuclear powers. These weapons are stored at approximately 142 locations worldwide (see Table 1). U.S. nuclear weapons are stored at 24 locations in 14 states and seven European countries. Russian nuclear weapons are stored at approximately 90 locations, all in Russia.[2] British nuclear weapons are stored at two locations; French nuclear weapons at four locations; and Chinese nuclear weapons at approximately 20 locations.

TABLE 1

Nuclear Stockpiles and Storage Locations Worldwide

	Warheads Total*	Warheads Operational	Storage Sites	Operational Silos	Missile Submarines
United States	12,070	8425	24	550	18
Russia	22,500	10,240	90	350	23
Britain	380	260	2	0	2
France	500	450	4	0	5
China	450	400	20	7	1
Total	**~36,000**	**19,775**	**142**	**907**	**49**

* A portion awaiting final dismantlement. In the case of the U.S. another portion is part of a reserve/hedge.

As older nuclear weapons continue to be retired and the U.S. and Russia implement reductions under Strategic Arms Reductions (START) treaties, the number of warheads and deployment sites will decline further. Approximately 14,000 of the almost 36,000 existing warheads await dismantlement or are in the process of being retired. The balance of almost 22,000 warheads are either active and operational, or are scheduled to be retained after all current reductions, retirements, and warhead dismantlement are completed. Only in Russia does nuclear warhead production continue to any significant degree. But even there, new production is no more than a few hundred warheads a year, a recent low. The cessation of nuclear explosive testing impedes, though does not completely halt, the development of new nuclear warheads.

* * *

In 1992, a survey by the authors of nuclear deployments of the United States[3] reported a very dynamic situation at the end of the Cold War, with the withdrawal of large numbers of warheads from domestic and foreign sites, and the disruption of the normal rhythm of new production at the Department of Energy's warhead complex due to safety problems at the Rocky Flats Plant and elsewhere. This trend continues. The United States has not produced a completely new nuclear warhead since October 1990. Of the 12,070 warheads that currently exist in the U.S. arsenal, about 1350 are scheduled for disassembly over the next three years. The remaining 10,720 warheads of nine types consti-

tute the residual post-START II and "hedge" nuclear force. If and when START III is fully negotiated, signed, and implemented, another 1000-1500 strategic warheads will likely be withdrawn from operational status. Whether those warheads, and possibly others, are dismantled or merely shifted into the "hedge" or reserve category will depend on how successful the two sides are in negotiating new protocols that stipulate nuclear warheads (as opposed to launchers and delivery systems) as the accountable unit to be destroyed.

In Russia, treaty reductions, technological obsolescence, a lack of finances, and new concerns about physical security as a result of the break up of the Soviet Union have resulted in even more dramatic changes than in the U.S. Just prior to, and soon after, the breakup at the end of 1991, several thousand nuclear weapons were moved from Eastern Europe and the 14 former non-Russian Soviet republics to storage sites in Russia, followed by further consolidation within Russia itself. This consolidation has now largely been completed. Though the Russian "stockpile" of warheads is estimated to be 22,500, only 10,240 are thought to be operational: 6240 in strategic forces and 4000 in non-strategic forces. Dismantlement of strategic weapons withdrawn under terms of the START Treaty is on schedule. Nuclear warheads have now been completely withdrawn from operational use in the Russian Army; the few still intact await dismantlement. Russian spokespersons claim that the unilateral reductions in nuclear weapons from the tactical air force, air defense forces, and the Navy are largely on track to be completed by the year 2000.

The approximate 10-15 year cycle of modernization and replacement that characterized typical Russian Cold War warhead production has been completely disrupted by the break up of the Soviet Union. Though new nuclear warhead production continues the level is far less than the number of retirements. We estimate that the only "new" warhead in production is that for the single-warhead SS-27 *Topol-M* ICBM which was deployed in December 1997. Other strategic missile warheads are likely being remanufactured to extend the life of missiles being retained under START, but it is not believed that other "new" missile warheads are in full scale production.

Russian warheads, according to most accounts, are not as robust as their U.S. counterparts. As a consequence there may be a process taking place that renders Russian warheads inoperable at a certain point through aging and the interaction of various materials. Thus, if significant numbers of Russian warheads are not refurbished and remanufactured and then returned to operational forces the stockpile could shrink to as few as 1000 strategic warheads and several hundred tactical ones over the next ten years.

* * *

Though neither Britain or France are formally included in START or INF treaties, the end of the Cold War has also had a profound impact on their nuclear forces. From a peak of 350 warheads in the mid-1970s, the British stockpile has been reduced to 260 nuclear warheads at the end of 1997. A decade ago there were three types of British nuclear warheads (and four American types allocated for British use). This has been reduced to two today and by the end of March 1998, British nuclear forces will be comprised of a single warhead type (Trident II). New warheads for Trident II SLBMs are in production at Aldermaston and Burghfield. We estimate that about one-half of the projected number have been produced thus far.

Similarly, French forces have undergone profound changes since the end of the Cold War, with reductions in strategic air-launched weapons, retirement of land-based missiles (short- and intermediate-range), and elimination of most tactical naval weapons. The current French stockpile of 450 warheads is believed to be deployed at just four locations, down from over a dozen locations at the beginning of the 1990's. At the Valduc plant the TN 75 warhead is in production for the M45 SLBM carried on the new *Triomphant*-class ballistic missile submarines.

The Chinese have effectively kept secret details about the size and composition of their nuclear stockpile. Thus, the exact size of the nuclear bomber force, the number of ballistic missiles deployed, and whether or not there are Chinese "tactical" nuclear weapons remains uncertain. Our estimate of 400 nuclear weapons in the Chinese stockpile is based upon common assumptions regarding the number of dedicated missile and bomber delivery systems. Knowledge of Chinese deployment is equally impenetrable, though the relatively small stockpile and presumed dictates of secrecy and security leads us to conclude that there are no more than 20 or so storage locations. In fact, there is evidence to suggest that Chinese nuclear forces and deployments will remain stable in both number and deployment for the foreseeable future. Even if new mobile ICBMs are deployed they will probably not radically alter the makeup of forces.

* * *

Overall, a survey of nuclear deployments–still one of the most secret and enduring elements of the Cold War–shows a markedly different picture than that commonly portrayed in the popular press. Those officially charged with the custody and security of nuclear weapons began a process, starting at about the time of the Intermediate Range Nuclear Force Treaty (INF) at the end of 1987, to consolidate far flung stockpiles and weapons. The breakup of the Soviet Union, and the end of the Cold War, further facilitated centralization of dispersed forces, some on high levels of alert. The START Treaties and other arms control initiatives contributed significantly to reducing the overall numbers of weapons and bases.

Much work still needs to be done to guarantee the security of nuclear weapons and weapon materials, and to further reduce alert rates and logistical activity. If one key to disarmament is verification and physical control, the trends in nuclear deployments that have already taken place provides hope that forces, weapons, and materials can be constrained and controlled. Yet greater transparency regarding nuclear deployments is essential to design more robust confidence-building measures, security procedures, and verification regimes. Secrecy should no longer be the basis for physical security.

Methodology

FACTS REGARDING STOCKPILES AND LOCATIONS of nuclear weapons remain official secrets for all of the five declared nuclear nations, but the authors have developed a record of deployments and have adopted a set of assumptions to estimate the types and numbers of nuclear weapons. Earlier works by the authors—the five volumes of the *Nuclear Weapons Databook* series, *Nuclear Battlefields*, contributions to the annual yearbook of the Stockholm International Peace Research Institute (SIPRI), the 1992 "Taking Stock" report, and the NRDC Nuclear Notebook column published in *The Bulletin of the Atomic Scientists*—form the documented history of these assumptions.

For almost twenty years the authors have closely followed changes in the deployment of nuclear forces worldwide, the introduction of new nuclear weapon systems and the retirement of old ones, and the unique and often easily identifiable programs associated with nuclear storage and activity. They have also been in the forefront of field research, visiting Soviet (and Russian) nuclear facilities in Eastern Europe and the republics of the former Soviet Union, U.S. military facilities in the United States and abroad, as well as the Nevada Test Site and Department of Energy facilities, and British and Chinese military bases and laboratories.

United States

Not surprisingly the United States supplies the most information about its nuclear weapons. Officially the Pentagon does not acknowledge deployment locations or numbers of warheads (the "neither confirm nor deny" policy). But by closely monitoring known nuclear certified units and where nuclear-capable delivery vehicles are deployed, one can draw an accurate picture of nuclear weapons locations. What is more, the Department of Energy in the last few years has increasingly moved towards releasing specific data regarding warhead production and retirement, helping to account for the weapons in the U.S. arsenal.

Through a keen appreciation of the how the U.S. military is organized and how it carries out it roles and missions, a basic database can be established to monitor nuclear commands and units. This database has been developed through study of the historical evolution of the nuclear forces and stockpile since the end of World War II. The major sources are Department of Defense and military service announcements, histories, studies, and documents (many released under the Freedom of Information Act), Congressional hearings, General Accounting Office and other independent agency reports, the trade press, and, increasingly the World Wide Web.

Russia

Specific information on the Soviet Union's nuclear forces was never easy to come by during the Cold War. Although the Russian government is more open today, and the Russian press of late has been filled with nuclear news, extensive interviews with government officials, and investigative reports, the exact details of the arsenal, particularly locations, remains a well kept secret.

During the Cold War, the prime source of information about the military forces of the Soviet Union was the U.S. government, specifically the intelligence agencies, which supplied information to the public through glossy booklets like *Soviet Military Power*, and in presentations to Congress to rationalize budget requests. The Department of Defense, though less strident on Russian nuclear capabilities, continues to publish an annual proliferation threat report, and the Navy issues an annual submarine review. The Foreign Broadcast Information Service (FBIS) of the Central Intelligence Agency pub-

lishes an extensive translated record of the Russian press (as does the BBC in "Summary of World Broadcasts"), and the authors closely monitor these sources.

Some independent scholars and researchers in Russia are beginning to emulate the U.S. model for openness and are publishing new information, and the Russian parliament (Duma) is supplying more and more information about Russian military forces. Through greater interchange between Russians and Americans, including visits to Russia by U.S. officials and scientists, much new non-official information is being gathered. Field visits and local interviews by private researchers has also been possible for at least a decade, and the authors have made extensive use of field research to piece together a picture of Russian nuclear capabilities.

Nevertheless, one should caution that the information in this report on Russian nuclear arsenals and locations is nowhere near of the same quality or done with the confidence of the U.S. estimates. The estimates and discussion in this report regarding strategic nuclear forces are considered to be quite accurate. In part they are derived from the "data exchange" that Russia supplies to the United States under the terms of the START and INF treaties. For non-strategic nuclear forces, the information is mostly authors' estimates, based upon the distribution of military forces.

Britain, France, and China

The arsenals of Britain, France, and China are a fraction of those of the U.S. and Russia and thus there is less to keep track of. Adopting a similar approach we are able to follow where the nuclear-capable planes, submarines, and missiles have been and are located and thus conclude that that is where the warheads and bombs are as well. In the case of Britain and France, the locations of nuclear storage sites is also fairly well known, given the monitoring of nuclear forces by national and international peace organizations.

Though the governments of these three are no where near as open or talkative as those of the big two (and China provides almost nothing officially), there are numerous official publications where bits of information about nuclear forces are supplied. White Papers are published and Parliamentary committees responsible for defense matters supply some information in Britain and France. For detailed information about Chinese forces U.S. government intelligence reports, sometimes leaked to the press, are helpful, as is the Taiwanese press (when used with caution). The information about the nuclear arsenals and locations of Britain and France is thus of high confidence, whereas the Chinese data is the best possible, with little opportunity for verification of what appears in open reports and the press.

Arms Control and Nuclear Weapons Deployments

THREE ARMS CONTROL TREATIES AND AGREEMENTS, and two packages of arms control and disarmament initiatives by the U.S. and Soviet/Russian Presidents have made a major contribution to reducing the size and spread of the nuclear stockpiles.

Strategic Arms Reduction Treaty (START I)

After almost a decade of negotiations the original START Treaty was signed on July 31, 1991 in Moscow. Well before the Treaty entered into force on December 5, 1994 withdrawals and retirements had been accomplished. In September 1991, President Bush directed the retirement of 10 Poseidon-equipped ballistic missile submarines—armed with approximately 1600 W68 Poseidon warheads. The 450 Minuteman II ICBMs were also removed from "alert" status starting in September. And in December 1991, warheads and missiles began to be removed from dispersed silos at Ellsworth Air Force Base (AFB) in South Dakota, followed by Whiteman AFB in Missouri, and Malmstrom AFB in Montana.[4]

The Treaty mandated reductions of U.S. strategic forces from 13,000 warheads to 6000 "accountable" warheads, though the actual number was about 8500. To meet the lower levels the Air Force reduced the size of the bomber and missile force, keeping the most modern delivery vehicles and warhead types. Because of the reduced number of bombers, over 1600 bomber weapons (B61 and B83 nuclear gravity bombs and W80 air-launched cruise missiles), were withdrawn from active bases. However, the warheads were moved to storage depots rather than dismantled.

Under START I, Russian strategic nuclear forces also were significantly reduced. According to the most recent public Memorandum of Understanding (MOU) between the parties to the Treaty, dated July 1, 1997, 526 ICBM launchers (with 2068 warheads), 302 SLBM launchers (and 20 ballistic missile submarines), and 38 heavy bombers have been eliminated. In actual fact, the reductions are far larger because the figures in the MOU count many systems that, while not operational, are not yet eliminated within the terms of the Treaty.

Of more importance is the removal of warheads from republics outside Russia. Ukraine by March 1994, Kazakhstan by April 1995, and Belarus by November 1996, transferred a total of some 3300 strategic nuclear warheads to Russia. All SS-19 and SS-24 M2 silo-based missiles in Ukraine have been deactivated. According to the July 1997 MOU sixty-six SS-19 silos have been destroyed and Kazakhstan has completed the process of destroying the 104 silos that once housed SS-18 ICBMs. The 81 SS-25 mobile missile launchers originally in Belarus have been redeployed to Russia with their missiles and warheads.

Russian START I reductions have been achieved mainly by the deactivation, elimination, and withdrawal of the ICBM and bomber warheads in Belarus, Kazakhstan, and Ukraine. From September 1990 to July 1997, the number of accountable warheads in the former Soviet Union fell from 10,779 to 6736, a reduction of 4043 warheads. But the number of accountable warheads deployed in Russia declined by only 845 from 7581 to 6736. Thus, the vast majority of reductions, some 3198 warheads, comes from the weapons removed from the three former republics. Russian reductions so far have consisted of the retirement of over 400 older SS-11, SS-13 and SS-17 ICBMs and 20 SSBNs. Only a couple of dozen newer MIRVed Russian SS-18s and SS-19s have been retired.

Strategic Arms Reduction Treaty (START II)

The original START limits were overtaken by events when President Bush and Russian President Yeltsin signed a framework agreement on June 17, 1992. After seven more months of negotiations the START II Treaty was signed on January 3, 1993 in the final days of the Bush Administration. Three years later, on January 26, 1996, the U.S. Senate approved a resolution consenting to ratification by a vote of 87 to 4.

The Russian *Duma* still has not ratified START II. Some analysts are cautiously optimistic that the treaty may now have a chance of gaining legislative approval, perhaps even in the first part of 1998. This is a consequence of better organization in the Yeltsin government, the March 1997 Helsinki Summit agreements, the NATO Founding Act, the settling of ABM demarcation issues, the Russian-U.S. agreements signed in New York on September 26, 1997 codifying the Helsinki Summit agreements, and the passage of the Chemical Weapons Convention by the *Duma* on October 31, 1997.

START II mandates the reduction of each nation's strategic arsenal to a level of 3500 accountable warheads by the beginning of the year 2003. However, the September 1997 Protocol to START II extends the implementation period five years, from the beginning of 2003 to the end of 2007. Prior to the March 1997 Helsinki summit, Russian policy makers had expressed concern that they would be unable to pay for the physical dismantling of the requisite launch vehicles by the START II implementation deadline of January 1, 2003. Some conservatives also wanted to keep MIRVed missiles in the operational arsenal, rather than trying to build many more single warhead ICBMs. Thus, to help get START II ratification by the *Duma*, the U.S. agreed at Helsinki to extend the implementation deadline until December 31, 2007.

At the same time, to insure that the military and strategic stability benefits of START II were not lost, the U.S. and Russia agreed that all delivery vehicles which are to be eliminated to meet the START II ceilings will have to be deactivated by the removal of their warheads or through some other jointly agreed method by December 31, 2003. Thus Russia will not have to expend funds to accelerate the removal and destruction of missiles and silos. Some smaller level of funding will still have to be incurred to remove or store warheads.

The START II Treaty bans "heavy" ICBMs and land-based multiple warhead (MIRV) missiles. In accordance with START II provisions, the U.S. MX missile will be retired (and its W87 warheads refitted to single-warhead Minuteman III ICBMs). To implement the reductions, the Air Force is in the process of moving 150 Minuteman III missiles from Grand Forks AFB in North Dakota to 150 empty silos at Malmstrom AFB in Montana (that once housed Minuteman II missiles). This will consolidate the Minuteman III force at three bases (150 at Minot AFB in North Dakota; 150 at F.E. Warren AFB in Wyoming, Colorado and Nebraska; and 200 at Malmstrom AFB in Montana).

To meet the lower warhead ceilings, the U.S. Navy also retired its older Poseidon submarines carrying the Trident I missile. Based at Charleston, South Carolina and operated out of Kings Bay, Georgia at the end of the Cold War, all twelve submarines were decommissioned between November 1992 and October 1994. However, none of the more than 1500 W76 warheads from the dozen submarines were retired; instead they were used to arm Atlantic Fleet Trident II missiles on newer Ohio-class Trident submarines.

The smaller bomber force, and more stringent restrictions on the basing of nuclear bomber weapons under START II, has resulted in the denuclearization of a number of bomber bases. First, the U.S. Air Force decided to "denuclearize" the B-1B bomber and make it a conventional-only weapons carrier. This process was completed by the end of 1997and has resulted in the removal of bomber weapons from four B-1B bases (McConnell AFB in Kansas, Grand Forks AFB in North Dakota, Ellsworth AFB in South Dakota, and Dyess AFB in Texas.)[5] In addition, the decision was made to retire B-52G bombers, leading to the removal of nuclear weapons from Eaker AFB in Arkansas, Wurtsmith AFB in Michigan, and Carswell AFB in Texas.

The Intermediate Nuclear Forces (INF) Treaty

The INF Treaty was signed in December 1987 and entered into force in June 1988. Over a subsequent three year period, all U.S. and Soviet missiles with ranges between 500 and 5000 kilometers were eliminated. On the U.S. side, these included Pershing II ballistic missiles and Ground-launched cruise missiles (GLCMs) in five European countries. Missiles were removed from three Pershing II bases in Germany and six newly-built GLCM bases in the United Kingdom, Italy, Germany, Belgium and the Netherlands.

The treaty did not mandate that the warheads associated with the INF missiles be destroyed. In fact, we estimate that approximately 200 W85 Pershing II warheads were converted into B61 Mod 10 bombs for the tactical Air Force and remain in the stockpile, with some even redeployed back to Europe.[6] The 400 W84 GLCM warheads were placed in an "inactive reserve" status and are in storage at Kirtland AFB, NM.

The INF Treaty resulted in the elimination of six types of Soviet/Russian missiles: 654 SS-20, 718 SS-12, 239 SS-23, 149 SS-4, 80 SSC-X-4 and 6 SS-5. The last two types were not operational. The total number of warheads for all of these missiles probably totaled 1800 to 2000. The "data exchange" mandated by the INF Treaty gave the United States its first confirmation of the specific Soviet deployment of nuclear warheads in Eastern Europe.

Unilateral Initiatives

On September 27, 1991 President Bush announced a series of arms control and disarmament initiatives intended to reflect the end of the Cold War. These included withdrawal of U.S. Army nuclear weapons from overseas bases and the elimination of some 3000 artillery shells and short-range Lance missile warheads. On July 2, 1992, the Pentagon announced that these warheads had all been removed from foreign bases and returned to the United States (some 2000 additional warheads were later removed from Europe.) At this time, the last 60 or so warheads were also removed from South Korea.

However, the process of retirement began before President Bush's speech. Many warheads had already been moved from Europe to Seneca Army Depot in Romulus, New York and Sierra Army Depot in Herlong, California for temporary storage before further shipment to DOE's Pantex Plant, near Amarillo, Texas for disassembly. As transfer to Pantex took place, the Army announced that the nuclear weapons mission at Seneca would end by October 1, 1992. Previously one of the largest nuclear storage sites in the United States, Seneca was soon joined by its west coast counterpart, Sierra, which also ended its nuclear storage mission and the Army ceased to possess nuclear weapons altogether.

