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U.S. NUCLEAR TESTING: ENHANCING DETERRENCE

INTRODUCTION

The United States detonated its first nuclear test of 1987 on February 3. Three weeks later, the Soviet Union triggered its first test of the year. And Britain, France, and China are continuing their nuclear weapons test programs.

As nuclear testing continues, so do debates over banning or limiting it. Pending in Congress is legislation that would deny funds to test nuclear weapons with a yield in excess of one kiloton, that is, with an explosive force equal to 1,000 tons of TNT (current testing is limited by the Threshold Test Ban Treaty to yields of 150 kilotons).

Proposals to halt or limit underground nuclear tests have been discussed for years. They have not been approved because significant and persuasive objections have been raised. For one thing, any testing agreement with Moscow requires foolproof verification of Soviet compliance; so far, Moscow has refused to agree to such verification procedures. For another thing, it is not at all certain that halting or limiting nuclear testing would advance arms control. To the contrary. Until strategic defense systems replace the current deterrent based on offensive weapons, testing will be essential to ensure the effectiveness and reliability of these weapons. Doubts about weapons reliability destabilizes the U.S.-Soviet nuclear relationship.

Testing Warhead Reliability. So long as the U.S. and Western world therefore depend on the nuclear deterrent for their security, it will be necessary that the weapons comprising that deterrent work as designed. Nuclear testing is the only way to verify the reliability of the warheads in the inventory. In addition, and as important, testing is the only means to modernize U.S. weapons and improve nuclear weapon safety, security, and survivability, including strategic defenses, communications and equipment. U.S. national security and continued deterrence thus depend on continued nuclear testing.

WHY THE UNITED STATES MUST TEST

Assess Weapons Flaws

Instead of exploding nuclear devices, say some experts, it would be sufficient to test nonnuclear components of nuclear weapons and use computer simulations of nuclear explosions. This, in fact, can provide useful information. But because of the extreme complexity of nuclear weapons, no simulation can provide the results that are obtained from the actual testing of their nuclear components. Nuclear weapons are fabricated from chemically active materials which may possess mutually incompatible properties. As a result of subtle changes, the behavior of these materials is often unpredictable. Tests are needed to ensure that these changes do not lead to weapons failure.

Experience also shows that all flaws cannot be accounted for by design, extrapolation, or inspection alone. Only testing can assess the impact of unpredicted deterioration of nuclear materials and ensure that proposed design changes will work. Testing alone ensures that the U.S. nuclear stockpile is reliable and can serve as a nuclear deterrent.

Undiscovered Problems. Since 1958, over one third of all weapons designs introduced into the U.S. stockpile have suffered reliability problems. Without nuclear testing, 75 percent of these problems would have gone undiscovered and uncorrected.[1] Stockpile reliability problems have affected, among other systems, the W47 warhead for the Polaris submarine-launched ballistic missile (SLBM), the W68 warhead for the Poseidon SLBM, and the W56 warhead for the Minuteman Intercontinental Ballistic Missile (ICBM).[2]

Some claim that a decline in stockpile reliability is a good thing, reducing the likelihood of a disarming first strike, since reduced stockpile reliability increases uncertainty, which is the basis of deterrence. In fact, the opposite is just as likely to be true: a decline in nuclear weapon reliability could prompt a first strike. Former Acting Assistant Secretary of Energy Donald Kerr has testified that survival favors the attacker after a certain level of stockpile degradation. As reliability declines, the attacker gains a significant advantage by launching a first strike, since he has less to fear from the defender's retaliatory force.[3]

Five-to-One Soviet Edge. U.S. and Soviet stockpiles in any event would not degrade symmetrically. Because of differences in weapons designs and materials, the reliability of the U.S. stockpile is likely to decline faster. The reason: U.S. designers emphasize smaller, more accurate missiles, and warheads optimized for each delivery system. They economize on the use of special nuclear material (enriched uranium, plutonium, and tritium), and give high priority to safety and security devices. Soviet designers, by contrast, emphasize throwweight (a measure of what a missile can launch at a target) and volume. The Soviets have a five-to-one advantage in ICBM throwweight over the U.S., which also means they have developed larger and heavier ICBM warheads. These are likely to retain a higher yield longer than smaller U.S. weapons.

