Analysis of Warhead Retirement Programs and Plans

2

Recent treaty agreements and announcements by the United States and Russia to substantially reduce the nuclear weapons arsenals of both nations (see box 2-A) present a unique opportunity, as well as a technical and political challenge, to the Nation. The opportunity is to remove many thousands of these weapons from current arsenals. The challenge is to devise feasible and practical methods of rendering existing weapons benign and to formulate reasonable plans and make decisions regarding the short- and long-range goals of this effort (17,20).

Decisions to retire and dismantle large numbers of nuclear weapons have provided the incentive to define and initiate major Federal programs. Both the Departments of Energy (DOE) and Defense (DOD) have established offices and task forces to plan and implement various steps in dismantlement.[1] Thousands of weapons have been taken out of the active stockpile; a few thousand warheads have been retired and disassembled; and the remaining warheads from retired weapons will be disassembled over the next decade. Table 2-1 shows the major types of weapons in the current U.S. arsenal.

Even though world leaders have made these announcements about the elimination of nuclear weapons and declared that the "Cold War is over,' the recent Strategic Arms Reduction Treaty (START) and its successor (START II) have not yet been ratified

Point

"Although major emphasis within the nuclear community has shifted *from development to retirement and disposal of weapons, I do not view it as a major change in mission, but more of a shift in national emphasis. "*

Pentagon reviewer of OTA report

Counterpoint

"This is no time for complacency. The arms race may be over, but it is still too much business as usual for the nuclear weapons industry. The government has yet to indicate that it can handle conversion to peacetime work. "

A citizens' guide to the future of the Nuclear Weapons Complex

[1] For example, the Executive Management Team for Dismantlement under Defense Programs; the Plutonium (and highly enriched uranium) Strategy Task Forces under DOE (Defense Programs and Nuclear Energy Program); Midnight Sun—the Defense Nuclear Agency (DNA) or the Dismantlement Planning Effort; the Prioritization Working Group of DNA and DOE; the Nuclear Weapons Safety Committee, established by DOE.

Box 2-A–Proposed Reductions in U.S. and Russian Nuclear Arsenals

In just the past 2 years, political leaders in the United States and the former Soviet Union have made remarkable pledges and set an agenda for denuclearization that, if completed, will eliminate a large part of the nuclear weaponry built during the Cold War. Some of the key pledges follow (l):

- In the fall of 1991, Presidents Bush and Gorbachev pledged to withdraw almost all tactical nuclear weapons from forward deployment and destroy most of them.
- As the Soviet Union dissolved toward the end of 1991, leaders of the newly independent states, where nuclear weapons were based, pledged to join the international communit y as nonnuclear weapons nations and to remove such weapons from their territories.
- In May 1992, the current nuclear nations pledged to ratify the Strategic Arms Reduction Treaty (START) that calls for sharply reducing the strategic arsenals of the United States and the former Soviet Union.
- In June 1992, Presidents Bush and Yeltsin agreed to the outline of a START II treaty that would eliminate all but 3,000 to 3,500 nuclear weapons deployed (deliverable) in each of their remaining strategic arsenals.
- Presidents Bush and Yeltsin signed the START II treaty in Moscow in January 1993.

SOURCE: Office of Technology Assessment 1993.

and no international agreements exist on the subject of warhead dismantlement. However, there is substantial agreement among interested parties within and outside of government that nuclear weapons retirement and dismantlement in both the United States and the former Soviet Union are important steps in promoting national security and world peace.

This chapter discusses the programs and plans now in place to retire nuclear weapons and return the warheads to DOE for dismantlement. The programs are mainly the responsibility of the Department of Defense and the Department of Energy, which is the Nation's nuclear warhead design, construction, and testing agency.

The current process of dismantling nuclear weapons begins with an action by DOD to retire a weapon from the active stockpile and, when appropriate, return it to a military base within the continental United States.[2] By making such a retirement decision, DOD takes an action that eventually leads to return of the weapon to DOE, which originally built the warhead and will retain custody until it has been dismantled and its components have been disposed of in a manner determined by DOE. The individual services (Army, Navy, Air Force) have physical custody of these weapons until they are transferred to DOE (5).

There is a long-standing administrative process for the management, handling, and control of nuclear weapons within the Federal agencies having such responsibilities, principally DOE and DOD. These agencies are now beginning to modify their procedures for the new, post-Cold War mission of dismantlement and disposal. Figure 2-1 illustrates this administrative process. It begins with preparing a Nuclear Weapons Stockpile Memorandum—a document that is revised and updated each year and contains a 5-year projection of the U.S. stockpile. The three-member Nuclear Weapons Council (the Assistant Secretary of Defense for Logistics, the Vice-Chairman of the Joint Chiefs of Staff, and the Assistant Secretary of Energy for Defense Programs) considers and submits the memo to the President through the Secretaries of Defense and

[2]**The term "retirement' as it relates to nuclear weapons within DOD is an administrative decision to change the weapon's charge code. This change in charge code is from the active stockpile to either the retired stockpile or one of the reserve stockpiles. DOD has the responsibility of removing the warhead from the delivery system and disposing of that delivery system. Activities associated with launcher disposal are not covered in this study but are, nonetheless, an important part of the total scheme,**