President Bush also directed the withdrawal of tactical nuclear weapons from surface ships and attack submarines and the elimination of numerous naval tactical nuclear missions. Between September 1991 and June 1992, about 500 nuclear weapons were permanently removed from aircraft carriers, surface ships and attack submarines and returned to naval weapons stations in California, Florida, Hawaii, New Jersey, South Carolina, and Virginia. With elimination of the nuclear aircraft carrier and airborne anti-submarine warfare mission altogether, B57 and B61 strike and depth bombs in the possession of the Navy were moved from dispersed bases in Alaska and Maine and from aircraft carriers, and were retired. With elimination of a nuclear capability on surface ships altogether, storage of nuclear weapons in Florida (Cecil Field/Mayport) and New Jersey (Earle) ceased. Eventually, the only remaining navy tactical weapon, Tomahawk sea-launched cruise missiles (SLCM) with their W80 warheads for use by attack submarines, were consolidated at Yorktown, Virginia and North Island, California, ready to be reloaded on Atlantic and Pacific Fleet attack submarines in an emergency.

When directing the acceleration of the retirement of 450 Minuteman II ICBMs scheduled to be eliminated under START I (see above) President Bush further ordered that strategic bombers be taken off ground alert and canceled three nuclear programs: the rail-garrison MX, Small ICBM ("Midgetman"), and the Short-range Attack Missile (SRAM) II. Development of a new tactical air-to-surface missile modeled on the strategic SRAM designated the SRAM-T, was also canceled, as was development of follow-on Tactical Air-to-surface Missiles (TASMs) to replace gravity bombs.

In response to the Bush initiatives, on October 5, 1991, President Gorbachev announced his own set of measures to further dealert, reduce, and centralize Soviet nuclear forces.[7] In regards to strategic forces, he announced that: strategic bombers would not be kept on combat alert and their weapons would be stored in depots; the development of a modified short-range missile for strategic bombers would be discontinued; the development of a new small-size mobile ICBM would be stopped and; no further SS-24 rail-launched MIRVed ICBMs would be deployed, their modernization would be abandoned, and they would be restricted to their bases. Also, 503 ICBMs were to be removed from combat duty as well as an additional three SSBNs.

In terms of tactical nuclear weapons, President Gorbachev said the Soviet Union would eliminate all nuclear warheads for tactical missiles, all nuclear artillery shells, and all nuclear "mines." In addition, tactical naval nuclear weapons from ships, submarines, and aircraft were to be removed and stored in centralized storage sites with a portion to be eliminated. Anti-aircraft nuclear weapons (presumably surface-to-air missile warheads) were to be removed from operational forces, concentrated at central bases, with some to be eliminated. Finally, it was proposed on a reciprocal basis with the United States that tactical aviation weapons (bombs and air-to-surface missiles) would be consolidated at central storage sites.

A month later, Chief of the Soviet General Staff, General Vladimir Lobov provided a time schedule for Gorbachev's announced elimination's:

- nuclear warheads for tactical missiles would be retired by the year 2000;
- nuclear artillery warheads would be retired by the year 2000;
- nuclear mines would be retired by 1998;
- naval weapons would be retired by 1995; and
- nuclear anti-aircraft missile warheads would be retired by 1996.[8]

In January 1992, shortly after President Yeltsin assumed control of Russian nuclear policy, he made some unilateral initiatives and arms control proposals of his own.[9] In terms of strategic systems, he stated: production of Tu-160 Blackjack and Tu-95MS Bear strategic bombers and existing long-range ALCMs was being terminated; production of long-range nuclear SLCMs was canceled and no new types were to be developed; exercises with large numbers of strategic bombers would not be held; SSBN patrols were being cut in half and further reductions would occur and; Russia would meet its START I limits in three years rather than seven. In addition, he proposed in conjunction with the United States: to halt the development of new long-range ALCMs and to eliminate long-range nuclear SLCMs. Finally, he proposed two new arms control initiatives: the detargeting of strategic nuclear weapons and achieving a new strategic arms treaty (i.e., START II) with limits of 2000 - 2500 strategic nuclear weapons in each country.

As for tactical weapons, Yeltsin reconfirmed that all nuclear weapons for tactical missiles, all nuclear artillery shells and all nuclear mines would be eliminated. He added that their production had recently been terminated. He provided details on the size of the other services' dismantlements by noting that one third of sea-based tactical nuclear weapons and one-half of nuclear anti-aircraft warheads were to be eliminated. And, finally, he went a step further than Gorbachev and said that one-half of tactical nuclear weapons for aviation would be eliminated.

In late 1993, General Vitalii Yakovlev, then deputy chief of the Ministry of Defense's 12th Main Directorate stated that with regard to tactical nuclear weapons, Gorbachev's and Yeltsin's initiatives meant that:

- All nuclear warheads on three types of shorter-range missiles would be eliminated by the year 2000;
- All nuclear warheads for six types of artillery guns of 152mm, 203mm, and 240mm caliber would be eliminated by the year 2000;
- All nuclear "mines" (so-called atomic demolition munitions in U.S. parlance) would be eliminated by the year 1998;
- One-half of tactical nuclear weapons in the inventory of the Air Forces would be eliminated by 1996;
- One-third of the sea-based tactical nuclear weapons would be eliminated by 1995, and;
- One-half of the inventory of nuclear anti-aircraft warheads would be eliminated by 1996.[10]

Although the U.S. Defense Department remains skeptical about the pace of Russian tactical nuclear weapons elimination,[11] as of 1997, Russian officials state that the dismantlement of these weapons is proceeding as planned.[12] On the strategic side, Russia is ahead of the START I schedule, but did not manage to fulfill Yeltsin's pledge to implement START I within three years. Overall, due to less than adequate disassembly procedures, quite a number of weapons await disassembly at Ministry of Atomic Energy (Minatom)plants because their service life has expired.[13] Nonetheless, Minister Victor Mikhailov has declared that nearly half of Russia's nuclear arsenal has been dismantled.[14]

Future Nuclear Deployments

IN MARCH 1997, Presidents Clinton and Yeltsin agreed to a framework for START III at the Helsinki summit, setting the stage for even further reductions in strategic nuclear warheads. Under the framework, warheads will be reduced to 2000 - 2500 in number, and for the first time, non-strategic nuclear weapons will be incorporated into discussions. At the September 27, 1997 signing of the Protocol to START II in New York, Russia further stated that Russia assumed that a START III agreement would be "achieved and enter into force" by December 31, 2003.[15]

Under U.S. plans (even under START II), the U.S. operational stockpile will be about 5000 warheads by around the turn of the century. Of these about 4000 will be for strategic forces and 1000 will be for non-strategic (tactical) forces. Some 3500 of the strategic warheads will be the accountable number under the START II, with another 500 for spares. The ICBM force will be 500 single warhead Minuteman III missiles at three fields. The ballistic missile submarine force will be split, perhaps equally, between Atlantic and Pacific bases of the 14 Trident SSBNs. The bomber force will be made up of B-52 ALCM-carrying aircraft and bomb carrying B-2s.

Supplementing the fielded warheads are another 2,500 augmentation warheads (often referred to as the "hedge"), a contingency stockpile available for redeployment back onto missiles and aircraft. The formal decision to establish the hedge came from the Nuclear Posture Review which was announced in September 1994. Warheads that are, or will be, in the hedge include the W62 and W78 from the Minuteman III ICBM, W76s from downloaded Trident SLBMs, B61 and B83 bombs and W80 air-launched cruise missile warheads for B-1 bombers that could return to the nuclear strike force.

The START Treaties do not require destruction of the warheads that are removed from the missiles, submarines, or bombers to meet the lower ceilings. The "unit of account" that must be destroyed, with detailed procedures specified in the treaties are, ICBM silos, SSBN missile tubes, and heavy bombers. These launchers were initially chosen because they could be observed by each others satellites, and thus were verifiable. The same launcher types were adopted in the subsequent START Treaties. To make the warhead the "unit of account" would demand more intrusive procedures to verify destruction.

A third set of warheads are kept in inactive reserve status to replace warheads in the active stockpile should they develop reliability or safety problems. We estimate that this will eventually be another 2500 warheads. They are to be stored in military depots and are not scheduled for disassembly at this time.

The potential inclusion of non-strategic weapons into START III negotiations may result in the withdrawal of the last 150 or so U.S. nuclear bombs from Europe. Of no logical military value, the weapons presence is solely for internal NATO political reasons, as a reassurance of U.S. "commitment" to Europe's defense, and as a means of maintaining the extremely close military-to-military relationships created during the Cold War. Tomahawk SLCMs, increasingly incorporated in U.S. strategic nuclear plans and forces, will likely remain at the same level, but could also become accountable under a non-strategic counting framework.

In Russia, much attention has been focused on the reluctance of the *Duma* to ratify the START II Treaty, and the associated worries that Russia is keeping an excess of nuclear weapons or even building up its nuclear forces. But even if mandated dismantlement and destruction lags behind the pace of the United States (and that is not clear), Russian nuclear forces will continue to decline due to a lack of financing and the natural effects of aging, exacerbated by the interruption of the cycle of Cold War modernization.

Because of the limited life of Russia nuclear warheads and fewer delivery systems, the Russian nuclear stockpile is shrinking and will continue to decline in number. Strategic nuclear forces, now estimated at some 6240 operational warheads, will likely shrink to some 1000-2000 warheads by 2004. By the year 2008, if there is a large increase in defense spending, Russia may manage to keep more than 2000 strategic warheads. A more likely scenario is that the forces continue to shrink, to some 800-1500 warheads.[16]

As for ICBMs, START II mandates the elimination of MIRVed ICBMs. But Russia will be able to convert 90 SS-18 silos to hold the new single warhead SS-27 ICBM. In addition, 105 SS-19 missiles will be downloaded to carry one warhead. Which missile fields will be affected by these changes is not yet known. New production SS-27s and downloaded SS-19s could be spread over the existing six SS-18 and SS-19 operating bases, or deployments could be consolidated and several bases closed. Financial pressures are already slowing production of the SS-27.[17] Given current trends, Russia is likely to end up with a total of some 400 single warhead ICBMs—SS-19s, SS-25s and SS-27s—mobile and silo-based, by the end of 2003.

As for ballistic missile submarines (SSBNs), Russia has not announced plans for its force. It is thought Russia will stay under the START II 1750 warhead limit by continuing to retire older model Delta/Yankee SSBNs and by reducing the warhead loading of newer Typhoons, or by retiring the flawed Typhoons altogether. Depending on financing Russia may have around 10-15 operational SSBNs by the end of 2003 (seven Delta IVs and a combination of Typhoons and Delta IIIs). Again these reductions could lead to closing SSBN bases or even the consolidating all SSBNs in the Northern Fleet. The keel of the first ballistic missile submarine of a new class–the *Borey*-class–was laid in November 1996 and will likely be operational after 2004. Depending on production rate of the new *Borey* SSBNs, the number of warheads per SLBM, and the numbers of Delta IV and Typhoons kept in service, about 448 to 1632 warheads on five to 14 submarines by the end of the decade.

The future of the Russian bomber force is equally unclear. As of the end of 1997 about 70 strategic bombers existed, but due to a lack of financing not all were operational. More than likely strategic aviation will continue to decline and could possibly disappear altogether. Of the six Tu-160 Blackjacks in the Russian inventory only two can reportedly take off.[18] The 1995 deal to purchase the Ukrainian Tu-160s fell through during spring-summer 1997 and plans to buy the bombers have been shelved, probably for good.[19] Blackjack bomber production stopped in 1994, and though it appeared no new production seemed to be on the horizon, General Eugene Habiger, Commander-in-Chief U.S. Strategic Command recently said upon his return from Russia that some Tu-160 Blackjack bombers were still in production and should be "rolling out of a plant," sometime soon.[20] Habiger remarks were based upon an article in the Russian press that stated the Defense Ministry will buy six bombers from the Kazan Aviation Production Company. Five are ready for delivery and the sixth is in the final assembly stage.[21] As for the 60-odd older Tu-95 Bear Hs, they probably will be retired around 2005 due to age,[22] if not before.

The Russian non-strategic nuclear arsenal appears to be shrinking as well. Russia says it has not produced any non-strategic warheads since about 1994, and many of the warheads being retained (air and naval weapons) are nearing the end of their service lives. This means that the remaining arsenal of an estimated 4000 operational weapons could conceivably shrink to a few hundred over the next decade. Russian proposals to include non-strategic weapons in START III discussions are probably aimed at elimination of U.S. nuclear weapons from Europe and reducing or controlling U.S.

Tomahawk SLCMs. Due to the operations and readiness of the U.S. attack submarine force, the Tomahawks are far more capable of threatening the Russian homeland than any equivalent Russian system is capable of threatening the U.S.

The Russian stockpile, now and for at least the next decade, will be divided into three general categories: operational strategic warheads, operational tactical warheads, and warheads awaiting dismantlement. At this time Russia, unlike the U.S., is not thought to have a "hedge" category of warheads for reconstitution or a reserve pool of warheads to be utilized in unforeseen circumstances. The design of Russia nuclear warheads requires perhaps some ten percent of the existing arsenal to be remanufactured annually.[23] Thus, if Russia needs additional warheads they will be provided through manufacturing rather than drawing on ones stored to create a strategic reserve.

* * *

Under plans formulated by the Conservative Government of Prime Minister John Major, the future British stockpile was to have increased slightly from the present 260 to about 275 warheads of one type (Trident) around the turn of the century. Victory of the Labour Party in May 1997 resulted in a "Strategic Defence Review" scheduled to be completed early in 1998. Among the proposals being considered are fewer warheads per Trident missile (placing the total stockpile in the 175 to 200 warhead range), a "no first use" policy, and the ending of continuous SSBN patrols. The implementation of a "sub-strategic" Trident plan in Britain–deployment of dual strategic and non-strategic Trident II missiles on submarines, some allocated to national tasks and some to NATO–will likely lead to a future operational stockpile of about 200 warheads. When a four submarine force is fully operational in the year 2001, the number on patrol at any given time would be two SSBNs with about 120-130 warheads of mixed types. A third SSBN could put to sea fairly rapidly while the fourth is undergoing overhaul and maintenance.

* * *

Future French forces will center around four SSBNs and the Rafale tactical fighter carrying air-to-surface missiles (ASM). In February 1996, President Chirac announced that a new SLBM known as the M51 would replace the current M45 around the 2010 time frame. He also announced a longer range ASM known as the ASMP Plus to be ready in a decade. These plans must contend with some very serious budgetary issues facing the French military in particular and the entire government in general. For 1998 the military budget will decrease by 3.3 percent.[24] Military procurement spending will be cut 7.8 percent for conventional armaments and 13.3 percent for nuclear forces. An extensive review, scheduled for completion in February 1998, is examining ways to cut costs further.

* * *

China was the last nation to end explosive nuclear testing, and it is logical to assume that the most recent series of tests were aimed at providing warheads with improved yield-to-weight ratios for a next generation of ballistic missiles. A yield estimate of the 11 nuclear tests since 1990 suggests that one warhead may be in the 100-200 Kt range and a larger one in the 600-700 Kt range. At the turn of the century, it appears that China plans to begin production and deployment of at least one new solid-propellant ICBM. Two missiles–the DF-31 and DF-41–are currently under development, reportedly with ranges of at least 8000 and 12,000 kilometers, respectively.

The United States

THE UNITED STATES POSSESSES approximately 12,070 nuclear weapons as of the end of 1997, 8420 of which are operational, 2300 are in long-term storage as part of a reserve, and 1350 are awaiting dismantlement and disposal (see Table 2).

TABLE 2

U.S. Nuclear Forces, 1998

Type	Designation	No. deployed	Year first deployed	Range (km)	Warheads x yield	Warheads
Bombers						
B-52H	Stratofortress	71/44	1961	16,000	ALCM x 5-150 kt	400
					ACM x 5-150 kt	400
B-2	Spirit	21/9	1994	11,000	Bombs, sub kt to 1.2 Mt	1000
Subtotal		**92/53**				**1800**
ICBMs						
LGM-30G	Minuteman III					
	Mk-12	200	1970	13,000	3 x 170 k	600
	Mk-12A	300	1979	13,000	3 x 335 kt	900
LGM-118A	MX/Peacekeeper	50	1986	11,000	10 x 300 kt	500
Subtotal		**575**				**2000**
SLBMs						
UGM-96A	Trident I C4	192	1979	7400	8 x 100 kt	1536
UGM-133A	Trident II D5	216		7400		1920
Mk-4			1992		8 x 100 kt	1536
Mk-5			1990		8 x 475 kt	384
Subtotal		**432**				**3456**
Strategic Total		**1099**				**7450***
Non-strategic forces						
B61 Tactical Bombs			1979	na	0.3-170 kt	650
SLCM/W80-0			1984	2500	5 and 150 kt	320
Grand Total						**8420**

* Includes approximately 200 spares
** There are an additional 2300 warheads in hedge/reserve status

U.S. nuclear weapons are currently stored at 24 main depots in 14 states (see Tables 3 and 4) and seven foreign countries (see Table 5). An additional 550 underground missile-launching (ICBM) silos are spread across five states. Eighteen ballistic missile submarines (SSBNs) operate from bases in Georgia and Washington, with approximately two-thirds at sea at any one time. In Europe, there are ten nuclear storage sites, a marked decline from some 164 sites in 1985, when small nuclear warhead storage sites dotted the European countryside.[25]

Since 1992, the process of withdrawing and consolidating the U.S.-based nuclear arsenal has virtually been completed. Nuclear weapons have been withdrawn from twelve states: Alaska (Naval Air Station Adak), Arizona (Davis-Monthan AFB), Arkansas (Ira Eaker AFB), Florida (Naval Air Station Cecil Field), Hawaii (Barbers Point Naval Air Station and the West Loch annex of the Naval Magazine Lualualei), Kansas (McConnell AFB), Maine (Naval Air Station Brunswick), Michigan (K.I.

TABLE 3

U.S. Nuclear Weapons Storage Sites

	1985	1992	1998
Storage Sites			
Domestic	39	34	14
Overseas	125	16	10
Total	164	50	24
Individual ICBM Silos			
U.S.	1052	900	550

TABLE 4

Nuclear Weapons in the United States, by State

	1985		1992		1998	
	Rank	Number	Rank	Number	Rank	Number
New Mexico	11	410	2	2090	1	2450
Georgia	12	406	11	576	2	2000
Washington	5	1172	3	2016	3	1685
Nevada	17	260	14	400	4	1350
North Dakota	3	1510	4	1650	5	1140
Wyoming	19	247	10	582	6	592
Missouri	22	155	21	150	7	550
Montana	16	315	20	250	7	550
Louisiana	9	530	7	910	9	540
Texas	6	630	5	1365	10	350
Nebraska	18	255	19	255	11	255
California	4	1437	6	1085	12	160
Virginia	8	542	9	595	12	160
Colorado	23	138	23	138	14	138
South Carolina	1	1962	1	2898	-	0
Michigan	6	630	8	650	-	0
New York	2	1900	12	555	-	0
South Dakota	13	365	13	450	-	0
Kansas	26	20	15	350	-	0
Florida	20	230	16	300	-	0
Hawaii	14	345	17	275	-	0
Arkansas	10	430	18	260	-	0
New Jersey	24	100	21	150	-	0
Alaska	25	70	24	25	-	0
Maine	15	320	24	25	-	0
Total U.S.		**14,600**		**16,200**		**11,920**
Overseas		6480		970		150
At sea		4100*		(1800)		(1700)
Grand Total		**25,200**		**18,970**		**12,070**

* The 2700 strategic ballistic missile warheads and 1400 tactical naval nuclear warheads at sea at any one time are not included in the state totals for 1985 above.

TABLE 5

U.S. Nuclear Weapons Overseas, Historical

	1975	1985	1992	1998
Germany	5116	3396	325	45
United Kingdom	1018	1268	300	30
Turkey	467	489	150	15
Italy	439	49	150	30
Greece	232	164	25	10
Netherlands	96	81	10	10
Belgium	40	25	10	10
South Korea	683	151	0	0
Guam	1213	428	0	0
Canada	240	0	0	0
Spain	512	0	0	0
Philippines	225	0	0	0
Puerto Rico	30	0	0	0
Total	**10,311**	**6551**	**970**	**150**

Sawyer AFB and Wurtsmith AFB), New Hampshire (Pease AFB), New Jersey (Earle Naval Weapons Station), New York (Seneca Army Depot), South Carolina (Naval Weapons Station Charleston), and South Dakota (Ellsworth AFB). Other nuclear bases have been closed in states still possessing weapons.

