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A Short History of the U.S. Nuclear Stockpile: 1945–1985 (U)

Raymond Pollock*

January 2, 1991

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A Short History of the U.S. Nuclear Stockpile: 1945–1985 (U)

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Raymond Pollock is a consultant on national security policy and strategy, strategic defense, and nuclear-weapons technologies. This follows an earlier career with the Los Alamos National Laboratory, where he specialized in nuclear-weapons design and headed the Theoretical Design Division. His research has focused on weapons physics, fluid dynamics, and computational physics. He served as Director of Defense Programs for the National Security Council (1982–1984). He received a Ph.D. in physics from the University of New Mexico.

The first draft of this report was written in 1988, and the information in the report does not reflect events or research since 1988.

CONTENTS

PREFACE

This report is one in a CNSS series that surveys the development of nuclear weapons over the past forty-five years. The unifying themes throughout the series are the technical advances and failures associated with new weapon systems, and the creation of the stockpile.

Authors, titles, and report numbers are listed below.

William G. Davey, *Free-Fall Nuclear Bombs in the U.S. Stockpile (U)*, LA-11397

William G. Davey, *Nuclear Tests Related to Stockpiled Weapons Development (U)*, LA-11402

Lawrence S. Germain, *A Brief History of the First Efforts of the Livermore Small-Weapons Program (U)*, LA-11404

Lawrence S. Germain, *The Evolution of U.S. Nuclear Weapons Design: Trinity to King (U)*, LA-11403

Lawrence S. Germain, *A Review of the Development of Los Alamos Gnats and Tsetses before the 1958 Test Moratorium (U)*, LA-11749

Raymond Pollock, *The Evolution of the Early Thermonuclear Stockpile (U)*, LA-11748

Raymond Pollock, *A Short History of the U.S. Nuclear Stockpile 1945–1985 (U)*, LA-11401

(All reports are classified Secret Restricted Data)

A SHORT HISTORY OF THE U.S. NUCLEAR STOCKPILE: 1945–1985 (U)

Raymond Pollock

ABSTRACT (U)

This report, one in a series concerned with the history of nuclear-weapons research and development, examines the evolution of the U. S. nuclear weapons stockpile. The report distinguishes between weapon requirements resulting from strategic and operational demands and requirements created by technological advances. The acquisition of nuclear weapons through four distinct, evolutionary phases is also reviewed.

INTRODUCTION

The purpose of this report is to identify the possible causes of significant change in the U.S. nuclear-weapons stockpile as it evolved between 1945 and 1985. While we will be concerned with the relationship between stockpile characteristics and national security policy, we concentrate on qualitative changes rather than on inventories. Our principal interest is to distinguish between weapon requirements generated by strategic and operational demands and those resulting primarily from opportunities created by the advance of technology.

As a first step, we examine the diversity of the U.S. nuclear-weapons stockpile, or more particularly, its variation over time. Figure 1 shows the total number of distinct weapon systems (as distinguished by mark number), both strategic and tactical (non-strategic) weapons. The bar charts of Fig. 2 indicate, for the strategic category, system entries and retirements; the net of these determines the data points of Fig. 1. Figure 3 shows entries and retirements for non-strategic systems. Examination of these figures leads to the conclusion that between 1945 and 1985 the U.S. nuclear-weapons acquisition process proceeded in four distinct phases.

In the early postwar phase (1945–1950), the stockpile remained based on the wartime Fat Man and Little Boy designs. Air Force heavy bombers provided the only delivery vehicles, and the "atomic" bomb was clearly seen as solely a strategic weapon of awesome power.

During the second phase (1950–1955), the variety of stockpiled systems grew quite rapidly, as the results of postwar R&D allowed lighter, more efficient fission bombs to be developed. New, heavier bombers made possible the entry into stockpile of the first huge, high-yield, "emergency capability" thermonuclear weapons. And the first weapons developed especially for tactical applications made their appearance.

DOE (b)(3)

Fig. 1. Nuclear weapons stockpile census.

DOE (b)(3)

Fig. 2. Strategic systems—yearly changes.

(b)(3)

Fig. 3. Nonstrategic systems—yearly changes.

The third phase, extending from about 1955 to 1965, was characterized by massive growth and turnover. The development of practical thermonuclear weapons coupled with the introduction of ballistic-missile delivery systems led to the entry of 16 new strategic systems into the stockpile, while at the same time, 10 weapon systems were retired. Delivery platforms were developed and deployed that established all three legs of the current Triad, and the strategic planning process was refined into the Single Integrated Operational Plan (SIOP). Equally impressive is the surge experienced in tactical/theater weapon systems—17 introduced and only 3 retired. Toward the end of this period, the stockpile reached its all-time high in terms of total number of weapons deployed and included a number of different weapon systems (33) that has only recently been exceeded.

The fourth phase, extending from 1965 to 1985, appears to be a period of relative stability. The total number of active systems remained relatively constant, with the rate of new introductions matched by an equal rate of retirements and with neither rate approaching anywhere near the hectic pace of 1955–1965. The number of individual weapons stockpiled has declined markedly from the peak, and the total megatonnage dropped even more rapidly as moderate-yield systems replaced earlier thermonuclear weapons for bombers and for the second-generation missile forces.

From this, one might draw the conclusion that nuclear-weapons technology—or demand—reached essential maturity approximately 20 years ago and has been largely in a state of refinement ever since. An examination in some detail of the actual circumstances dictating the complexion of today's stockpile should reveal the degree to which this is correct. In carrying out this investigation, our major concentration will be on the years following the introduction of thermonuclear weapons and the development of the first SIOP, i.e., the mid-to-late 1950s on. We will deal only lightly with the opening decade of the nuclear era, which is already the subject of an extensive literature. There is little question that in this early phase of nuclear development, technology drove policy almost without exception.

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DEVELOPMENTS TO 1965

Phases I and II: The First Decade

The opening of the nuclear age at Alamogordo in July 1945 demonstrated that man now had the ability to release explosive energy on a hitherto inconceivable scale and fundamentally changed perceptions of warfare, probably for all time. With this success, the scientists and engineers of the Manhattan District wrote an indelible finish to the extraordinary surge in technology that characterized World War II. For the foreseeable future, technology would dominate military science, and it appeared that nuclear-weapon technologists would dominate technology. The implosion device tested at Alamogordo was the prototype of the Fat Man weapon used August 9, 1945, to destroy Nagasaki and to end World War II. The gun-type Little Boy dropped over Hiroshima on August 6 had no prior test, so confident were its designers. Thus, by the close of the war the two distinct patterns of fission-weapon that have formed the functional basis for the U. S. nuclear-weapons stockpile ever since were established and demonstrated. But there was room for improvement.

In the immediate postwar years, efforts to better understand the destructive potential of nuclear weapons took priority, leading to the Bikini Able and Baker tests of Operation Crossroads to determine the effects of air and underwater bursts on ships. The major force shaping the U. S. stockpile was scarcity of fissile materials.

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The Mk-IV (or B4) entered the stockpile in early 1949.

To this point, the strategic bomber was the only platform that ever had—or could have—delivered a nuclear weapon. Army B-29s delivered the Hiroshima and Nagasaki bombs and the air-dropped tests in the Pacific. Only specially modified B-29s could carry the heavy, bulky Fat Man; through most of 1948, the Strategic Air Command (SAC) had 30 such airplanes. The nuclear-capable B-50 entered service in 1948, and SAC finished the year with a total of 60 nuclear-capable aircraft.

Planning for nuclear war was similarly limited. World War II experience had shown that attacks on specific functions were more damaging to the enemy's war-making capacity than was the indiscriminate bombing of urban areas. But Russia was a vast and largely undefined target. When serious planning for nuclear strikes began, the small inventory of weapons did not allow for precision destruction of significant military capability: war plan BROILER in 1947 called for 34 weapons to be used on 24 cities. But as the stockpile expanded, so did the target list. Plan TROJAN, approved in December 1948, called for 133 nuclear weapons on 70 cities. In

May 1949, a study headed by Air Force Lt. General H. R. Harmon reported that even if all 133 weapons detonated on target the Soviet leadership would not be critically weakened, Soviet military ability to take selected areas of Western Europe and of the Middle East and Far East would not be seriously impaired, and Soviet industrial capacity would not be sufficiently reduced to prevent recovery. The resulting reassessment of targeting requirements led to a substantial increase in nuclear production. And in the fall of 1949, the Joint Chiefs of Staff (JCS), in conjunction with the North Atlantic Treaty committing the U. S. to European defense, tasked the Strategic Air Command with "retardation of Soviet advances in Western Europe."[1]

With General Curtis LeMay as SAC commander, and freed by the results of Sandstone from the constraints of weapons scarcity, the 60 nuclear-capable aircraft available at the end of 1948 grew to 250 by June 1950. The giant B-36 came on line in 1949, and the all-jet B-47 medium bomber would arrive in 1951. The October 1949 target annex for war plan OFFTACKLE called for attacks on 104 urban targets using 204 weapons, with 72 bombs to be held in reserve.[2] The prime objective was still disruption of the Soviet will to fight, but a number of "retardation" targets were included. By August 1950, concern over growing Soviet nuclear strength led to a further re-prioritization to assign first priority to targets supporting Soviet nuclear-delivery capability. The mission of retarding a Soviet attack in Europe was assigned second priority, and disruption of Soviet war-making capacity by attacks on electric power, atomic energy industries and liquid fuel facilities was assigned third priority. This war-fighting allocation system persisted in U. S. targeting doctrine for the next 10 years.

The move away from simple urban targeting to a more elaborate military targeting doctrine designed to meet specific military objectives was to a large degree made possible by the increasing availability of nuclear weapons, and this move, in turn, stimulated the need for new weapons.

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For the European retardation mission, which needed to deal with somewhat transitory targets, the relatively lightweight B5 tactical bomb entered stockpile in 1952. This was followed in short order by a series of new tactical weapons, including development of the Mk-9, 280-mm artillery shell; adaptation of the B5 as the W5 warhead for the Navy's Regulus and Air Force Matador cruise missiles; and development of the W7, as both bomb and warhead for the short-range missiles, and as the first atomic demolition munition (ADM). All of these were implosion weapons, with the exception of the 280-mm artillery-fired atomic projectile (AFAP), which was gun-assembled. Interestingly, the gun-assembled B8 bomb ("Improved Little Boy") also entered stockpile in 1952 and remained for nearly 6 years.

Turning again to the strategic arena, a growing perception that many critical Soviet targets were harder than previously expected, and often covered a large area or were grouped such that "bonus" damage could be achieved with a large enough weapon, drove the quest for higher yields. Boosting was first tested in the Item shot in the 1951 Greenhouse series, and it appeared clear that megaton-yield, boosted fission weapons of reasonable weight and size could be developed. But it was also apparent that the thermonuclear weapon, first considered by Edward Teller and others in a 1942 meeting in Berkeley, would offer an economical route to very high yields if it could be made to work. And the boosted fission explosive offered the possibility of an energy source small and hot enough to provide an ideal primary stage for the practical thermonuclear concept developed by Teller and Stanislaw Ulam.

The controversy surrounding President Harry Truman's decision to go forward with a vigorous effort on the Super is a well-documented story and will not be repeated here. The first thermonuclear device, the liquid-deuterium-fueled Ivy Mike, was tested at a yield of 10 Mt in October 1952 at Eniwetok. [redacted]

By the end of 1955, the total megatonnage in the stockpile began to climb rapidly.

Phase III: 1955 to 1965

At the start of the second Eisenhower administration, the "New Look" strategy of massive retaliation had placed the Strategic Air Command (SAC) in control of U. S. nuclear targeting strategy and had guaranteed the Air Force the lion's share of defense budgets. Between 1955 and 1960, the total megatonnage in stockpile grew enormously as multimegaton warheads were added for the growing SAC bomber fleet, which, with the introduction of the B-52 in June 1955, attained 1,000 nuclear-delivery aircraft. The nuclear stockpile grew in parallel with the growth of nuclear-delivery capability, both in quantity and quality; by the end of 1959, the majority of the weapons intended for SAC delivery would be of the modern, sealed-pit design.

The last years of the 1950s were not focused solely on strategic needs, however. During this same period, a number of new warheads for tactical systems were developed, including the first instances of upgrading existing carriers such as Honest John and Regulus with better nuclear tips. [redacted] This was a clear instance of service needs—safety of the launch platform for close-in engagements—driving technology.

