

Operation HARDTACK II

Note: For information related to claims, call the Department of Veterans Affairs (VA) at 1-800-827-1000 or the Department of Justice (DOJ) at 1-800-729-7327. For test participation verification or radiation dose reconstruction, call the Nuclear Test Personnel Review (NTPR) program at 1-800-462-3683.

Operation HARDTACK II was a series of nuclear weapons tests conducted at the Nevada Test Site (NTS) from Sept. 12 through Oct. 30, 1958. The operation consisted of 19 nuclear weapons tests and 18 safety tests. The nuclear weapons tests were conducted to evaluate the yield and efficiency of newly developed nuclear devices. The safety tests were designed to determine the stability of nuclear devices during transportation and storage. Operation HARDTACK II involved an estimated 1,750 Department of Defense (DoD) participants in scientific test activities, air support, and administrative staff support.

Historical Background

HARDTACK II was the continental phase of Operation HARDTACK. It followed Operation HARDTACK I, the nuclear test series conducted in the Pacific Ocean from April to August 1958. The Atomic Energy Commission (AEC), in conjunction with Field Command, Armed Forces Special Weapons Project (AFSWP), the Office of Civil and Defense Mobilization (OCDM), and other Government agencies, was involved in the planning for HARDTACK II. In August 1958, the President of the United States approved the AEC request to conduct the operation. HARDTACK II was the last series before the United States adopted a nuclear test moratorium, which had been originally intended to last one year but continued until 1961. HARDTACK II was designed to:

- Test nuclear devices for possible inclusion in the defense arsenal
- Test safety characteristics of nuclear devices
- Improve containment techniques for underground detonations.

DoD participants were involved in three activities:

- Administrative staff support
- Test group activities
- Air and ground support, including radiological safety monitoring.

DoD personnel assisted the AEC Test Manager in planning, coordinating, and executing the programs and activities associated with HARDTACK II. They oversaw the technical and military objectives of the series for the DoD. The following five test groups conducted scientific experiments to evaluate effects characteristics of the nuclear devices:

- DoD Effects Test Group, AFSWP
- Los Alamos Scientific Laboratory (LASL) Test Group
- University of California Radiation Laboratory (UCRL) Test Group
- Civil Effects Test Group (CETG)
- Office of Civil and Defense Mobilization (OCDM) Test Group.

The largest number of DoD participants took part in 11 projects conducted by the DoD Effects Test Group. Information gained from the projects was used in developing delivery systems for nuclear devices and in determining the military requirements for future nuclear device designs. At least one DoD Effects Test Group project was conducted at all the nuclear weapons tests except Shot BLANCA, the last weapons test of the series. One project was also conducted at four of the safety tests: MARS, HIDALGO, NEPTUNE, and VESTA.

Two of the nuclear weapons events, HAMILTON and HUMBOLDT, were effects tests cosponsored by the DoD and UCRL, an AEC weapons development laboratory. All 11 DoD Effects Test Group projects were performed at HAMILTON, and five were conducted at HUMBOLDT. For the DoD projects conducted only at these two shots, personnel placed thermal and radiation measuring instruments and soil samples in foxholes, in armored personnel carriers, and along cables between 5 and 730 meters from ground zero to determine the radiation and thermal effects produced by low-yield nuclear detonations. Participants also placed pigs and mice in the foxholes and armored personnel carriers to obtain data on biological effects of blast, heat, light, and radiation from nuclear detonations. Many of the experiments had to be retrieved soon after the detonations, while others could be collected later, when radiation intensities had decreased.

The DoD Effects Test Group projects involved personnel from the following service laboratories and agencies:

- Ballistic Research Laboratories
- Chemical Warfare Laboratories
- Chemical Corps Training Command
- Army Chemical Center
- Army Artillery Board
- Engineer Research and Development Laboratories
- Signal Research and Development Laboratories
- Walter Reed Army Institute of Research
- Headquarters, Continental Army Command
- Air Force Special Weapons Center

- Air Force Cambridge Research Laboratories.

The LASL and UCRL Test Groups conducted experiments to obtain information on diagnostic and effects characteristics of the devices developed and sponsored by each laboratory. LASL sponsored nine nuclear weapons events and nine safety experiments. UCRL sponsored 10 nuclear weapons events, including two sponsored with DoD, and nine safety experiments.