Nuclear History

Hundreds of highly secure nuclear storage sites were built in the United States and overseas during the Cold War. The original atomic weapons storage program, under the code name "Water Supply," was planned and begun under the Manhattan Engineer District (MED)–commanded by Major General Leslie R. Groves of the Army Corps of Engineers–predecessor to the Atomic Energy Commission (created on January 1, 1947.) General Groves initiated the project early in 1946, and prospective sites were surveyed. Three initial locations were designated: Site A, Site B, and Site C; each a separate area of an existing military installation. When three additional locations were added, the six initial facilities were labeled National Stockpile Sites (NSS). These were later supplemented by seven sites called Operational Storage Sites (OSS). National Stockpile Sites were Armed Forces Special Weapons Project (AFSWP) sites built for the AEC. Operational Storage Sites were under one or another of the military services.

The initial 13 sites are identified in Table 6. Five continue to house nuclear weapons today (Barksdale AFB, LA; Nellis AFB, NV; Kirtland AFB, NM; Fairchild AFB, WA, and Yorktown, VA) (see Appendix A.) Manzano Base, at Kirtland AFB, was the first storage site to be built (Site A), due to its proximity to the Los Alamos Laboratory where nuclear warheads were initially produced. Construction began in 1946 at Killeen Base (known as West Fort Hood, TX today), the second site (Site B) but the first of the three to receive weapons in 1948. Site C was Clarksville Base at Fort Campbell, KY.

Initially, the NSS and OSS bases were jointly operated by the AEC, the AFSWP (predecessor of today's Defense Special Weapons Agency), and the respective service (Air Force, Army, and Navy.) Over the years, the AEC presence declined as custody of warheads was given over in stages to the

TABLE 6

Original U.S. Nuclear Deployment Sites

Codename	Site	Base	Years Operational	Service
National Stockpile Sites				
Able	Manzano Base	Kirtland AFB, NM	1949-present*	Army/AF
Baker	Killeen Base	Fort Hood, TX#	1948-1969	Army/AF
Charlie	Clarksville Base	Fort Campbell, KY##	1949-1965	Navy
Dog	Bossier Base	Barksdale AFB, LA	1951-present	AF
Love	Lake Mead Base	Nellis AFB, NV	1954-present	Navy/AF
King	Medina Base	Lackland AFB, TX	1955-1965	AF
Operational Storage Sites				
Easy	Caribou AFS	Limestone** AFB, ME	1952-1988	AF
Fox	Rushmore AFS	Ellsworth AFB, SD	1952-1993	AF
George	Deep Creek AFS	Fairchild AFB, WA	1952-present	AF
How	Fairfield AFS	Travis AFB, CA	1953-1970	AF
Item	Stony Brook AFS	Westover AFS, MA	1955-1971	AF
Jig	Skiffes Creek Annex	Yorktown NWS, VA	1954-present	Navy
Yoke	North Ordnance Area	Seneca Army Depot	1957-1992	Army

* Manzano Base was closed and the nuclear weapons are currently stored at the Kirtland Underground Munitions Complex (KUMSC) on Kirtland AFB.
\# Ten miles to the west was Gray AFB
\## Nine miles to the southwest was Campbell AFB
** After 1954 Loring AFB

Defense Department. By 1962, when full control of nuclear weapons in the military's custody was relinquished by the civilian agency, the AEC ceased having a presence at the nuclear depots. By that time, nuclear storage sites were being built at missile, bomber, and naval bases throughout the United States. Overseas, permanent nuclear storage sites were proliferating widely.

The story of U.S. nuclear deployments overseas remains an untold, but significant and fascinating chapter in the history of the Cold War and the arms race. It is not publicly known precisely when the first U.S. nuclear weapons were introduced to Europe on a permanent basis. About 40 specially modified atomic-capable B-45 bombers were sent to Royal Air Force Base, Sculthorpe in the U.K. between May and mid-June 1952. The planes were configured to carry Mark 5, Mark 6, and Mark 8 fission bombs. The first nuclear bombs were probably deployed permanently overseas in the United Kingdom in 1953.

Earlier, Strategic Air Command (SAC) B-29 bombers began to operate from the United Kingdom beginning in April 1949. B-36 bombers began flights to Morocco in 1951, and B-47 bombers, in great numbers, would begin rotational flights to Europe and elsewhere in 1953. In October 1953, the first nuclear weapons were deployed to the continent of Europe when mammoth Army 280mm nuclear artillery guns and projectiles arrived in West Germany. In 1955, the U.S. and NATO came to agreement to exchange nuclear information, the basis for deployment of "custodial" weapons under U.S. control for allied forces. In December 1957, NATO Ministers formally decided to equip with atomic weapons and Honest John short-range missiles were soon deployed with nuclear warheads amongst non-U.S. ground forces.

During the 1960's, nuclear stocks in Europe grew to over 7200 warheads in eight countries (Belgium, Greece, Italy, the Netherlands, Spain, Turkey, the United Kingdom and West Germany). Allied air forces became nuclear capable starting in 1960 with deployment of the F-104 nuclear strike aircraft. Nuclear artillery units, atomic demolition munitions engineer units, missile units, and air bases all hosted nuclear warheads, in addition to dozens of central support bases and depots.

In Asia, nuclear warheads were deployed in Guam, the Philippines, South Korea, Taiwan, and Okinawa (under U.S. occupation).

- Andersen AFB, near Agana, Guam hosted B-29, B-36, B-47 and B-52 rotational units from 1953 to 1964. The 3rd Aviation Depot Squadron originally established the storage facilities. Beginning in 1970 the 43rd Strategic Wing was deployed to Andersen with B-52G aircraft. The Wing remained there until the bombers and bomber weapons (bombs and SRAMs) were removed in 1988.
- A variety of Naval/Marine Corps nuclear weapons were also deployed in Guam until the 1980s, from Polaris warheads for SSBNs (using Apra Harbor) to nuclear artillery shells, and depths bombs for P-3s, all stored at Santa Rita.
- Matador missiles were deployed in Korea from 1959 to 1962 with the 58th Tactical Missile Group.
- Two squadrons of Matador/Mace missiles (16-18 per squadron) were deployed in Okinawa from 1961 to 1969 with the 498th Tactical Missile Group.
- Nike-Hercules nuclear-armed missiles were deployed to Taiwan in 1958.
- Various nuclear capable tactical aircraft were deployed to bases in Philippines, Korea, and Taiwan.

After Okinawa reverted to Japanese control in 1974 overseas deployments focused on the seven European countries, Guam, the Philippines and South Korea. The last nuclear weapons were withdrawn from the Pacific region in 1991.

In all, some 17 countries and three U.S. territories (Guam, Johnston Island, and Puerto Rico) have hosted permanent nuclear weapons deployments since the 1950's (see Table 7). Eleven countries and two U.S. territories (Guam and Puerto Rico) hosted 10,311 warheads in 1975–the peak period–a number that declined to 6551 warheads in eight countries (and Guam) by 1985, to some 970 warheads in seven countries by 1992 and to 150 today.

TABLE 7

Countries with U.S. Nuclear Weapons Deployments

Current	Former	
Belgium	Azores (Portugal)	Okinawa (Japan)
Greece	Bermuda	Philippines
Italy	Canada	Puerto Rico
Netherlands	France	South Korea
Turkey	Greenland (Denmark)	Spain
United Kingdom	Guam	Taiwan
West Germany	Johnston Island	

Nuclear Organization

Currently only the Air Force and Navy operate nuclear weapon systems, whereas as recently as six or seven years ago the Army and Marine Corps did so as well. The weapons are allocated for use in accordance with general national and Department of Defense (DOD) policy that becomes specific in detailed strategic and regional nuclear employment documents and war plans. The Nuclear Posture Review, approved by President Clinton in September 1994, set the overall basis for the force structure and nuclear requirements of the military. In November 1997, President Clinton signed Presidential Decision Directive–60 (PDD) which sets the national guidelines for deterrence and the employment of nuclear weapons. It replaced, in whole, guidance signed by President Reagan in October 1981.

National guidance is supplemented by employment policy documents signed by the Secretary of Defense. The Joint Chiefs of Staff also issue planning assumptions and requirements, and an annual Nuclear Weapons Deployment Authorization, which specifies the assignments, locations, and types of nuclear weapons in the U.S. and overseas.

The Chairman of the Joint Chiefs of Staff is the senior uniformed military authority responsible for nuclear requirements and capabilities. The Joint Staff, reporting to the Chairman, oversees the military staff that develops and maintains nuclear weapons employment and deployment policy. The Chairman is also responsible for coordinating the requirements developed by the Commanders of the nuclear-responsible unified (joint service) commands. The Vice Chairman is one of two DOD members of the DOD-DOE Nuclear Weapons Council, a body which coordinates the technical cooperation between the Department of Defense(the nuclear "user") and the Department of Energy(the nuclear "producer").

There are currently five unified nuclear commands responsible for planning and executing U.S. military operations. They are:

- Strategic Command (STRATCOM): Global strategic nuclear force planning and command and control, and assistance to regional unified commands in nuclear targeting and execution.
- European Command (EUCOM): European-based nuclear forces, including the Mediterranean and the continent of Africa, not including the Middle East (under Central Command).
- Pacific Command (PACOM): Contingencies for the use of nuclear weapons in Asia and the Pacific Ocean region, including the Korean peninsula.
- Atlantic Command (ACOM): Worldwide augmentation of overseas military forces, non-strategic nuclear weapons in the United States, and the North American and Caribbean regions.
- Central Command (CENTCOM): The Middle East and Southwest Asia, including the Red Sea and Indian Ocean.

In addition, the Special Operations Command (SOCOM), is responsible for counter-proliferation missions, among them the recovery and capture of nuclear weapons.

STRATCOM is obviously the most important nuclear command, preparing the nuclear war plans and operating the national level command and control mechanisms and systems for the use of nuclear weapons. In peacetime, STRATCOM exercises control of strategic nuclear weapons via Air Combat

Command (ACC), Atlantic Fleet (LANTFLT), Pacific Fleet (PACFLT), and Air Force Space Command (AFSPC). When forces are generated on alert, these same commands and others organize as STRATCOM Commander Task Forces (CTFs), as follows:

CTF-Mediterranean (Sub Gp 8)	CTF 64	Trident submarines operating in the Mediterranean
CTF-TACAMO (STRATCOMWG 1)	CTF 124	E-6 TACAMO
CTF-PAC (SUBPAC)	CTF 134	Tridents in Pacific
CTF-LANT (SUBLANT)	CTF 144	Tridents in Atlantic
CTF-Bomber (8th AF)	CTF 204	B-2, B-52 bombers
CTF-ICBM (20th AF)	CTF 214	MM III, MX ICBMs
CTF-Battle Management (ACC)	CTF-224	E-4, EC-135 command and control aircraft
CTF-Tanker (15th AF)	CTF-294	KC-10, KC-135 aerial refuelers

Overall nuclear policy, budgeting and acquisition plans and programs, are under the authority of the Secretary of Defense. The Under Secretary of Defense (Policy) remains the chief official responsible for nuclear weapons policy, operating through a subordinate Assistant Secretary of Defense (International Security Policy), whose portfolio includes nuclear and counter-proliferation policy matters. On the technical side, in February 1994, the Secretary of Defense designated the Assistant to the Secretary for Atomic Energy (ATSD(AE) as the focal point for biological and chemical matters as well, changing the name of the long-standing position to the Assistant to the Secretary of Defense (Nuclear, Chemical, and Biological Defense Programs) (ATSD(NCB). The ATSD(NCB) is the principal staff assistant to the Secretary for all nuclear weapons-related technical matters, including safety, security, and certification. The office is designated the lead for coordination with the Department of Energy regarding all warhead matters.

Under the 1997 DOD Defense Reform Initiative, the USD (Policy) office is being reorganized under three Assistant Secretaries, and the present Assistant Secretary of Defense for International Security Policy (ASD (ISP)), primarily responsible for formulation of nuclear policy, will be eliminated. Nuclear policy-related functions will be incorporated into a new ASD (Strategy and Threat Reduction), incorporating elements of the ISP and current Strategic and Resources offices. This expanded Assistant Secretariat will include offices related to policy and strategy for nuclear weapons and selected conventional weapons, counterproliferation, threat reduction activities (denuclearization, nuclear safety, security, and dismantlement) and treaty compliance policy (arms control negotiations and implementation). It will also manage security relations with Russia and the states of the former Soviet Union. The Under Secretary of Defense (Acquisitions & Technology) (USD(A&T) is the ultimate senior DOD official dealing with technical nuclear matters and acquisitions. The Under Secretary is the DOD civilian member of the Nuclear Weapons Council. The ATSD(NCB) serves as the staff director of the Council and chairs the Nuclear Weapons Council Standing and Safety Committee (NWCSSC), the day-to-day interdepartmental organization coordinating stockpile matters.

In the office of the USD(A&T), the Director, Strategic and Tactical Systems is responsible for oversight of nuclear delivery systems and force equipment. The Director of Defense Research and Engineering (DDR&E) exercises oversight of all DOD science and technology programs and laboratories.

With the planned elimination of the ATSD (NCB) position under the 1997 DOD Defense Reform Initiative, the Director of Defense Research and Engineering, through a Deputy for NCB Matters, will assume responsibility to serve as the principal technical staff advisor to the Secretary of Defense on nuclear matters, to include serving on the Nuclear Weapons Council and as the DOD point of contact with the Department of Energy.

The Defense Special Weapons Agency (DSWA) is the lead agency for DOD stockpile management, and continues, through its Field Command located at Kirtland AFB, NM, to be the field organization responsible for ensuring that the nuclear arsenal is properly accounted for and secured. It operates the Nuclear Weapons Accounting System (NUCWAA) which tracks the location and movement of every individual warhead in DOD possession, conducts nuclear certifications of individual units, and conducts a broad-based research program dealing with nuclear strategy and effects. The NUCWA data base contains warhead types, locations, quantities on hand, unit identification, shipping information, and other related facts which may be used to assist in decision making.[26] The Defense Nuclear Weapons School, also subordinate to DSWA since 1993 (transferred from the Air Force), is the primary training establishment for nuclear matters.

The 1997 DOD Defense Reform Initiative includes creation of a Defense Threat Reduction and Treaty Compliance Agency, formed by consolidating three existing agencies—the Defense Special Weapons Agency, the On-Site Inspection Agency, and the Defense Technology Security Administration—as well as by incorporating non-policy making functions currently assigned to the Office of the Secretary of Defense dealing with weapons of mass destruction (specifically, offices from the Under Secretary of Defense for Policy dealing with threat reduction, nuclear treaty programs, and counterproliferation). The office of the Assistant to the Secretary of Defense (Nuclear and Chemical and Biological Defense Programs) will also be eliminated.

The new Threat Reduction Agency will be charged with providing expertise on weapons of mass destruction, nuclear weapons stockpile support, and arms control. It will manage defense activities pertaining to counterproliferation, the Cooperative Threat Reduction program, the Partnership for Peace program, and arms control treaty compliance. It will report to the Under Secretary of Defense for Acquisition and Technology through the Director of Defense Research and Engineering.

Under Defense Department regulations, units with nuclear roles are required to undergo nuclear certification every 18 months. This is done in the form of a Nuclear Surety Inspection (NSI) (for the Air Force) or Navy Technical Proficiency Inspection (NTPI). Other inspections that prepare nuclear units for NSI/NWTIs are Nuclear Weapons Technical Inspection (NWTI), Nuclear Operational Readiness Inspections (NORI), and Nuclear Staff Assistance Visits (NSAVs). The services conduct preliminary and update inspections, but final certification rests with the DSWA.

Currently, there are some 61 nuclear certified units in U.S. military (see Table 8). A “unit” is defined as follows:

- For ICBM units, the unit is the Wing.
- For bomber units, the unit is the Wing.
- For tactical aircraft units, the unit is the Wing together with supporting fighter, security forces (formerly security police), and munitions squadrons.

- For nuclear airlift units both PNAF (Prime Nuclear Airlift Force) and ENAF (Emergency Nuclear Airlift Force), the unit is the Wing.
- For explosive ordnance disposal units, the unit is the detachment or flight.
- For Navy units afloat, if the storage unit and employing unit are the same (i.e., SSBN), the unit is the ship.
- For Navy shore activities, the unit is the "special weapons" component of Weapons Stations and Departments.
- For independent Air Force storage and maintenance units (i.e., MUNSS, MUNS), the unit is the squadron or group.
- For command and control units (i.e., TACAMO), the unit is the Wing.

TABLE 8

U.S. Nuclear Certified Units

	1980	1985	1990	1996*
Air Force	66	54	44	26
Army	250	202	139	1
Marine Corps	30	29	18	0
Navy	376	310	200	34
Total	**722**	**595**	**401**	**61**

* Data as of the end of FY 1995

The Air Force owns the intercontinental ballistic missiles (ICBMs), and the dual-capable bombers and tactical aircraft in strategic and non-strategic forces. Headquarters of the Department of the Air Force is probably the most deeply involved of all the services in nuclear weapons policy and developments. On January 1, 1997, the Directorate for Nuclear and Counter-proliferation Matters (AF/XON) with the office of the Deputy Chief of Staff for Air and Space Operations was established to provide comprehensive oversight for nuclear matters. The incumbent AF/XON Major General position is the Air Force's representative to the Nuclear Weapons Council Standing and Safety Committee (NWCSSC).

Under Air Force Headquarters are five major commands with direct nuclear responsibilities. Air Force land-based missiles are operated by the Air Force Space Command (Peterson AFB, CO). The 20th Air Force at F.E. Warren, AFB, WY serves as the operational headquarters for ballistic missiles, commanding the individual Space Wings (formerly Missile Wings).

Bombers and tactical fighters in the United States are operated by the Air Combat Command (Langley AFB, VA). The 8th Air Force at Barksdale AFB, LA serves as the operational headquarters for bombers commanding the individual Bomber Wings. Aerial refueling tankers of ACC are also nuclear certified, given their critical role in refueling bombers in nuclear war plans, and their secondary roles in transporting nuclear weapons. In addition to bomber and aerial refueling units, four tactical fighter wings of the ACC are also thought to be fully nuclear certified: the 57th Wing at Nellis AFB, NV with F-15E and F-16 aircraft; the 27th Fighter Wing at Cannon AFB, NM with F-16 aircraft; the 49th Fighter Wing at Holloman AFB, NM with F-117 stealth fighters; and the 4th Fighter Wing at

Seymour-Johnson AFB, SC with F-15E aircraft. Tactical nuclear weapons are physically stored only at Nellis, but this is a general support depot and the weapons are not thought to be in support of the local Wing. Instead, each of these Wings would fly to European (or Pacific) bases and meet up with nuclear weapons already stored there or transported there separately during wartime.

United States Air Forces in Europe (USAFE) (Ramstein Air Base (AB), Germany) controls dual capable fighter aircraft in Europe, as well as nuclear bombs kept in custody for use by Belgian, Dutch, German, Greek, Italian, and Turkish air forces. USAFE is the only overseas command of the U.S. military that still physically possesses nuclear weapons.

Air Force Material Command (Wright-Patterson AFB, Ohio) is in charge of the central storage of Air Force nuclear weapons as well as depot-level support for warheads. The Munitions Squadrons of Air Force Materiel Command (located at Nellis AFB, NV and Kirtland AFB, NM) provide the depot-level maintenance capability as well as traveling teams to support worldwide maintenance requirements. The ICBM System Program Office (Hill AFB, UT), newly created from the deactivated Air Force Ballistic Missile Office, has responsibility for strategic systems, missiles, guidance, and reentry vehicles; an Air Force Center of Excellence for nuclear weapons is also being created at Kirtland AFB, NM, taking on other nuclear warhead related functions from Kelly AFB, TX, which is slated for closure. The Air Force Safety Center (Kirtland AFB, NM) conducts certification and update inspections of Air Force nuclear units.

Air Mobility Command (Scott AFB, Illinois) is responsible for the long-range transport of nuclear weapons. A specially trained transport Wing serves as the Primary Nuclear Airlift Force (PNAF) for the entire U.S. military. This 60th Air Mobility Wing, located at Travis AFB, California (see Appendix C) is also augmented by an Emergency Nuclear Airlift Force (ENAF), provided by units such as the 437th Airlift Wing, Charleston AFB, SC.

The Navy possesses submarine-launched ballistic missiles (SLBMs) and nuclear-armed Tomahawk sea-launched cruise missiles (SLCMs). The entire Navy nuclear force is under the control of the submarine establishment, and the Submarine Forces Atlantic (SUBLANT) and Pacific (SUBPAC) fleet commands serve as contingency task forces of STRATCOM. The Navy Nuclear Weapons Inspection Center (NWIC) opened its doors on April 15, 1997, and is the principal Navy nuclear weapons safety/security advisor, performing all inspections and providing technical support for custody, safety and maintenance of nuclear weapons. Located at SUBLANT headquarters in Norfolk, NWIC includes a weapons inspection component in Kings Bay, GA. An Inspection Detachment in the Pacific (Bangor, WA), provides certified inspectors to conduct weapons inspections and assistance visits. SUBLANT also established a Force Security Organization in 1997 to serve as the central point for all matters relating to submarine force and nuclear weapons security. The organization is under the cognizance of the Department of the Navy's Assistant Chief of Staff for Strategic Operations and Nuclear Weapons (N9) and handles all matters relating to physical, information, and submarine security.