Table 2-I—Major Nuclear Weapons Types in the Current U.S. Arsenal

Designation	System/common name	Service	Primary uses
W48	155-mm AFAP	A	Surface to surface
B53	Strategic bomb	AF	Air to surface
W56	MINUTEMAN II ICBM	AF	Surface to surface
B57	Bomb/depth bomb	N, AF	Air to surface/subsurface
B61	Tactical/strategic bombs	N, AF	Air to surface
W62	MINUTEMAN Ill ICBM	AF	Surface to surface
W68	POSEIDON C3 SLBM	N	Underwater to surface
W69	SRAM	AF	Air to surface
W70	LANCE	A	Surface to surface
W77	SPARTAN	A	Surface to air
W76	TRIDENT 1 C4 SLBM	N	Underwater to surface
W78	MINUTEMAN Ill ICBM	AF	Surface to surface
W79	8-inch AFAP	A	Surface to surface
W80-O	TOMAHAWK (TLAM N)	N	Underwater to surface/ surface to surface
W80-I	ALCM	AF	Air to surface
B83	Strategic bomb	AF	Air to surface
W84	GLCM	AF	Surface to surface
W87	PEACEKEEPER ICBM	AF	Surface to surface
W88	TRIDENT II D5 SLBM	N	Underwater to surface

NOTE: This is an official unclassified list of weapons types, with the older ones at the top and the newer ones at the bottom. It should be noted that all Army (A) weapons have been retired and the Marine Corps' nuclear mission has been deleted. Both the Navy (N) and the Air Force (AF) are reducing the total numbers of weapons in their stockpiles. Total stockpile numbers are classified.

SOURCE: Defense Nuclear Agency, 1993.

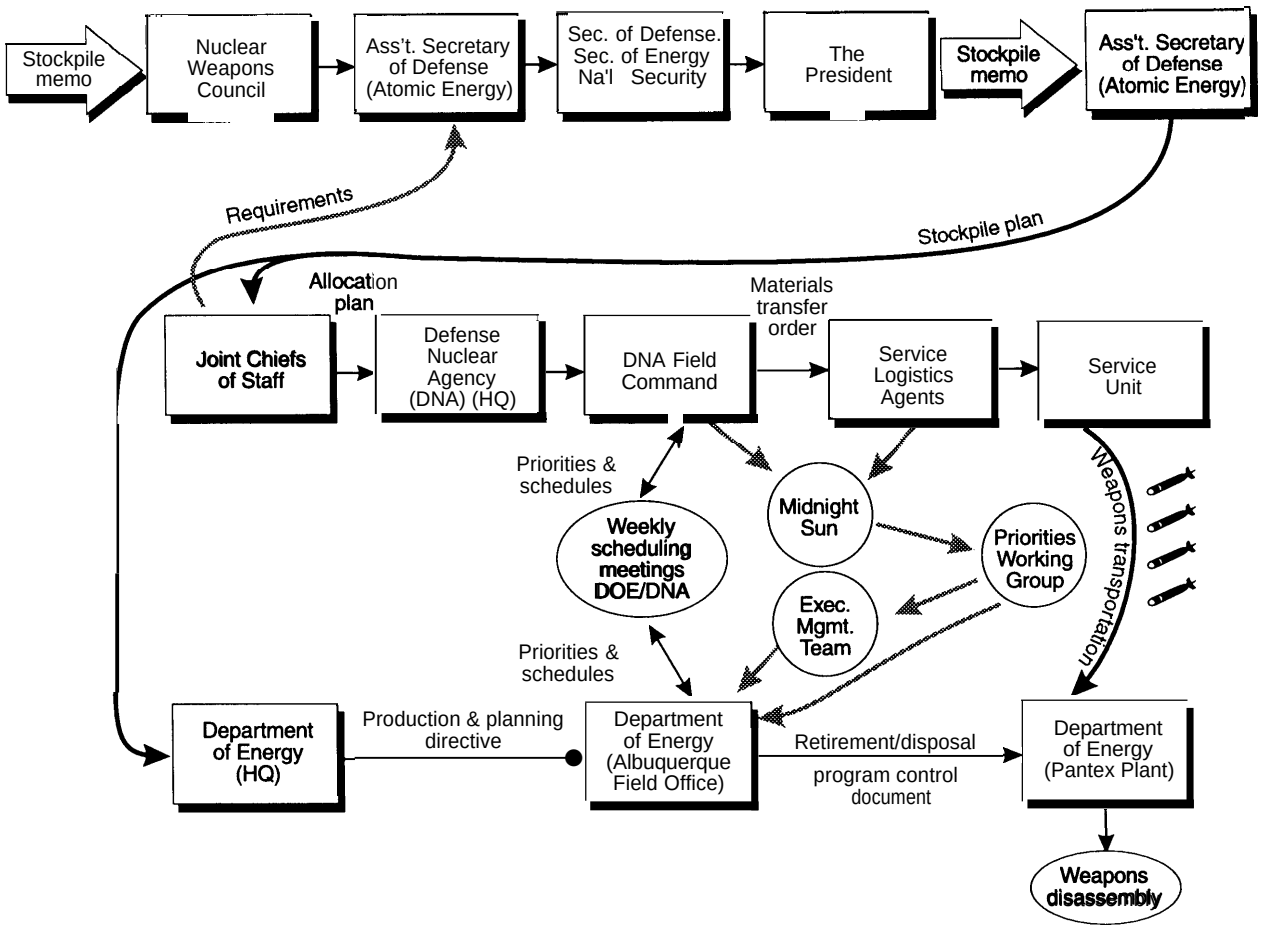
Energy and the National Security Council. When the President approves, it becomes the Nuclear Weapons Stockpile Plan (NWSP) and is executed by the Assistant Secretary of Defense (Atomic Energy).