DoD involvement in LASL and UCRL Test Group projects included cloud-sampling missions conducted by Air Force Special Weapons Center (AFSWC) personnel. One AFSWC unit, the 4926th Test Squadron, flew aircraft through the clouds at 16 of the nuclear weapons events and 12 of the safety experiments to collect particulate samples of the clouds. The samples aided the laboratories in determining the yield and efficiency of each nuclear device.

The CETG and OCDM Test Groups conducted projects to determine potential effects of blast, heat, radiation, and fallout on civilian populations and structures. Although some DoD personnel were assigned to the agencies and laboratories conducting the projects, there was no documented DoD participation at these projects.

DoD personnel participated in air support activities for the Test Manager and the test groups at HARDTACK II. AFSWC, located at Kirtland Air Force Base (AFB), New Mexico, provided air support to the Test Manager. AFSWC conducted cloud-sampling missions for the UCRL and LASL Test Groups and cloud-tracking missions, sample courier missions, aerial terrain surveys, and other air support, as requested by the Test Manager.

The 4950th Test Group (Nuclear) was the principal AFSWC unit involved in HARDTACK II. The 4950th consisted of four squadrons, three of which participated in the operation. The 4926th Test Squadron (Sampling) and the 4952nd Support Squadron (Test) were located at Kirtland AFB. The 4935th Air Base Squadron was the permanent unit at Indian Springs AFB, Nev., 30 kilometers east of Camp Mercury, and was central to the mission of that base. Other Air Force units involved in Operation HARDTACK II included the 4900th Air Base Group from Kirtland AFB, N.M., elements of the 20th Helicopter Squadron of the Tactical Air Command (TAC), and the 865th Air Control and Warning Squadron of the Air Defense Command. Peak strength of these air support units during Operation HARDTACK II was approximately 400 personnel.

Summaries of HARDTACK II Nuclear Weapons Events

The 19 HARDTACK II nuclear weapons events were conducted in Areas 3, 5, 7, 9, and 12 of the NTS. There were 10 balloon, four underground, and five tower detonations. The accompanying table presents information on the nuclear weapons events, and the accompanying figure indicates their locations.

Eleven of the 19 tests had yields under 1 kiloton. Some of these, including HAMILTON, HUMBOLDT, and EVANS, resulted in yields lower than expected. Shot BLANCA produced the largest yield.

BLANCA was detonated on Oct. 30, 1958, in a tunnel 987 feet underground, with a 22-kiloton yield. Some radiation vented into the atmosphere producing a cloud that reached 7,700 feet above the ground and drifted southwest. DoD participation was limited to cloud-sampling, cloud-tracking, photography, and observer missions conducted by AFSWC.

Shots HAMILTON and HUMBOLDT were the two DoD effects tests and had the largest number of DoD participants. Shot HAMILTON was detonated on Oct. 15, 1958, on a 50-foot wooden tower. The device produced a lower-than-expected yield of 0.0012 kiloton. Before the detonation, personnel set up instrumentation for 11 DoD Effects Test Group projects. Many of the projects required that instruments be placed as close as 4.5 meters to the shot tower. One project was conducted 160 kilometers from the NTS. For six of the projects, the same personnel both placed and retrieved the instruments. This reduced the number of personnel required to enter the shot area after the detonation. In addition to the DoD Effects Test Group projects, AFSWC conducted cloud-sampling, cloud-tracking, sample courier, and terrain survey missions. Nine aircraft with 26 AFSWC aircrew personnel conducted these missions.

Shot HUMBOLDT, the second DoD effects test, was conducted on Oct. 29, 1958, at 6:45 a.m. The device, detonated on a 25-foot wooden tower, had a yield of 0.0078 kiloton. Personnel placed instruments between 9 meters and 2 kilometers from ground zero for all five DoD Effects Test Group projects. For three of the projects, personnel worked together to place and retrieve experiments, as they did at Shot HAMILTON. Cloud-sampling, cloud-tracking, and sample courier missions were conducted after the detonation. One aircraft participated in each of the missions. The missions engaged ten AFSWC aircrew personnel.