The Strategic Systems Program Office (SSPO), the organization that today is the ancestor of Admiral Hyman Rickover's nuclear navy, has "cradle to gave" responsibility for Navy ballistic missiles, ballistic missile submarines, and nuclear weapons research and development. The Strategic Weapons Facility Atlantic (SWFLANT) (Kings Bay, GA) and Pacific (SWFPAC) (Bangor, WA), the main shore facilities and depot-level support sites for the two ballistic missile submarine bases, nominally report to the SSPO.

The 1994 Nuclear Posture Review mandated that the level of control over nuclear weapons in possession of the submarine force be the same as the rest of the nuclear force, with Permissive Action Links (PALs) and other use controls to guarantee no unauthorized use of nuclear weapons. As of 1997, the Navy has adopted a "dual command and control path" in its ballistic missile and attack submarines. Under the dual command and control system, a parallel launch authorization requirement must be satisfied in order to conduct a missile launch. The "Use Control" system is not actually technically the same as a PAL, but provides similar levels of security. A thorough "Table Top Review" incorporating crew walk-throughs was completed in January 1997 and an "End-to-End" test was conducted in each Fleet in May. The submarine force was scheduled to implement the new controls beginning July 1, 1997 with full implementation by October 1, 1997.

The Army, principally through staff offices at major commands and its Nuclear and Chemical Agency (USANCA), continues to be involved in nuclear war planning, particularly in support of ground component commanders.

Nuclear Weapons Deployments

The distribution of nuclear weapons within the United States has undergone marked change since 1992, when South Carolina lead all states with 2898 warheads stored in the Charleston area. Since then the South Carolina warheads have been either sent to the Department of Energy's Pantex Plant for disassembly or to Kings Bay, Georgia for use on Trident II SLBMs. As of the end of 1997, New Mexico is first in terms of the number of weapons. Its rise to the top comes as Kirtland AFB in Albuquerque assumes a greater role in storing warheads awaiting disposal at Pantex. Weapons are both permanently stored at Kirtland and temporarily "staged" as they await shipment to Texas. Georgia (No. 2) and Washington (No. 3) host the Atlantic- and Pacific-based Trident submarine forces respectively (including warheads temporarily at sea on ballistic missile submarines that are on alert). About 15-18 percent of the U.S. active stockpile (1500-1700 warheads) is deployed at sea aboard four or five SSBNs patrolling in each ocean at any given time.

Table 4 provides a state-by-state accounting for 1985, 1992, 1998. Appendix C contains a profile of each state, identifying nuclear bases and weapons stored and deployed.

Currently less than two percent of the U.S. nuclear stockpile is deployed in Europe (150 bombs), a marked contrast with the 30 percent deployed overseas in the mid-1980's and a decline from five percent in 1992. Weapons are deployed at ten bases in seven countries: Belgium, Germany, Greece, Italy, Netherlands, Turkey, and United Kingdom (see Table 9 and Appendix A). All of these weapons are B61 strike bombs belonging to the Air Force.

A flurry of reports in October 1996 falsely reported that nuclear weapons had been withdrawn from the United Kingdom, and in 1997, Greek newspapers were again reporting that nuclear weapons had been withdrawn from that country. But nuclear weapons remain in each of the seven countries they have been in since the end of the Cold War, albeit in greatly reduced numbers. Partly due to reductions in U.S. and allied forces, and partly to improve the security of nuclear warheads, the U.S. has created regional support centers for nuclear weapons remaining overseas. This has resulted in the closure of numerous custodial sites. In late 1995, two custodial sites–at Memmingen and Norvenich–were closed in Germany, instituting a regional basing mode at Büchel air base (earlier

TABLE 9

European-Based U.S. Nuclear Weapons, by Country

Location	U.S. Unit	Number Warheads
Kleine Brogel, Belgium	52nd MUNSS (52nd Fighter Wing)	10
Buechel AB, Germany	817th MUNSS (52nd Fighter Wing)	10
Ramstein AB, Germany	86th Airlift Wing	15
Spangdahlem AB, Germany	52nd Fighter Wing	20
Araxos, Greece	731st MUNSS (31st Fighter Wing)	10
Aviano, Italy	31st Fighter Wing	20
Ghedi-Torre, Italy	31st MUNSS (31st Fighter Wing)	10
Volkel, Netherlands	752nd MUNSS (52nd Fighter Wing)	10
Incirlik, Turkey	39th MUNSS (39th Fighter Wing)	15
RAF Lakenheath, UK	48th Equipment Maintenance Sqn (48th Fighter Wing)	30

Lechfeld had been closed). In 1996, two Turkish custodial sites–Akinci and Balikesir–were closed, consolidating regional nuclear support at the main U.S. base at Inçirlik.

Coincident with the consolidation of nuclear bases has been the construction of Weapons Storage and Security System (WS3) vaults, which has resulted in closing most main Weapons Storage Areas (WSAs) on air bases throughout Europe. The vaults are highly secure, locked, underground mini-bunkers to house nuclear bombs, located in the floors of hardened aircraft shelters. Each vault can hold up to three nuclear bombs. Rather than wheeling bombs out onto the tarmac from the WSAs and then loading them, nuclear weapons can now be attached to the planes inside the shelters, out of view. Maintenance can be performed inside the shelter as well.

The U.S. custodial units assigned to allied bases with nuclear weapons are called Munitions Support Squadrons (MUNSS). They are normally made up of 100-130 people, including command and administration, security, and nuclear weapons technicians. Each MUNSS usually has a “sister” relationship with an allied wing that is nuclear certified and contains the nuclear specialists of the allied military.

Russia

THE RUSSIAN NUCLEAR STOCKPILE is estimated to contain about 22,500 warheads, down from a peak of some 45,000 during the mid-1980s. Of those 22,500 weapons, some 10,240 are thought to be operational, that is, associated with active and usable delivery vehicles (see Table 10).

With the withdrawal of the last nuclear warheads from Belarus in November 1996, all nuclear weapons belonging to the former Soviet Union are now physically located in Russia.[27] This completes a process of movements and unilateral weapons reduction initiatives that began at the end of the Cold War and included withdrawal of nuclear weapons from Eastern Europe, and non-Russian republics. As noted above, the 1991 unilateral initiatives of President Gorbachev built upon and added to reductions in nuclear weapons mandated by the INF and START treaties, and eventually were joined by the process for removing nuclear weapons remaining in the newly independent republics of Belarus, Kazakhstan, and Ukraine.

As a result of various withdrawals and closures, we estimate that Russian nuclear weapons are currently stored at about 90 facilities (not counting nuclear weapons in individual missile silos and submarines). This is a decline from an estimated 500 nuclear storage sites that existed at the end of the Cold War.[28] In addition to the storage sites for nuclear weapons large amounts of nuclear materials–plutonium and uranium in particular–are dispersed among five dozen government and civilian facilities.

In 1993, the Defense Intelligence Agency (DIA) estimated that Russia had an arsenal of some 27,000 nuclear weapons.[29] In March 1997, General Eugene Habiger, commander-in-chief of U.S. Strategic Command, stated that, "by most estimates, Russia retains some 20,000-25,000 nuclear weapons. . . ,"[30] including 7000 to more than 12,000 non-strategic warheads.[31] The large range is due to American uncertainties regarding the pace of dismantlement under the 1991 unilateral reduction initiatives. However, since at least 1992, it is clear that Russian dismantlement activities have exceeded production,[32] and few or no tactical warheads have been produced in Russia since 1994.[33]

Russian Nuclear Deployments

MISSILE SITES
1 Aleysk
2 Dombarovskiy
3 Kartaly
4 Ushar
5 Kozelsk
6 Tatischevo
7 Bershet
8 Kostroma
9 Krasnoyarsk
11 Drovyanaya
12 Irkutsk
13 Kansk
14 Nizhniy Tagil
15 Novosibirsk
16 Teykovo
17 Vypolzovo
18 Yoshkar-Ola
19 Yurya

DESIGN LABORATORIES
20 Arzamas-16
21 Chelyabinsk-70

WARHEAD PRODUCTION (ASSEMBLY) FACILITIES
22 Penza-19
23 Sverdlovsk-45
24 Zlatoust-36

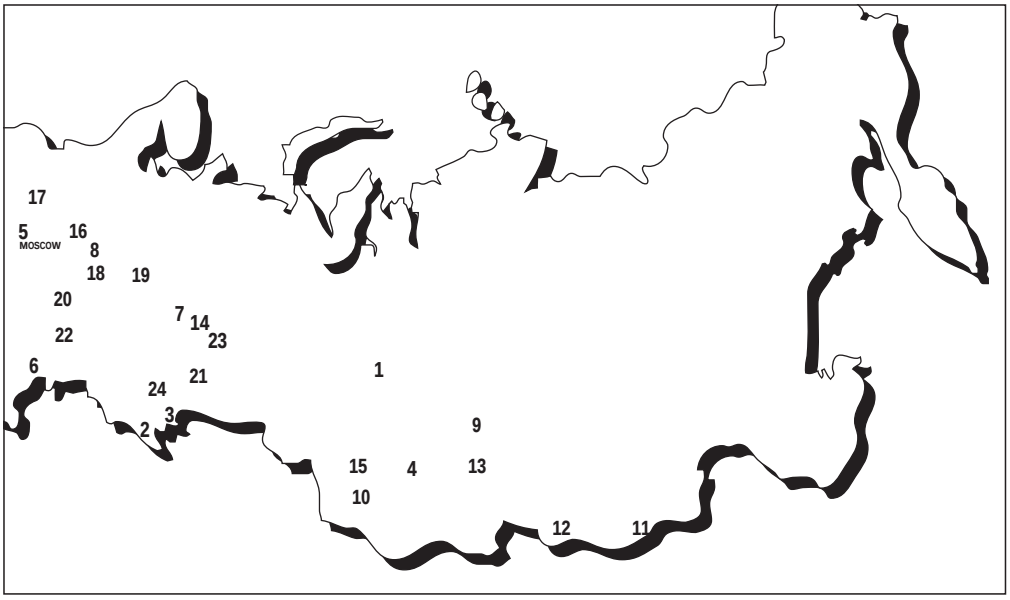


TABLE 10

STRATEGIC FORCES

Russian Operational Nuclear Forces, 1998*

Type	NATO designation	No.	Year first deployed	Range (km)	Warheads x yield	Warheads
Bombers						
Tu-95M	Bear-H6	29	1984	12,800	6 x AS-15A ALCMs, bombs	174
Tu-95M	Bear-H16	35	1984	12,800	16 x AS-15A ALCMs, bombs	560
Tu-160	Blackjack	6	1987	11,000	12 x AS-15B ALCMs or AS-16 SRAMs, bombs	72
Subtotal		**70**				**806**
ICBMs						
SS-18	Satan	180	1979	11,000	10 x 550/750 kt (MIRV)	1800
SS-19	Stiletto	165	1980	10,000	6 x 550 kt (MIRV)	990
SS-24 M1/M2	Scalpel	36/10	1987	10,000	10 x 550 kt (MIRV)	460
SS-25	Sickle	360	1985	10,500	1 x 550 kt	360
Subtotal		**751**				**3610**
SLBMs						
SS-N-18 M1	Stingray	192	1978	6500	3 x 500 kt (MIRV)	576
SS-N-20	Sturgeon	80	1983	8300	10 x 200 kt (MIRV)	800
SS-N-23	Skiff	112	1986	9000	4 x 100 kt (MIRV)	448
Subtotal		**384**				**1824**
Total		**1205**				**6240**

Type	Weapon (no.)	Weapon number	Warhead number
Strategic Defense			
ABMs	SH-08 Gazelle (64), SH-11 Gorgon (36)	100	100
SAMs	SA-5B Gammon, SA-10 Grumble	1100	1100
Subtotal			**1200**
Land-based Nonstrategic			
Bombers and fighters			
	Backfire (120), Fencer (280) (AS-4 ASM, AS-16 SRAM, bombs)	400	1000
Subtotal			**1600**
Naval Nonstrategic			
Attack aircraft	Backfire (70), Fencer (70) (AS-4 ASM, bombs)	140	400
SLCMs	SS-N-9, SS-N-12, SS-N-19, SS-N-21, SS-N-22		500
ASW weapons	SS-N-15, SS-N-16, torpedoes	na	300
Subtotal			**1200**
Total			**~ 4000**

* Another 12,000 non-strategic warheads could be in reserve, and/or awaiting dismantlement.

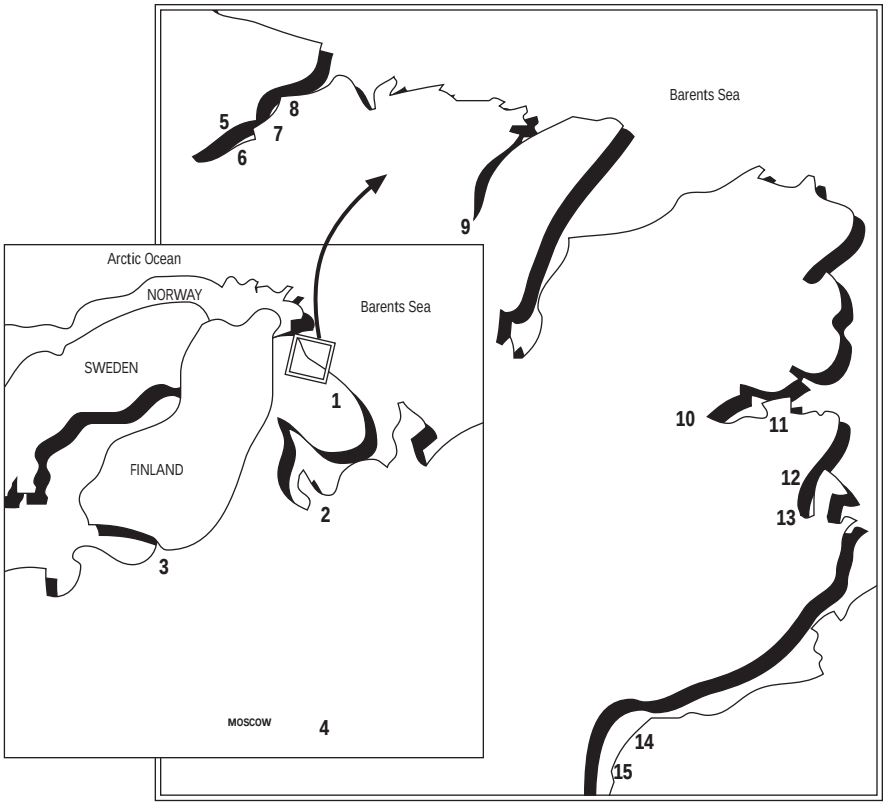
Russian Northern Fleet Deployments

NUCLEAR-POWERED SUBMARINE BASE
- **1 Gremikha**
- **6 Nerpichya Guba**
- **7 Bolshaya Lopatka Guba**
- **9 Ara Guba**
- **10 Sayda Guba**
- **11 Yagelnaya Guba**
- **12 Olenya Guba**

DECOMMISIONED SUBMARINE BASE
- **1 Gremikha**
- **7 Bolshaya Lopatka Guba**
- **9 Ara Guba**
- **11 Yagelnaya Guba**
- **12 Olenya Guba**
- **13 Pala Guba**
- **15 Rosta**

STORAGE AND/OR DECOMMISIONING FACILITY
- **1 Gremikha**
- **2 Severodvinsk**
- **5 Andreeva Guba**
- **10 Sayda Guba**
- **14 Atomflot**
- **15 Rosta**

SHIPYARD AND/OR SUBMARINE REPAIR FACILITY
- **2 Severodvinsk**
- **3 St. Petersburg**
- **4 Nizhniy Novgorod**
- **8 Malayâ Lopatka Guba**
- **12 Olenya Guba**
- **13 Pala Guba**
- **15 Rosta**



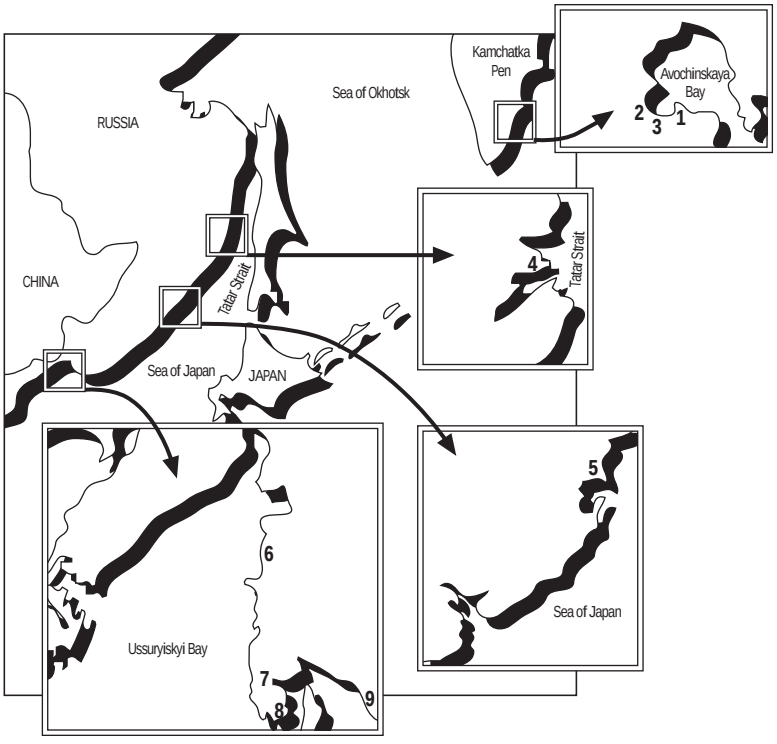
Russian Pacific Fleet Deployments

NUCLEAR-POWERED SUBMARINE BASE
- **1 Rybachy**
- **5 Vladimir Bay**
- **9 Paylovsk**

DECOMMISIONED SUBMARINE BASE
- **1 Rybachy**
- **4 Zavety Ilyicha**
- **5 Vladimir Bay**
- **6 Bolshoi Karmen**
- **9 Paylovsk**

STORAGE
- **3 Military Unit 95051**
- **6 Bolshoi Karmen**
- **8 Military Unit 40752**

SHIPYARD AND/OR SUBMARINE REPAIR FACILITY
- **2 Gornyak**
- **6 Bolshoi Karmen**
- **7 Chazhma Bay**



Nuclear Organization

The President of the Russian Federation is also the supreme Commander-in-Chief of the Russian Armed Forces, and as such is the ultimate authority for all matters relating to nuclear weapons. The Security Council, under the President, and made up of membership by the Ministers of various national security-related organizations, is the primary policy-making body of the armed forces. The Security Council determines all aspects of national nuclear policy and controls all aspects of the nuclear weapons complex from production to fielding to dismantlement.

Russian nuclear warheads in the military's custody are controlled by the Ministry of Defense (MOD) and belong to four of the five armed services: the Strategic Rocket Forces, the Air Defense Force, the Navy, the Air Forces. As a result of Gorbachev's and Yeltsin's initiatives, the Army (Ground Forces) are not believed to possess any operational nuclear weapons as of the beginning of 1998.[34]

A reorganization of the military begun by the new Minister of Defense Col. General Igor D. Sergeyev will change the number of services and so the number of services possessing nuclear weapons. During 1997-2000, to combine strategic defense, space, and strategic deterrence functions, the Military Space Forces and Anti-Missile Defense forces of the Air defense Force will be merged into the Strategic Rocket Forces. The remaining Air Defense troops will be consolidated into the Air Force. Finally, the Ground Forces will be reorganized along territorial lines.[35] Thus, by the year 2000, nuclear weapons will be controlled by the three remaining full armed services: Strategic Rocket Forces, Air Force, and Navy.

MOD Headquarters in Moscow sets internal nuclear procedures, and supervises budgeting, and research and development priorities. The Minister sits on the Security Council. The General Staff of the Russian Armed Forces—reporting to the Minister of Defense—serves as a sort of Joint Chiefs of Staff and super-unified command, responsible for most operational matters, including nuclear weapons planning, command and control. The General Staff is believed to be responsible for formulating Russian nuclear war plans. The Chief of the General Staff is also in the chain of command between the President and the Minister of Defense and the armed services.

The Defense Ministry's 12th Main Directorate (*Glavnoye Upravleniye Ministerstvo Oborony*) or 12th GUMO, one of the "main and central directorates," reports directly to the Minister, and serves as the organization in charge of storage, transportation, and security of nuclear weapons. The Directorate takes possession of nuclear weapons upon production, guards central nuclear storage sites, supervises and guards the movement of nuclear weapons, services nuclear warheads, inspects nuclear facilities, and provides the standards for the safety and security of nuclear weapons in the possession of the armed services. Analogous units—thought to be the 6th Directorate of the headquarters of the Air Force, Air Defense Force, SRF, and Navy—exist within each of the armed services and are in central control of nuclear warheads.