The strategic arena, however, provided the major focus of attention. By 1956 the list of targets for SAC had grown to [redacted] and was still expanding rapidly. Nuclear counterforce targets (including defense suppression targets required to ensure penetration by SAC bombers) continued to receive top priority, and their number grew with every new intelligence assessment. Although the Navy forcefully argued the strategic role of its carrier-based aircraft and targeted these quite independently, the U. S. strategic punch resided almost entirely in the SAC bombers—a "monad." But the situation was changing rapidly. [redacted] To exploit this new capability, the Air Force and Army were developing ballistic missiles—the Air Force the intercontinental Atlas and Titan and intermediate-range Thor, and the Army the intermediate-range

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Jupiter. Perhaps even more significant, the feasibility of solid-fueled missiles made the submarine a practical ballistic-missile-delivery platform, and in 1956 the Navy committed to developing Polaris.

But while the strategic forces grew and diversified, SAC doctrine of massive retaliation and emphasis on counterforce targeting, with its apparently unlimited requirements for weapons, came under steady attack within the Joint Chiefs of Staff (JCS). In the spring of 1958, a JCS majority under the leadership of Army Chief of Staff General Maxwell Taylor argued for the need to prepare for limited war. Secretary of State John Foster Dulles agreed that, with the Soviets now a major nuclear power, the doctrine of massive retaliation had outlived its usefulness. President Dwight Eisenhower, however, felt that an increase in conventional forces could be bought only at the cost of increased defense expenditures, which he would not accept, or of weakened strategic (air) forces, which he could not accept without further study. He tasked the National Security Council (NSC) to give high priority to a careful analysis of the minimum requirements for deterrence and retaliation.

In July 1958, Admiral Arleigh Burke weighed in with the Navy's strategy to exploit the flexibility and invulnerability of the coming Polaris force. Burke argued that, while it had once made sense for the U. S. to deploy sufficient force to disarm the Soviet Union, the growing Soviet intercontinental ballistic missile (ICBM) deployment made this "blunting" or disarming mission now unworkable. In addition, the Soviets could now put at risk all U. S. land-based forces; their vulnerability invited surprise attack. The alternative was to secure the U. S. strike force by mobility and concealment, eliminating the pressure to preempt and allowing the U. S. to respond selectively in order to apply political coercion. This strategy of "finite deterrence" would require a small submarine-launched ballistic missile (SLBM) force sized for deterrence alone (i.e., the ability to destroy major urban areas).

Recognizing the Navy threat, SAC in November 1958 proposed that a U. S. Strategic Command embracing all strategic forces, including Polaris, should be formed, with the Air Force in charge. SAC would then be abolished. Burke admired the idea of dismantling SAC, but rejected the notion that anyone but sailors could operate Polaris submarines in conjunction with other naval forces. He also saw no need for any new coordination structure since Polaris would use its missiles against a (Navy-determined) target system that was generally stable.

Despite Admiral Burke's assurances, the problem of controlling and coordinating U. S. nuclear retaliation was growing more serious—even in the absence of Polaris. Thoughtful Air Force leaders believed that an overhaul of "atomic coordination machinery" was overdue. In March 1959, JCS Chairman General Nathan Twining wrote a memo to Secretary of Defense Neil McElroy addressing "Target Coordination and Associated Problems." This memo triggered no immediate action but laid the groundwork for the later formation of the Joint Strategic Target Planning Staff (JSTPS).[3]

In the last year of the Eisenhower administration, the divergence of strategic planning combined with the above considerations to create a situation that demanded resolution. President Eisenhower had grown increasingly dubious about the seemingly endless growth in Soviet targets, but, in the absence of any alternative, had acceded to SAC demands for additional weapon platforms and nuclear-weapons production. In March 1960, the Air Force Intelligence Directorate (AFID) identified [redacted] targets and projected that this total would grow to [redacted] by 1965 as the Soviets added offensive and defensive missiles. Highest priority was assigned to suppressing Soviet air defenses and stopping Soviet nuclear attack on the U. S. and its allies. Halting Soviet land and sea operations (the retardation mission) received a lower priority and was assigned to tactical air forces. The last and smallest group of targets involved the disruption of the war support and recuperation capability of Soviet industry. The explicit emphasis on counterforce targeting fit SAC doctrine but was at odds with Army and Navy positions.[4]

At about the same time, the Hickey Committee proposed an "optimum mix" targeting strategy composed of a combination of counterforce targets, control centers, war-supporting installations, and population centers. The Hickey target list projected for 1962 endorsed basic SAC strategy but included [redacted] total targets, some 40 percent fewer than the AFID list presented for 1960. With General Twining's support, Eisenhower endorsed the Hickey Committee recommendation as the point of departure for all future JCS planning. At the same time, Eisenhower rejected Air Force pleas for the B-70 aircraft on the grounds that its intended second-strike counterforce mission was not sensible. He also decided that Polaris would be used to clear the way for SAC bombers by knocking out organized defenses and dismissed Navy arguments for Polaris as a vehicle for selective, controlled response.[5]

The festering issue of target planning and nuclear strike coordination came to a head at a stormy White House meeting of the Joint Chiefs and top defense officials on August 11, 1960. This meeting is described in detail by Rosenberg. Secretary of Defense Thomas Gates proposed that the SAC commander-in-chief be designated "Director of Strategic Target Planning" with authority to develop, on behalf of the JCS, a National Strategic Target List (NSTL) and an SIOP. Gates argued that the advent of ballistic missiles, especially SLBMs, created an urgent demand to replace the current system of joint target guidance and separate operational commands. Despite strong Navy objections, Eisenhower, convinced of the need to utilize both the Navy and the Air Force's capabilities simultaneously in any retaliatory strike, endorsed Gate's proposal.[6]

On December 2, 1960, the JCS approved SIOP-62. The NSTL selected [redacted] targets out of a target data base of 4,100, lumped into [redacted] designated ground zeroes (DGZs), including [redacted] urban-industrial targets. With sufficient warning, the U. S. would launch its entire strategic force carrying 3,500 nuclear weapons against this target set. At the very least, an "alert force" of 880 bombers and missiles would attack [redacted] with some [redacted] weapons totaling up to [redacted] The target list developed by JSTPS was 29 percent greater than the Hickey list, and any restraints on target selection had been negated by requirements for overlapping laydowns. Eisenhower left behind an impressive and rapidly expanding nuclear deterrent capability. SAC had 538 B-52s, 1,292 B-47s, 19 B-58s, and 1,094 tanker aircraft. [redacted] Construction of 650 additional Atlas, Titan, and Minuteman missiles was authorized, along with 14 Polaris boats. The first Polaris had gone on station in November.[7]

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The nuclear-weapon stockpile had grown even more rapidly. President Eisenhower had steadily endorsed increases in production of all categories of nuclear weapons. Although the strategic questions occupied most of his attention, he was committed to tactical nuclear weapons as an economic means of augmenting conventional strength. Accordingly, tactical weapons and air defense warheads were stockpiled and dispersed in large numbers. By the end of his administration, the stockpile was growing rapidly (Rosenberg claims that it tripled—from 6,000 to nearly 18,000 total weapons—in the 2 years 1958–1960[8]).

At the end of the Eisenhower administration, U. S. nuclear posture had taken the shape it has held ever since. The strategic Triad, though not yet fully implemented, had been designed and was in procurement. Nuclear strike planning, after much strain, had been consolidated into the JSTPS, and the first SIOP was in effect. Nuclear support for the North Atlantic Treaty Organization (NATO) in the theater had been prepared and the weapons to implement NATO MC 14/2 were in procurement. The list of strategic weapons that entered stockpile during the last 5 years of the Eisenhower administration attests to the vigor of the nuclear production complex:

- B28 (thermonuclear bomb)
- B36 (thermonuclear bomb)
- B39 (thermonuclear bomb)
- B41 (thermonuclear bomb)
- W28 (thermonuclear warhead: Hound Dog, Mace)
- W39 (thermonuclear warhead: Bomarc)
- W47 (thermonuclear warhead: Polaris A1, A2)
- W49 (thermonuclear warhead: Thor, Jupiter, Atlas, Titan I).

The list of tactical weapons is equally impressive:

- W25 (fission weapon: Genie air-to-air defense missile)
- W27 (thermonuclear warhead: Regulus II)
- W30 (fission warhead: Navy Talos, TADM missiles)
- W31 (fission weapon: ADM,
- W33 (gun-assembled fission weapon: 8-in. artillery shell)
- W34 (multipurpose fission warhead: Hotpoint).

The momentum built up during the Eisenhower years carried over into the Kennedy Administration, even though Defense Secretary Robert McNamara found SIOP-62 too rigid and apparently lacking in strategic rationale. The new administration initiated a rethinking of strategy and doctrine and introduced flexible options into the SIOP, but did not slow the entry of new weapons into stockpile. As a result, by the end of 1965 the following additional nuclear systems had become operational:

Strategic:

- W38 (thermonuclear warhead: Atlas, Titan I)
- B43 (thermonuclear bomb)
- W53 (thermonuclear warhead: Titan II)
- W56 (thermonuclear warhead: Minuteman II)
- W58 (thermonuclear warhead: Polaris A3)
- W59 (thermonuclear warhead: Minuteman I).

Tactical:

- W44 (fission weapon: ASROC)
- W45 (fission weapon: MADM, Little John, Terrier, Bullpup)
- W48 (fission weapon: 155-mm artillery shell)
- W50 (thermonuclear warhead: Pershing I)
- W52 (thermonuclear warhead: Sergeant)
- W54 (fission weapon: Falcon, Davy Crockett, SADM)
- W55 (thermonuclear warhead: SUBROC)
- B57 (multipurpose fission bomb).

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Except for the gun-assembled W33, which required extensive field assembly before firing, all stockpiled weapons were now sealed-pit designs. While there was much innovative detail, and a few really new wrinkles yet to be worked out, the major inventions had been made and heavily exploited, and the basic patterns of nuclear-weapons technology had been firmly established.

THE STOCKPILE FROM 1965

Since 1965, the growth in the nuclear-weapons stockpile has shown a character entirely different from that of the first two decades. Referring once again to Figs. 1 and 2, we see that only 23 new systems entered stockpile in the 20 years 1966–1985 and that 15 systems were retired during this period. The functional makeup of the stockpile, that is, the proportions dedicated to strategic and nonstrategic missions, remains steady at the pattern established by 1965. This pattern is consistent with a view that little change in fundamental U. S. nuclear strategy has taken place over the last 20 years. Apparently, no nuclear innovation during this period has been sufficiently dramatic to once more induce sea changes like those of the 1940s and 1950s. To a large extent, turnovers in the stockpile appear designed to make more effective use of the technologies first developed in the 1950s in order to match weapon systems to military requirements.

This is not to say that the art and science of nuclear weaponry has not advanced during the modern era. Steady progress in basic weapon technology and a few major technical innovations have substantially enhanced the operational and logistical utility of nuclear weapons. To examine this in detail, we shall in the balance of this report adopt an organization centered on distinguishing weapons by the operational requirements they are designed to fill. Specifically, we shall develop the history of the stockpile in seven different categories:

- Strategic offensive: land-based ballistic missiles
- Strategic offensive: sea-based ballistic missiles
- Gravity bombs
- Air-to-surface missiles
- Tactical missiles
- Defensive weapons
- Miscellaneous tactical weapons.

Before a chronological survey of stockpile development is resumed, the more important advances of the past 20 years will first be described.

Basic Knowledge

While not an identifiable single technology, increased knowledge of basic weapon physics, materials properties and behavior, electronics, and computing technology have resulted in substantial steady improvements in nuclear-weapons design and construction. Weapons designers have been able to use their understanding of the physics of weapon function, plus the marked improvement in their ability to model weapon behavior, to eliminate unnecessary weight and fit a given yield into a smaller envelope. At the same time, miniaturization of weapon electronics and the development of new structural materials have made it possible to use more of the total warhead volume for the nuclear physics package. The result has been a steady improvement over the years in the yield-to-weight ratio, reductions in warhead diameter and size, and the ability to tailor weapons to particular delivery modes.