The Office of the Assistant to the Secretary of Defense (Atomic Energy) (ATSD(AE)) performs a coordination function within the Office of the Secretary of Defense before the memorandum is submitted to the Secretary of Defense and Secretary of Energy for approval/transmission to the President. DOE also coordinates internally before the Secretary of Energy signs it. Once signed by the President, the document is addressed and delivered to the Secretary of Defense, Secretary of Energy, and Chairman of the Joint Chiefs of Staff. ATSD(AE) gets the copy sent to the Secretary of Defense and sends it to the services. It forms the basis of the allocation plan that is sent to the services and the Defense Nuclear Agency (DNA) for tracking (6).

As shown in figure 2-1, the NWSP generates other procedures and actions through DNA, the various military services, and DOE. The process eventually results in directives to retire specific weapons, return the warheads from DOD to DOE, and begin dismantlement under a schedule that accommodates the capabilities and constraints of all the parties involved (5).

Both DOD and DOE have embarked on planning efforts to ensure that the process will proceed safely and effectively. Plans continue to be

Figure 2-I—Planning and Coordination Process **for Nuclear Weapons Retirement**



Midnight Sun: the name of the DNA working group charged with planning and monitoring weapons retirement and return
DOE Executive Management Team: DOE's dismantlement planning group
Priorities Working Group: the joint DOE/DNA group charged with planning and logistics

SOURCE: U.S. Department of Defense, Defense Nuclear Agency.

updated as variables such as base closures have their effect. Actual weapons retirements are now under way at various military bases, warheads are being transported to DOE, and dismantlement operations at DOE facilities are following suit. It is not clear, however, when the new planning and review activities will be incorporated into such operations, or how carefully the new mission will be defined so as to result in the needed management and institutional changes. Box 2-B illustrates some of the challenges ahead.

In some ways, the work required to retire and dismantle weapons is similar to that of producing weapons and maintaining a stockpile. Over the past four or five decades, some classes of nuclear weapons have been retired and others have taken

Box 2-B-The Challenge of Stockpile Reduction

Pledges to rid the world of massive numbers of nuclear weapons have been made with great fanfare and hopes for lasting peace. The challenge of turning these pledges into deeds and accomplishing the goals, as viewed in mid-1993, is formidable (l):

- Several tens of thousands of nuclear warheads are located at hundreds of sites worldwide. These warheads have massive explosive power, and their continued existence --especially in politically unstable areas of the world--poses serious dangers. The threat is not only from certain governmental or individual terrorists who may be able to detonate a weapon, but also from either accidental or intentional dispersal of radioactive materials.
- If not carefully controlled, the stockpiles of highly enriched uranium and plutonium produced over the past 50 years could be diverted to terrorist groups that may have the ability to make crude but dangerous bombs.
- Radioactive materials from weapons can pose substantial long-term threats to human health and the environment if not safely contained and managed, and no direct methods are currently available for destroying them.
- Worldwide, more than a million people work in laboratories, facilities, and factories engaged in nuclear materials or weapons production and maintenance. These workers and their families face an uncertain future, a changing mission, and a threat to their livelihood and position in society,
- Thousands of nuclear-weapons-related facilities and huge expanses of the environment are contaminated with radioactive and toxic waste from 50 years of plutonium and tritium production. This poses *serious* environmental and public health threats that are just beginning to be addressed. As nations prepare to dismantle warheads and dispose of materials from them, they will need to focus serious attention and resources on requirements for human health and safet y, which will involve both a change of attitude and an assumption of hitherto neglected environmental responsibilities.

SOURCE: Office of Technology Assessment, 1993.

their place. Representative weapons of all types have been dismantled for purposes of quality assurance and reliability testing. In some cases, conventional weapons systems have replaced retired systems. Parts and materials have been recycled whenever advantageous, and significant efforts have been devoted to careful disassembly and accounting, as well as the handling of sensitive parts and materials. Accurate accounting for fissile materials has been basic to weapons materials security.

Both DOD and DOE claim that because weapons have always been dismantled as part of their replacement or maintenance-and because materials from these weapons have always had to be recycled or disposed of in some way—there is nothing very different about the present mission. Thus dismantlement is considered by many to be merely a change in emphasis and an adjunct to the technical operations (4,7,8). Yet in many ways, the work represents a significant change of focus from the past missions of these agencies.

The new mission for these agencies is to significantly reduce the overall stockpile and manage materials that are no longer part of national defense. This mission offers new challenges and requires different technical and management skills. It also brings a need for planning that rests on an entirely different premise from the weapons production mission. Planning is necessary now to ensure that more nuclear materials are safely stored and controlled outside the military system, that goals for stockpile reduction and disposition of materials are met in the United States and elsewhere, and that past mistakes leading to environmental degradation or threats to public health are not repeated (15).

DOD: WEAPONS RETURN AND PREPARATIONS FOR DISMANTLEMENT

The Department of Defense is responsible for the separation of warheads from their delivery systems, such as missiles, for which it retains responsibility. DOD is currently implementing substantial reductions of the U.S. nuclear arsenal. However, neither the international agreements concerning the reduction of deployed weapons nor the START and Intermediate Range Nuclear Forces (INF) treaties specify that warheads be dismantled—they merely call for removing warheads from delivery systems (e.g., missiles) and, in some cases, destroying the delivery systems. Certain experts, in fact, argue that dismantlement goals should not fall within the terms of these agreements (7).[3]

DOD has stated in the past that if the United States had to "destroy" existing warheads that are being "retired" under current treaties and agreements, it would have to produce new warheads to maintain its reduced inventory. Yet the U.S. Nuclear Weapons Complex currently has little, if any, operational capability to produce new warheads. There is also concern on the part of some military planners that future weapons readiness capabilities, and even U.S. military supremacy, could suffer if too many nuclear warheads are destroyed before future world threats have been carefully evaluated (7).