The 12th GUMO had its origins in a special department which was formed on September 4, 1947 in the Ministry of Defense for the purpose of studying the United States' use of nuclear weapons and nuclear weapons effects. Shortly after the detonation of the first Soviet atomic bomb in August 1949, the Main Directorate was established in the Ministry of Defense on the basis of the already existing department and parts of the First Main Directorate. Its mission was "to provide centralized direction of testing, stockpiling, and operating nuclear weapons and protection against nuclear weapons."

Today, all military research organizations and units immediately engaged in nuclear weapons work are directly subordinate to the 12th Directorate. In recent years the Directorate has additionally become responsible for dismantling nuclear weapons prior to their final disassembly by the Ministry of Atomic Energy.[36]

The Strategic Rocket Forces (RVSN) (aka "Strategic Missile Forces") control the land-based intercontinental missiles (ICBMs) and continue to be the premier service of the Russian Armed Forces. The service is organized into four missile armies–headquartered at Vladimir, Omsk, Orenburg, and Chita–and 19 missile divisions,[37] corresponding with the 19 main operating bases. The SRF's 6th Main Directorate is responsible for nuclear security and custody. As of the end of 1997, 751 missiles of four missile types are located at the 19 bases: 355 SS-18s, SS-19s and SS-24s in underground silos, 36 SS-24s on railroad cars, and 360 road-mobile SS-25s. As noted above, all SS-18 and SS-24s, and all but 105 SS-19s will be eliminated under START II. The SS-19s will be downloaded to one warhead each from their present six and 90 SS-18 silos can be converted to take a silo-based version of the SS-25, a new missile called the SS-27 or *Topol-M*. Some 400 SS-19s, SS-25s and SS-27s may be in the force by the end of 2003.

The Troops of Air Defense (VPVO) (aka "Air Defense Force") as noted, will be split between the Strategic Rocket Forces and the Air Force. Until then, VPVO operates the ABM system around Moscow, made up of 100 nuclear-armed missiles. Early warning systems and the functions of the Military Space Forces will also be merged with the Strategic Rocket Forces. Air defense fighters will be part of the Air Force. The fate of the nuclear-armed surface-to-air missiles under the control of the VPVO is unclear.[38] In any event, as part of the 1991 unilateral reduction initiatives, Russia stated that half of the inventory of nuclear anti-air warheads would be retired by 1996 and the rest would be removed from units and put in centralized storage. Given Soviet era estimates of some 3000 warheads of this type, this would still leave over a thousand warheads. It is believed that these nuclear warheads can arm SA-5 and SA-10 surface-to-air missiles. Most warheads are believed to have been withdrawn from the 200 or so remaining field units and consolidated at regional VPVO depots (except perhaps in the Moscow Air Defense District where the warheads may be closer to operational units).

The Navy (VMF), comprised of Baltic, Black Sea, Northern, and Pacific Fleets, operates the ballistic missile (SSBN), cruise missile (SSGN) and attack submarines (SSNs), as well as surface ships with nuclear capabilities. Only the Northern and Pacific Fleets are considered to be nuclear capable. Nuclear-capable Backfire and Fencer bombers belonging to Naval Aviation are also assigned to the two fleets. Due to the 1991 unilateral reduction initiatives, tactical nuclear weapons are not deployed on ships or submarines during peacetime and are kept in storage. Thus, naval nuclear weapons are located on operational or homeported ballistic missile submarines or are in naval or 12th Directorate storage depots. Unlike the United States, strategic and tactical naval nuclear weapons are kept within the same storage complex. The Navy's 6th Main Directorate is responsible for nuclear security and custody.

The preponderance of nuclear capability in the Navy resides in the strategic nuclear submarine force. Strategic nuclear ballistic missile submarines are assigned solely to the Northern and Pacific Fleets and are homeported at five bases.[39] Under the latest START data exchange (July 1997), 42 boats are considered to be in the fleet, including six types of submarines: Typhoon-class, Delta IV-class, Delta III-class, Delta II-class, Delta I-class, and Yankee I-class. However, due to financial

problems associated with dismantlement the actual number of available and fully operational submarines is much less. The Russian Navy only counts some 27 SSBNs as operational, 17 in the Northern Fleet and 10 in the Pacific.[40] The remaining Delta I/IIs and Yankee class SSBNs are either non-operational or nearing retirement, and one Delta III SSBN has been retired.[41] In addition, two third-generation modern Typhoon submarines have been removed from service because of a technical problem and without further financing are likely to be retired rather than overhauled.[42] Thus, the actual number of operational submarines is some 23 boats.

The level of operations of SSBNs has also decreased dramatically. The number of patrols by Russian SSBNs fell by almost 70 percent from 1991 to 1996 (see Table 11). Currently, only one to two SSBNs are thought to be at sea at any given time, but apparently with longer patrols.[43] And these submarines do not venture very far from the Russian mainland.

TABLE 11

Russian SSBN and SSN/SSGN Patrols per Year, 1991-1996

	1991	1992	1993	1994	1995	1996
SSBNs	37	28	19	19	14	12
SSN/SSGNs	18	9	13	14	13	14

Source: U.S. Navy, Office of Naval Intelligence, "Russian Strategic and General Purpose Nuclear Submarine Patrols, 1991-1996," letter 26 March 1997, released under the Freedom of Information Act.

As for the Navy's nuclear future, Russia laid the keel of the first of a newer *Borey*-class SSBN, the *Yuriy Dolgorukiy*, on November 2, 1996.[44] This and other *Borey*-class boats will reportedly carry 12 or 16 missiles each armed with up to 10 or 8 warheads respectively.[45] A new SLBM under development for the submarine, the SS-NX-28, is currently undergoing land-based research and development flight testing, and the first Typhoon hull has been modified as a test platform.[46] If funding continues for the submarine, the U.S. estimates it will become operational in 2004–2005.[47] Yet current financing suggests the construction of this and additional submarines will proceed more slowly. Thus, the Russian SSBN force will likely consist of some 10-15 SSBNs by the middle of the next decade.[48]

The fleet of nuclear-capable Oscar and Charlie cruise missile submarines(SSGNs) and Akula, Sierra, and Victor attack submarines (SSNs) is in the same poor condition as the SSBN force. Oscar and Akula production is being completed and construction of the first of the new *Severodvinsk*-class SSN is proceeding slowly. According to Admiral Aleksin, "Since 1991, we have laid the keel for only one SSN, the *Severodvinsk* and one SSBN, the *Yuri Dolgoruki*."[49] The schedule for any further *Severodvinsk*-class submarine construction is unclear. The *Severodvinsk* keel was laid in late 1993, but it may only enter the fleet in 2002.[50] Since the *Severodvinsk* boat will reportedly have the ability to fire anti-ship cruise missiles (like their American counterparts)[51] it is thought that no follow-on to the dedicated Oscar-class and other SSGNs will materialize.

The Air Forces (VVS) include the bomber force assigned to Strategic Air Armies (including Tu-95 Bear G/H and Tu-160 Blackjack strategic bombers) and tactical ("frontal") aviation of the military districts, made up of Backfire and Fencer nuclear-capable bombers, and lesser dual- capable Flogger and Fitter ground-attack aircraft. Older Badger and Blinder medium bombers are no longer thought to be nuclear capable.

Strategic Air is organized into divisions and subordinate regiments. Air-delivered nuclear weapons include gravity bombs, air-to-surface and air-launched cruise missiles. Though Backfire and Fencer units are all considered to be fully nuclear "certified," it is believed that nuclear weapons are only stored at the strategic bomber bases on a regular basis. Other nuclear weapons belonging to frontal aviation are believed to be stored at12th Directorate main sites and VVS regional sites serving several bases.

The Ground Forces (SV) or Army, the largest of the five services, was once in control of nuclear-armed tactical missiles, nuclear artillery, and atomic land mines. But the 1991 unilateral initiatives have now lead to the denuclearization of this armed service.

The Ministry of Atomic Energy (Minatom) (somewhat equivalent to the U.S. Department of Energy) is responsible for the research, development, and production of nuclear warheads, as well as the transportation, security, dismantlement and disposal of nuclear materials. The Minister sits on the Security Council. The main nuclear weapons laboratory is the All-Russian Scientific Research Institute of Experimental Physics (VNIIEF) located in Sarov, and often called by its old Soviet code name Arzamas-16. VNIIEF is the Russian equivalent to the Los Alamos National Laboratory. The second lab, equivalent to the U.S. Lawrence Livermore National Laboratory, is the All-Russian Scientific Research Institute of Technical Physics (VNIITF) in Snezhinsk, often called Chelyabinsk-70.

Warhead assembly, disassembly and storage takes place at the following facilities:

Location	**Facility**	**Warhead Work**
Arzamas-16	Avangard Electromechanical Plant	dis/assembly (Sarov, Nizhniy Novgorod Oblast)
Sverdlovsk-45	Electrokhimpribor Plant	dis/assembly (Lesnoy at Nizhnyaya Tura)
Penza-19	Production Association Start	dis/assembly (Zarechnyy at Kuznetsk)
Zlatoust-36	Priborostroitelyny Zavod	dis/assembly (Trekhgornyy at Yuryuzan)

Minatom is believed to operate a number of storage sites in close proximity to these facilities, both for the storage of warheads, materials, and "pits" from dismantled warheads. Eight additional Minatom facilities of the defense complex also produce and/or store nuclear materials (Krasnoyarsk-26/Zheleznogorsk, Krasnoyarsk-45/Zheleznogorsk, Chelyabinsk-65/Ozersk (Mayak Production Association), Sverdlovsk-44/Novouralsk, Tomsk-7/Seversk, the Special Scientific and Production State Establishment (ELERON), the All-Russian Scientific Research Institute of Automatics (VNIIA), and the Bochvar All-Russian Scientific Research Institute of Inorganic Materials.[52]

Like the United States, Russia has a nuclear weapons accounting system where the location of each nuclear warhead is registered at all times. Each weapon is given a "personal number, and a technical maintenance log and record are filled out in which an accounting of all operations performed is kept and an evaluation of [its] condition is made."[53] At least two copies of this record or "formula" are supposed to exist, one in the Ministry of Defense and one with the unit having the weapon.

Activities concerning nuclear weapons are governed by a "three-person" rule, where the actions of one or two are monitored by a third.[54] At storage sites, each special container for the nuclear warhead has the last name of the person responsible for it stenciled onto it, along with the date it was put into storage, and the time period for standard maintenance. Any movement of the weapon must be done with the party responsible for it present.[55] The 12th Main Directorate is responsible for keeping overall track of the warheads, and an accounting of the entire stockpile is held every six months[56] and the inventory of Minatom is harmonized with the 12th GUMO annually.[57] At the service level, as noted, a 6th Directorate operates, performing the same function for the service. Although there has been concern expressed about the need to upgrade the 12th Directorates computer system,[58] at least in the Strategic Rocket Forces, a computer system allows the tracking of every weapon under the control of the service on a daily basis.[59]

In addition, a separate institution within the Ministry of Defense, the Nuclear Safety Inspectorate conducts two types of inspections to insure control and accounting: regular inspections to count warheads, look inside storage canisters, and examine the administrative records of units controlling nuclear weapons, and surprise inspections. Surprise inspections are both surprises to the inspectors and to the unit involved as both are given little or no advance notice. During the surprise inspections, technical records are checked (e.g., tapes which record the opening and closing of doors) and these are subsequently compared to the paper records to make sure all is accounted for.

As a result of claims made by former Secretary of the Security Council Aleksandr Lebed in September 1997 that atomic land mines were possibly missing from the Russian inventory, the Russian government made a number of candid announcements regarding the state of weapons dismantlement and security, insisting that all nuclear weapons were securely stored and accounted for as of the end of 1997.[60]

Nuclear Weapons Deployments

Russian nuclear weapons are estimated to be deployed at 90 storage sites (see Table 12). After nuclear warheads are produced at the Minatom production plants, they are transferred to the custody and control of the MOD 12th Main Directorate, which then further transports the warheads to Directorate or service storage sites. Warheads being sent to Minatom for dismantlement go through the same process in reverse.[61] During the Cold War, with the exception of ICBMs, SLBMs, ABM missiles and some strategic level SAMs, and tactical naval weapons at sea, Soviet nuclear weapons were not routinely mated to delivery systems but were stored at depots or exclusion areas within large military bases.[62]

The CIA in 1995 estimated that there were some 500 nuclear storage facilities in the Soviet Union before it broke up.[63] By 1995, the head of the 12th Directorate claimed that Russia had reduced the number of nuclear-capable bases by over 250.[64] In 1996, he declared the number of nuclear storage facilities in Russia had declined to one-third of their 1991 levels.[65] More recently, U.S. and Russian officials have stated off the record that some 100 sites remain.

Reductions of nuclear storage sites have resulted from the closure of many depots at tactical air bases and naval facilities, the denuclearization of ground forces units and the closure of Army nuclear storage sites, the removal of nuclear weapons from virtually all dispersed air defense facilities, and the elimination of external Groups of Forces and armies (ground and air) located in Eastern Europe

TABLE 12

Estimated Russian Nuclear Weapons Sites by Military District, 1998

Military District (MD)/Forces	Storage Sites			Estimated Warheads*
	National/ MINATOM	"Auxilliary" and Service	Object "S"	
Northern MD				
Strategic Forces		4		1500
Air/Missile Defense		2		200
Aviation		3		600
Tactical Navy		4		500
Subtotal	**0**	**13**	**3**	**2800**
Moscow MD				
Strategic Forces		4		550
Air/Missile Defense		7		350
Aviation		3		350
Subtotal	**2**	**14**	**3**	**1250**
North Caucasus MD				
Strategic Forces		0		0
Air/Missile Defense		1		50
Aviation		2		200
Army		1		0
Subtotal	**0**	**4**	**1**	**250**
Volga MD				
Strategic Forces		4		1800
Air/Missile Defense		1		100
Aviation		1		100
Army		1		0
Subtotal	**2**	**7**	**1**	**2000**
Ural MD				
Strategic Forces		4		700
Air/Missile Defense		1		100
Aviation		1		100
Subtotal	**1**	**6**	**1**	**900**
Siberian MD				
Strategic Forces		6		1000
Air/Missile Defense		2		150
Aviation		1		100
Army		1		0
Subtotal	**0**	**10**	**1**	**1250**
Transbaikal MD				
Strategic Forces		3		60
Air/Missile Defense		1		50
Aviation		1		100
Army		1		0
Subtotal	**0**	**6**	**1**	**210**
Far East MD				
Strategic Forces		3		850
Air/Missile Defense		2		200
Aviation		2		450
Tactical Navy		5		300
Subtotal	**0**	**12**	**2**	**1800**
Total	**5**	**72**	**13**	**~10,500**

* Operational warheads, numbers are rounded and may not match with Table 10.

and the 14 non-Russian republics. Russian nuclear warheads are today presumed to be stored at four different classes of facilities:

- In national facilities near production and dismantlement sites controlled by Minatom or the 12th Directorate,
- At so-called Object "S" central sites controlled by the 12th Directorate,
- At "Auxiliary" central storage sites controlled by services' 6th Directorates,
- At depots for frontline (strategic forces) units controlled by the services.

National and Object S depots controlled by the 12th Directorate are next to the production plants and in central Russia. Auxiliary central storage sites controlled by the services are regionally dispersed to be nearer concentrations of nuclear-capable platforms. Depots for frontline units exist closer to the delivery systems they are meant to supply. The location and type of such storage sites, however, depends on the type of service and delivery platform involved. As a result of the 1991 unilateral initiatives, it is thought that all tactical weapons have been withdrawn from unit-level depots and moved to auxiliary service storage or 12th Directorate controlled central storage sites.

During the Cold War, Soviet nuclear warheads were stored at highly secure special depots or exclusion areas within large military bases. With the exception of ICBMs and SLBMs, they were not routinely mated to delivery systems.[66] The main depots have always been thought to be both at the national level (in the Moscow region and near the production plants) and assigned to services in each of the Military Districts (and formerly in the Armies and Tactical Air Armies).

For the Air Force, long-range (and perhaps medium-range bombers) have their nuclear weapons stored at or near their bases. During the Cold War, however, nuclear weapons were not stored with Frontal Aviation units in the Soviet Union but were kept at separate auxiliary storage depots which serviced several regiments in the area. For the Navy, prior to 1991-92 weapons were routinely deployed—i.e., stored with frontline units—on ships and submarines. Auxiliary storage sites ashore, controlled by the Navy's 6th Directorate, handled both tactical and strategic nuclear weapons and were located near major fleet and naval aviation concentrations in the North, Far East, Baltic and Black Sea areas. For the Air Defense Forces, auxiliary storage probably always existed to service a region, while depots for frontline units existed near air defense missile concentrations. Today these storage sites are significantly fewer in number. For the Ground Forces, auxiliary storage sites probably existed to service a region, Army or Group of Forces, while front line depots existed near nuclear capable units (particularly in Eastern Europe and the western USSR). For the RSVN, storage with frontline units, like the Navy, meant actual deployment on ICBMs. An auxiliary level storage site was associated with each main operating base and with Rocket Armies. Today the service is thought to operate auxiliary central storage sites at each of the four remaining Armies.

In terms of central storage, some 20 national-level storage sites were said to exist in 1992.[67] The number may be lower now as many have been closed.[68] These sites were previously throughout Russia and several other republics. Of those that remain, major ones are thought to be near or even collocated with the assembly and dismantlement sites at Arzamas-16 (Sarov), Sverdlovsk-45, and Zlatoust-36. Sverdlovsk-45 serves as one of the larger weapons storage sites in Russia.[69] Tomsk and Chelyabinsk are also mentioned as warhead destruction facilities, implying some whole warhead storage (vs. dismantled warhead storage) is there.[70]

As for the storage of nuclear weapons assigned to the strategic nuclear forces today, there are 19 ICBM main operating bases (divisions) and four bomber bases (Engels, Ukrainka, Ryazan, and Mozdok) that have their own storage sites. Reportedly nuclear weapons for the strategic bombers based at Mozdok were removed several years ago due to the political turmoil in the region.[71] Naval strategic and tactical nuclear weapons are kept within the same Navy auxiliary storage sites, and thus could be in any of the several sites associated with Fleet concentrations in the North and Pacific. Separate auxiliary and auxiliary storage sites likely also exist for the anti-ballistic missile facilities in the Moscow region.

As for tactical nuclear weapons, all "operational" non-strategic nuclear weapons–numbering approximately 4000 warheads–are believed to be stored in 12th Directorate Object S sites or in service controlled central auxiliary sites assigned to each of the military districts.

* * *

The Russian Military Districts (MD) remain responsible for raising, training, and equipping general purpose forces in their respective areas. Sixteen Soviet-era MDs have been consolidated into eight in Russia: Northern, Moscow, North Caucasus, Volga, Ural, Siberian, Transbaikal, and Far Eastern. Each has a higher level Army formation as well as a Tactical Air Army (and some have naval task forces) which are presumed to exercise command and control of nuclear non-strategic assets in wartime.

The Northern MD with its headquarters in St. Petersburg, covers northwest Russia, the Kola peninsula, Arkangelsk and the St. Petersburg area. Some 2800 nuclear weapons are thought to be stored in some 16 facilities to support the Strategic Rocket Forces, Air Force non-strategic forces, Air Defense Forces, and Navy strategic and non-strategic forces. These facilities include three central "Object S" sites. An RSVN auxiliary storage site is associated with the Vypolzovo SS-25 ICBM base. Three auxiliary storage sites support the 76th Air Army and its two Backfire and Fencer regiments/divisions.[72] A couple of auxiliary storage sites may support the Air Defense forces in the MD.

Finally, the Navy has three strategic submarine bases in the military district, all located in the Northern Fleet and based on the Kola peninsula(the Ostrovnoy/Gremikha base is thought to host only retired SSBNs). Naval non-strategic forces are homeported at several bases in the Kola peninsula and near Arkangelsk. Two regiments of Backfires and Fencers are also assigned to Northern Fleet Naval Aviation, their weapons in naval auxiliary depots. Since the Russian Navy co-locates strategic and tactical nuclear weapons in the same storage facilities, seven nuclear storage sites are estimated to exist, four on the Kola peninsula, one near Arkangelsk, and two near St. Petersburg (to store weapons removed from the Baltic Fleet).