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1. Roger E. Batzel, Director, Lawrence Livermore National Laboratory, before the Senate Foreign Relations Committee, January 15, 1987.

2. Jack Rosengren in Report of the Special Panel on Arms Control and Disarmament, House Armed Services Committee, January 1986, pp. 127-157.

3. House Armed Services Committee, Effects of a Comprehensive Test Ban Treaty on United States National Security Interests, August 14-15, 1978 (HASC No. 95-89), p. 30.

As reliability declines, moreover, military planners would seek to counter increasing uncertainty about warhead reliability by assigning more warheads to a given target and by shifting to higher yield weapons. Thus, in the absence of testing, the downward trend in numbers and yields of U.S. weapons since the early 1960s would have to be reversed. The U.S. again would have to begin building monster-sized missiles and warheads.

Modernize Nuclear Stockpile

Testing is needed to modernize the U.S. nuclear arsenal. This modernization has four objectives:

1) Ensure Safety and Security. Safety is of paramount concern to the U.S. nuclear weapons program. Testing is conducted to preclude accidental nuclear explosions, to prevent the dispersal of radioactive material in accidents, and finally to minimize radiation exposure to personnel handling weapons.

Consider the use of Insensitive High Explosive (IHE) in nuclear weapons. A nuclear explosion is initiated by means of a high explosive charge. There always has been the danger that in an accident involving nuclear weapons the detonation of the high explosive, while not causing a nuclear detonation, still could scatter nuclear materials. Such accidents occurred in 1966 near Palomares, Spain, and in 1968 over Thule, Greenland. In neither incident was there a nuclear detonation, but plutonium was dispersed over a wide area. These events led to the development of IHE as an explosive that would not detonate in an accident. Without nuclear testing, such a major safety improvement could not have been achieved.

2) Improve effectiveness. U.S. strategic doctrine has evolved from massive nuclear retaliation to flexible response, requiring a more diverse stockpile composed of a variety of warheads with a range of yields. Testing has enabled development of new warheads for small, low-flying cruise missiles; for the fast, low-flying B-1 bomber; for the mobile Pershing II missile; and for other weapons designed for purposes other than a massive nuclear exchange.

3) Respond to the changing threat. Soviet targets and defenses change constantly. U.S. weapons designed for one particular set of targets may not be as effective against another kind of target. Example: the Soviets have hardened their missile silos with concrete and have buried deeply their command and control centers. One potential U.S. response to this would be to develop warheads designed to penetrate the earth before exploding. To do so requires testing. And it was testing which permitted development of the nuclear-tipped Air-Launched Cruise Missile (ALCM) for the B-52 bomber and the development of new bombs for the low-flying B-1. Bombs designed for the high-flying B-52 cannot be used on the B-1, because the speed and angle of delivery requires a substantially different warhead design.

4) Preserve strategic stability. A critical component of strategic stability is survivability of the weapons in the stockpile. Testing has enabled the U.S. to develop smaller warheads that permit smaller delivery systems, such as cruise missiles and mobile ICBMs. These smaller systems are harder for the Soviets to locate, more easily hardened, and better hidden. Mobile nuclear missiles are more survivable and less destabilizing than missiles in fixed silos. Testing is required to develop the warheads for mobile systems. Opponents of testing claim to want a more survivable and stable deterrent, yet without testing,

survivability would be more difficult to improve. What is puzzling, moreover, is that many opponents of testing claim to support the Midgetman mobile missile or the Trident submarine, yet they oppose the testing needed for the warheads for those new systems.

Ensure Equipment Functioning in a Nuclear Environment

Testing subjects military equipment to nuclear effects to determine whether it will function in a nuclear environment. The Defense Nuclear Agency (DNA) tests, among other things, the vulnerability of: 1) U.S. missiles and warheads to the electromagnetic effects and radiation of nuclear explosions; 2) missile silos and deeply buried facilities to cratering and ground shock; 3) silos, ICBM launchers, antennas and tactical systems to Electromagnetic Pulse (EMP); 4) communications and command and control systems to electrical and optical nuclear effects; and 5) weapons and defenses to directed-energy weapons.