Summaries of HARDTACK II Safety Tests

The 18 remaining detonations in HARDTACK II were safety tests conducted to determine the stability of newly developed nuclear weapons during transportation and storage. Elements of the conventional high explosive portions of these devices were fired to simulate accidental damage and to determine the potential for such partial firings to result in nuclear yield. Data gained from the tests were used to develop devices that could withstand shock, blast, fire, and other accidents and produce nuclear yields of less than four pounds.

The HARDTACK II safety tests were conducted in Areas 3, 7, 8, 9, and 12 of the NTS. The shots consisted of six shaft, three tunnel, one balloon, five tower, and three surface detonations. The safety experiments ranged in yield from Shot NEPTUNE, which had a yield of 0.115 kiloton, to Shots SAN JUAN, OBERON, and GANYMEDE, which had no measurable yield. The accompanying table presents data on the safety tests, and the accompanying figure shows their locations. DoD participation in the safety tests was limited to one DoD Effects Test Group project conducted at four safety tests, cloud sampling conducted at 12 events, cloud tracking at 11 events, sample courier missions after seven safety experiments, one aerial photography mission and one observer mission during the final safety test, TITANIA.

Summary of Operation HARDTACK II Nuclear Weapons Events (1958)								
Shot	Sponsor	Planned Date	Actual Date	Local Time	NTS Location	Type	Height of Burst (feet)	Yield* (Lilotons)**
EDDY	LASL	Sept. 19	Sept. 19	7 a.m.	Area 7	Balloon	500	0.083
MORA	LASL	Sept. 28	Sept. 29	6:05 a.m.	Area 7	Balloon	1,500	2
TAMALPAIS	UCRL	Oct. 8	Oct. 8	2 p.m.	Area 12	Tunnel	-407	0.072
QUAY	LASL	Oct. 10	Oct. 10	6:30 a.m.	Area 7	Tower	100	0.079
LEA	LASL	Oct. 13	Oct/13	5:20 a.m.	Area 7	Balloon	1,500	1.4

HAMILTON	DoD/UCRL	Oct. 15	Oct. 15	8 a.m.	Area 5	Tower	50	0.0012
LOGAN	UCRL	Oct. 15	Oct. 15	10 p.m.	Area 12	Tunnel	-932	5
DONA ANA	LASL	Oct. 16	Oct. 16	6:20 a.m.	Area 7	Balloon	450	0.037
RIO ARRBA	LASL	Oct. 18	Oct. 18	6:25 a.m.	Area 3	Tower	72.5	0.09
SOCORRO	LASL	Oct. 21	Oct. 22	5:30 a.m.	Area 7	Balloon	1,450	6
WRANGELL	UCRL	Oct. 20	Oct. 22	8:50 a.m.	Area 5	Balloon	1,500	0.115
RUSHMORE	UCRL	Oct. 19	Oct. 22	3:40 p.m.	Area 9	Balloon	500	0.188
SANFORD	UCRL	Oct. 23	Oct. 26	2:20 a.m.	Area 5	Balloon	1,500	4.9
DE BAC	LASL	Oct. 26	Oct. 26	8 a.m.	Area 7	Balloon	1,500	2.2
EVANS	UCRL	Oct. 24	Oct. 29	4 p.m.	Area 12	Tunnel	852	0.055
MAZAMA	UCRL	Oct. 27	Oct. 29	3:30 a.m.	Area 9	Tower	50	0
HUMBOLDT	DoD/UCRL	Oct. 29	Oct. 29	6:45 a.m.	Area 3	Tower	25	0.0078
SANTA FE	LASL	Oct. 29	Oct. 30	7 p.m.	Area 7	Balloon	1,500	1.3
BLANCA	UCRL	Oct. 29	Oct. 30	7 a.m.	Area 12	Tunnel	-987	22

*Source: *United States Nuclear Tests, July 1945 through September 1992*, DOE/NV-209-Rev 15 Dec 2000.

**One kiloton equals the approximate energy release of the explosion of one thousand Tons of TNT.

aPacific Daylight Time for Shot EDDY; Pacific Standard Time for all other shots.

Radiation Protection Standards

The Nevada Test Site Organization (NTSO) and AFSWC developed radiological safety procedures to minimize exposure of individuals to ionizing radiation while they accomplished their missions at HARDTACK II. The AEC recommended a gamma plus neutron exposure limit of 3 rem (roentgen equivalent man) per calendar quarter or a total exposure of 5 rem per year for DoD participants at the operation. This was the accepted occupational limit for gamma exposure recommended by the National Committee on Radiation Protection and Measurements.