Safety

It is noteworthy that, over the span of more than 40 years, there has never been an accidental detonation of a nuclear weapon that produced a nuclear yield. However, there have been accidents with nuclear weapons, and there have been accidental detonations of high explosive (HE) in nuclear weapons. Requirements for one-point safety adopted and enforced many years ago have ensured that, even in the event of an accident sufficiently severe to detonate the HE of a nuclear weapon, no significant nuclear yield will result. However, explosion and fire can still result in the dispersal of weapons materials—most notably plutonium—that still present a significant hazard to indigenous populations and cleanup personnel. The most noteworthy such event occurred in 1966 near Palomares, Spain, when a B-52 carrying four bombs collided with a tanker during aerial refueling and dropped its bombs. Although three were recovered at sea, the HE of one detonated over the Spanish countryside, resulting in a massive effort to scrape up and dispose of contaminated soil.

To avoid further such incidents, the weapons laboratories have introduced several techniques for mitigating the results of any accidental fire or explosion. Some of these involve mechanically isolating the plutonium pit from the HE until the time comes to arm the weapon—a modern version of the original Fat Man. The most widely used method, however, employs insensitive high explosive (IHE, commonly a formulation designated as PBX9502), which combines energetic explosive material with an inert binder in such a way as to make accidental detonation virtually impossible. Only a precision detonator designed to produce an extraordinarily strong shock can explode IHE.

Weapons designed with IHE tend to be somewhat larger and heavier than they would have to be if a more sensitive explosive (PBX9404) were used. For this reason, the use of IHE has become routine in weapons subject to handling, such as air-carried weapons and tactical systems, but it has not become routine until recently in strategic missile warheads. However, with mobile basing of ICBMs now on the horizon, the W87 MX warhead will incorporate IHE, and it is likely that most future weapon designs will do so.

Selectable Yields

[redacted]

This logistic advantage has continued to drive interest in selectable yields for many, if not most, nuclear warheads. [redacted] From time to time, interest in precision strategic warfare surfaces and leads to arguments about the need for low-yield missile options, but so far this complication has not crept into the SIOP.

[redacted]

Enhanced Radiation

[redacted]

As a tactical antipersonnel warhead, the "neutron bomb" ignited much controversy when it was originally proposed for NATO nuclear artillery in the 1970s—controversy that now has somewhat subsided but has not disappeared. [redacted]

A FUNCTIONAL CHRONOLOGY OF THE MODERN STOCKPILE

Land-Based Strategic Ballistic Missiles

As recounted earlier, by the end of 1965 the single-warhead Titan II, Minuteman I, and Minuteman II ICBMs were all operational. Growing concern over the possible need to cope with Soviet missile defenses, an increasing list of hardened Soviet targets, and continued decrease in warhead size and weight came together to spark interest in MIRV technology. Development of the first multiple integrated reentry vehicle (MIRV) warhead for land-based U. S. missiles began formally with the entry of the W62 into Phase 3 in June 1964. By mid-1967, the 1,000th single-warhead Minuteman missile had gone on strategic alert, with 550 Minuteman I and 450 Minuteman II missiles deployed. The first flight test of Minuteman III took place in August 1968, and the three-warhead MIRVed missile became operational in December 1970.

[redacted] result was a MIRV system with high accuracy that could place at risk a growing number of Soviet missile silos and other hard targets. Between 1970 and 1975, 550 Minuteman III missiles replaced an equal number of single-warhead Minuteman I ICBMs in the strategic alert force.

Even before deployment of Minuteman III was completed, however, efforts were under way to improve the hard-target capability of U. S. ICBMs. In 1974, a contract was issued to develop the improved-accuracy Mk-12A reentry vehicle, and the W78 warhead to be carried by this vehicle entered Phase 3. The Advanced Ballistic Reentry Vehicle (ABRV) program, dedicated to maximizing accuracy achievable with small reentry vehicles, was begun in 1975. In July 1976, Minuteman III was flight-tested with the more accurate INS-20 inertial guidance set.

The original specifications for the W78 Mk-12A illuminate the progress made in strategic warhead technology in the decade since the predecessor W62 entered Phase 3.

[redacted] The military justification for this was the need to compensate for continual hardening of Soviet strategic targets.

[redacted]

As it turned out, the W78 Mk-12A almost met all specifications, but was slightly overweight. By 1988, deployment of 300 Minuteman IIIs carrying the Mk-12A was completed.

[redacted]

work on the latest U. S. ICBM—the MX Peacekeeper—began formally in 1971 and entered advanced development in 1974. As a completely new weapon system rather than a derivative of Minuteman or any other earlier missile, the MX incorporates advanced technology in all components, including the Mk-21 reentry vehicle (out of the ABRV program).

While controversy over MX basing has clouded the program almost from its beginning—and is not yet completely settled—the process of choosing a warhead for MX was also not serene.

[redacted]

Segments of the Air Force strongly opposed this, however, arguing that Soviet construction of a new generation of "superhard" missile silos, control centers, and leadership bunkers made it imperative that the MX be used to improve U. S. hard-target kill capability. The March 1976 imposition of a 150-kt limit on nuclear test yields by the Limited Test Ban Treaty (LTBT) complicated the decision process. This meant that a new high-yield warhead for MX would have to be fielded without ever undergoing tests in its complete design configuration. Advocates of hard-target kill won the day fairly early on, but the specifics of the warhead remained uncertain for some time; for an extended period the W78 Mk-12A was carried as the baseline MX warhead. However, in early 1982 the Department of Defense (DoD) chose a new warhead, the W87, to be mated with the new Mk-21 reentry vehicle.

The W87 began the modern era of treaty-constrained development of high-yield warheads.

[redacted]

Sea-Based Strategic Ballistic Missiles

October 1965 saw the last ballistic-missile nuclear submarine (SSBN) patrol of the Polaris A1 missile and the start of development of the Poseidon C3 missile for the new Poseidon boats. Only 5 years after the first Polaris SSBN had gone on station, the Navy was retiring the earliest elements of its first-generation SLBM force and was entering development of a second, MIRVed generation.

[redacted]

Neither of the Polaris versions offered very good delivery accuracy, nor would this be a requirement on the yet-to-be-developed Poseidon C3. The primary mission of the SLBM force seemed to be to provide a secure retaliatory force, either to meet the requirements for finite deterrence, spelled out 10 years earlier by Arleigh Burke, or to pave the way for SAC bombers by knocking out defenses, as stipulated by President Eisenhower. In any case, the SLBM force was clearly designed for soft targets.

[redacted]

The Trident program began as ULMS—Undersea Long-Range Missile System—in 1969 as a result of the STRAT-X studies. As a follow-on to Polaris/Poseidon, Trident was envisioned as a quieter submarine, carrying missiles that could be launched at intercontinental range. The need for Trident was driven by two primary considerations: a replacement for Poseidon would be needed before the end of its projected service life of 20 to 25 years, and the replacement submarines should operate over a wider range of ocean in order to ensure survivability against a growing Soviet surveillance and ASW capability. Development of the Trident I C4 missile and the Ohio-class Trident boat was approved by the Secretary of Defense in September 1971.

The Trident I missile was sized to allow retrofit into the smaller Poseidon SSBNs—a later Trident II missile will fit only the larger Trident boats. By the time the W76 warhead for the C4 was selected in 1973, the Navy had become more interested in missile range than in any further fractionation of payloads.

[redacted] liver its full load of eight W76 warheads to ranges greater than those attainable by an off-loaded Poseidon C3. Although the accuracy of the [redacted]

The W76 is the latest SLBM warhead to enter stockpile. [redacted] will complete the Navy's conversion from concentration solely on soft targets. [redacted]

Gravity Bombs

The story of gravity bombs since 1965 is to a large extent the story of the B61 bomb in all its variants. The B61, which entered Phase 3 development in January 1963, is a multipurpose modern tactical bomb, weighing approximately 700 lb, which now exists in eight models designed for air delivery by both strategic and tactical forces. Because the B61 is a truly multipurpose weapon, carried by a wide variety of U. S. and Allied aircraft dispersed all over the world, the development and refinement of B61 mods has been heavily influenced by requirements for safety and security. All B61 variants but one carry Permissive Action Link (PAL) arming systems, and some of the earlier mods that predated the introduction of IHE are now being replaced by versions employing an IHE primary and more elaborate safety and security systems.

[redacted] The Mod 0 employs a Category B PAL, requiring entry of a four-digit code to arm the weapon. The Mod 1 does not have the PAL (it is intended for Navy use); otherwise, it is identical to the Mod 0. Both of these early versions use PBX9404 HE. [redacted] his version also incorporates command disable, which will destroy critical components of the warhead on coded command. The B61 Mod 5 is the last of the non-IHE versions. [redacted]

Beginning with the Mod 3, IHE has become standard equipment for B61s, along with weak link/strong link and unique signal generator systems. [redacted] The Mod 7 is a retrofit of Mod 0 and Mod 1 models to incorporate IHE and Category D PALs.

DOE (b)(3)

The history of the B61 program presents a clear case of technical innovation's creating military opportunities, which, as they are exploited, go on to generate further elaborations as military requirements. [redacted]

DOE (b)(3)

Redacted

Only one other gravity bomb has entered stockpile since 1965. [redacted]

DOE (b)(3)

Air-to-Surface Missiles

Modern (i.e., post-Snark) interest in air-to-surface missiles originates from concerns over the ability of aging SAC-Air Force B52s to penetrate Soviet air space with sufficiently low attrition to allow delivery of gravity bombs on target. Two air-to-surface missiles—the AGM-69 SRAM (Short-Range Attack Missile) and the AGM-86B ALCM (Air-Launched Cruise Missile)—are now in the stockpile.

The W69 warhead for the SRAM entered Phase 3 development in 1967 and full production in 1972. The SRAM is a supersonic missile with a range of about 200 km and an accurate inertial guidance system, carried on B-52G/H and FB-111 aircraft. [redacted] There are now plans to retire the SRAM in favor of a more advanced missile in the early 1990s.

DOE (b)(3)

The AGM-86B ALCM, initially deployed in 1982, carries the W80 Mod 1 warhead. [redacted] The W80 is of conventional thermonuclear pattern, designed to fit the physical envelope and operational environment presented by the small cruise missile airframe and external stowage for extended periods on high-altitude B-52G/H weapon platforms. In other words, military requirements drove the W80.

DOE (b)(3)

Tactical Missiles

Five warheads for tactical missile systems have entered the stockpile since 1965:

the W70-1/2 for the MGM-52 Lance short-range Army ballistic missile; the W70-3 enhanced radiation version for Lance; the W80 warhead for the Tomahawk Sea-Launched Cruise Missile (SLCM); the W84 warhead for the Ground-Launched Cruise Missile (GLCM); and the W85 warhead for the Pershing II intermediate-range ballistic missile.

The W70 Lance warhead entered Phase 3 development in 1969 and full production in June 1973. [redacted] In April 1976, as a consequence of successes in demonstrating the tactical value of enhanced radiation (ER) warheads, a Phase 3 program was initiated to develop an ER version of the W70, which entered stockpile in 1981 as the W70-3. [redacted]

Phase 3 for the W84 GLCM warhead was initiated in September 1978, and the warhead entered full production in September 1983. [redacted] Other design features include those becoming common for all weapons requiring ready access by operational crews: IHE, command disable, and Category F PAL systems. [redacted]

[redacted] To comply with the 1987 INF treaty, the W84 and W85 are no longer part of the deployed stockpile.

Defensive Weapons

The surge in demand for defensive air-to-air and surface-to-air weapons experienced in the 1955–1960 period has not been sustained. In fact, the only two defensive warheads to enter stockpile since 1965 were for the defunct Safeguard/Spartan ABM system; one of these warheads has now been put in special reserve and the other has been retired and dismantled. Both warheads were technically very innovative, yet both appear to have led to dead ends.

The W66 warhead for the Sprint terminal interceptor entered Phase 3 in January 1968 and full production in late 1974. The ABM terminal defense mission presented conflicting requirements—a nuclear warhead to kill the incoming weapon at a range of 100 m or more, limited by defensive missile guidance and agility constraints, and the need to minimize the radar blackout produced by nuclear fireballs. [redacted]

[redacted] The small number of W71s eventually built are now in reserve and may soon be dismantled.

Miscellaneous Tactical Weapons

Only two weapon systems have entered or have been scheduled to enter stockpile since 1965. [redacted]

The W79 replacement for the ancient W33 8-in. shell entered Phase 3 in January 1975 and full production in 1981. It is a modern, one-point-safe implosion design incorporating a Category D PAL in the warhead and command disable in the shipping container. Unlike the W33, the W79 requires no field assembly and is a ballistic match to the conventional HE round. [redacted] The ER feature provided the source for controversy in Europe in 1977 and led to President Jimmy Carter's 1979 decision to rescind his earlier approval for production and deployment. Currently, the W79 is being stockpiled only in the United States, without the ER component. [redacted] It is this feature that has produced the controversy that has kept the warhead out of production.