The uncertainty about decisions to retire and dismantle nuclear weapons—as well as vagueness in the definitions of these and other terms—means that long-range plans, goals, or capabilities cannot be accurately determined or evaluated at this time. The near-term technical questions are, therefore, whether the retirement and dismantlement operations now under way are being carried out safely and effectively, and whether the United States will be able to safely and adequately prepare for the next step in the process-the long-term disposition of nuclear materials from warheads.

Important policy questions are:

- whether informed public debate will be brought to bear on major retirement and dismantlement decisions;
- whether it will be necessary to develop new policies to direct and coordinate this work;
- whether the retirement and dismantlement process now under way will proceed efficiently and effectively, with adequate attention to health, safety, and environmental protection; and
- whether the effort will sufficiently advance the stated national security goal of international reduction of nuclear armaments.

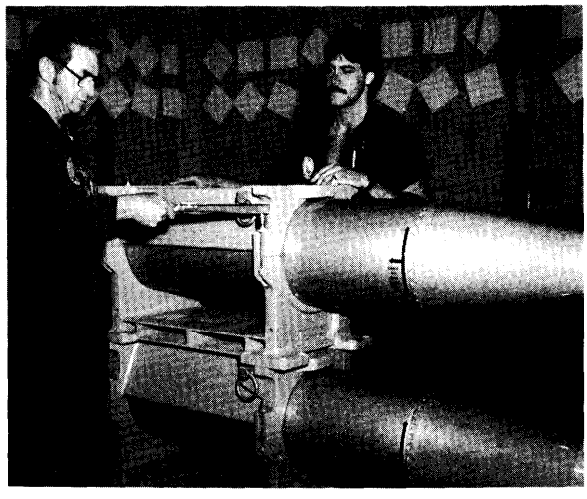
Number of Weapons To Be Retired or Dismantled

No official government list of U.S. nuclear weapons to be retired or dismantled is publicly available. It is generally agreed, however, that the stockpile will be reduced substantially, but the precise number of each type of weapon (retained or dismantled) is reflected in the Nuclear Weapons Stockpile Plan, prepared by the joint DOD-DOE Nuclear Weapons Council and approved by the President. That document is classified, and the plan is continually modified to reflect the most current U.S. policies and international understandings (18).[4]

As a beginning, DOE has developed a general policy for dismantlement. In its policy, DOE has stated that it will dismantle all retired warheads turned over to it by the Department of Defense.

[3] DOD claims it needs the flexibility to reuse some warheads from retired weapons if it so chooses; that the greatest cost in weapons is delivery vehicles, not warheads (which are easy to reassemble); and that elimination of warheads is of no use unless constraints are also placed on fissile material production.

[4] The U.S.-Russian agreement, signed in June 1992 and codified by the START II treaty signed in January 1993 by Presidents Bush and Yeltsin, reduces the size of each nation's nuclear arsenal to 3,000 to 3,500 deployed (deliverable) strategic warheads by 2003. The reductions called for are the most sweeping in U.S.-Russian bilateral arms control history. They represent a major reduction in present arsenals.



Retired nuclear weapons received at the Department of Energy Pantex Plant.

Dismantlement will consist of disassembling each warhead, removing and storing the uranium and plutonium components, and disposing of the remaining parts in accordance with State and Federal regulations. Most of the weapons retired by DOD are now being shipped (or will be shipped) to DOE's Pantex Plant near Amarillo, Texas for dismantlement (one weapons type was recently dismantled at the Y-12 Plant in Oak Ridge, Tennessee). These shipments are planned and controlled jointly by DOD and DOE to ensure safe and effective weapons dismantlement. DOE has determined that its current safe maximum rate is approximately 2,000 weapons per year. According to DOE, this rate was selected to ensure that dismantlement could be carried out in an orderly, safe, and environmentally sound manner. DOE has also said that this rate will allow the United States to complete the dismantlement of anticipated planned retirements by the end of this decade (4).

On further investigation, the above rate appears to be optimistic over the near term. Pantex managers have indicated that the current targets are 1,700 per year in FY 1993 and 2000 in FY 1994. The FY 1992 rate was about 1,300 at Pantex (see table 2-2 and figure 2-2). At the current FY 1993 Pantex dismantlement rate, the year-end total would be about 1,430 warheads.

Current U.S. warhead dismantlement plans are governed by reductions in the nuclear stockpile planned by the Nuclear Weapons Council. Some of these plans also take into account the general goals of the 1988 INF treaty, the 1991 announcement of unilateral withdrawal of tactical weapons by President Bush, and both the 1991 START treaty and the START II treaty signed by Presidents Bush and Yeltsin in January 1993 (see table 2-3). Taken together, these initiatives, if ratified and fully implemented, could lead to the eventual dismantlement of more than 10,000 U.S. warheads by early in the next century (16). In fact, START II sets a limit of no more than 3,500 deployed (deliverable) strategic nuclear warheads each for the United States and Russia by the year 2003. The actual number of warheads to be returned to DOE for dismantlement is specified in the annual Nuclear Weapons Stockpile Memorandum. This classified memorandum is submitted to the President for approval each year on September 30.[5] The most recent two submissions have included an attachment listing the specific weapons to be retired. The President does not directly approve or disapprove this list, but could consider it in review of overall stockpile strategy. If the above treaties are fully implemented, the results should be reflected in the annual stockpile memorandum, which also contains specific numbers of nuclear weapons projected to be in the active stockpile, the reserve stockpile, and retired.