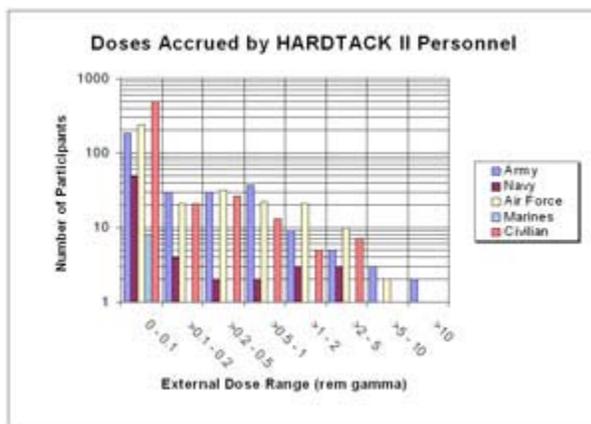
AFSWC personnel who conducted cloud-sampling missions at HARDTACK II were permitted to receive up to 10 rem during the series, and those individuals who participated in cloud sampling at both HARDTACK I and HARDTACK II were permitted to receive 15 rem during the two series.

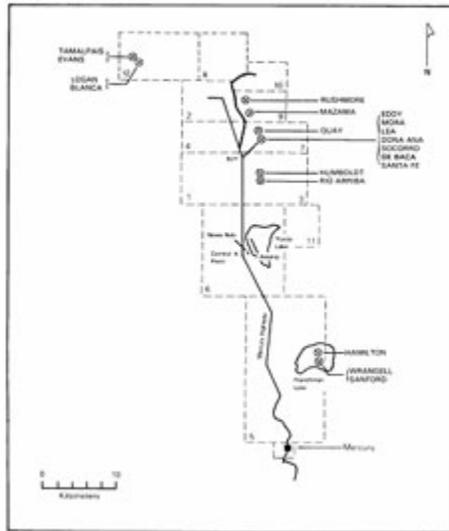
The radiological safety procedures at HARDTACK II were essentially the same as those used for Operation PLUMBBOB, the series of tests conducted at the NTS in 1957. Personnel from the Radiological Safety Division of the Reynolds Electrical and Engineering Company (REECo) conducted all onsite radiological safety activities and functions, including:

- Personnel dosimetry--issuing, exchanging, and developing film badges for participants and determining gamma radiation exposures recorded on film badges
- Clothing and equipment--providing anti-contamination clothing and respiratory equipment
- Monitoring--providing radiological survey equipment, performing radiological surveys, and controlling access to all radiation areas
- Decontamination--detecting and removing contamination on personnel, vehicles, and equipment.
- Personnel from the 4950th Test Group provided radiological safety for AFSWC participants at Indian Springs AFB and Kirtland AFB. These responsibilities included monitoring and decontaminating personnel and aircraft.

Radiation Doses at Operation HARDSTACK II

HARDTACK II participants wore film badges as a requirement for access to the NTS, and dosimetry records were maintained for all participants. Fifteen DoD participants had doses greater than 3 rem of gamma radiation. The highest doses, accrued by two Army officers, were between 10 and 11 rem. The totals of film badge and reconstructed doses for DoD participants at HARDTACK II are depicted below.





LOCATIONS OF HARDTACK II NUCLEAR WEAPONS EVENTS
WITHIN THE NEVADA TEST SITE

For more information, see the report, "Operation HARDTACK II 1958," (DNA6026F).

*

A rem is a unit that quantifies the biological effect of ionizing radiation (gamma, x-ray, beta, neutron or alpha) on man. Ionizing radiation is any radiation capable of displacing electrons from atoms or molecules, thereby producing ions. Microwaves and lasers are examples of nonionizing radiation. The general U.S. population receives about 0.36 rem per year (National Council on Radiation Protection and Measurements (NCRP), Report No. 93, Table 8.1) from natural background radiation sources (radon, cosmic rays and rocks) and man-made radiation sources (medical diagnostic x-rays and consumer products). The standard diagnostic chest x-ray delivers a dose of about 0.02 rem. For more information about NCRP Report 93, contact the NCRP internet site <http://www.ncrp.com>.

July 2007