

The Department of Energy's Stockpile Stewardship Program

by Frank von Hippel

After the Soviet Union agreed to in-country seismic monitoring in 1978, the principal objection by the U.S. nuclear laboratories to a Comprehensive Test Ban Treaty (CTBT) became that it would be impossible to maintain the reliability of U.S. nuclear weapons without testing. Indeed, that same year, the Directors of the Los Alamos and Livermore National Laboratories met with President Carter to inform him that they would be unable to certify the continuing reliability of the U.S. stockpile in the absence of testing. Knowing that the Joint Chiefs of Staff would not support a test ban under such circumstances, and the Senate would therefore not ratify it, President Carter abandoned his efforts to achieve a CTBT.

On hearing of the position of the laboratory Directors, former Los Alamos Director Norris Bradbury; former head of the Los Alamos Theoretical Division, Carson Mark; and long-term Los Alamos consultant, Richard Garwin, wrote a letter to President Carter in which they argued that the reliability of U.S.

nuclear weapons could be maintained indefinitely by periodic remanufacture to original design specifications.

The Weapons Labs Respond

The response from the weapons labs was that remanufacture to the original specifications would not be possible. As time went on, different manufacturing processes would be used and some materials used in nuclear explosives would become unavailable. They argued that the phenomena occurring during a nuclear explosion—especially the fusion “boosting” of the energy of the fission trigger—were not well enough understood to provide weapons experts with full confidence that such changes would have an insignificant effect on the performance of a nuclear weapon. Indeed, they claimed that 14 problems had developed in U.S. nuclear weapons since 1958 which had only been resolved definitively with nuclear tests.

The labs' arguments were rebutted in turn in 1987, in a report commissioned by a group of Congressmen from retired Livermore weapons expert, Ray Kidder. Kidder analyzed each of the problems that the labs had cited and found that nine had been found in the early 1960s in weapons that had not been fully tested before deployment because of the 1958-61 testing moratorium. He found also that the five post-deployment tests conducted in the 1980s were of designs which had never received full pre-deployment certification tests in their final configurations. Kidder concluded that such problems were very unlikely to occur in the well-tested warhead designs which the U.S. Government plans to keep in its "enduring" stockpile. Indeed, virtually all the problems cited by the labs had been identified within four years of initial deployment, while the youngest warhead design currently in the stockpile is now over ten years old.

How the Deadlock was Broken

This debate was finally ended by two government decisions: In the fall of 1992, Congress passed and President Bush reluctantly signed the Hatfield-Mitchell-Exon amendment, which gave the nuclear-weapons laboratories up to 15 tests before September 1996 to fix any existing reliability or safety problems in the U.S. enduring nuclear stockpile. Then, in May 1993, after a review of the 15 tests proposed by the labs, Secretary of Energy O'Leary concluded that none of them were essential. Instead, the Secretary offered the laboratories a "Science-based Stockpile Stewardship Program" which would allow them to greatly strengthen their ability to simulate the phenomena taking place during nuclear explosions using experimental facilities and computers, thereby hopefully enabling them to understand the significance of any changes in materials properties.

The proposed budget for the combined Stockpile Stewardship and Stockpile Management Programs was set at about \$4 billion per year—approximately the average Cold War level of nuclear-weapons spending—including about \$1 billion per year for nuclear-weapons R&D. The Clinton Administration also committed to a number of major new facilities, including the National Ignition Facility for Livermore—a huge 192-laser facility designed to ignite a fusion reaction in a small pellet containing deuterium and

tritium.

The deal was cemented by President Clinton's agreement that the Directors of the weapons laboratories would each year have to certify the safety and reliability of the enduring stockpile. If the Directors found that they could not so certify a critical warhead, the President promised that could be a basis for invoking the "supreme national interests" escape clause from the CTBT and conduct any necessary tests.

President Chirac appears to have made a similar deal with France's nuclear-weapons establishment. In addition, the U.S. has promised both the U.K. and France that relevant insights developed in the U.S. Stockpile Stewardship Program will be shared with them. Neither Russia nor China can expect comparable access to the results of the U.S. Stockpile Stewardship Program, however, and neither has the resources to mount a comparable program.

The scale of the Stockpile Stewardship Program has also raised suspicion that the U.S. might be trying to work around the constraints of a CTBT by developing capabilities to design and deploy new nuclear warheads without testing. These suspicions have been exacerbated by the Department of Energy's announcement that the U.S. will be conducting about four explosive but "sub-critical" tests with plutonium under the Nevada Test Site each year. Given the surprises that inevitably occur when theoretical simulations of complex phenomena are subjected to test, however, it is highly unlikely that the U.S. would develop and deploy a new warhead such as a "third-generation" X-ray laser or directional microwave generator which was radically different from the designs it developed before the test ban.

Given the record of virtually no test failures of conservative variants of well-understood designs, however, the weapons labs might well have enough confidence to develop and deploy such variants with-



Frank von Hippel addressing the Chengdu conference

out testing. The labs might also develop more radical designs to be tested if the CTBT should break down. Thus the U.S. would be well positioned to resume the competition to develop "more useable" nuclear-weapons should the CTBT break down—even though this competition has generated more paranoia than advantage in the past.

The DoE hopes to defuse concerns about its sub-critical tests by establish arrangements by which independent observers can verify that they are indeed subcritical. In that case, they will not differ significantly from the "hydrodynamic" tests of the implosion systems of nuclear warheads that are routinely conducted above ground. Nevertheless, given that the information that is to be learned from the subcritical tests could probably also be obtained from above-ground experiments, one must wonder why the weapons labs are insisting on these provocative underground experiments. Fermi's observation about physics appears to apply also to the labs: "What ever is not forbidden, is compulsory."

Since it would be contrary to the spirit of the CTBT for the U.S. to design new types of nuclear weapons, a number of analysts have suggested that the Administration make it U.S. policy to forbid work on new nuclear weapons designs by the laboratories. Indeed a clarification of U.S. policy with regard to new weapons design has been sought by at least one high-level lab official. Interagency consensus on such a policy appears to have been blocked, however, by the Department of Defense. According to the public (viewgraph) version of the report on DoD's 1994

Nuclear Posture Review, the Department of Energy has been instructed by the DoD to "maintain capability to design, fabricate and certify new warheads." Arguments for such a requirement may have been stimulated by the fact that, during Desert Storm, the U.S. had no low-yield nuclear weapon which could, with assurance, have destroyed deeply-buried Iraqi bunkers. In the event, however, the DoD found that it could adapt the "physics package" of an existing B-61 bomb to an earth-penetrating shell. Non-nuclear earth-penetrating bombs have been developed as well.

Stewardship Program Costs More than Necessary

Thus, although commitment to the Stockpile Stewardship program appears to have been necessary to get the nuclear-weapons labs to accept a CTBT, it remains far from established that all of the costly programs and facilities that are to be funded under this Program are required to maintain the reliability of the enduring nuclear stockpile. Furthermore, the stated purpose of the Program, to lay the basis for a deep scientific understanding of hitherto only partially understood nuclear-explosion phenomena, has raised suspicions abroad that the U.S. is still trying to achieve some type of nuclear superiority. Such suspicions can never be laid fully to rest but U.S. Government would reduce them significantly if it announced that it will be U.S. policy that the national nuclear laboratories are not to work on the development of new types of nuclear warheads. □