At present, the return of retired nuclear warheads to DOE is well under way. All retired weapons that were to be returned to the United States under former President Bush's initiative had been returned to continental U.S. bases by the end of 1992. Since 1990, DOD has been shipping retired warheads from military bases to the Pantex Plant for dismantlement. Almost 4,000 retired warheads were dismantled at Pantex from 1990

[5] See classified Annex to this report for a discussion of current weapons stockpile amounts and future plans,

Table 2-2—DOE's Pantex Plant: Nuclear Warheads Disassembly History, 1990-92

Fiscal year	Numbers retired and disassembled
1980	535
1981	1,416
1982	1,360
1983	960
1984	860
1985	927
1986	574
1987	1,068
1988	510
1989	1,134
1990	1.056
1991	1,546
1992	1,274
Total	**13,223**

NOTE: In addition to these weapons that were disassembled subsequent to retirement, additional warheads were disassembled for quality assurance and reliability testing each year-some in this category were disposed of and others were reassembled and returned to the stockpile. The number in this category ranged from less than 100 to about 400 per year.

SOURCE: U.S. Department of Energy.

through mid-1993 (table 2-2). If the current retirement plans are followed, at least 10,000 warheads should be returned for dismantlement over the next decade.

The total numbers of warheads in the active and reserve stockpiles currently, and in the past, are classified. The number of each type and design of warhead that has been retired and dismantled is classified. Annual warhead dismantlement rates at Pantex are available but not in a form that would allow one to calculate back to actual stockpile numbers. Even so, it is clear that the challenge of effectively and safely managing a return, dismantlement, and materials disposition program of the magnitude resulting from the above stockpile reduction goals is daunting.

This study by the Office of Technology Assessment does not attempt to determine dismantlement quantities and rates beyond the very general estimates given above. If all of these data remain classified, an important question is how public policy will be established for the future storage, control, and safe management of warheads and of the materials from their dismantlement. If there is to be a public discussion, however, useful order-of-magnitude information about the quantities, rates, and storage or processing requirements of weapons to be dismantled may need to be made public and official.

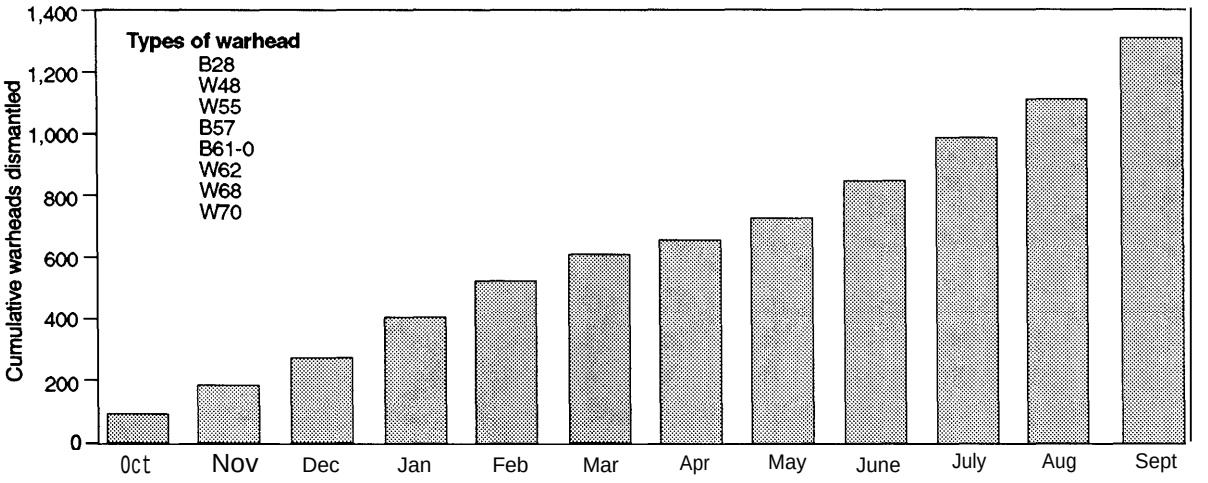
U.S. DEFENSE NUCLEAR AGENCY

DOD planners evaluating schedules for weapons returned to DOE.

Current DOD Plans and Programs

Because the information is classified, the Defense Department will not divulge the location, storage, or transportation routes of nuclear weapons. However, the movement of weapons from overseas to continental U.S. bases has been completed. Further retirement of weapons will continue to take place under the guidance of stockpile reduction policies. The individual services with custody of the weapons have storage and maintenance facilities for all weapons whether the weapons are active, active reserve, inactive reserve, or retired awaiting DOE pickup prior to dismantlement. Because this information is classified, the storage capacity relative to the number

Figure 2-2—Pantex Warhead Dismantlement FY 1992



SOURCE: U.S. Department of Energy.

of warheads to be retired cannot be revealed. Currently, the armed services believe they can store projected warhead retirements, given current base closures and the DOE dismantlement capability. However, any delays in dismantlement or changes in base closure or base operation consolidation plans could impact DOD's capability to store its warheads. The number of active DOD nuclear capable storage sites is gradually decreasing, primarily through the services' effort to consolidate operations. The Army is heading toward complete elimination of its nuclear arsenal and the other services are closing certain of their storage sites (5).

Figure 2-3 shows the process of weapons retirement in DOD and dismantlement in DOE, and indicates some of the major issues affecting the key steps. For DOD, the questions of transportation, safety, and security, as well as pressures to move weapons because of facility closures, appear to be driving many of the logistical decisions.

