OCCASIONAL REPORT

The 1969 ACDA Study on Warhead Dismantlement

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In response to a Freedom of Information request, the US Arms Control and Disarmament Agency (ACDA) has just unearthed from its retired files and largely declassified the January 1969 *Final Report on Field Test 34 on the Demonstrated Destruction of Nuclear Warheads (1969).** The following is my brief summary.

Background

Field test 34 was an experiment on the tradeoffs between revelations of one side's weapon-design information and the other side's ability to verify that authentic warheads were being dismantled. The experiment was organized after US Ambassador to the UN Arthur Goldberg put forward a US offer to dismantle warheads containing a total of 60,000 kilograms of uranium-235 and to turn over to safeguarded peaceful uses the recovered uranium and plutonium if the USSR would do the same with warheads continuing a total of 40,000 kilograms of uranium-235.

Warheads and Fake Warheads Dismantled

In the experiment, US military officers were given 10 days' training to be "inspectors" and followed four batches of "weapon shapes" through the normal warhead dismantlement process. The weapon shapes included five types of real nuclear weapon that were scheduled for dismantlement. These (with my attempted identifications from the *US Nuclear Forces and Capabilities* databook[1]) were:

- "Mk-25, AIR-2A configuration" [the 1.5-kiloton W-25 range warhead of

* Copies of the complete report may be obtained from Steve Aftergood, who initiated the Freedom of Information request, at the Federation of American Scientists, 307 Massachusetts Avenue NE, Washington DC 20002

Genie air-to-air missile entered the US stockpile in 1957]

- "Mk-28 Y2, Mod 1 Ex Bomb" [the B-28 70-kiloton–1.45-megaton bomb entered the stockpile in 1958]
- "Mk-30 Y1, Mod 2" [the 5-kiloton W-30 warhead for the US Navy's Talos surface-to-air missile and US Army/Marine Corps atomic demolition mine entered the stockpile in 1959]
- "Mk-39 Y1, Mod-2 bomb" [the B-39 strategic bomb entered the stockpile in 1957 and was retired in 1966]
- "Mk-56, Mod 1 warhead" [the W-56 Minuteman II warhead entered the stockpile in 1960]

Also included were four types of fake weapon:

- "Mk-57 BDU [ballistic drop unit]." This is apparently a dummy of the B-57 (subkiloton–20-kiloton range) tactical bomb that entered the stockpile in 1967. "For the FT-34 test, each unit was modified by the addition of a 1/2-kilogram plutonium ball, suspended in foam plastic, in the nose section and a lead ballast in the rear case section"
- A conventional 8-inch artillery shell with a 1-inch "bar made up of two 1-kilogram sections of uranium. One was uranium-235 and the other uranium-238"
- A Mk 28 Ex bomb in which the secondary stage had been replaced by steel ballast containing in its center a 3-kilogram cylinder of uranium-235.
- A modified training warhead for the surface-to-air Hawk missile. The warhead was modified into a fake nuclear warhead "configured to resemble an advanced fission warhead with two detonators."

Dismantlement Arrangements

The weapon shapes were delivered first to the Pantex plant outside Armarillo,

Texas, where the warheads were dismantled and the high explosive burned. The components were then shipped to three different facilities where they were destroyed:

- Most of the non-nuclear components were shipped to the Paducah Plant at Paducah, Kentucky, where they were destroyed by smelting and/or burial
- Plutonium components were shipped to Rocky Flats Plant, Golden, Colorado, where they were melted down for assay
- Uranium components were similarly melted down for assay at the Y-12 plant in Oak Ridge, Tennessee.

Access Provided to Inspectors

The "inspectors" were given different levels of access during the five phases of the dismantlement process:

Phase 1. Before the dismantlement, inspectors were allowed to walk through the dismantlement areas to check "that the facility was equipped to process *bona fide* weapons [and search] for indications that nuclear material had been prepositioned." Some inspectors were allowed to use Geiger counters to search for fissile material.

Phase 2. The inspectors were allowed to inspect the intact weapon shapes. Four degrees of access were allowed:

i) Simple external inspections, including dimensional measurements, weighing and determination of center of gravity. (The total mass of the warhead components was tracked throughout the dismantlement process)

ii) Some inspectors were allowed in addition to look inside access doors in the weapon shapes and to use Geiger counters at the surfaces in order to deter-

mine the locations of radioactive materials

iii) Some inspectors were allowed in addition to take photographs of the weapon shapes, to use neutron counters to detect indications of the presence of plutonium and to use gamma spectrometers to determine the types of the radioactive material located previously by the Geiger counters

iv) Some inspectors were allowed in addition to inspect x-rays of the weapon shapes.

Phase 3. The inspectors watched the burning of the high explosive and other burnable components removed from the weapon shapes. At the highest level of access, they were allowed to look into and photograph the contents of boxes containing these components before burning and to inspect the residues after burning.

Phase 4. The inspectors checked the disposal of the non-nuclear components with four levels of intrusiveness ranging from weighing the closed boxes of material to be disposed of all the way up to being able to handle, measure, and photograph—but not to further disassemble—the components.

Phase 5. The inspectors assayed the recovered uranium and plutonium at Oak Ridge and Rocky Flats respectively. Access ranged from watching others do the assays to assaying the uranium themselves—but not the plutonium, because of safety concerns.

Conclusions

One of the conclusions drawn from the project was that, if the US actually undertook to dismantle warheads in a verifiable manner, this should be done at a specially designed integrated facility. In such a case, the exposure of classified information could be much reduced by using universal tooling and

fixtures to replace jigs that would reveal the dimensions of warhead components.

In addition, to further reduce loss of classified information, it was recommended that:

- Certain surface features on the warheads that could reveal information about internal structures such as radars be masked
- Access to non-nuclear components be allowed only after they had been made unrecognizable by crushing or smelting
- Inspectors be allowed to see the residues of the burning of the high explosives only after the debris had been thoroughly mixed
- Different enrichments of uranium be mixed and smelted together before assay.

With these protections, it was concluded that the loss of classified information would be much reduced—especially at the lower levels of access:

Access Level 1 (external inspection, no radiation instruments, materials assay) would reveal only one piece of classified information: that not all the uranium was weapon-grade.

Access Level 2 (looking in warhead access doors and running Geiger counters over their surfaces) would reveal two more (unspecified) pieces of classified information.

Access Level 3 (using neutron counters and gamma spectrometers) would reveal yet two more (unspecified) pieces of classified information.

Access Level 4 (inspection of x-ray plates of the warheads) would reveal 54 more (unspecified) pieces of classified information.

In total, the Department of Energy identified 445 items of classified informa-

tion that would have been revealed if the inspectors had been permitted to dismantle the warheads themselves.

With regard to the inspectors' abilities to detect fake weapons, the probabilities went as follows:

Access level	Percentage of fake warheads detected by ordinary inspectors	by weapon experts
1	0	15
2	20	25
3	20	25
4	55	60

Comment

Note that field test 34 did not include any specially designed procedures to enhance confidence in the authenticity of the weapon shapes being dismantled. Such procedures were discussed in Ted Taylor's article, "Verified Elimination of Nuclear Warheads," (*Science & Global Security* 1, 1–2, p.1 [1989]) and will be a special focus of a Federation of American Scientists–Committee of Soviet Scientists workshop planned for late October 1990.

NOTES AND REFERENCES

1. Thomas B. Cochran, William M. Arkin, and Milton M. Hoenig, *Nuclear Weapons Databook Volume 1: U.S. Nuclear Forces and Capabilities* (New York: Ballinger, 1984).