The Moscow MD, covering the area around Moscow up to the borders of Belarus and Ukraine, has a heavy nuclear emphasis on anti-ballistic missile (ABM) installations and surface-to-air fixed sites defending the capital. Some 1250 nuclear weapons are thought to be stored in some 19 facilities to support the Strategic Rocket Forces, Air Force strategic and non-strategic forces, Strategic Defense Forces, and Air Defense Forces in the MD. These facilities include two national and three central "Object S" sites, one or two of which are associated with the Arzamas-16 production facility and laboratory. An RSVN auxiliary storage site is associated with the Teykovo SS-25, Kozelsk SS-

19, and Kostroma SS-24 bases. Four auxiliary Air Force storage sites are estimated to exist to support the Ryazan Bear G strategic bomber base and at least two Backfire and Fencer regiments/ divisions in the MD. Up to seven auxiliary storage sites may support the Air Defense forces in the region, four of which are believed to support the Moscow ABM system.

The North Caucasus MD, with headquarters in Rostov, covers the Caucasus area south of the Moscow and Volga MDs to the north. Some 250 nuclear weapons are thought to be stored in five facilities to support the Air Force non-strategic forces and Air Defense Forces in the MD. These facilities include perhaps one central "Object S" site in Rostov. Two Air Force auxiliary sites may exist to support the Air Force units in the MD (one bomber division of Su-24 Fencers is stationed in the area). One auxiliary storage site may support the Air Defense forces in the region. Also, an Army auxiliary storage site may exist to support any remaining Army nuclear weapons in the region that are awaiting dismantlement.

The Volga MD, with headquarters at Kuybyshev/Samara, extends to the east from Moscow to about the Ural Mountains. An estimated 1800 nuclear weapons are stored in 10 facilities supporting the Strategic Rocket Forces, Air Force strategic and non-strategic forces, Air Defense Forces, and weapons production facilities. These facilities include three national and central "Object S" sites, two of which are associated with the Zlatoust-36 and Penza-19 weapons assembly/disassembly plants. An RSVN auxiliary storage site is associated with the Yoshkar-Ola SS-25 base, the Tatischevo SS-19 and SS-24 bases, and the Dombarovskiy SS-18 base. Two Air Force auxiliary storage sites are estimated to exist to support the Engels Blackjack strategic bomber base and any other non-strategic aviation in the MD. One auxiliary storage site may support the Air Defense forces in the region. Also, an Army auxiliary storage may exist to support any remaining Army nuclear weapons in the region that are awaiting dismantlement.

The Ural MD, with headquarters in Yakaterinburg, extends east of the Volga MD. Some 700 nuclear weapons are estimated to be stored in eight facilities supporting the Strategic Rocket Forces, Air Force non-strategic forces, Air Defense Forces and weapons production facilities. A RSVN auxiliary storage site is associated with the Kartaly SS-18 base, the Yurya and Nizhniy Tagil SS-25 base, and the Bershet SS-24 base. One Air Force auxiliary storage site is estimated to exist for the air forces in the MD (a regiment of Su-24 Fencers may be based in the MD). One auxiliary storage site may exist to support the Air Defense forces in the region. And at least one central "Object S" site is thought to be associated with the Sverdlovsk-45 assembly/disassembly plant.

The Siberian MD, with a headquarters at Novosibirsk, is east of the Ural MD and extends almost to Lake Baikal. Some 1250 nuclear weapons are estimated to be stored in 11 facilities supporting the Strategic Rocket Forces, Air Force non-strategic forces, and Air Defense Forces in the MD. An RSVN auxiliary storage site is associated with the Novosibirsk, Barnaul, and Kansk SS-25 bases, the Aleysk and Uzhur SS-18 bases, and the Krasnoyarsk SS-24 base. One Air Force auxiliary storage site is estimated in the MD. Up to two auxiliary storage sites may support the Air Defense forces in the region. Also, an Army auxiliary storage site may exist to support any remaining Army nuclear weapons in the region that are awaiting dismantlement

The Transbaikal MD, with its headquarters at Chita is to the east of the Siberian MD and west of the Far East MD. Some 210 nuclear weapons are estimated to be stored in seven facilities supporting the Strategic Rocket Forces, Air Force non-strategic forces, and Air Defense Forces in the MD as well

as the Chita Rocket Army. An RSVN auxiliary storage site is associated with the Drovyanaya and Irkutsk SS-25 bases. One Air Force auxiliary storage site is estimated to exist for the air forces in the MD (both Su-24 Fencers and Backfire bombers reportedly have been based in the MD). One auxiliary storage site may support the Air Defense forces in the region. Also, an Army auxiliary storage site may exist to support any remaining Army nuclear weapons in the region that are awaiting dismantlement.

The Far East MD, with headquarters at Khabarovsk, is located east of the Siberian MD and includes the Kamchatka peninsula. Some 1800 nuclear weapons are estimated to be stored in 14 facilities supporting the Air Force strategic and non-strategic units, Air Defense Forces, and Navy strategic and non-strategic forces. These storage facilities include two central "Object S" sites. An Air Force auxiliary storage facility is associated with the Ukrainka Bear H strategic bomber base in the Amur Oblast, and another two are estimated to support Air Force tactical aviation in the MD (two Air Force bomber divisions of Su-24 Fencers). Two auxiliary storage sites may support the Air Defense troops in the MD.

The Navy has two strategic nuclear submarine bases in the MD, one at Rybachiy near Petropavlovsk and another at Pavlovsk near Vladivostok. However, the Pavlovsk base holds decommissioned submarines, or older submarines on the verge of retirement. Also, nuclear capable non-strategic naval forces in the Far East MD are extensive and widely dispersed. A significant number of major nuclear capable surface ships and attack and cruise missile submarines are assigned to the Pacific Fleet. Six major homeports are believed to exist: Vladivostok, the Strelok/Abrek Bay/Pavlovsk complex, Nahodkha, Sovetskaya Gavan, Magadan, and Petropavlovsk/Rybachiy. Naval aviation includes a regiment of Su-24 Fencers and one of Backfire bombers (at Alekseyevka). Since the Russian Navy co-locates strategic and tactical nuclear weapons in the same storage facilities, five storage sites are estimated to exist, two on Kamchatka, one in the Khabarovsk Kray, and two in the Primorskiy Kray, to support the Pacific Fleet.

Britain

THE BRITISH NUCLEAR STOCKPILE is estimated to be approximately 260 warheads of two types (some 160 Trident submarine-launched ballistic missile (SLBM) warheads and 100 WE177 tactical aircraft bombs). Very shortly, at the end of March 1998, there will be only one type (Trident II) when the last gravity bombs are retired (see Table 13). The entire stockpile is currently stored at three, possibly four facilities, and will be at just two when the final post-Cold War consolidations are fully implemented.

TABLE 13

British Nuclear Forces, 1998

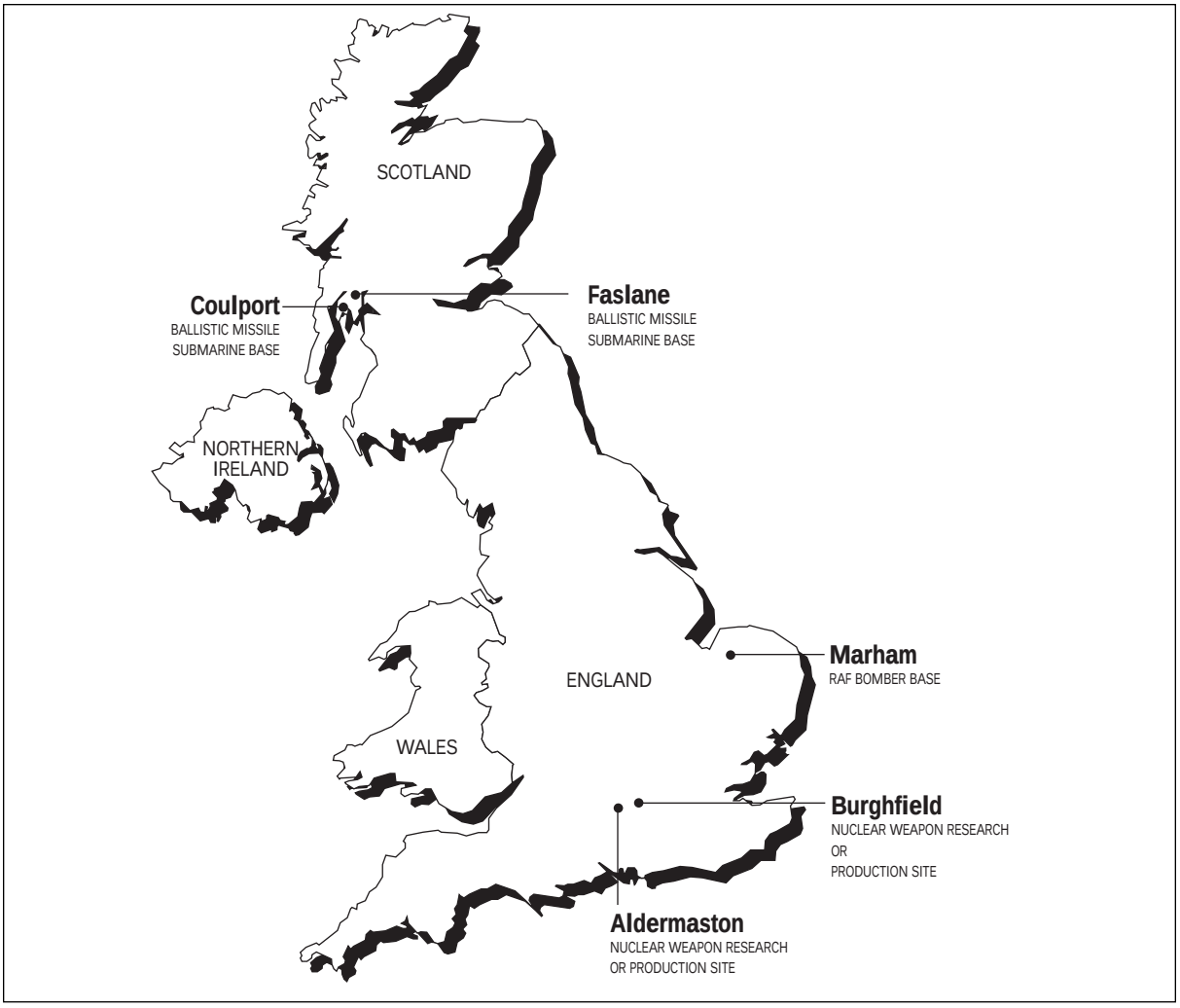
Type	Designation	No. deployed	Year first deployed	Range (km)	Warheads x yield	Warheads
Aircraft						
GR-1/1A	Tornado	96	1982	1300	1-2 x 200-400 kt	100
SSBNs/SLBMs						
D5	Trident II	32	1994	7400	4-6 x 100 kt	160

The retirement of the WE177 is the culmination of almost a decade of dramatic changes in the composition and deployment of British nuclear forces. Britain was already in the process of reducing the nuclear roles of its Army at the end of the Cold War. These were all weapons (artillery and rockets) supplied by the United States. Following the Bush-Gorbachev initiatives of September-October 1991, British Secretary of State Tom King announced that Britain would "no longer routinely carry nuclear weapons on our ships." In June 1992, the Defence Minister took a further step announcing that all naval tactical nuclear weapons had been removed from surface ships and aircraft, that the nuclear mission would be eliminated and that the "weapons previously earmarked for this role will be destroyed." Britain eliminated its land-based Army nuclear role, its tactical naval nuclear weapons capability, and (by the end of March) its strategic air, and tactical air, land attack missions.

The British Prime Minister is the ultimate authority over the use of British nuclear weapons. British nuclear weapons are researched, produced, and controlled by the Ministry of Defence (MOD), under the overall supervision of the Chief of the Defence Staff and the Permanent Secretary. Though nuclear weapons are currently deployed with the Royal Air Force (RAF) and Royal Navy (RN), very shortly only the RN will have nuclear weapons. The Atomic Weapons Establishment (AWE), an organization of the MOD, is the British equivalent of the Department of Energy's defense programs. Nuclear warheads are designed by the AWE at Aldermaston and assembled and disassembled at Aldermaston and Burghfield.

The remaining WE177 bombs in the operational inventory are believed to be stored at RAF Marham, Norfolk. Nine Tornado GR.1/1A strike aircraft squadrons were capable of nuclear operations at the end of the Cold War. Two squadrons were located at Marham, and seven were forward deployed in Germany. The two U.K.-based Tornado strike squadrons (nos. 27 and 617) operated as part of NATO SACEUR's Strategic Reserve (Air). The German-based nuclear capable Tornadoes, located at RAF Laarbruch and Bruggen, consisted of squadron nos. 9, 14, 17, and 31 (at Bruggen) and squadron nos. 15, 16, and 20 (at Laarbruch). As a result of the end of the Cold War and budget pressures in the early 1990s, four squadrons were withdrawn from RAF Laarbruch, leaving only a forward nuclear capability at Bruggen. These were denuclearized in the 1996-1997 time period as part of the retirement of the WE177.[73]

British Nuclear Deployments



The Royal Navy (RN) currently possesses two operational ballistic missile submarines. Britain originally built and deployed four Resolution-class SSBNs, commonly called Polaris submarines for the missiles they carried. The first boat (HMS *Resolution*) went on patrol in mid-June 1968, the fourth (HMS *Revenge*) in September 1970.[74] Today construction, training, testing, and sea trials continues with the $18.8 billion Vanguard-class ballistic missile submarine (SSBN) program. Designed and built by Vickers Shipbuilding and Engineering, each Vanguard-class boat displaces some 16,000 tonnes, about twice as much as the Polaris/Resolution-class SSBNs they replace. Each carries sixteen U.S. produced Trident II D-5 Submarine Launched Ballistic Missiles (SLBM).

The first submarine of the class, the HMS *Vanguard*, went on its first patrol in December 1994. The second, HMS *Victorious* entered service in December 1995. The third, HMS *Vigilant* was launched in October 1995 and will enter service in the summer or fall of 1998. The fourth and final boat of the class, HMS *Vengeance* is under construction. Its estimated launch date is 1998 with service entry in late 2000 or early 2001.

Not only will the Vanguard boats use the U.S. Trident II missile, but the American and British missiles are thought to be interchangeable. There is a pool of SLBMs at the Strategic Weapons

Facility Atlantic at the Kings Bay Submarine Base, Georgia. Britain has title to an eventual 70 missiles but it does not actually own them outright. Thus a missile that is deployed on a U.S. SSBN may at a later date deploy on a British one, or vice versa. When a Vanguard-class SSBN is ready to enter service it sails to Kings Bay, collects missiles and conducts one or two demonstration/shake-down test firings at the eastern missile range off Cape Canaveral, Florida. When ready to deploy it is loaded with a full complement of missiles, sailing back to the Royal Naval Armament Depot at Coulport where the nuclear warheads are mated.

British Trident II missiles carry a British-designed nuclear warhead, 160 of which are estimated to be in the stockpile today. As few as 40 and as many as 115 remain to be produced, depending on future plans. The first batch was completed in September 1992. The warheads are thought to be similar in size, shape, and yield to the U.S. W76 warhead. The estimate of 275 total warheads for the British Trident II program assumes that only enough warheads will be produced for three boatloads of missiles, a practice followed with Polaris as well (240 warheads for 48 missiles, assuming five warheads per missile, plus another ten percent for spares and maintenance).

As Britain settles on its single leg nuclear force, it is also implementing a program to assign a "sub-strategic" (tactical) mission to the Trident missile and submarine. This means that the number of nuclear warheads on operational missiles will likely be even lower for those vessels and missiles placed in the sub-strategic pool. A MOD official described the program as follows: "A sub-strategic strike would be the limited and highly selective use of nuclear weapons in a manner that fell demonstrably short of a strategic strike, but with a sufficient level of violence to convince an aggressor who had already miscalculated our resolve and attacked us that he should halt his aggression and withdraw or face the prospect of a devastating strategic strike."[75]

The sub-strategic mission has begun with HMS *Victorious* and, according to the 1996 White Paper, "will become fully robust when Vigilant enters service." The plan is to put a single warhead on some Trident II SLBMs and have them assigned to NATO-assigned targets once covered by WE177 gravity bombs (and presumably other targets for U.K. contingencies). For example, a submarine could be armed with 10, 12 or 14 of its SLBMs carrying an average of five warheads per missile, and the other two, four or six missiles armed with just one. There is some flexibility in the choice of yield of the British Trident warhead as well. (Choosing to only detonate the unboosted primary could produce a yield of one kiloton or less. Choosing to detonate the boosted primary could produce a yield of a few kilotons.) With the sub-strategic mission the submarine would have approximately 56-72 warheads on board during its patrol.

An elite component of the Royal Marines is responsible for guarding British nuclear weapons and ballistic missile submarines. Known as the Commachio Group, the unit was first formally activated in May 1980. The key naval installation they guard is the Royal Naval Armament Depot (RNAD) Coulport in Scotland, where British ballistic missile submarine (SSBN) missiles and warheads are stored. Commachio commandos escort the submarine out to open waters, ostensibly to protect it from terrorist attacks and anti-nuclear demonstrators.

The unit is named after Lake Commachio, north of Ravenna, Italy, where Royal Marine Tom Hunter won the Victoria Cross in World War II. Commachios were selected from Royal Marine commando units and the number eventually grew to number 350. Other missions that they have responsibility for include anti-smuggling operations and protection of U.K. oil rigs in the North Sea.

France

THE FRENCH STOCKPILE as of the beginning of 1998 is estimated to be approximately 450 warheads of three types, down from the historical peak of 538 warheads of XX types in 1991-1992 (see Table 14). By the year 2005, the stockpile will further decline to around 400 warheads of two types. The number of locations where French nuclear weapons are deployed has also decreased from more than a dozen military bases at the beginning of the 1990's to four today (Istres, Luxeuil, Ile Longue, and Landivisiau). Nuclear warheads are also presumably stored at the Valduc assembly/disassembly plant and the Centre d'Etudes de Limeil-Valentin (the Los Alamos laboratory of France).

TABLE 14

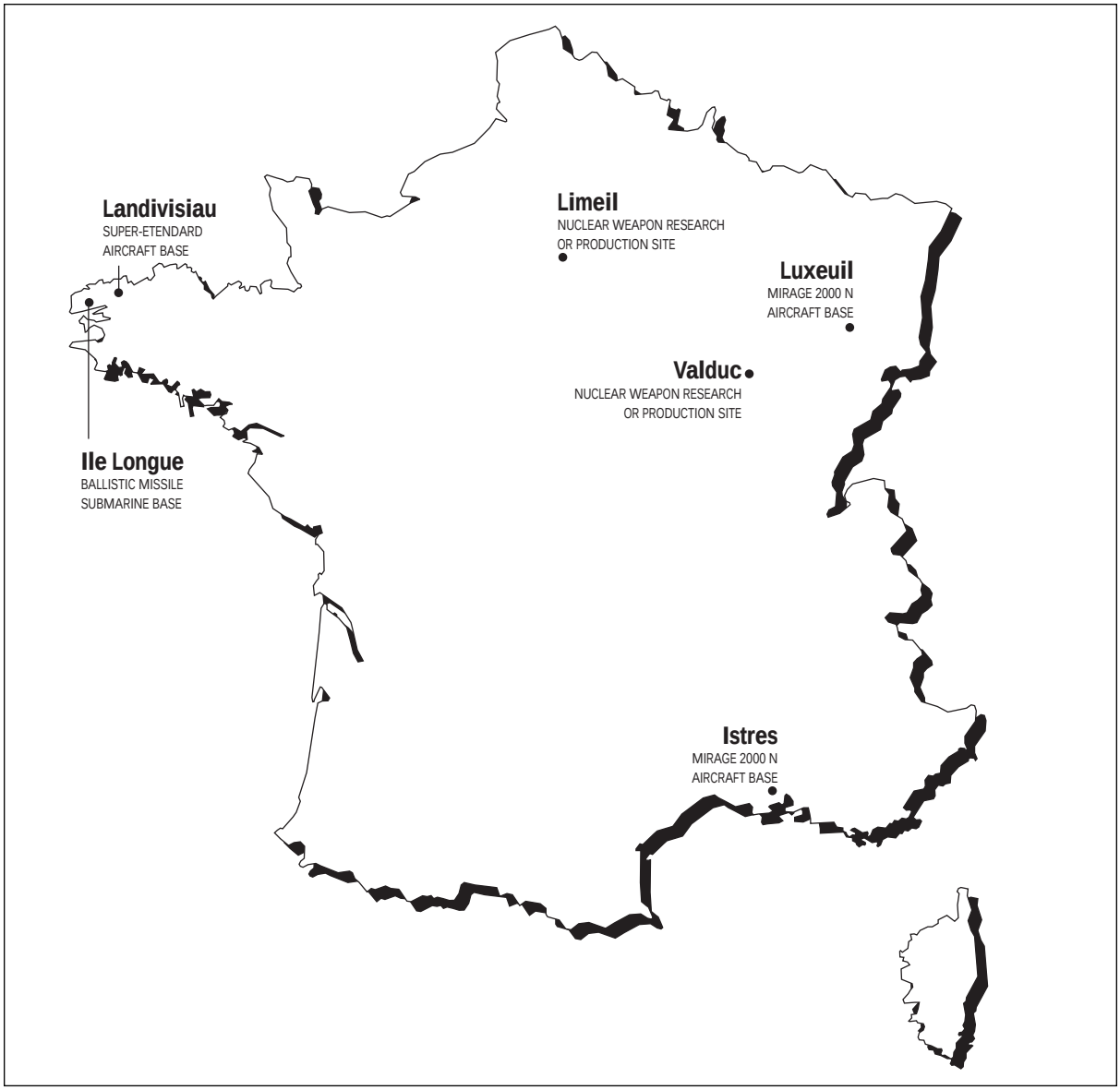
French Nuclear Forces, 1998

Type	No. deployed	Year first deployed	Range (km)	Warheads x yield	Warheads
Land-based aircraft					
Mirage 2000N/ASMP	45	1988	2750	1 x 300 kt ASMP	45
Carrier-based aircraft					
Super Etendard	24	1978	650	1 x 300 kt ASMP	20
SLBMs					
M4A/B	48	1985	6000	6 x 150 kt	288
M45	16	1996	6000	6 x 100 kt	96
Total					**450**

On February 22 and 23, 1996 President Chirac announced several dramatic reforms for French armed forces for the period 1997-2002. The most significant was the introduction of a professional armed force with the phasing out of conscription over a six year period, ending in 2001. The size of the armed forces will also decrease from almost 400,000 to 260,500. A number of decisions were announced in the nuclear area, resulting in the withdrawal of several obsolete systems. This was combined with a commitment to modernize those that remained. Already many of the programs announced in the early 1980's to increase the size of the French nuclear stockpile had been canceled, modified, or scaled back for budgetary and geopolitical reasons. Most recently, in May 1992 it was announced that the number of new *Triomphant*-class ballistic missile submarines (SSBN) would be reduced from six to four. Speculation that France might not even purchase a fourth boat was quelled, and Chirac stated that a new M51 SLBM would replace the current M45 in the 2010-2015 time period.