NUCLEAR WEAPONS SAFETY ISSUES

Nuclear weapons have been handled by the U.S. military services over the past four decades with great attention to safety of operations. The DOD process of retiring large numbers of weapons and returning warheads for dismantlement, however, brings a responsibility to review the suitability and comprehensiveness of safety practices.

Safety questions have long had high priority among agencies with nuclear weapons responsibilities. The Nuclear Weapons System Safety Group maintains a safety report on each weapon. The Defense Nuclear Agency reviews safety reports from the Nuclear Weapons Systems Safety Group and performs safety analyses. Many types of safety analyses are performed regularly.

DOD is responsible for returning nuclear weapons located outside the continental United States. Weapons are returned via air or sea transport to bases at designated locations within the continental United States. The intact warhead delivery system is considered rugged enough to be its own shipping container in the case of warheads placed in missile reentry vehicles or in air-dropped bombs. Other types of warheads are placed in special containers, when appropriate, prior to shipment back to the United States from Europe. Some weapons, although rugged enough to constitute their own shipping containers, require other containers, for efficient stacking.

Table 2-3-START-II Deployed (Deliverable) Warhead Limits
(for each country–the United States and Russia)

Warhead type	Limits	
	Phase i[a]	Phase II[b]
Strategic total (warheads attributed to deployed ICBMs, deployed SLBMs, and deployed heavy bombers)	3,800-4,250	3,000-3,500
MIRVed ICBMs	1,200	0
SLBMs	2,160	1,700-1,750
Heavy ICBMs	650	0

NOTE: ICBMs = intercontinental ballistic missiles. SLBMs = submarine-launched ballistic missiles. MIRV= multiple independently targetable reentry vehicle.
a To be Completed 7 years after the treaty becomes effective.
b TO be completed by the year 2003.

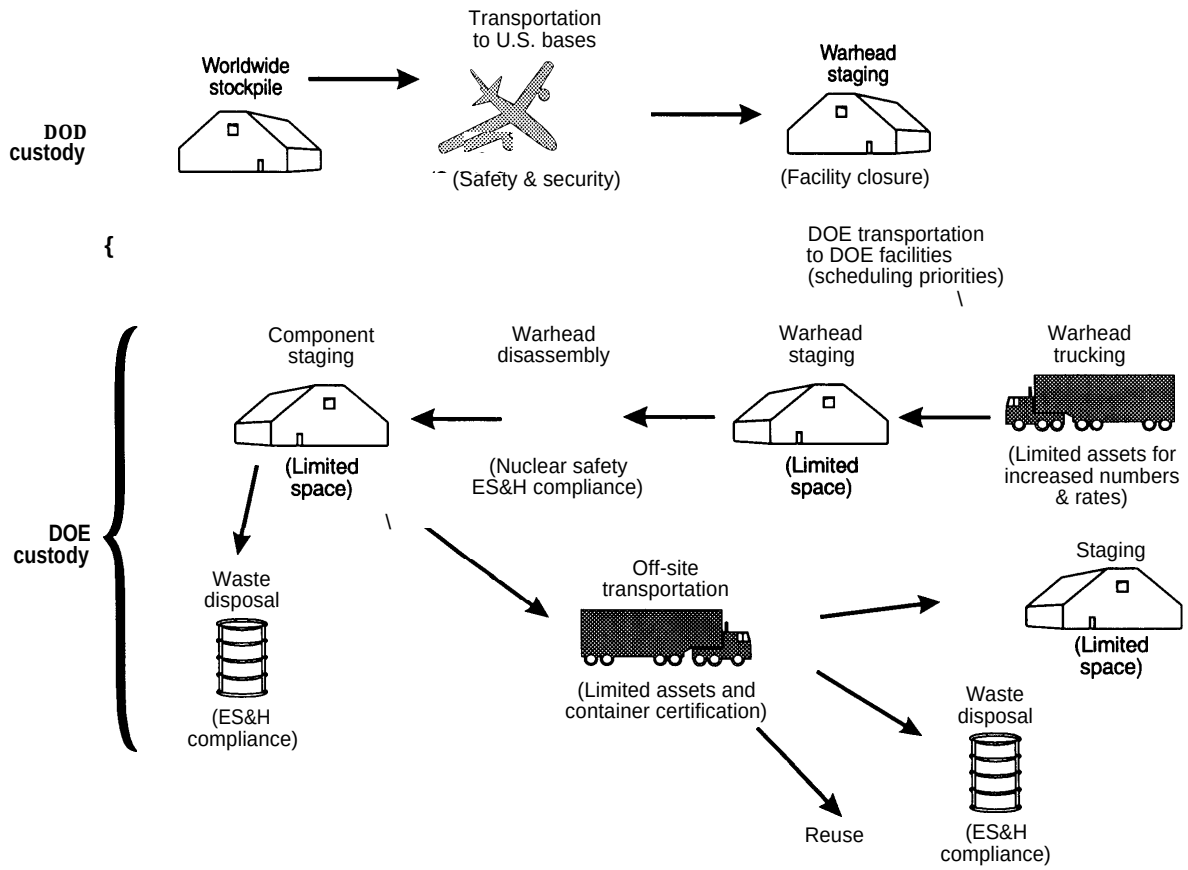
SOURCE: U.S. Arms Control and Disarmament Agency.

For the expanded retirement program just completed, DOD used existing planes and bases, with limits dictated by safety considerations. DOD and DOE are also using Safe Secure Trailers to the maximum extent for transportation within the continental United States. According to Pentagon officials, as of mid-1993, all of the planned weapons' returns from overseas to U.S. home bases had been accomplished. The movement of weapons by DOD will now focus on the consolidation of U.S. bases with a future goal of a minimum number of nuclear weapons storage sites for each service within the United States (2,3,8).