SUMMARY

The evolution of the U. S. nuclear stockpile over some 40 years has been shaped by the interplay of technical, military-operational, and political forces. Our examination of the stockpile history indicates that the development and acquisition of U. S. nuclear forces has occurred in four distinct phases.

In the first phase, ending about 1950, the stockpile remained based on the wartime Fat Man and Little Boy designs, while weapons research concentrated on nuclear effects and on means to mitigate shortages of fissile material. During the second phase, from 1950 to 1955, the variety of stockpiled systems grew rapidly as lighter, more efficient fission weapons were developed and the first thermonuclear weapons were introduced. There can be little doubt that, throughout this first decade, the composition and capabilities of U. S. nuclear forces were determined virtually entirely by the rapidly changing state of nuclear-weapons technology.

The third phase, covering roughly the years 1955–1965, was in many ways the most interesting. Revolutionary innovations in delivery vehicles were coupled with the rapid advance of nuclear-weapon technology to underwrite massive growth in the strategic stockpile. Simultaneously, the intensified Soviet threat to Europe and the consolidation of U. S. nuclear strategy led to the introduction of large numbers of weapons designed for tactical/theater applications. During this period, the three legs of the strategic triad were established and the first SIOP was developed. While progress in nuclear-weapon technology continued to play a major role, technical advance across a broader front, including electronics and ballistic-missile technology, became very important. This era, perhaps more than any other, displays the symbiosis of nuclear and nonnuclear technologies in both prodding and responding to military requirements.

The fourth phase, extending from about 1965 to 1985, might be characterized as largely a period of refinement. While the total number of stockpiled weapons has varied over these years, the number of distinct types—mark numbers—has stayed relatively constant until the recent Reagan administration buildup. Second- or even third-generation warheads have replaced earlier systems, offering quantitative improvements in performance and operational characteristics. Technical advance in the state of the art in nuclear weaponry has continued, but military requirements have become the dominant force in determining the shape of the stockpile.

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Are These Capabilities Still Needed? (U)

Joseph S. Howard II
Edward I. Whitted

April 30, 1991

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The Future Of Non-Strategic Nuclear Forces

Are These Capabilities Still Needed? (U)

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The Future Of Non-Strategic Nuclear Forces

Are These Capabilities Still Needed? (U)

by

Joseph S. Howard II
Edward I. Whitted

ABSTRACT (U)

The epochal political events of 1989–1990 are greatly influencing US non-strategic nuclear forces (NSNF). NATO NSNF strategy is undergoing revision. The London Communique of July 6, 1990 is the harbinger of an intense debate upon future NATO nuclear roles and missions. The President's cancellation of the Follow-on-to-Lance missile (FOTL) and the offer of withdrawal of forward-deployed nuclear cannon projectiles to NATO indicate downward trends in future NSNF stockpiles.

This report, in the form of an executive summary and an annotated briefing, presents the results of a yearlong policy and systems analysis investigation. The authors examine plausible rationale, first principles, that govern the justification for future NSNF. They then assess the capabilities of reduced stockpiles during 1995–2000 wherein regional powers may possess nuclear arms. By configuring three nuclear scenarios in which US vital interests are at stake, the authors analyze the number of NSNF weapons to investigate "how much NSNF is enough?" They also examine implications to the US Army should downward trends in short-range nuclear forces continue.

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EXECUTIVE SUMMARY

Background

The world has witnessed such revolutionary changes over the past 18 months that clearly a new era has started. In this context, the authors undertook a study in late 1989 with partial Army support that would assess future European short-range nuclear force (SNF) structures and target sets. The rapidity of the political changes in Europe and the Soviet Union at the early stages of the effort motivated broadening the study to include strike non-strategic nuclear forces (NSNF) in a worldwide context. Also, the nature of the evolving era indicated that a traditional target-based analysis would be sadly deficient without underlying policy and economic assessments. These assessments have led us to conclude that, even more than before, future stockpiles will not be determined strictly on the basis of threat target defeat. Stockpiles will be configured from a complex interaction of domestic and international politics, defense budgets, arms control treaties, and differing threat perceptions.

The events in Europe are also affecting US NSNF strategies for other theaters. The outcome of future Nuclear Weapons Requirements Studies (NWRS) from the nuclear CINCs may profoundly affect NSNF roles and missions of the services. Trends in late 1990 were moving toward a denuclearization of the Army in the sense that organic nuclear systems might be retired.

Therefore, this paper examines the 1995-2000 rationale, roles, and capabilities of US NSNF in light of the revolutionary changes in Europe, plausible future nuclear threats worldwide, and downward trends in NSNF due to economic and political pressures.

Policy Findings: Strong Reasons for NSNF

The strategy and policy reassessment of US NSNF identified strong rationale for a continued role:

• As a visible instrument of superpower status in an uncertain and unpredictable world

• As a deterrent to future non-superpower nuclear-capable adversaries in a proliferated world

• As a deterrent to regional Soviet or Russian aggression as long as resurgence or reconstitution remains feasible

• To provide stability and insurance in a post-CFE Europe through a small air-delivered, forward-deployed force

Because of European politics, US NSNF structure decisions must be broader than peacetime NATO strategies, policies, and constraints.

DOD b(1) EO 1.5(a),(c),(e),(g)

Quantitative Findings: [redacted]

The force assessment finds utility from a span of non-strategic delivery capabilities: deterrence credibility, force survivability, launcher availability and responsiveness, and appropriate response options. A triad of delivery modes, sea, air, and land, inherently provides the most flexible spectrum of options to the National Command Authority (NCA).

We analyze three potential scenarios where NSNF could prevent or terminate war. In addition to a reconstituted Soviet theater threat, two regional nuclear adversaries, for example, [redacted] are representative of future nuclear threats where US vital interests might be at stake. [redacted]

DOD b(1) EO 1.5(a),(c),(e),(g)

DOD FRD b(3)

Force Structure Findings: SRAM T and organic Army SNF offer significant deterrent value

The need for SRAM T and Army organic SNF rests upon perceptions of future threats. We configured a range of threats that, we would argue, are credible in a multipolar world where nuclear weapons are proliferating. The prospect of such a world is not encouraging. If the policies of the US involved confrontation with threats of the magnitude depicted here, then a reasonable number of targets to hold at risk equal about 500 fixed targets and ten divisions.

The quantitative analyses of the three scenarios and the force structure assessments present strong, if not compelling, arguments in favor of SRAM T deployment. [redacted]

DOD b(1) EO 1.5(a),(c),(e),(g)

Equally strong arguments exist for the Army to keep at least a residual organic capability with the W79. [redacted]

DOD b(1) EO 1.5(a),(c),(e),(g)

Maintaining a residual organic capability with the W79-1, pending the identification and development of a more capable system, provide the following benefits.

- Cheap to maintain
  - W79 exists
  - New operational concepts available for minimal force structure

- Avoids cost of changing roles/missions
  - Joint command, Air Force, and Navy implementation costs substantial
  - Army doctrine, training, and leadership still required for integrated warfare

- Three-service NSNF more credible deterrent and more capable force
  - Avoids unrealistic demands upon AF/Navy DCA
  - Enhances survivability
  - Timely responsiveness for the battlefield
  - Stronger motivation for enemy forces to disperse
  - Not weather constrained

Recommendations

The essential findings support a three-service NSNF [redacted] the deployment of SRAM T (or a theater standoff air-to-surface missile), and the maintenance of an organic Army nuclear capability. We also recommend a joint Army-DOE study with these elements:

- Formally assess future Strategic Army battlefield nuclear rationale, missions, and operational concepts in light of current trends

- Examine organic Army force structure and organizational alternatives, facilities, and deployment requirements

- Define technical system options for future organic nuclear fire support alternatives.

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I. INTRODUCTION

- **Purpose**
- **Scope**
- **Objectives**

Non-strategic nuclear forces (NSNF) have composed a significant portion of the US nuclear stockpile due, primarily, to their deterrent capabilities against the Soviet Union and its conventional and theater forces. But the political watersheds of 1989 and 1990 in Europe are causing, and rightfully so, NATO governments, policymakers, and the public to challenge the need, roles, and composition of US forward-based nuclear systems.

The events in Europe are also affecting US NSNF strategies for other theaters. The outcome of future Nuclear Weapons Requirements Studies (NWRS) from the nuclear CINCs may profoundly affect NSNF roles and missions of the services. Current trends are moving in the direction of a denuclearization of the Army in the sense that organic nuclear systems might be retired

This paper examines the future rationale, roles, and capabilities of US NSNF in light of the revolutionary changes in Europe, plausible future nuclear threats worldwide, and downward trends in NSNF from economic and political pressures.

We conclude that NSNF still have a critical role to play within future US defense strategy. Our findings (summarized on pages 62–63) include the need for a flexible and versatile force through a variety of systems, including an organic Army capability and an Air Force theater stand-off capability, but at substantially reduced numbers from the present. The rationale for US NSNF should broaden its focus from Europe, where a small force of air-delivered munitions may remain for stability and insurance, to one embracing roles both as a deterrent against future regional adversaries with incipient nuclear capabilities, and also as a US political instrument of power in a multipolar world.

This briefing summarizes an extensive 12-month analysis of:

+ **Changing European Politics**
  ECAP, JOWOG, NWDG meetings; NATO policy papers and discussions
+ **Evolving US and DoD Policies**
  Current & programmed US NSNF
+ **Future Conventional and Nuclear Threats**
  Intelligence Community
+ **Future Target Sets**
  Types, locations, characteristics
+ **Army Organic SNF Implications**
  Army staff, TRADOC, JCS, OSD

The world has witnessed such revolutionary changes over the past 18 months that clearly a new era has started. In this context, we initiated a study in late 1989 with partial Army support (TRADOC TRAC-Leavenworth) that would assess future European SNF structures and target sets. The rapidity of the political changes in Europe and the Soviet Union at the early stages of the effort, however, necessitate a broadening of the study to include strike NSNF in a worldwide context. And the nature of the evolving era indicated that a traditional target-based analysis would be sadly deficient without underlying policy and economic assessments. Indeed, these assessments have led us to conclude that, even more than before, future stockpiles will not be determined strictly upon defeat of threat targets. Stockpiles will be configured from a complex interaction of domestic and international politics, defense budgets, arms control agreements and finally, differing threat perceptions.

Shown above is a summary list of the areas and sources that provided information. The views expressed are those of the authors and do not reflect official US government positions.

Objectives

Investigate the rationale and roles for future US NSNF stockpiles

Assess capabilities of US NSNF given limited NSNF systems and numbers

Examine implications for Army nuclear forces

The objectives listed above and on the next page stem from six major issues that raise uncertainty as to the need and size for NSNF. Taken as a whole these issues will certainly lead to substantial reductions in the US NSNF war-reserve stockpile. Some influential thinkers will argue that central strategic systems can, and even must, take over all of the roles and missions of NSNF. Other analysts will support NSNF but at reduced levels, raising the question of 'how much is enough?'.

The first issue concerns the gradual ascension of multipolarity in world political and economic relationships, even prior to the epochal restructuring in Europe. A number of industralized countries have become powers in their own right. Other third-world nations have the potential to become regional powers with the proliferation of advanced technologies. Clearly this diffusion of power has profound implications upon US defense strategy.

Second, the collapse of the WTO and the severe economic dislocations facing the Soviet Union have led to a greatly diminished Soviet threat to the NATO alliance. NATO nuclear strategy reviews will be the focus of unprecedented debates in the Atlantic community over the next year.

The third issue pertains to the impending CFE and START treaties. The President's offer to withdraw artillery-fired atomic projectiles (AFAPs) from Europe, the cancellation of the Follow-on-to-Lance (FOTL), and the termination of the W82 155mm AFAP are indicative of future SNF and NSNF arms control understandings and agreements.

Objectives (contd)

Investigate the rationale and roles for future US NSNF stockpiles

Assess capabilities of US NSNF given limited NSNF systems and numbers

Examine implications for Army nuclear forces

The ongoing deficit crisis with large reductions in military manpower and procurement budgets, the fourth issue, portends significant NSNF reductions and cancellations. The Congress will scrutinize production monies for the SRAM T and B90 NDSB. A very real prospect is no new NSNF production starts for several years.