After consideration of numerous plans to replace the silo-based S3D IRBM during President Mitterrand's tenure, President Chirac announced that the venerable land-based missiles would be retired without a replacement. Thus on September 16, 1996 all 18 missiles on the Plateau d'Albion were deactivated. A two year effort is planned to fully dismantle the silos and the complex, at a cost of $77.5 million. President Chirac also announced that the short-range Hades missile would be dismantled and the regiment reassigned to other duties. Hades was to have replaced the Pluton, removed from service at the end of the Cold War. The original program called for 60 launchers and 120 missiles (and warheads). The initial regiment was activated at Suippes, in eastern France, on September 1, 1991. President Chirac announced that missiles and warheads for Hades were to be stored intact allowing them to be reintroduced if need be.

French Nuclear Deployments



Ultimate authority to use French nuclear forces rests with the President of France. Nuclear warheads are assembled and disassembled at the Centre d'Etudes de Valduc (the equivalent of the U.S. Pantex Plant), near Is-sur-Tille, 25 miles north of Dijon.

The centerpiece of France's current and future nuclear force is the ballistic missile submarine fleet. France currently possesses four SSBNs, three of the old class and one of the new *Triomphant* class. The lead SSBN of a new class, *Le Triomphant*, was rolled out from its construction shed in Cherbourg on July 13, 1993. It entered service in September 1996 armed with the M45 SLBM with new TN 75 warheads. The second SSBN of the class, *Le Temeraire* is under construction, and will be ready in 1999. The schedule for the third, *Le Vigilant* has slipped and will not be ready until 2001. The service date for the fourth is approximately 2005. Eventually there will be 288 warheads for the fleet of four new *Triomphant*-class SSBNs. Similar to British and historical practice, only enough missiles and warheads will be purchased for three boats.

New TN 75 warheads are currently being produced at Valduc. The TN 75 program began in 1987 and the warhead was tested numerous times up until July 1991 when explosive testing ceased. It is a miniaturized, hardened thermonuclear warhead, lighter than the current TN 71. It has a new coating material and a precisely computed shape to give it a better penetration capability during reentry. President Jacques Chirac said in June 1995 that a final certification test of the TN 75 would be needed, one of the reasons he gave for resuming testing. It is likely that the October 1, 1995 test at Fangataufa with a reported yield of 110 Kt was a full scale test of the TN 75. Series production at Valduc probably began soon thereafter and will continue for the next five to seven years.

The French Air Force and Navy both fly nuclear capable airplanes, though in smaller numbers and fewer types than during the Cold War. Since 1990 the most significant development has been the retirement of the Mirage IVP "strategic" bomber, leaving two active types of aircraft configured to carry nuclear weapons: the Mirage 2000 N and Super Etendard.

The Mirage IV armed with 60 kiloton AN 11 gravity bombs assumed nuclear alert on October 1, 1964. And at peak strength–from 1966 to 1976–there were 36 front line bombers deployed in nine four-plane squadrons at nine separate bases. Beginning in 1967 the AN 22 parachute-retarded gravity bomb began to replace the AN 11. In 1988, modernized Mirage IVPs were armed with a newer *Air-Sol-Moyenne-Portee* (ASMP) supersonic air-to-surface missile. In July 1996, after 32 years of service, the Mirage IVP relinquished it nuclear role and was retired.

The Mirage 2000 N was deployed in 1988 to supplement the strategic force. Initially, 75 aircraft in five squadrons were committed to nuclear missions, but this number was scaled back in 1989 to 45 aircraft in three squadrons. On 11 September 1991, President Mitterrand announced that the AN 52 "tactical" gravity bomb, once carried by older Mirage IIIEs, Jaguar As and naval Super Etendards, had been withdrawn from service. This consolidated the non-strategic bombing role on the ASMP missile, and with the retirement of the Mirage IVP, transferred the strategic role to the Mirage 2000 Ns. Today there are 45 ASMPs with two Mirage 2000N squadrons at Luxeuil and one at Istres. The 15 ASMPs deployed with the now retired Mirage IVP at Mont-de-Marsan and Cazaux were likely redistributed to Luxeuil and Istres. President Chirac stated in February 1996 that a longer-range ASMP (500 km vs. 300 km, sometimes called the "ASMP plus") will be developed for service entry in about a decade.

The Navy's Super Etendard carried-based fighter-bomber achieved a nuclear capability in 1981 with the AN 52 bomb, and was also converted to the ASMP missile starting in 1989. The Super Etendard flies from a single aircraft carriers, the *Foch*. The *Clemenceau* (which entered service in 1961) was originally modified to handle the AN 52 nuclear gravity bomb with Super Etendard aircraft in 1979, but after the bomb was retired in July 1991, only the *Foch* was modified to "handle and store" the replacement ASMP. The *Foch* is only two years younger than the *Clemenceau*; approximately 20 ASMPs are allocated for two squadrons--approximately 24 Super Etendard aircraft. The new aircraft carrier *Charles de Gaulle* is scheduled to enter service in December 1999, three years behind schedule, and will be home ported at Landivisiau. At that time the *Foch* will be laid up. The *de Gaulle* will have a single squadron of Super Etendard (with presumably about 10 ASMPs) until the Rafale M is introduced in 2002. Rafale M will replace the Super Etendard completely in the nuclear role beginning in about 2005. An Air Force Rafale D with a nuclear strike role will be introduced in approximately 2005, also carrying the ASMP or the ASMP-plus.

China

WE ESTIMATE THAT CHINA maintains an arsenal of about 400 warheads of two basic categories: some 250 "strategic" weapons structured in a "triad" of land-based missiles, bombers, and submarine-launched ballistic missiles; and some 150 "tactical" weapons--presumably lower yield bombs for tactical aircraft, artillery shells, atomic demolition munitions, and possibly short range missiles such as the DF-15 (CSS-6) or the DF-11 (CSS-7), better known by their export names M-9 and M-11, respectively (see Table 15). The stockpile is believed to be deployed at about 20 locations (see Appendix H) under the control of the Central Military Commission.

TABLE 15

Chinese Nuclear Forces, 1998

Type	NATO Designation	No. deployed	Year first deployed	Range (km)	Warheads x yield	Warheads
Aircraft*						
H-6	B-6	120	1965	3100	1- 3 bomb	120
Q-5	A-5	30	1970	400	1 bomb	30
Land-based missiles**						
DF-3A	CSS-2	50	1971	2800	1 x 3.3 Mt	50
DF-4	CSS-3	20	1980	4750	1 x 3.3 Mt	20
DF-5A	CSS-4	7	1981	13,000+	1 x 4-5 Mt	7
DF-21A	CSS-6	36	1985-86	1800	1 x 200-300 kt	36
DF-31	CSS-?	0	Late 1990s?	8000	1 x 200-300 kt	?
DF-41	CSS-?	0	2010?	12,000	MIRV	?
SLBMs						
Julang-1	CSS-N-3	12	1986	1700	1 x 200-300 kt	12
Julang-2	CSS-N-4	0	Late 1990s	8000	1 x 200-300 kt	?
Tactical Weapons						
Artillery/ADMs, Short-range missiles					low kt	120
Total						**400**

* All figures for bomber aircraft are for nuclear-configured versions only. Hundreds of aircraft are also deployed in nonnuclear versions. The Hong-5 has been retired and the Hong 7 will not have a nuclear role. Aircraft range is equivalent to combat radius. Assumes 150 bombs for the force, with yields estimated between 10 kt and 3 Mt.

** The Chinese define missile ranges as follows: short-range, < 1000 km; medium-range, 1000-3000 km; long-range, 3000-8000 km; intercontinental range, > 8000 km. The nuclear capability of the M-9 is unconfirmed and not included.

The use of the term "strategic" in the Chinese case needs some qualification. China has only a handful of missiles able to go intercontinental distances with about 100 other missile with ranges from 1800 to 4750 kilometers. The bomber force, normally considered part of strategic forces, could not go great distances.

Information on Chinese tactical nuclear weapons is limited and contradictory, and there is no confirmation from official sources of their existence. China's initial interest in such weapons may have been spurred by worsening relations with the Soviet Union in the 1960s and 1970s. Several low yield nuclear tests in the late 1970s, and a large military exercise in June 1982 simulating the use of tactical nuclear weapons, suggests that they have been developed. Recently the Taiwanese Defense Minister has specifically referred to nuclear capable "M Missiles" (M-9 and M-11), both deployed in the south.[76]

One feature of all Chinese weapon system programs is that it takes a long time for a missile, submarine or bomber to enter service. From initial research through development and testing to deployment can take a decade or two, by which time the system is also largely obsolete by American standards. Thus it is important to keep China's military modernization and nuclear forces in perspective. As one close observer of China, has recently written,

> *It is important . . . not to confuse ambition with capability–the PLA's doctrinal desires at present stand in sharp contrast to its severely limited capabilities. The PLA's current weapons inventory remains 10 to 20 years or more behind the state of the art in almost all categories, although some gaps are being closed.*[77]

A recent Pentagon report to Congress is worth quoting at some length:

> *Chinese statements and actions support the theory that China will continue to emphasize economic growth and economic modernization, rather than military might, as a foundation for national greatness. As an emerging great power, China will probably build its military power to the point where it can engage and defeat any potential enemy within the region with its conventional forces and can deter any global strategic threat to China's national security. Evidence suggest, however, that China will develop her military strength at a measured pace. A more rapid or large-scale military build-up is seen by the Chinese leadership as unnecessary and detrimental to continued economic growth.*

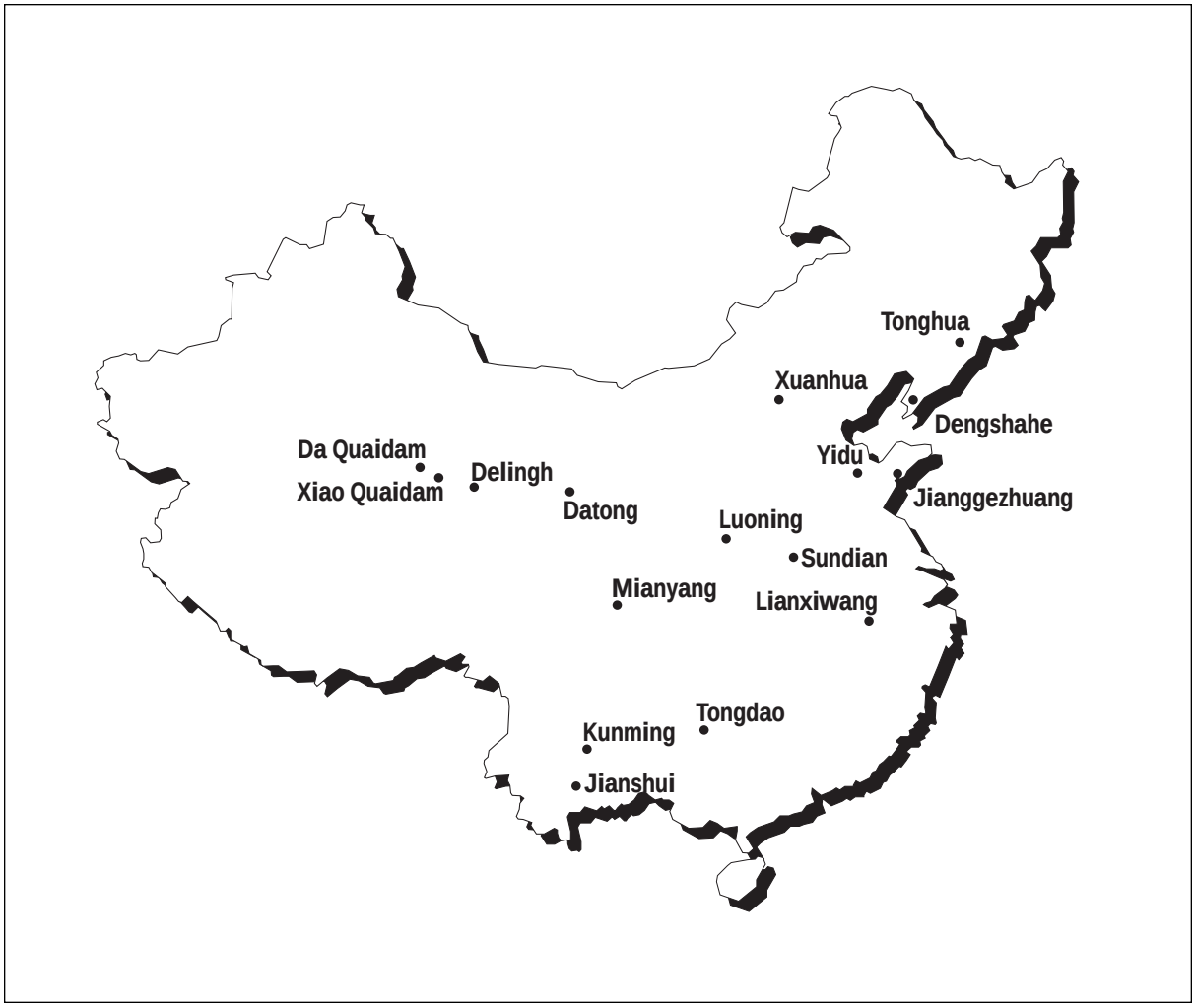
The Chinese military, the Pentagon says, will probably focus on three components in the future: small high-tech forces for flexible use in regional contingencies; large low-tech and medium-tech forces for internal security and reinforcement in defense of the homeland; and modest levels of strategic nuclear forces "to maintain a viable deterrent against other nuclear powers."[78]

The size of China's military and nuclear budget is also extremely difficult to calculate. Many Western experts multiply the "official" figure three to four times, using various methodologies, to arrive at an estimate, since it is assumed that not all military expenditures are included. Another scholar, using Chinese sources, concludes that the total military budget is only slightly higher (about 1.2 times) than the official public figure.. Nevertheless a broad group of experts concur that the budget is probably in the $28 to $36 billion range.[79] To put it in some perspective this is seven to nine times smaller than the U.S. military budget.

The mainstay of Chinese nuclear forces is the ballistic missile. Land-based versions vary in range from 1700 to 13,000 kilometers, with only a handful capable of hitting targets in North America. More advanced systems have long been under development with emphasis on improved accuracy and guidance, increased range, mobile launch platforms, solid fuel technology, and multiple warheads.

Currently, China has four types of nuclear-capable ballistic missiles (DF-21, DF-3, DF-4, and DF-5). The DF-4 (CSS-3) is a fixed long-range ballistic missile deployed at five main bases: Da Qaidam, Delingha, Sundian, Tongdao, and Xiao Qaidam. The DF-5A is an upgraded ICBM version deployed at Luoning and Xuanhua. Forty to fifty launchers of DF-3 MRBMs are deployed at Jianshui, Kunming, Yidu, Tonghua, Dengshahe, and Lianxiwang. The moble DF-21 (CSS-5) MRBM is replacing the DF-3 at some of the same sites (Tonghua, Jianshui, Lianxiwang) and the process is likely to continue to the other sites.

Chinese Nuclear Deployments



Not nearly as successful as the land-based systems has been the adoption of the ballistic missile at sea. China has only one operational Xia-class SSBN and technical difficulties with solid fuel for missiles and submarine nuclear reactors slowed the full development of this "leg" of its strategic triad. The single existing submarine was built at Huludao Naval Base and Shipyard in the northern Bohai Gulf and was launched in April 1981. It was finally deployed in January 1989 to the Jianggezhuang Submarine Base, where the nuclear warheads for its Julang-1 missile are believed to be stored. The Xia SSBN, and the five Han-class SSNs (which may also be nuclear capable), have never sailed beyond their regional waters. No additional Xia-class SSBNs are projected to be built, but there is a replacement design under development.[80]

The Julang-1 SLBM on the Xia class remains China's first and only solid fueled ballistic missile. The missile underwent a series of flight tests between 1981 and 1984 and there was one successful at-sea launch from a Chinese-built, modified Soviet-designed Golf-class SSB in 1982. A second generation SLBM is under development. It seems unlikely that a future fleet will number more than four to six submarines.

The Chinese bomber force is antiquated, based on Chinese produced versions of 1950s-vintage Soviet aircraft. With retirement of the Hong-5, a redesign of the Soviet Il-28 Beagle medium bomber, the main bomber is the Hong-6, based on the Soviet Tu-16 Badger medium range bomber, which entered service with Soviet forces in 1955. Under a licensing agreement the Chinese began producing the H-6 in the 1960s. It was used to drop live weapons in two nuclear tests in 1965 and 1967. For more than a decade China has been developing a supersonic fighter-bomber, the Hong-7 (or FB-7) at the Xian Aircraft Company. The plane is not assessed to have a nuclear mission.

The modernization of the Chinese bomber force could also occur through adaptation of aircraft purchased from abroad. China purchased 26 Soviet/Russian Su-27 Flanker fighter in 1992 at a cost of $1 billion. These aircraft are currently with the 3rd Air Division at Wuhu airfield, 250 kilometers west of Shanghai. Under a new agreement Russia intends to sell production rights to China to assemble and produce Su-27s in China. The Su-27 does have an air-to-ground capability though there is no evidence that the PLAAF is modifying it, at this time, for a nuclear role. Many reports of purchases or licensed manufacturing of other types of Russian aircraft (e.g., MiG-31, Tu-22M, and Su-25) remain unsubstantiated.

Endnotes

[1] This includes South Korea and Guam; Warsaw Pact members Bulgaria, Czechoslovakia, East Germany, Hungary, and Poland; and former Soviet republics of Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Khirgizia, Latvia, Lithuania, Moldova, Tajekistan, Turkmenistan, Ukraine, and Uzbekhistan.

[2] For purposes of this report the dozens or hundreds of ICBMs that are satellited to U.S.Air Force Bases or Russian Strategic Rocket Base are not counted as storage locations.

[3] William M. Arkin and Robert S. Norris, *Taking Stock: U.S. Nuclear Deployments at the End of the Cold War*, (Washington, DC, August 1992).

[4] The actual dismantlement of the W56 Minuteman II warhead will take place at the Pantex Plant over a two period beginning in March 1998.

[5] "Nuclear bomb delivery equipment has been removed;" Steven Komarow, "Deployment of B-1s Marks New Strategy, " *USA Today*, November 24, 1997, p. 1.

[6] Robert S. Norris and William M. Arkin, "Beating Swords into Swords, " *Bulletin of the Atomic Scientists*, November 1990, pp. 14-16.

[7] Text of statement by M.S. Gorbachev, "Gorbachev Proposals on Nuclear Arms Control," *Central Television, First All Union Programme,* 2040 GMT, October 5, 1991 (translated and transcribed by BBC Summary of World Broadcasts, October 7, 1991).