In the past, concerns about accidents with nuclear weapons caused DOD to make certain safety improvements. For example, plutonium scatter accidents, in which accidental detonation of the chemical explosives in a warhead disperses plutonium and other nuclear materials into the environment, are of particular concern during nuclear weapons transportation. Such accidents involving aircraft on alert have occurred in the past. For example, a bomber carrying nuclear weapons crashed near Palomares, Spain, in 1966 during a refueling exercise, and another crashed during takeoff in Thule, Greenland, in the late 1960s. Even though these accidental detonations of high explosives did not lead to actual nuclear explosions, they did result in widespread dispersal of the weapons' plutonium, extensive environmental contamination, and high cleanup costs (14).

The practice of airborne alert has been discontinued, and the Pentagon reports that no aircraft crashes have occurred during logistic movements of nuclear weapons. One response to dispersal accidents was to develop new types of high explosives for use in nuclear warheads. The nature of the chemical high explosives used in a particular warhead is of critical importance to the risk of plutonium scatter accidents. All nuclear warheads produced before 1979 contain an older-design, conventional chemical high explosive (HE) that can detonate under some accidental conditions, including airplane crashes or fires, causing plutonium to scatter. The most modern warhead designs utilize insensitive high explosive (IHE), which is safer since it is designed so that detonation will not occur under similar accident scenarios (9,13). Research efforts at Sandia National Laboratory have developed approaches to minimize plutonium scatter accidents. One past improvement was the development of accident-resistant air shipping containers

Figure 2-3—The Nuclear Stockpile Dismantlement Process (with major Issues In parentheses)



NOTE: ES&H = environment, safety and health.

SOURCE: U.S. Department of Energy.

that were designed to prevent dispersal of nuclear materials should an accident occur.

Weapons with conventional HE could be a problem under certain conditions if these accident-resistant containers are not used or other precautions are not taken (9). Even though the services have used such containers when necessary, DOD does not require the use of these special containers even if the weapons contain conventional HE.

A more recent analysis of safety issues conducted in 1990-and known as the "Drell Report" (19)-was an independent study by the Panel on Nuclear Weapons Safety requested by the House Committee on Armed Services, joined by the Senate Commitee on Armed Services. It considered safety issues as part of developing future U.S. nuclear forces in the context of recent profound changes in the strategic, political, and military dimensions of international security. The report painted a picture of a weapons program that had in the past been far more concerned with production than with safety. Its organizational recommendations are now being implemented by the Defense Nuclear Agency and others. They included establishing or improving the organizations and procedures for evaluating and correcting defects, enhancing training programs, and evaluating new concerns for operations and

functions in the post-Cold War world. It will be important to support these efforts in the future if safety is to remain in the forefront.

Based on the recommendations in the Drell Report, DOD and DOE have recently established two advisory committees on nuclear weapons safety. The first is the DOE-DOD System Safety Red Team Advisory Committee. The Red Team is responsible for the technical evaluation of weapons designs and procedures on preventing inadvertent detonation or plutonium dispersal, and for reviewing the safety of warhead and subsystem designs in all credible environments as well as the documentation related to such subsystems (5). The second committee is the Joint Advisory Committee on Nuclear Weapons Surety. This committee has responsibility for advising on inadvertent detonation and plutonium dispersal, and for making recommendations on national policies and procedures to ensure safe handling, stockpiling, maintenance, and risk reduction technologies for nuclear weapons (see box 2-C).

Transportation Safety

The responsible services within DOD take great care to ensure the safety of transport when weapons or warheads are moved between military bases or depots, or between staging sites and destinations within the United States or overseas. Because larger numbers of weapons are being retired and weapons are being moved more frequently, transportation safety has received even more attention.

Over the last few years, some comprehensive assessments have been accomplished and new directives have been proposed to modify and improve transportation safety. Much work has been done to analyze what changes could be effective, but most have not yet been fully approved and put in place. Also, significant controversy exists about the merits of certain proposals, whereas others have generally been accepted but are being implemented slowly.

A specially equipped DOE transport vehicle used to ship retired weapons to Pantex as well as to ship components to other sites.

As of mid-1993, a major study (begun in 1988 and completed at the end of 1992) still awaits approval of the Nuclear Weapons Council (10). This joint DOE-DOD Study on the Logistic Transportation of Nuclear Weapons represents the first rigorous and formal probabilistic risk assessment ever done on the subject. It incorporates an extensive database on accidents and their probabilities; assessments of how individual warheads may respond to accidents; the probability and consequences of plutonium dispersion; and an extensive assessment of security problems associated with various transportation modes. It includes specific investigation of all modes of transportation (air, rail, ship, truck) and assessment of the transport containers used. The study is intended to serve as a tool for service commanders in analyzing the relative safety and security of various transportation options so as to choose the one with lowest risk. It is expected to be approved and released by late 1993 (10)

The other major recent initiative is the development of a new DOD directive for the movement of nuclear weapons. This directive has not yet been approved or implemented but would replace an older one, refer to the new transportation study, and provide improved guidance to commanders

Box 2-C-Ensuring the Safety of Nuclear Weapons

The United States has always been concerned about the possibility of an accidental or unauthorized detonation of a nuclear weapon. Warheads have, thus, been designed and built with a variety of safety features and technical obstacles to prevent these occurrences. However, to provide a credible deterrent force, the weapons must also be reliable; that is, confidence that warheads will detonate when used must be high. "Nuclear weapons surety" is the phrase used to describe these often contradictory needs.