A fifth issue is the continuing promise of advanced acquisition and nonnuclear technologies. These technologies, by acquiring and delivering lethal ordnance upon enemy fixed and mobile assets in near-real time, offer the potential for replacing some missions that previously required NSNF. However, analyses have demonstrated that these technologies, even when fully funded, deployed, and reliably delivered, cannot replace NSNF forces for deterrence or for effectiveness against many target classes.

The last issue concerns proliferation of nuclear technology to third-world nations. How does the US deter a non-superpower regional adversary from using its few nuclear weapons against committed US forces? Should we rely on our conventional might? On our central strategic forces? How should we respond if he actually employs nuclear weapons on committed US forces, causing massive casualties?

II. FORCE RATIONALE

Force Rationale
- Past rationale
- Start of a new epoch
- Determinants of a future US NSNF strategy

Force Assessment
- Roles and attributes
- Systems
- Numbers

Force Structure
- Army SNF
- SRAM T

Summary
- Findings
- Recommendations

To understand the future rationale for NSNF, we first consider the past reasons for having NSNF. We then explore in more detail the epoch-making changes in Europe, and how these might affect forward-deployed forces. We then argue what the main strands of a future US NSNF strategy ought to be (summarized on page 25).

This type of effort can quickly be overtaken by world events and decisions made at the national level. The report describes potential NATO and US policy directions gleaned from a number of forums and reports through December 1990. It is not meant to describe official US policy; instead it prescribes our policy recommendations derived from current trends. It then assesses the capabilities of shrunken US NSNF within three theaters of vital US interests where NSNF might be evoked against nuclear-armed adversaries.

The old *raison d'etre* for US NSNF: the Soviet Threat

1. **Democracies and economies of Western Europe**
2. **The overriding threat: the Soviet Union**
3. **NATO was unable to provide sufficient conventional forces**
4. **Deployment of nuclear weapons to Europe created an extended deterrence umbrella for conventional force deficiencies**

Other US CINCs were also allocated NSNF for deterrence of the worldwide Soviet Threat

Initially behind the deployment of US forward-based nuclear forces has been the threat of Soviet landpower, and subsequently the Soviets' own theater nuclear capabilities. The victory of the allies in the Second World War led to several unforeseen events: one was the raising of the Iron Curtain in the late 1940s through the subjection of Eastern European countries by the Soviet Union. The US, after fighting a war against totalitarianism, turned to a grand strategy of containment of Soviet imperialism. A free and prosperous Western Europe continued to be of utmost interest to the US; and therefore, the NATO alliance was formed to draw the line against further Soviet expansion. Unfortunately, the Soviet Union and its Warsaw Treaty Organization (WTO) alliance deployed forces far beyond those required for its own defense. Unable and unwilling to match the conventional force goals of the 1952 Lisbon Conference, the US deployed its first theater nuclear weapons for NATO in 1953.

Over the past 45 years, NATO nuclear doctrine has evolved from "massive retaliation" in MC 14/2, to "flexible response" in MC 14/3, then to the development of provisional political guidance (PPG) for initial and follow-on nuclear use, next to the Montebello modernization decisions, and now to the proposed "weapons of last resort" from last summer's London communique. But behind all of these declaratory doctrines and revisions, excepting the last, has been the massive Soviet threat.

The US strategy of extended deterrence, operative with the forward-deployment of US weapons and nuclear guarantees to the allies, has created a tension between the Europeans and the US. The presence of US weapons in Europe has been emphasized by the Europeans as a coupling to the US Central Strategic Forces. Hence, the specter of Armageddon must always reside in the calculus of the Soviet Union. Conversely to the US, the presence of theater nuclear weapons (now NSNF) gave an aura of credible response options before the ultimate response.

Several important factors drove stockpiles to large sizes

- **The size of the Soviet threat continued to grow**
- **The advances in nuclear weapon and delivery system technologies allowed for a myriad of theater/tactical delivery systems**
- **All three services deployed systems, developed operational concepts, and trained personnel to provide a variety of NSNF capabilities**
- **The political element of Allied participation for credible NSNF deterrence led to NATO programs of cooperation**

One byproduct of the end of the Cold War will be a large builddown of NSNF warheads. This warhead reduction will be in the thousands, a legacy of the Cold War balancing between the US and the Soviet Union.

The two major powers have competed with such vigor that arsenals grew to thousands of theater nuclear weapons on both sides. The US and the NATO alliance perceived that the massive Soviet land and theater nuclear capabilities presented an unacceptable threat to Western Europe without the political and military power of large nuclear weapon inventories. Further, this Soviet threat grew and modernized without abatement until the economic realities of a nearly bankrupt economy began to become so apparent in the last two years. But even today the bureaucratic resistance and inertia to change exists: 'Comrades, we have converted our factories to produce washing machines and sewing machines....but half of the time a tank still rolls out.'

Another reason for the large stockpiles stemmed from the remarkable technological advances in the period of the 1950s to 1970s. Warhead and carrier developments allowed a myriad of systems to be developed and deployed. The apex of the Cold War fostered budgets and political support for nuclear weapons that might never be seen again.

All three services also justified the need for their own NSNF. For example, the Army spent considerable resources in the 1950s toward the development of the nuclear battlefield with the Pentomic Division, which involved an extensive process of developing and testing ground forces in simultaneous operations with conventional and nuclear fires. The other two services also devoted significant resources to their nuclear programs.

In NATO, programs of cooperation were instituted for allied participation in the US extended deterrence strategy, thereby increasing stockpiles.

The presence of NSNF in Europe contributed to the long peace of 45 years

These weapons helped to deter the Soviet Union from initiating nuclear coercion or overt aggression against the NATO alliance

This occurred in spite of, or perhaps because of:

Ambiguities in NATO declaratory policies such as Flexible Response

Difficulties in developing battlefield nuclear weapon doctrine and concepts

Questions in survivability of NATO main operating bases

Unclear or unfavorable results from NATO nuclear exercises and war games.

The sheer destructive power of NSNF made the cost of a general European war too high, too uncertain about the prospect of victory, Pyrrhic or otherwise. NSNF engendered cautious behavior.

We argue that the existence of theater nuclear weapons was a major factor for the past 45-year peace in Europe. Prior to the stabilizing effects of NATO, due in part to its nuclear weapons, the European continent had been the scene of several major wars and periods of crises, largely stemming from rampant nationalism. The bipolar Cold War stabilized Europe, and the mass destruction available from nuclear weapons made a European general war too horrible. The evidence of NSNF contributing to the long peace of the past 45 years is persuasive:

- The Soviets in their own writings admit to unfavorable "correlation of force ratios" when NATO nuclear weapons are factored in.

- The danger of NATO nuclear use is clearly evident in their doctrine and training exercises. Dispersion of their forces is a norm prior to quick massing at the point of decisiveness.

- The Soviets undertook their own huge development and deployment program to field theater weapons for every practical delivery means.

The strategies of NATO worked. They worked in spite of ambiguities in NATO declaratory policies; ambiguities necessitated by political constraints and public acceptability. A number of employment questions and apparent deficiencies arose over the years as witnessed by changes in NATO doctrine (MC 14/2 to MC 14/3), results from exercises, and in recurring debates on NATO modernization such as the two-track decision.

But it all worked to keep the peace. The US policy of extended deterrence within NATO's nuclear declaratory and operational strategies made the cost of aggression too high to Soviet leaders. These weapons engendered cautious behavior. The costs of a general war became much too high.

NATO is entering a new epoch: its strategy is evolving

- **The London Communique is a harbinger**
  - Proposal to WTO: Non-aggression treaty, no longer adversaries
  - Nuclear forces are weapons of last resort
  - Elimination of nuclear artillery shells
  - Significantly reduced role for sub-strategic weapons of shortest range

- **The Soviet Union is no longer perceived to be a credible threat to Western Europe**
  - No intentions to attack
  - Capabilities to conduct a theater strategic offensive no longer credible
  - Must mobilize and pass through neutral or unfriendly East European nation(s)

- **The economic and political imperatives are reducing NATO & Soviet forces**
  - Declining budgets for forward-deployed conventional and NSNF forces
  - CFE treaty reducing conventional armaments
  - Short-range nuclear force agreements

The revolutionary changes of the past two years demand that NATO adapt its nuclear weapon strategies in order to preserve political legitimacy and acceptability. The first official response to the new era is the London Declaration of July 1990. By recognizing the disappearance of the Soviet short-warning and large-scale theater strategic operations (TSO) threat, the communique discounts the need for short-range nuclear forces, and offers the elimination of nuclear artillery shells. Furthermore, the joint declaration stipulates that NATO nuclear weapon strategy is moving away from "flexible response" to "weapons of last resort." As part of this revision, the President terminated the Follow-on-to-Lance modernization program. Clearly, the debate is just starting and will be controversial as to the future shape of NATO nuclear policies and stockpiles.

Indeed, many NATO thinkers and policy makers maintain that the Soviet Union should no longer be considered an adversary since their aggressive intentions are gone. They argue that the collapse of the WTO and the planned withdrawal of Soviet forces from Eastern Europe by 1994-95 reduces their capabilities to, at best, limited aggression. Only the threat remains of a reconstituted and resurgent Soviet Union after lengthy mobilization, however remote. And the probability of that event is considered to be so small by many in NATO governments as to be no longer a politically legitimate scenario for the maintenance of large NSNF stockpiles in Europe.

The ongoing economic crises in the Soviet Union are to a lesser degree matched by the deficit problems of the US budget and the calls for a peace dividend. Other NATO nations are already planning for large defense reductions. Eventually the CFE treaty may act more as a floor to defense cuts rather than a ceiling. SNF understandings and agreements will be in the forefront of arms control negotiations pending completion of the CFE treaty.

First Rationale: Stability, not "deterrence", for European-based US NSNF in a post CFE Europe

1. An insurance policy, a hedge against future uncertainty

- Stability with Allied POCs
- Balance power to restrain resurgent nationalism
- Preclude any potential opponent from contemplating aggression

DoD b(1) EO 1.5(a),(c),(e),(g)

Evolving NATO Declaratory Nuclear Policy

Going out:
- SNF
- Target-based deterrence
- Peacetime targeting of Soviet Union?

→

Coming in:
- Fact of NSNF capabilities/commitments
- Existence to respond to aggressive military action

Papers and briefings by NATO defense analysts are providing insights for the ongoing strategy review. These initial directions include a movement away from the traditional rationale of deterrence in its broad European connotations: as a counter to the large Soviet threat, peacetime employment planning, wartime direct defense, and so on. For public acceptability, declaratory policy may shift from deterrence in lieu of a Soviet threat, to one of "persuasion," "dissuasion," and "insurance". The elements of the insurance rationale are three-fold: stability and full Allied participation with the programs of cooperation during this uncertain era; the balancing role to prevent power blocs and ultra-nationalism from recurring in Europe; and finally, the traditional deterrent role of preventing war against any future aggressor, a resurgent Soviet Union or whomever.

In consonance with the London communique, SNF will clearly be withdrawn. Declaratory policy will indicate no nuclear targeting in peacetime, especially in light of the vanished large-scale Soviet threat. The sheer presence of nuclear weapons, and the fact that NATO can use them, might become the only announced tenets to preclude damaging debates between the NATO governments. This declaratory strategy may take on the connotations of an "existential" force that deters by its simple existence; but it is beyond the scope of this effort to predict the future operational concepts involving training, construction of options, and the nuclear infrastructure. However, we can estimate that the land-based NATO stockpiles will shrink to at most a few hundred air-delivered weapons. It is our judgment that forward-deployment of SRAM T to Europe will not be politically acceptable to the NATO governments and publics if current trends continue. The exact number of bombs might be determined by the number of allied DCA and MOBs necessary for current participation and adequate survivability.

But Future Regional Threats dictate three NSNF Deterrent Rationales broader than European stability forces

War prevention and war termination where US vital interests are involved:

2. A visible symbol of national power in an uncertain & unpredictable multipolar world

3. A deterrent to future non-superpower nuclear–capable adversaries in a proliferated world

4. A deterrent to regional Soviet or Russian aggression as long as resurgence or reconstitution remains feasible.

NSNF Roles

- **An incalculable risk to the threat(s)**
- **Appropriate & credible non-strategic nuclear options including capabilities for in-kind nuclear response**
- **Direct defense of endangered US forces**

The first major rationale for NSNF derives from its contribution as a political instrument and an insurance policy for the superpower US Although not often on center stage in a number of regional disputes or conflicts, NSNF availability in the wings has certainly played an important role in diplomatic interchanges and crises.