Such tests have uncovered vulnerabilities in U.S. military systems undetected by highly developed nonnuclear simulation techniques.

Testing is very important for the Strategic Defense Initiative (SDI). The survivability of SDI weapons, communications, and systems, especially space-based systems, is critical to an effective strategic defense. Testing those systems against nuclear explosions is the only way to make them as survivable as possible against attack by nuclear armed weapons.

Avoid Technological Surprises

Enough is known about Soviet technological capabilities to be skeptical of any claim that Moscow is significantly behind the U.S. in nuclear technology. The Soviets have made a substantial capital investment in design laboratories and production facilities, and maintain a massive advantage over the U.S. in the production of plutonium and other special nuclear materials.[4] The Soviets also originated many of the concepts that have advanced nuclear weapons technology. Example: the x-ray laser, usually identified with the U.S. Strategic Defense Initiative, was a discovery of Soviet scientists. Consequently, tests are needed to keep U.S. technology advancing, and to prevent the U.S. from being taken by surprise by a Soviet technological gain. It similarly is critical that the U.S. keep its nuclear labs at technology's cutting edge.

Kennedy's Complaint. This the U.S. failed to do during the 1958-1961 U.S.-Soviet nuclear testing moratorium. Complained President John F. Kennedy on March 2, 1962:

> Some may urge us to try [a moratorium] again, keeping our preparations to test in a constant state of readiness. But in actual practice, particularly in a society of free choice, we cannot keep topflight scientists concentrating on the preparation of an experiment which may or may not take place on an uncertain date in the future. Nor can large technical laboratories be kept fully alert on a standby basis waiting for some other nation to break an agreement. This is not merely

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4. This is an important but little discussed aspect of testing. The limited U.S. capacity to produce special nuclear materials has forced U.S. weapon laboratories to economize in their designs. This results in extremely close tolerances and specifications in U.S. weapons, requiring that they be tested more often than if U.S. designers were unconstrained by materials' availability, as is the case with the Soviets.

difficult or convenient--we have explored this alternative thoroughly, and found it impossible of execution.[5]

During the three year moratorium the Soviets maintained their technical base and prepared in secret to conduct the most intensive series of nuclear tests in history before breaking out of the moratorium in 1961. By contrast, it took the U.S. nearly a year to restore its testing capabilities.

Kennedy's advice remains valid today.

OTHER ISSUES

In 1986, the House of Representatives passed legislation prohibiting tests over 1 kiloton. The Senate is expected to pass similar legislation this year. Some see such proposals as a first step toward a comprehensive test ban. Currently, U.S. testing is limited to 150 kilotons. This already imposes serious constraints. Example: high yield earth penetrators cannot be tested against deeply buried targets.

In testimony last January before the Senate Foreign Relations Committee, the directors of the Lawrence Livermore and Los Alamos national laboratories said that slashing the testing threshold to 10 kilotons or even 1 kiloton, the most frequently proposed limits, would place unrealistic demands on weapons designers and lead eventually to a serious degradation of stockpile reliability. At 10 kilotons, testing that is necessary to verify the function of high yield warheads such as those designed for the ICBM missile, the Trident II, and the SRAM II attack missile, would not be possible; fission triggers could not be tested on some systems; and tests of the x-ray laser, including defenses against it, would be precluded. At 1 kiloton the function of fission triggers (primaries) could not be verified; high explosive primaries could not be put on old secondaries; and most x-ray laser research could not be conducted.

VERIFICATION AND COMPLIANCE

As part of his compromise with Congress prior to last October's Reykjavik summit, Ronald Reagan agreed to submit the Threshold Test Ban Treaty (TTBT) and the Peaceful Nuclear Explosions Treaty (PNET) to the Senate for the advice and consent process needed for ratification. Though signed in the mid-1970s by the U.S. and the USSR, these treaties have never been ratified. Both countries claim to have observed the 150 kiloton testing limit that the treaties would impose. U.S. experts believe, however, that the Soviets have exceeded the 150 kiloton limit on as many as 24 occasions.

Reagan sent the two treaties to the Senate this January, accompanied by a "reservation" that would prevent them from taking effect until a more effective verification method is accepted by the Soviets. Seismographic equipment is not precise enough to distinguish with certainty whether a Soviet test yields 75 kilotons, 150 kilotons, or even 300 kilotons.