[8] Vladimir Lobov, General of the Army, "The Motherland's Armed Forces Today and Tomorrow," *Krasnaya Zvezda*, November 29, 1991, pp. 1-2.

[9] "Boris Yeltsin's Statement on Arms Control," ITAR-TASS, January 29, 1992.

[10] General Vitalii Yakovlev, "Realization of Reduction and Limitation Programs for Nuclear Weapons and the Opportunity of an Information Exchange on Amount of Produced Fissile Materials and Their Localization," Talk Prepared for the U.S.-Russian Workshop of CTB, fissile material cutoff and plutonium disposal," December 15-17, 1993, Washington, DC.

[11] Franklin Miller, Acting Assistant Secretary of Defense for International Security Policy, Statement before the Strategic Forces Subcommittee of the Senate Armed Services Committee on the Subject of Weapons Proliferation and the FY 1998 Defense Budget, March 5, 1997.

[12] According to the new head of the Ministry of Defense 12th Directorate, nuclear shells and mines are being destroyed. Also, sixty percent of the tactical nuclear weapons withdrawn from Belarus, Ukraine and Kazakhstan have been destroyed; Press Conference with Lieutenant-General Igor Valynkin, Chief 12th Main Directorate of the Russian Ministry of Defense, regarding the nuclear security in Russian Federation armed forces, Russian Ministry of Defense, September 25, 1997. In addition, a senior Minatom official stated in September 1997 that Russia was dismantling well over 2000 warheads a year.

[13] As of November 1996, over 2000 weapons were in this category. The number was expected to increase "several-fold" if dissassembly rates stay lower than rate of retirements; Comments by General Igor Valykin, then First Deputy Head of the 12th Main Directorate before the Duma Committee on Security, "Stenographic Record of the Parliamentary Hearings on the Topic: Issues Concerning the Security of Hazardous Nuclear Facilities," *Yaderny Kontrol Digest*, No. 5, Fall 1997, p. 12.

[14] Interfax, "Country Dismantles Nearly Half Its Nuclear Arsenal," 27 April 1997 (transcribed in FBIS-TAC-97-117, April 27, 1997).

[15] Foreign Minister Y. Primakov's letter on "Early Deactivation," to Secretary of State Madeline Albright, 26 September 1997 (available at http://www.acda.gov/).

[16] Joshua Handler, "The Future of Russian Strategic Forces," *Jane's Intelligence Review*, April 1995, pp. 162-165.

[17] A lack of financing has delayed introduction of the SS-27 by some two and half years; Valeriy Borisenko, "Interview with Defense Minister Designee Igor Sergeyev. I. Sergeyev: " "Both the Missiles and the People Are Always in Complete Readiness," *Moskovskaya Pravda*, June 4, 1997, pp. 9-10, (translated in FBIS-SOV-97-110, 4 June 1997).

[18] Sidebar accompanying Aleksandr Zhilin, Why Russian Hero is Retiring," *Moskovskiye Novosti*, No. 50, December 14-21, 1997 (translated in FBIS-UMA-97-352, December 18, 1997). Other reports confirm that the Russian Tu-160s are basically non-operational and even may be retired. Alexander Velovich, Russia's Air Force Faces Cuts to Save Projects," *Flight International*, September 17, 1997.

[19] Interfax, "Air force commander rules out buying strategic bombers from Ukraine," June 18, 1997; Raisa Stetsyura, "Kiev studying possible peaceful use of strategic bombers," *ITAR-TASS*, September 19, 1997.

[20] General Eugene Habiger, "Department of Defense News Briefing," November 4, 1997.

[21] Interfax, "Russia: Russian Defense Ministry to Buy 6 Bombers From Tupolev, October 28, 1997.

[22] Piotr Butowski, "Russia's air forces face up to their dilemmas," *Jane's Intelligence Review*, October 1997, Vol. 9, No. 10.

[23] "As for the warheads, it is simply dangerous to keep them longer than the warranty period. For they also contain conventional explosives. After approximately 10 years' storage these start to crack, to change their physical and chemical properties. . . . All this can lead to various consequences;" Colonel Oleg Falichev, Interview with Colonel General Ye. P.

Maslin, Chief of the Defense's Ministry's 12th Main Directorate, "Who Has the Keys to the Nuclear Arsenal," *Krasnaya Zvezda*, 26 November 1993, (translated in FBIS-SOV-93-228, November 30, 1993).

"The nuclear weapon is a complex device consisting of electronic elements, generators, active nuclear materials -- uranium, plutonium, and tritium–and conventional explosives. It also has a limited service life–10 or 15 years, for example–after which it is disassembled;" Viktor N. Mikhaylov, *I Am a Hawk*, Moscow: Kron-Press, 1993. (Reprinted in Yu. Popov and L. Chernenko, interview with V.N. Mikhaylov, "The Keys to the Nuclear Arsenal," *Pravitelstvenny Vestnik*, No. 1, 1992 (translated in JPRS-TAC-94-010-L, August 24, 1994.)

[24] Pierre Sparaco, "French Defense Budget Takes New Hit," *Aviation Week & Space Technology*, September 29, 1997, p. 34.

[25] In 1985 an accounting was made of the locations and numbers of U.S. nuclear weapons. William M. Arkin and Richard W. Fieldhouse, *Nuclear Battlefields: Global Links in the Arms Race* (Cambridge, MA: Ballinger Publishing Company, 1985).

[26] DNA, "Nuclear Weapons Accounting Manual (Keyword)," DNA 3100.7, June 10,1981, p. 2-1.

[27] Russia had roughly 2600 tactical nuclear weapons on the soil of Ukraine, Kazakhstan and Belarus; Testimony of Acting Assistant Secretary of Defense Franklin Miller to the Senate Armed Services Committee, March 5, 1997.

[28] "We estimate that there were over 500 nuclear storage sites in the former Soviet Union and Eastern Europe in 1990 and there are less than 100 today, mostly in Russia, with a few remaining in Ukraine, Belarus and possibly Kazakhstan." John Deutch, Director of Central Intelligence, statement before the U.S. Senate Governmental Affairs Committee, Permanent Subcommittee on Investigations, hearing on "Global Proliferation of Weapons of Mass Destruction," March 22, 1996, S. Hrg. 104-422, Pt. 2, p. 311.

[29] DIA, Proliferation of Weapons of Mass Destruction, PC-2660S-694-93, July 1, 1993, p. 12 (partially declassified and released under the Freedom of Information Act). The Director of the CIA testified six-months later that "We continue to monitor the disposition and status of Russia's 27,000 or so nuclear warheads, as well as the strategic systems still deployed to deliver these weapons;" R. James Woolsey, Director of Central Intelligence, "Statement before the Senate Select Committee on Intelligence, Hearing on "Current and Projected National Security Threats to the United States and Its Interests Abroad," January 25, 1994, p. 7.

[30] Statement of General Eugene E. Habiger, Commander in Chief, United States Strategic Command, before the Senate Armed Services Committee, March 13, 1997, p. 4.

[31] "One on One," Gen. Eugene Habiger (Interview), *Defense News*, March 10-16, 1997, p. 70. In 1994, the Defense Department estimated the Russian tactical nuclear stock to be some 6,000-13,000 warheads; "Press Conference with Secretary of Defense William Perry," DOD New Release No. 546-94, September 22, 1994.

[32] Interview with V.N. Mikhailov, "The Keys to the Nuclear Arsenal," *Pravitelstvenny Vestnik*, No. 1, 1992 (JPRS-TAC-94-010-L, August 24, 1994).

[33] "As for Russia itself, all we are doing as far as tactical weapons are concerned is dismantling them. Our enterprises have not produced a single device since the time of the agreement was signed with the republics;" Kirill Belyaninov, "Can the Nuclear Charge Be Lost: Major General Vitaliy Yakovlev from the Ministry of Defense Categorically Asserts That it Can't," *Literaturnaya Gazeta*, June 1, 1994 (JPRS-UMA-94-028, June 29, 1994, p. 6).

[34] "All the warheads of the ground forces, artillery shells and tactical nuclear warheads, have been removed and the units which maintained nuclear warheads have been disbanded;" Press Conference with Lieutenant-General Igor Valynkin, Chief 12th Main Directorate of the Russian Ministry of Defense, regarding the nuclear security in Russian Federation armed forces, Russian Ministry of Defense, September 25, 1997. Although Army nuclear weapons may still be kept in central Army depots in the military districts awaiting dismantlement.

[35] Official Kremlin International News Broadcast, "Press Conference with Defense Minister Igor Sergeyev," August 7, 1997, (transcribed by Federal Information Systems Corporation).

[36] Yevgeniy Petrovich Maslin, "Nuclear Weapons: Results and Prospects," *Vooruzheniye, Politika, Konversiya*, No. 4 (7), 1995 (translated in JPRS-UMA-95-026, June 27, 1995, p. 29).

[37] Valeriy Borisenko, "Interview with Defense Minister Designee Igor Sergeyev. " I. Sergeyev: Both the Missiles and the People Are Always in Complete Readiness," *Moskovskaya Pravda*, June 4, 1997, pp. 9-10, (translated in FBIS-SOV-97-110, 4 June 1997); Anatoliy Pankov, reporting on visit to Strategic Rocket Forces command center at Vlasikha near Moscow, "Man With a Gun: The Most Destructive Troops Which Never Fought," *Kuranty*, May 21-27, 1997, No. 20, p. 10.

[38] Perhaps they will also be merged into the Air Force or they could be assigned to Military District or theater commands.

[39] Two of the five, Ostrovnoy at Gremikha on the Kola Peninsula in the Northern Fleet and Palovskoye near Vladivostok in the Pacific Fleet hold mainly if not solely retired SSBNs that are waiting to be declared ready for elimination under START procedures.

[40] Admiral A.M. Ovcharenko, "Russia's Strategic Naval Forces. Problems and Prospects," *Vooruzheniye, Politika, Konversiya*, No. 2 (13), 1996 pp 38-40 (translated in FBIS-UMA-96-245-S, December 26, 1996).

[41] *Jane's Fighting Ship*s, 1997-1998, p. 547.

[42] According to one retired senior Admiral, 23 SSBNs, including two Typhoons, have been retired from the navy before their time in the last five years; L. Belyshev, Rear Admiral in retirement, candidate of technical sciences, "Ship-Building and the Development of the Navy," *Morskoy Sbornik*, No. 11, 1996, pp. 63-67. Indeed, if the level of financing seen during 1990-1995 continues, the Russian Navy says all Typhoon systems will have to be retired by the year 2003; Admiral A.M. Ovcharenko, "Russia's Strategic Naval Forces. Problems and Prospects," *Vooruzheniye, Politika, Konversiya*, No. 2 (13), 1996 pp 38-40 (translated in FBIS-UMA-96-245-S, December 26, 1996).

[43] In 1995, General Sheehan, CINCACOM, stated ". . . but the curious piece is the SSBNs have increased their patrol length. They have gone from 52 or 55 days, to 72 days on patrol." General John J. Sheehan, Commander-in-Chief, U.S. Atlantic Command, Testimony before the HAC, Department of Defense Appropriations for 1996, Part 3, March 7, 1995, p. 335.

[44] "First Deputy Defence Minister on New Nuclear Submarine," *ITAR-TASS*, November 2, 1996, (translated in BBC Summary of World Broadcasts, November 5, 1996); "Yeltsin's chief of staff, Moscow mayor attend submarine ceremony," Russian Public TV, Moscow, 1500 GMT, November 2, 1996, (translated in BBC Summary of World Broadcasts, November 5, 1996).

[45] Alexei Arbatov, "Russian Military Doctrine and Strategic Nuclear Forces to the Year 2000 and Beyond," paper for NPS, Monterey, CA, March 23-29, 1997. Some analysts predict it will carry 12 missiles, each armed with six warheads.

[46] Slides accompanying U.S. Navy Testimony to Senate Armed Services Committee on FY 1998 Budget, April 8, 1997.

[47] Office of Naval Intelligence, "Worldwide Submarine Challenges," 1997, p. 16; General Eugene Habiger, "Department of Defense News Briefing," November 4, 1997.

[48] Joshua Handler, "Russia Seeks to Refloat a Decaying Fleet," *Jane's International Defense Review*, January 1997, pp. 43-47.

[49] Rear Admiral Valery Aleksin, Chief Navigator of the Russian Navy, "Russia Needs a Strong Navy," *U.S.N.I. Proceedings*, December 1997, p. 47.

[50] Slides accompanying U.S. Navy Testimony to Senate Armed Services Committee on FY 1998 Budget, April 8, 1997.

[51] *Jane's Fighting Ships, 1997-1998*, p. 549.

[52] Much valuable information can be found in Don J. Bradley, *Behind the Nuclear Curtain: Radioactive Waste Management in the Former Soviet Union* (Columbus, OH: Battelle Press, 1997).

[53] Sergei A. Zelentsov, former Chief Engineer of the 12th Directorate, "Nuclear Weapons Safety System," *Vooruzheniye, Politika, Konversiya*, No. 4 (7), 1994, (translated in JPRS-UMA-95-026, June 27, 1995, p. 21).

[54] Ibid., p. 20. "Storages of nuclear munitions are opened by a minimum of three persons and only with the permission of the commander of the military unit or his first deputy. No other person has the right to order the opening of a storage. This tough regulation of every operation carried out with munitions, the reflection of all this in documents. . . The performer signs for each operation, he does this in a ledger, and signatures are affixed also by controllers. Triple check of every operation is carried out;" Press Conference with Lieutenant-General Igor Volynkin, Chief 12th Main Directorate of the Russian Ministry of Defense, regarding the nuclear security in Russian Federation armed forces, Russian Ministry of Defense, 25 September 1997. A similar situation exists in the Strategic Rocket Forces: "During work in the missile troops a system of triple mutual control has taken shape which subsequently was adopted by the cosmonauts: One person executes the operation, the second reads the instructions for carrying out the operation, and the third checks the consistency and correctness of the operation's execution on the monitoring equipment. That measure is necessary because with such weapons errors are inadmissible;" Valeriy Borisenko, "Interview with Defense Minister Designee Igor Sergeyev. I. Sergeyev: Both the Missiles and the People Are Always in Complete Readiness," *Moskovskaya Pravda*, June 4, 1997, pp. 9-10, (translated in FBIS-SOV-97-110, June 4, 1997). General Habiger discovered this when he visited a Russian nuclear weapons bunker for SS-24 ICBMs. Moreover, according to General Habiger, to move a warhead under the control of the Strategic Rocket Forces requires an order from at minimum a two-star general; General Eugene Habiger, "Department of Defense News Briefing," November 4, 1997.

[55] Round table with Valentin Zakharov, Research Institute of Automatics, and others, "On the Way to Establish an Effective State MPC&A System," *Yaderny Kontrol Digest*, No. 5, Fall 1997, p. 21.

[56] Vladimir Orlov, "Interview with General Yevgeniy Maslin," *Yaderny Control*, May 1995, p. 2.

[57] "Moreover, we keep accounts not only in the armed forces, but also in the Atomic Energy Ministry. We check every year our figures with those of the Atomic Energy Ministry. It has never yet happened that we differed in respect of even one munition;" Press Conference with Lieutenant-General Igor Valynkin, Chief 12th Main Directorate of the Russian Ministry of Defense, regarding the nuclear security in Russian Federation armed forces, Russian Ministry of Defense, September 25, 1997.

[58] "We have been discussing with the United States the possibility of computer equipment deliveries to the Defense Ministry. We are behind the Americans in the computerization of nuclear warhead control and accounting;" Vladimir Orlov, "Interview with General Yevgeniy Maslin," *Yaderny Control*, May 1995, p. 3.

[59] General Eugene Habiger, "Department of Defense News Briefing," November 4, 1997.

[60] See: Press Conference with Lieutenant-General Igor Valynkin, Chief 12th Main Directorate of the Russian Ministry of Defense, regarding the nuclear security in Russian Federation armed forces, Russian Ministry of Defense, September 25, 1997.

[61] See: Valentin Zakharov, VNIIA (Research Institute of Automatics), "Roundtable: On the Way to Establish an Effective State MPC&A System," *Yaderny Kontrol Digest*, Fall 1997, p. 19.

[62] See: Dr. Sergei Rogov and Dr. Alexander Konovalov, eds., *The Soviet Nuclear Legacy Inside and Outside Russia: Problems of Non-Proliferation, Safety, and Security* (Moscow: Institute of USA and Canada Studies, 1993), p. 29.

[63] Dr. Gordon Oehler, Director, Non-Proliferation Center, Central Intelligence Agency, testimony before the Senate Armed Services Committee, January 31, 1995.

[64] Colonel General Evgeniy P. Maslin, Chief of the 12th Directorate of the Ministry of Defense," Summary of the Proceedings of the U.S. Defense Nuclear Agency's Fourth Annual International Conference on Controlling Arms, June 19-22, 1995, Philadelphia, PA.

[65] Colonel General Evgeniy P. Maslin, Chief of the 12th Directorate of the Ministry of Defense," remarks on U.S. and Russian Perspectives on the Cooperative Threat Reduction Program, made at the U.S. Defense Special Weapons Agency conference, "Walking the Walk: Controlling Arms in the 1990s," in "Summary of the Fifth Annual International Conference on Controlling Arms," June 3-6, 1996, Norfolk, VA.

[66] See: Dr. Sergei Rogov and Dr. Alexander Konovalov, eds., *The Soviet Nuclear Legacy Inside and Outside Russia: Problems of Non-Proliferation, Safety, and Security* (Institute of USA and Canada Studies: Moscow, 1993), p. 29.

[67] According to General Gely Batenin, special military adviser to the Foreign Ministry, in Andrew Higgins, "Deadly secrets for sale," *Independent* (UK), April 19, 1992.

[68] "Recently we reduced the number of storage facilities by 2.7 times: we closed four in Ukraine, one near Gomel in Belarus, in Semipalatinsk, in Nalchik [on Russian territory in the Caucuses], in the Far East;" Vladimir Orlov, "Interview with General Yevgeniy Maslin," *Yaderny Control*, May 1995, p. 2.

[69] Thomas Cochran, Robert S. Norris, Oleg A. Bukharin, *Making the Russian Bomb: From Stalin to Yeltsin* (Westview Press: Boulder, CO, 1995), p. 49.

[70] Nuclear materials are believed to be present at some 40 locations in Russia, including the 10 Minatom facilities of the so-called "Defense Complex."

[71] "Firstly, as soon as disturbances began in the Caucasus all the warheads were removed from Mozdak;" Press Conference with Lieutenant-General Igor Valynkin, Chief 12th Main Directorate of the Russian Ministry of Defense, regarding the nuclear security in Russian Federation armed forces, Russian Ministry of Defense, 25 September 1997. They may be stored at the Engels air base: ". . . the nuclear weapons were relocated to an air base in the city of Engels. We were told this by someone close to the Russian air force command," Boris Vishnevskiy on interview with retired Colonel Zaki Zaynullin, "As Many As 600 Nuclear Bombs in Chechnya," *Komsomolskaya Pravda*, December 1-8, 1995, (translated in FBIS-SOV-95-232).

[72] Units from Andrew Duncan, "Russian Forces in Decline–Part 2," *Jane's Intelligence Review*, October 1996.

[73] The 1992 Defence *White Paper* stated that, "As part of the cut in NATO's stockpile we will also reduce the number of British free-fall nuclear bombs by more than half." The next year, the *White Paper* stated that the WE177 "is currently expected to remain in service until well into the next century." The government announced in March 1994 that the retirement date would be the year 2007. On 1 May 1996 Defence Secretary Michael Portillo announced that RAF Bruggen would close in 2002 and the remaining Tornadoes would be reassigned to bases in the UK.

[74] The total number of patrols for the four boats over the 28 year period was 229. *Revenge* was retired on May 25, 1992, after 56 patrols. *Resolution* was decommissioned on October 22, 1994 after 61 patrols. *Renown* was decommissioned on February 24, 1996 after 52 patrols, and *Repulse* was withdrawn from service on August 28, 1996 after 60 patrols.

[75] David Omand, "Nuclear Deterrence in a Changing World: The View from a UK Perspective," *RUSI Journal*, June 1996, pp. 15-22.

[76] "MND Sets up Early-Warning Task Force, Central News Agency (Taiwan), September 22, 1997.

[77] David Shambaugh, "China's Military: Real or Paper Tiger?" *The Washington Quarterly*, Spring 1996, p. 24. The dozen articles on "China's Military in Transition" in the June 1996 issue of *The China Quarterly* should also be consulted.

[78] DOD, Selected Military Capabilities of the People's Republic of China, April 1997, p. 1.

[79] Shaoguang Wang, "Estimating China's Defence Expenditure: Some Evidence From Chinese Sources," *The China Quarterly*, September 1996, pp. 889-911.

[80] DOD, Selected Military Capabilities of the People's Republic of China, April 1997, p. 9.