A future nuclear-proliferated world would present enormous challenges to US defense interests. Over ten nations possess the capabilities to obtain nuclear armaments in the next decade. Several of these nations maintain profoundly hostile relations to the US As regional powers in their own right with significant conventional armaments, their addition of nuclear capability would raise grave risks to deployed US forces.

While the aggressive intentions of the Soviet Union towards Europe may have disappeared, their conventional and nuclear capabilities remain huge. While the short-warning scenarios are no longer credible, a future resurgent and mobilized Soviet Union remains feasible. While intentions can move towards amicability, they can subsequently be reversed upon change in leadership. The Soviet Union or the greater Russian Republic, should some republics become autonomous, may have future cause to counter US vital interests in critical regions such as Southwest Asia, despite present trusts.

Therefore, we are incredulous of US forces without NSNF to prevent war or to terminate war against hostile nuclear-armed states. The rationale for NSNF must rest upon its capabilities to deter a plausible resurgent Soviet Union, or any of several regional powers with potential nuclear capabilities. As NSNF kept the long peace in Europe because it engendered cautious behavior, so should NSNF be kept as an incalculable risk towards any nuclear state contemplating aggression.

The rationale for NSNF also involves the element of credibility: the NCA should have options other than central strategic forces for an appropriate response.

US NSNF structure issues and decisions should be broader than peacetime NATO strategies and policies

European political imperatives unsupportive of NATO NSNF modernization (except for safety and security enhancements to air-delivered weapons)

↓

NSNF rationales support some US nuclear capabilities kept up-to-date

↓

CONUS- based NSNF, subject to US political and budgetary constraints, can then be streamlined to meet broader US NSNF military requirements

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This study points to an expansion of the US rationale for having NSNF. Their *raison d'etre* has been to deter the massive Soviet threat to Western Europe. Now that this threat has been discounted by most policymakers, reasons for continued NSNF capabilities should be publicized. The US ought to forward deploy a relatively small stockpile of air-delivered munitions and DCAs as a hedge against uncertainty, but modernization for NATO likely will be foreclosed except for safety and security enhancements.

The rationales as a superpower instrument, to deter a resurgent Soviet Union, and to deter future nuclear capable regional powers in contingency operations require up-to-date NSNF capabilities. US decisions on force structures and issues must be broadened beyond the narrow confines of NATO acceptability to include worldwide US requirements. Decisions upon the character and composition of future CONUS-based NSNF will be subject to severe domestic political and budgetary constraints as is. NSNF ought not to be held captive to European concerns especially when they are not to be forward-deployed except in crises.

Strategic Arms treaties with the Soviet Union might strengthen the rationales for NSNF

√ **The impact of fewer strategic weapons under START I, and far fewer under START II, will:**

- Reduce the availability and responsiveness of strategic bombers to non-strategic missions
- Decrease the probability of employing scarcer SLBM and ICBM systems (with their MIRVs) on other non-strategic targets
- Reinforce the perceptions that use of central strategic assets in many NSNF scenarios is not credible.

But limited use of strategic bombers with ALCMs or SRAM II can provide the capability to fulfill some NSNF missions.

Many defense analysts argue that current political and budgetary trends will lead to a blurring of the traditional distinction between strategic and theater nuclear forces. We contend that this distinction will remain useful, especially as strategic forces decrease. [redacted] These forces may have just sufficient capability to meet US national strategic policy, that is, a countervailing capacity to deter the Soviet Union from accomplishing strategic war aims. Drawdowns to these forces for non-strategic missions might jeopardize the deterrent posture of the US

In specific terms, the strategic bomber fleet will be considerably smaller post-2000. Given their important contribution to Single Integrated Operation Plan (SIOP) options on the Soviet Union, it is questionable that they would be available in sufficient numbers except for very limited NSNF options, wherein only a few bombers are needed.

The restrictions for employing ICBMs and SLBMs are operationally much more severe due to footprinting. The use of intercontinental ballistic missiles also would risk misperceptions of all-out strategic exchange as to be, in our opinion, not credible for limited non-strategic deterrence.

DOD
b(1)
EO 1.5,
(a),(c),
(e),(g)

Rationale Findings

1. NSNF should remain a key element within US defense strategy
2. Rationale for existence is for broad worldwide contingencies
   - Visible instrument of national power in a multipolar world
   - Deterrence of future regional adversaries with nuclear capabilities
   - Deterrence of reconstituted Soviet theater threats
   - Forward-deployed force for stability in Europe
3. US NSNF structure issues and decisions should be broader than peacetime NATO strategies and policies
4. Reductions in strategic forces may strengthen rationale for NSNF

NSNF, in summary, should continue in its important role towards keeping the peace. Their rationale must broaden from a NATO *raison d'etre*, where a small force furnishes stability and insurance in Europe, to worldwide contingencies. These include the deterrence of a reconstituted Soviet Union and of future nuclear-capable regional threats. As a superpower, the US ought to maintain NSNF as a visible symbol in our relations within a multipolar world. Therefore, US NSNF structure issues and decisions should be made in the broad context of worldwide US strategies and policies. Reductions in strategic forces might strengthen the rationale for non-strategic nuclear systems.

III. FORCE ASSESSMENT

Force Rationale
- Past rationale
- Start of a new epoch
- Determinants of a future US NSNF strategy

Force Assessment
- Roles and attributes
- Systems
- Numbers

Force Structure
- Army SNF
- SRAM T

Summary
- Findings
- Recommendations

The study now evaluates the desired attributes and potential sizes of the force to fulfill its revised rationale. The scope of the study covers approximately the next five to ten years so that the boundary conditions are current and programmed weapon systems, and force levels.

This analytic section assesses NSNF capabilities within three non-strategic contingencies in which nuclear systems may have to be targeted against threat fixed and mobile targets for war prevention or termination. One contingency embodies a resurgent and reconstituted Russian threat. The other two contingencies incorporate future regional nuclear-capable adversaries. The analyses of the three contingencies confirm that large NSNF stockpile reductions are acceptable.

Credible deterrence

necessitates *will* to employ nuclear weapons as

expressed in declaratory strategies and roles,

and effective military *capability*

Capability is assessed in this study by analyzing the effectiveness of arms control-restricted, policy-driven, and budgetary-constrained stockpiles against reduced target sets

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An axiom – the degree of nuclear deterrence relates directly to will and to capability. Declaratory strategies and roles ought to express national will in explicit terms that will deter potential adversaries. Capability ought to be visible, perceived as effective, and trained with in peacetime to ensure that no doubts are raised concerning its credibility during crises or armed conflicts.

For the post-Cold War era, the target sets reflect substantial reductions in type and numbers. The availability of two systems, the Air Force SRAM T and the Army W79 for the 8-in. howitzer, is questionable in light of ongoing arms control, policy, and budgetary debates. The capabilities analyses that follow incorporate these considerations.

US NSNF desired attributes

1. **Attributes for CONUS force for contingency operations**
    - Sufficient spectrum of options for appropriate response
    - Span of yields and weapon ranges
    - Modern theater safeguard and security features
    - Deployable in sufficient numbers with entry forces
    - High probability of arrival and survival

2. **Attributes for European forward-deployed force for stability**
    - Political constraints (gravity bombs/DCA)
    - Modern safeguard and security features

To ensure an effective deterrent in contingency operations, as a balance to a future reconstituted Soviet threat, and as a force for stability in post-CFE Europe, the non-strategic nuclear force should possess certain attributes and capabilities.

For war prevention and war termination in contingency operations, the CONUS-based force attributes should incorporate: sufficient options for appropriate response, comprising a span of yields and ranges; modern safeguard and security features for command and control in unstable and risky deployment areas; rapid deployability with US entry forces; high alert rates and reliability for responsiveness; and high probabilities of arrival on target. Together, these desired characteristics deter war as a highly effective, responsive, and credible means to punish potential aggressors by holding their valued war-making assets at extreme risk.

For a forward-deployed force for stability in Europe, NSNF attributes must pass the litmus test of acceptability. Under current political imperatives and constraints, the force may be limited to air-delivered weapons, in particular gravity bombs. SRAM T might gain acceptability if relationships deteriorate with the Soviet Union. Clearly, up-to-date safeguard and security features are the most persuasive attributes towards modernizing the forward-deployed force. A force size of a few hundred weapons will likely result from satisfying the twin requirements of allied participation and "reasonable" main operating base survivability.

Current and programmed systems can provide a spectrum of options

- **Options against deepest high-value threat assets**
  - TLAM-N [redacted]
  - F-15E or F-111 with SRAM T [redacted]
- **Options against close to deep fixed targets**
  - F-16, F-15E, F-111 with gravity bombs [redacted] or SRAM T [redacted]
  - A-6, F/A-18 with strike bombs [redacted]
- **Options against troop assembly areas and maneuvering divisions**
  - **Army ground systems**
  - **AF DCA with gravity bombs, only with extensive changes to doctrine, training, and employment**

DoD b(1) EO 1.5(a),(c),(e),(g)

A triad of basing modes - at sea, on main operating bases, and in the bushes - provides for highest survivability, greatest flexibility, and widest spectrum of options

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Do current and programmed systems provide a sufficiently wide spectrum of options for credible deterrence? Although the types of strike NSNF as defined in the current nuclear weapon stockpile memorandum does not encompass a perfect set (new Army ground system needed to replace W79 AFAP), the three-service combination of NSNF appears to be robust. TLAM-N and SRAM T employment against the deepest fixed targets, DCA and gravity bombs and SRAM T against closer fixed targets, and Army ground systems against mobile forces offer adequate capabilites in range and responsiveness against most targets.

A span of NSNF delivery capabilities ought to be maintained for deterrence credibility, survivability, availability, responsiveness, and appropriateness. A triad of delivery modes (sea, air, and land) inherently ensures the most flexible spectrum of options to the NCA.

The problem arises when one considers the credibility of today's nuclear weapon force projections. Many opposing factors are at work that may result in the cancellation of the SRAM T, the withdrawal of Army organic capabilities, and the termination of TLAM-N production. We shall discuss these implications upon SRAM T and the Army systems in Section IV.

Current and programmed force systems provide a span of yields and ranges

- TLAM N with W80-0 [redacted]
- AF DCA with B61 Mods (3,4,5,9,10) or new TASM [redacted]
- Navy DCA with B61 Mods (5, 6, 8) and B90 NDSB [redacted]
- AF F-15E/F-111 with W91 SRAM T [redacted]
- Army Ground Systems - 8-in W79-0 and W79-1 [redacted]

DOE b(3)

Range & radius DoD b(1) deletions EO 1.5(a),(c),(e)

1990 planning documents of current and projected forces show a force with a wide span of yields and ranges. However, more realistic future projections cloud their availability.

[redacted]

DOE b(3) DOD b(1) EO 1.5(a)

Another example would be early retirement of the W79. The W79-1 enhanced radiation warhead is very effective against troop formations. Many DCAs delivering gravity bombs would be needed to substitute, probably inadequately, for this capability loss.

A third example would be the cancellation of the SRAM T. Our subsequent analyses reveal that the additional demands on TLAM-N and penetrating DCAs would be unrealistically high. An option, should this come about, might be a common system which can be delivered by both strategic and non-strategic aircraft.

Current and programmed systems can satisfy other desired NSNF attributes

- **Incorporate modern safeguard and security features**
  - All: CAT D PAL or CAT F PAL; Modern WES; and Integral CD
- **Deployable in sufficient numbers with entry forces**
  - AF or Navy DCA with strike bombs and SRAM T
- **Possess high probability of arrival**
  - **PLS (pre-launch survivability):** TLAM-N, AFAPs
  - **PTP (in-flight survivability):** AFAPs, SRAM T
  - **WSR (weapon system reliability):** AFAPs, bombs, SRAM T

Current and programmed systems also fulfill the other desired attributes. Of singular importance in contingency operations conducted from undeveloped bases is the outstanding need for the most modern safeguard and security characteristics — appropiate permissive action link (PAL) technologies, modern warhead electrical systems (WES), and integral command disable.

The NSNF should contain rapidly deployable systems to accompany conventional forces under contingencies against nuclear-armed adversaries. Dual-capable aircraft can best meet this need by their inherent abilities when accompanied by rapidly-deployable logistic packages.