If the test ceiling were reduced below 150 kilotons, verification would be even more difficult while the relative benefits derived from cheating would be far greater.

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5. Department of Energy, Policy Paper 5, "Nuclear Weapons Testing," January 1987, p. 15.

THE 1958-1961 MORATORIUM

The history of the test ban teaches a valuable lesson. In the expectation that a testing halt would be the initial step toward negotiations ending nuclear testing permanently, the Eisenhower Administration on October 31, 1958, agreed with the Soviets jointly to observe a one year moratorium on nuclear testing. When the talks on a comprehensive test ban became stalemated, Eisenhower declared that the U.S. would not be bound by the moratorium when the year's term expired in 1959. He did promise, however, that the U.S. would not resume testing without prior notice. Soviet leader Nikita Khrushchev replied that the USSR would not test either, adding that the country to resume testing first would be acting "illegally and immorally". The moratorium remained in effect for another twenty months.

On August 30, 1961 the Soviet Union announced its resumption of testing. Just two days later Moscow triggered the most intensive series of nuclear tests in world history. In 60 days the Soviets conducted 40 tests, including numerous multi-megaton tests in the atmosphere, and the largest single explosion ever conducted, a massive 58 megaton blast.

So scrupulously had Washington observed the moratorium and so ill-prepared was the U.S. for the Soviet breakout, that it was months before the Atomic Energy Commission could conduct a high yield test. [6] The U.S. conducted a miniscule two kiloton underground test two weeks after the Soviet breakout, by which time the Soviets already had exploded 10 or 11 atmospheric blasts with a total yield of nine megatons.

U.S. POLICY LESSONS

The experience of the 1958-1961 moratorium provides lessons which proponents of a new moratorium should heed. Among them:

◆◆ When not testing, the U.S. technological and scientific base deteriorates rapidly. During the 1958-1961 moratorium, many people critical to the nuclear program left the national laboratories. Activities at the Nevada test site, including test readiness activities and technical work, virtually came to a complete halt. In the Soviet Union, apparently, the laboratories continued working and the test sites were ready for action. The extent of the Soviet breakout confirms preparation.

◆◆ Without testing, many weapons problems go undetected. Scientists cannot effectively extrapolate performance from already known information. There always are "surprises," which only testing can discover and correct. Several different types of U.S. warheads suffered unanticipated deterioration and showed serious reliability problems when testing was resumed after 1961.

◆◆ The Soviets test episodically and can afford sustained breaks in testing once a series has been completed. Evidence suggests that when the Soviets declared their moratorium in 1958 they had just completed a major series of tests, but the U.S. was just about to begin a test series. The situation was the same when Moscow announced its unilateral moratorium

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6. It has recently been revealed that the U.S. conducted small nuclear experiments for safety reasons during the 1958-1961 moratorium. By no stretch of the imagination can these be called nuclear testing. They certainly did not prepare the U.S. to respond to the massive Soviet breakout. Robert N. Thorn and Donald R. Westervelt, "Hydronuclear Experiments," Los Alamos National Laboratory Report LA-10902-MS, February 1987.

in August 1985, which lasted until the Soviet tests this year. Before proclaiming the 1985 moratorium, the Soviets conducted a flurry of tests.

CONCLUSION

Nuclear weapons are the cornerstone of the U.S. nuclear deterrent and will continue to fulfill this role as long as the Soviets maintain their current superiority in conventional weapons. If a future arms control agreement significantly reduces offensive weapons and can be verified, then further testing limits may be pursued. But to push for testing limitations before these goals are accomplished damages U.S. security and contributes nothing to arms control. A test ban, after all, does not eliminate a single warhead.

Achilles' Heel. The nuclear testing issue is potentially the Achilles' Heel of U.S. national security, because until recently U.S. testing policy has not been adequately defended by the administration. Other national security issues have been given priority over testing. This situation is improving, but until Ronald Reagan unequivocally declares that the U.S. nuclear testing program is essential to the national security, testing opponents will have a chance of seriously curtailing or even ending it. Reagan should make clear the essential relationship between nuclear testing and U.S. security for the foreseeable future.

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