As a result of a congressionally commissoned study, a Joint Advisory Committee on Nuclear Weapons Surety (JAC) was established in September 1992 to consolidate the work of the Departments of Energy and Defense on the issue of surety. The JAC was established under the auspices of the Federal Advisory Committee Act.

The focus of the JAC has been on the safety side of the surety equation. It is tasked with advising the Secretary of Defense, the Secretary of Energy, and the Nuclear Weapons council on matters concerning "inadvertent detonation or plutonium dispersal."

. The JAC was officially chartered on September, 1992 and will operate until September 4, 1994. It meets twice a year and at other times designated by the Chairman.

. The designated Federal official for the JAC is the Assistant Secretary of Defense for Atomic Energy. The Committee is authorized to have five members, at most. It currently has five, as well as several designated alternates.

• Subcommittees and panels may be created as necessary to address specific issues. Reports from such groups are given to the JAC Chairman before being released outside the Committee.

. Meetings are announced in the *Federal Register.* If meetings are dosed to the public, the Executive Secretary "will issue an annual report setting forth a summary of its activities. . . as would be informative to the public."

The estimated annual operating cost of the JAC is $168,000.

The JAC considers safety issues in all aspects of nuclear weapons. For example, missile design, propellants, and transportation scenarios are examined, in addition to the warheads themselves. The JAC has not yet commissioned any substantive analyses (1 1,12).

SOURCE: Joint Advisory Committee on Nuclear Weapons Surety.

in judging and selecting the lowest-risk transport mode.

Several issues related to these studies involve the need to improve transportation safety and the prospects of expediting the process. First, several experts (mostly at the national laboratories) have long advocated greater safety and security in transportation, especially for older weapons that lack some of the safety features of the newer ones (9,13,14,19). These experts have been recommending the use of accident-resistant containers and Safe Secure Transport (SST) vehicles (tractor-trailers operated by the DOE Transportation Safeguards Division). At the same time, some of the armed services have claimed that the advantages of this approach may be outweighed by other considerations, such as the need to meet schedules and maintain high security of operations. Some say that accident-resistant containers can degrade security and are not worth that price.

Much effort has gone into the analysis of weapons transportation safety, and the resulting studies and proposed directives have merit. It appears that they will be adopted and implemented soon, but some constraints remain. If the process could be moved forward, it should have significant benefits for reducing the future risk of accidents that might result in the dispersal of dangerous nuclear materials. Even though accident-risk probabilities are very low, understanding how to decrease risk further, as shown by these rigorous assessments, can help decision-

makers make prudent choices and take all possible measures to increase safety.

Storage Safety

The safety of intact warheads while in storage is an issue that may merit an updated review because it is possible that certain storage depots will be maintained for the long term. Another factor involves the closing of DOD bases and other restructuring of forces that may increase logistical concerns regarding movements of weapons returned to DOE. Here again, the Defense Nuclear Agency will be challenged to maintain the best and safest balance between DOD needs and DOE capabilities. DNA keeps track of weapons in DOD custody and negotiates with DOE regarding the types and numbers to be transported to a DOE site for dismantlement in a given period. A critical factor is, thus, the ability of Pantex—both its physical capacity and its worker resources-to meet schedules without sacrificing safety or overloading any part of the process. There is a possibility that Pantex schedules will be delayed if DOE cannot adequately and quickly resolve problems related to increasing the storage capacity for plutonium pits from warheads[6]

Because the information is classified, no detailed analysis of DOD storage capabilities, scheduled closure of facilities, or transportation capacity for specific weapons return scenarios is available for public review. Also, safety oversight systems are mainly internal to DOD. These should be especially comprehensive and rigorous in protecting public health and the environment.

DOD and DOE have recently reviewed a range of nuclear weapons safety issues and listed those that may require study (in priority order) in a joint surety plan. In this list, an issue assessment of long-term storage was given a high priority. Such an assessment study may be initiated in the near future, but as of mid-1993, no firm plans have been made.

Other Safety Issues

Within the current joint surety plan, some other safety issues are given high priority. Two of these are fire resistance enhancement and dismantlement risk. The dismantlement risk issue is relegated to DOE's attention. Fire resistance enhancement is the subject of a study that has been initiated by DOD, following a key recommendation of the Drell Report. It will characterize credible future environments for warhead exposure to fire and will explore improvements in design, operational procedures, and mitigation measures that could be employed. The study began in late 1992 and will be completed in 1995.

Another concern regarding nuclear weapons safety is whether, in the rush to demilitarize, dismantle, and eliminate these major weapons, the system will still command high-quality attention and adequate resources. Although budgets may be reduced because weapons are no longer needed, it will still be necessary to provide resources to ensure that care is exercised in protecting both individuals and the environment from these devices and materials.

CONCLUSION

In sum, a substantial nuclear weapons retirement and warhead return process is now under way by DOD based on presidential directives and other factors. Retirement decisions are made in the context of which warheads are no longer needed in the active and reserve stockpiles. When such a decision is made, each service with physical control of a weapon arranges for transportation to a continental U.S. military base, if appropriate, and then puts either the weapon or the warhead into temporary storage until it can be returned to DOE. The DOD process of weapons retirement, following the national goal of stockpile reduction, has been under way for the past few years. Issues of logistical planning, safe transportation and storage, defining overall strat-

[6] See chapter 3 and appendix A.

egy, and making decisions about the Nation's nuclear future are being addressed by the responsible Federal agencies but with minimal public debate or input. Continuing issues that could be addressed include developing a national consensus, defining a unified mission, and ensuring that adequate improvements in safety, security, and protection of health and the environment are carried out.

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