The systems should possess high probabilities of arrival, that is, high probabilities of pre-launch survival, of inflight survival, and of system reliability. In contrast to high PLS due to sea-basing for TLAM-N and to field deployment for AFAPs, we are concerned about the PLS of DCA under certain scenarios. The main operating bases might be vulnerable to concerted conventional attacks by a determined enemy, and especially vulnerable from nuclear strikes. The PTP might also pose problems for penetrating non-stealth DCA.

Based upon IC projections we assumed an upper bound of three future regional threats to analyze NSNF stockpiles

1. **Reconstituted Soviet Union or greater Russian Federation**
   - Large stockpile of thousands of NSNF weapons: artillery, SSMs, cruise missiles, DCA bombs and TASMs
   - *Casus belli*: nuclear coercion; imperialistic; survival; or economic
   - Reentry into Eastern Europe; invasion into SW Asia/ Middle East
2. **Pacific basin, regional nuclear adversary** [redacted]
   - Nuclear stockpile with 10+ nuclear weapons: aircraft or SRBM delivery
   - *Casus belli*: nuclear coercion [redacted]
3. **Middle East, regional nuclear adversary** [redacted]
   - Nuclear stockpile with 10+ nuclear weapons: aircraft, SRBM, MRBM delivery
   - *Casus belli*: nuclear coercion; [redacted]

[redacted]

DOD b(1) EO 1.5 (a),(c), (e),(g)

Let us assume that the US would want to maintain an NSNF force for the rationale presented in Section II. This force should be configured to fulfill missions against a resurgent Soviet Union (or greater Russian federation) and against previously unnamed regional powers with incipient nuclear delivery means. Because the US has traditionally maintained conventional forces to fight in two directions -- across the Atlantic to Europe and towards the Middle East/Southwest Asia, and across the Pacific to the Far East --, we assume that future grand strategy will include the forces to undertake two contingency operations at the same time. And for insurance, the force should preserve the wherewithal in conventional and nuclear means to deter a reconstituted Soviet Union that might assist these regional powers.

Undoubtedly a reconstituted Soviet Union would drive US NSNF stockpile numbers (in addition to the forward-deployed nuclear weapons for peacetime stability in Europe). Their capabilities in NSNF remain almost awesome despite changing intentions and decreases in production of armaments. It is not necessary for our purposes to spell out the road to crisis or to war. It might be a future combination of nuclear coercion, renewed interest in East European domination, oil proclivities towards the Middle East, or others.

[redacted]

DOD b(1) EO 1.5 (a)(c) (e)(g)

Future NSNF options can be more limited in scope

1. **Initial Use Options:**
   - **Credibly deter or respond to limited threat nuclear use**
   - **Defeat the most important war-supporting and projection force assets**

2. **Follow-on to Initial Use Options**
   - **Credibly deter or respond to threat nuclear use**
   - **Prevent overrun of committed US forces**

3. **Selective Employment Options**
   - **Credibly deter or respond to wider threat nuclear use**
   - **Defeat high-priority fixed targets, defeat maneuver divisions**

DOD b(1) EO 1.5(a),(c),(e),(g)

Unquestionably the number of potential NSNF targets has fallen dramatically.

DOD b(1) EO 1.5(c) (e) (a) (g)

Notwithstanding, we think that CONUS-based US NSNF must be configured to meet operational requirements against potential threats: specifically a reconstituted Russian threat and two third-world nuclear threats at the same time.

DOD b(1) EO 1.5(a) (e),(c),(g)

Under the three categories of options would be the mission to credibly deter aggression or respond to threat nuclear use. The traditional rationale of deterrence or restoration of deterrence would hold: war prevention and if need be, war termination.

Capabilities analysis assumptions

- Probability of Arrival = 1
- Probability of Defeat/Damage (PD) ≥ 0.90 required for fixed targets; 50% defeat of mobile target essential combat elements
- Moderate fixed target damage VNTK; 30% mobile unit coverage at 3000 cGy
- Fixed target density is uniformly distributed
- All targets treated equally & independently with only one weapon per target; i. e., PD = PSSK ≥ 0.90
- Maximum combat radius (Hi-Low-Low-Hi flight profile) and delivery accuracies

DoD and DOE b(1) EO 1.5(a)(c)(e)(g)

[redacted]

In general, we used a typical methodology and standard assumptions to arrive at stockpile requirements against the target sets.

The methodology assumed 100% reliably arriving weapon systems, one weapon per target, target elements uniformly distributed, and a 90% probability of single shot kill (PSSK). The target defeat criteria consisted of moderate VNTK damage on fixed targets and 50% defeat of a division's essential combat elements (ECEs). An ECE was considered defeated when 30% of its elements were covered by at least 3000 cGy (immediate transient incapacitation) by the effects of the W79-1 or a B61 bomb.

DoD and DOE b(3) FRD

[redacted]

Capabilities analysis assumptions (cont.)

- **Prioritized weapon allocation on fixed targets**
  1. SRAM T, AF B61, Navy B61/B90, TLAM-N
  2. AF B61, Navy B61/B90, TLAM-N
- **Two weapon allocations on mobile targets**
  1. W79-1 only
  2. AF B61 only

[redacted]

DoD b(3)
DOE b(3)

Under an assumption of 100% reliably arriving weapons, we prioritized the assignment of weapon systems. Against fixed targets the analyses assumed two cases, first with and then without SRAM T. Under SRAM T availability, we assigned SRAM Ts to those targets which they could range and defeat. If the target could not be defeated by SRAM T due to insufficient yield, then Air Force bombs were assigned if in range and with sufficient yield. If AF bombs could not defeat the target, then the range and yields of Navy bombs were analyzed. And in turn if the Navy bombs were not in range, then the TLAM-N was examined. If the fixed target still could not be defeated in single attacks, then it was considered not defeatable. The assignment of weapons for the second case where SRAM T was not available followed an identical approach starting with Air Force bombs.

Against mobile targets we examined two cases using the most appropriate weapon systems. Those cases included the W79-1 AFAP only, and then Air Force DCA with B61s only. TLAM-N is not considered as sufficiently responsive and flexible for mobile target assignments; Navy DCA could have been allocated if proper C3 interfaces are in place and SRAM T could also have been allocated if available in sufficient numbers. We did not include SRAM T in our mobile target analyses because its [redacted]

DOD b(1) EO 1.5(a) (c)(e)(g)

Weapon launch points were chosen for each of the three contingencies. Once again a weapon could be assigned to a target only if in range.

DOD b(3) FRD DOE b(3)

[redacted]

Although we assumed probabilities of arrival (PA) of 1.0 in determining target defeat, the sizing of stockpiles requires assumptions on PAs. We assumed for the base case that the probabilities of pre-launch survival (PLS), weapon system reliability (WSR), and penetrability (PTP) determined in the 1989-1990 DNA/OSD Integrated Mix Analysis were still credible. During this study, the services provided raw probabilities on AFAPs, DCA with SRAM T, DCA with bombs, and TLAM-N. The study participants included DNA, SAIC, staff from the three services, OSD, and the DOE laboratories. The PAs that resulted from the Integrated Mix Analysis represent the best judgment of the participants and the most credible numbers available to us for sizing the stockpile.

We tested the sensitivity of the stockpiles to PAs by developing a lower set of reasonable probabilities. These lower PAs are study estimates that represent a reasonable floor. Although the WSRs are unchanged, we assumed significantly lower PLSs and PTPs for SRAM T and DCA bombs. In spite of the uncertainties surrounding future threats, we believe that these PAs comprise a reasonable spectrum.

Target Types: Reconstituted Regional Soviet Threat

- Define fixed target set to include capability to thwart Soviet force projection threat

[redacted]

DOD b(1) EO 1.5(a)(c) (e) (g)

The Soviet fixed target list was redefined from the European target list of the SRAM T Phase 2 study. The revised target list incorporated only those high-priority targets located in the Soviet Union: [redacted] In addition, we incorporated fixed targets that would support a resurgent Soviet projection force. [redacted]

DOD b(1) EO 1.5(a) (c) (e) (g)

DOE
b(1)
EO 1.5(a)

DOD
b(1)
EO 1.5(a)
(c)(e)(g)

[redacted]

DOE and DOD b(1) EO 1.5(a)(c)(e)(g)

DOE b(3)

DOE and DOD b(1) EO 1.5(a)(c)(e)(g)

DOE and DOD b(1) EO 1.5(a)(c)(e)(g)

[redacted]

DOD b(1) EO 1.5(a)(c) (e)(g)

The target assignment methodology assigned SRAM T (if available) as the preferred system.

[redacted]

DOD b(1) EO 1.5(a) (c)(e)(g)

DOE
and
DOD
b(1)
EO 1.5(a)
(c)(e)(g)

DOD b(1) EO 1.5(a) (c)(e)(g)

[redacted]

The analysis against a force of [redacted] also contained two cases. The first case assumed that the Army maintained an organic capability through retention of the W79-1. The second case necessitated the Air Force to deliver B61s against the mobile forces in lieu of Army organic capability.

[redacted]

DoD
b(3)
FRD

DOE and DOD b(1) EO 1.5(a) (c) (e) g

We eliminated all Soviet Union targets, but added several targets that would be necessary for a nuclear and chemical capability.

DOE and DOD b(1) EO 1.5(a) (c) (e) (g)

DOE and DOD b(3) EO 1.5(a)(c)(e)(g)

[redacted]

DOE
DOD
b(1)
EO 1.5(a)
(c)(e)(g)

Target Types [redacted]

DOD b(1) EO 1.5(a)(c)(e)(g)

- **Revise fixed target set to include future nuclear weapon capability**

[redacted]

DOD and DOE b(1) EO 1.5(a)(c)(e)(g)

We developed a Southwest Asia target set by modifying an earlier fixed target set from the Integrated Mix study. The modification involved the deletion of all Soviet targets, the addition of high-priority [redacted]

DOD and DOE b(1) EO 1.5(a)(c)(e)(g)

DOE
DOD
b(1)
EO 1.5(a)
(c)(e)(g)

DOE and DOD b(1) EO 1.5(a) (c)(e)(g)

DOE
b(3)

DoD
b(1)
EO 1.5(a)(c)(e)(g)

[redacted]

DOD
b(1)
EO 1.5(a)(c)
(e)(g)

DOE
b(3)

Force Assessment Findings

1. DCA with SRAM T/Bombs, TLAM-N, and W79 AFAP together possess proper attributes
2. Potential threat targets for worldwide contingency operations may number in the hundreds of fixed targets and [redacted]

DoD and DOE b(1) EO 1.5(a)(c)(e)(g)

In summary, the capabilities assessment arrived at these findings.

Future NSNF force attributes are best met with a triad of systems; air-delivered, land-based, and sea-based: for deterrence credibility, survivability, availability, responsiveness, and appropriateness. A triad of delivery modes (sea, air, and land) inherently provides the most flexible spectrum of options to the NCA.

[redacted]

DoD b(1) EO 1.5(a)(c)(e)(g)

IV. FORCE STRUCTURE

Force Rationale
- Past rationale
- Start of a new epoch
- Determinants of a future US NSNF strategy

Force Assessment
- Roles and attributes
- Systems
- Numbers

Force Structure
- Army SNF
- SRAM T

Summary
- Findings
- Recommendations

Section IV explores the implications of present trends upon Army short-range nuclear forces (SNF) and the Air Force SRAM T system.

We will discuss the implications to the Army for minimal or nonexistent organic nuclear capabilities. Present trends indicate that Army denuclearization is possible. Army doctrine, force structure, training, and joint service operations would be affected.

Army Nuclear Weapon Trends

- W50/P1A & W85/PII Systems Eliminated by INF Treaty
- FOTL Cancelled Spring 1990
- W82/155mm AFAP Cancelled Summer 1990
- W70/Lance Warhead Retirement Scheduled for FY93-98

DOE b(3)

[redacted]

- US 8-Inch Artillery Retirement Starts ~ CY96 and Concludes ~CY06
- Remaining Assets:
  - W33/8-Inch AFAP [redacted]
  - W79/8-Inch AFAP
  - W48/155 mm AFAP

DOE b(3)

- No ongoing conceptual weapon studies involving the Army, DoD, and DOE

Army nuclear weapon stockpiles are moving significantly downward. The cancellations or retirements of the Pershing systems, the new 155mm W82, the Follow-on-to-Lance (FOTL), and the Lance system means that 8-in. AFAPs comprise the remaining effective SNF. Furthermore, the 8-in. howitzer is scheduled to start leaving the active Army force structure around 1996, and to be out of the Reserve structure by 2006.

There are no ongoing conceptual weapon system studies for follow-on systems.

Probable post-2000 Army nuclear fire support structure

I. Minimal organic

- **W79 and 8-inch Active or National Guard; ordnance detachments**
- **New battlefield system under development for post-2000?**

or

II. Provided by NSNF Air Force and Navy assets

- **Formal JCS assignment as new service role**
- **Revised /newly implemented battlefield target employment concepts**
- **Upgraded joint and Air Force/Navy planning agencies and C3 interfaces for nuclear air-delivery against mobile targets**
- **Dedicated DCA and B61 assignment/withholds**
- **Gravity bomb mobile-target SEPs**

Most likely the post-2000 Army force structure will be a minimal organic one, or nuclear fire support will be provided by Air Force and Navy DCA using bombs.

The minimal organic force would probably be centered around a residual 8-in. capability. Although the force structure details must be studied by the Army, one possible option might be a dedicated FA brigade of two or three 8-in. battalions with worldwide missions but based in the US Perhaps the brigade could be part of the Reserve components due to force structure constraints. Another option under consideration is to centralize all nuclear functions in an ordnance unit of about 128 personnel. This organization would be under the personnel reliability program (PRP) and maintain all nuclear command and control, logistics, and release operations. The artillery would fire the AFAP upon authentication from the ordnance detachments.

The second path would be to eliminate an organic capability and request nuclear fire support from the Air Force/Navy. We have listed some of the impacts that would result from this transfer of roles and missions. The impacts would be major and large in scope. First, the JCS would have to formally assign new service roles. The adequate substitution of air-delivered munitions for Army ground systems would embody extensive rework of battlefield employment concepts, the upgrade of joint nuclear planning agencies, and the improvement of C3 interfaces to implement and allow responsive delivery of bombs upon mobile targets.

DOD
b(1)
EO 1.5(a)(c)
(e)(g)

[redacted]

We believe these are compelling arguments for maintaining an Army organic capability

1. Cheap to maintain
- W79 exists
- New operational concepts for minimal force structure

2. Avoids cost of changing roles/missions
- Joint, Air Force, and Navy implementation costs substantial
- Army doctrine, training, and leadership still required for integrated warfare

3. Three-service NSNF more credible deterrent and more capable force
- Avoids unrealistic demands upon Air Force/Navy DCA assets
- Enhances survivabiliy
- Enhances battlefield responsiveness
- Stronger motivation for enemy forces to disperse
- Not weather-constrained

DoD b(1)
DOE 1.5(a)(c) (g)

The arguments for maintaining an organic capability are strong. [redacted] further show the utility of maintaining an Army SNF capability. These include low Army costs, cost avoidance of changing service roles, enhanced survivability, responsiveness, availability, and effectiveness upon threat ground forces.

We recognize that arguments against this capability have been and will continue to be made. Essentially these arguments center on the perceptions that future enemy threats will be of such limited nature that other NSNF systems can be relied upon to prevent war or to terminate war without the need of organic Army systems.

Implications to the US Army from minimal or eliminated organic capabilities

- **Leadership paramount**
  - Especially without organic fire support against nuclear-capable adversaries
- **Large force structure reductions, but not total elimination**
  - Limited to 8-in. active/reserve brigade or eliminated
  - Ordnance support detachments
  - CINC and Corps level fire support elements remain for nuclear targeting
  - Staff elements for user and developer communities remain but reduced
- **Specialized training requirement reductions, but not force nuclear training**
  - Total force trains for operations in nuclear environment
  - W79 technical training or removed
  - PRP only at dedicated units or eliminated
  - Career field 52 and designator 5H functions in far fewer numbers
- **Doctrine imperatives remain**
  - Dedicated 8-in./ordnance support or joint nuclear operation doctrine
- **Materiel development diminished but not eliminated**
  - W79 as interim system, follow-on options; or liaison with Air Force and Navy to satisfy Army fire support requirements

Following either path will profoundly affect the Army in its force structure, training, doctrine, leadership, and materiel developments.

Leadership in operations without organic nuclear fire support against nuclear adversaries will be even more important. Leadership will remain paramount.

Large force structure reductions are possible. Organic capability within a dedicated 8-in brigade or a centralized ordnance support unit means FA manpower from Lance and other nuclear force billets are freed up. Ordnance manpower would also be reduced. But fire support elements, particularly if joint nuclear battlefield operations become necessary, will require nuclear target analysts. Staff elements from the user and materiel developer communities can be reduced but would still be necessary.

We understand that training requirements could also be lowered. Technical training might be limited to the W79 system or removed. The personnel reliability program (PRP) should only be necessary at the dedicated artillery or ordnance units or eliminated. However, the total force would still have to train for operations on the nuclear battlefield. The career field 52 and target analyst specialty 5H would also be required but in fewer numbers.

Extensive revisions to doctrine and concepts of operations must be implemented especially if fire support is provided externally. The development of DCA missions to support ground forces will necessitate much joint doctrinal work.

Materiel requirements will clearly diminish. But if an organic capability continues with the W79, then conceptual studies for a post-2000 replacement ought to be initiated. If organic capability is removed, then technical liaison with the other services must be conducted. Materiel developments for defensive nuclear operations must also be continued.

Advanced Munitions cannot replace NSNF

- **Significant RDT&E remains to be funded and completed**
  - Critical technical challenges in sensor development
  - Funding requirements are high
- **Potential capabilities against mobile targets**
  - If work as advertised, five times as effective as dumb munitions
  - Degraded by false target densities and threat countermeasures
  - Certain systems have limited effectiveness against heavy armor
  - High production costs preclude procurement in sufficiently large numbers
- **Potential capabilities against fixed targets**
  - Can defeat selected soft-point and small-area fixed targets
  - Cannot defeat hard point and large-area fixed targets

ACMs, when developed and fielded, offer enhanced military effectiveness over dumb munitions against certain classes of targets.

They do not possess all of the deterrence and lethality attributes of nuclear weapons.

An extensive amount of analyses have been completed upon the effectiveness of advanced conventional munitions (ACMs). The results of the work at Lawrence Livermore, Sandia, and Los Alamos support the above summary. We include it in this report because many ACM proponents have overstated probable battlefield effectiveness and overlooked war deterrence attributes (or lack thereof). Their argument is not whether short-range nuclear weapons are needed or not for their effects, but that ACMs can substitute with "near-nuclear" effectiveness.

The extensive analyses of the 1980s support this conclusion: ACMs, when developed and fielded, offer enhanced military effectiveness over dumb munitions against certain classes of targets. They do not possess all of the deterrent or lethality attributes of nuclear weapons.

The Pros and Cons of a SRAM T System

- **Arguments In Favor *vice* SRAM II**

  Permits delivery by theater aircraft for appropriate response

  Incorporates lower yields for minimal unwanted damage and political constraints

  Includes CAT F PAL for safety and security

- **Arguments In Favor *vice* Bombs**

  Provides stand-off capabilities and lowers aircraft attrition against defended NSNF targets

  Reduces the number of DCA withholds and sorties

- **Arguments In Favor *vice* TLAM-N**

  Reduces need for TLAM-N because of range extension

We now turn to the arguments for and against a SRAM T capability.

Above are summary arguments that we believe are compelling for a SRAM T deployment. When compared with the SRAM II (under development for strategic roles), we claim that SRAM T is needed because of its delivery by theater aircraft, [redacted] and the CAT F PAL for contingency operations in a hostile environment. DOE b(3)

The analyses presented show that SRAM T can allow a very significant reduction, about four-fold, in the number of DCA missions that require penetration to the target. And due to its range extension, the number of TLAM-N missions was cut by more than half.

Counter-arguments to the SRAM T are two: (1) in spite of the chances for high aircraft attrition, the future threats may be so reduced that the Air Force and Navy will have sufficient DCAs and bombs; and (2) the future threats may also be so reduced that strategic bombers and SRAM II or ALCM can satisfy all missions.

We have shown that the large size of plausible threats and the need for appropriate and credible NSNF options point to a continuing requirement for SRAM T.

Force Structure Findings

- Army Organic Nuclear Forces
  - Trends toward denuclearization or minimal with W79
  - Compelling arguments exist in favor of organic capability
  - Reduction but not elimination:
    - -- Force structure, training, materiel development
  - Doctrine and leadership imperatives unchanged
  - ACMs cannot replace nuclear weapons

- SRAM T
  - Standoff capability and range extension needed for theater DCA

The force structure assessment establishes strong reasons for maintaining an organic Army nuclear capability, despite current trends towards denuclearization. Perhaps the single most important element is not dedicating limited and valuable DCA to conduct nuclear fire support on enemy troop formations when deeper fixed targets must also be held at risk.

Current trends towards denuclearization or minimal support may have far-reaching effects upon the Army. Substantial reductions in force structure, training, and materiel development are possible. But these imperatives, along with doctrine and leadership, will not be eliminated.

Compelling arguments exist for a more robust DCA force through the deployment of SRAM T. These include standoff from terminal defenses for survivability, range extension to deep targets, and delivery by theater aircraft for credible and appropriate response.

V. SUMMARY

Force Rationale
- Past rationale
- Start of a new epoch
- Determinants of a future US NSNF strategy

Force Assessment
- Roles and attributes
- Systems
- Numbers

Force Structure
- Army SNF
- SRAM T

Summary
- Findings
- Recommendations

The final section of this paper concludes with a summary of the previous findings; and based upon these findings, offers recommendations.

In summary, our findings indicate that NSNF are justifiable & can be substantially reduced [redacted]

DOD b(1) EO 1.5(a)(c)(e)(g)

1. Strong rationales for CONUS and sea-based NSNF

- Visible instrument of national policy in an unpredictable, multipolar world
- Deterrence of future regional adversaries with nuclear capabilities
- Deterrence of reconstituted Soviet or Russian theater threats

Rationale for European forward-deployed force

- Stability and insurance in post-CFE Europe

[redacted]

DOD b(1) EO 1.5(a)(c)(e)(g)

The strategy and policy reassessment of NSNF identified strong rationale for their continued existence:

Visible instrument of national power in a multipolar world

Deterrence of future regional adversaries with incipient theater nuclear capabilities

Deterrence of reconstituted theater threats from a resurgent Soviet Union or Russian Federation

Forward-deployed force for stability in Europe

And because of the current European political climate, US NSNF structure issues and decisions should be broader than peacetime NATO strategies, policies, and constraints.

A span of theater delivery capabilities should be maintained for deterrence credibility, survivability, availability, responsiveness, and appropriateness. A triad of delivery modes (sea, air, and land) inherently provides the most flexibile spectrum of options to the NCA.

We analyzed three contingencies where NSNF could prevent or terminate armed conflict. In addition to a reconstituted Soviet theater threat two regional nuclear adversaries, for example, [redacted] are representative of future nuclear threats where US vital interests [redacted] might be at stake [redacted]

DOD b(1) EO 1.5(a)(c)(e)(g)

Our findings also support NSNF within three services

3. Large utility from Army SNF and SRAM T

[redacted]

DOD b(1) EO 1.5(a)(c)(e)(g)

4. Compelling reasons to keep an organic Army capability

An interim SNF delivery capability can be maintained with the W79. Substantial reductions may occur in force structure and materiel requirements but the capability (doctrine, training, leadership) to conduct operations in a nuclear environment will remain.

In the final analysis, the need for SRAM T and Army SNF rests upon perceptions of future threats. We configured a range of threats that, we would argue, are credible in a multipolar world where nuclear weapons are proliferating. The prospect of such a world is not encouraging. [redacted]

DOD b(1) EO 1.5(a)(c)(e),(g)

The quantitative analyses of the three scenarios and the force structure assessments present strong, if not compelling, arguments in favor of SRAM T deployment. [redacted]

Equally strong arguments exist for the Army to keep at least a residual organic capability with the W79. [redacted]

DOD b(1) EO 1.5(a)(c)(e)(g)

Recommendations

1. **Army should keep an organic capability**
   - **Maintain the W79 and 8-inch delivery as an interim system**
   - **At the appropriate time (suggest two years) initiate a study to**
     - Formally assess future Strategic Army battlefield nuclear missions
     - Examine organic Army force structure alternatives
     - Define technical options for future nuclear systems
2. **Air Force should develop a theater air-delivered stand-off missile**

DoD b(3) FRD

[redacted]

We make the above three recommendations based upon the essential findings of this study.

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