DOE/NV/0003590-53

DESERT RESEARCH INSTITUTE
CULTURAL RESOURCES REPORT TR118
PROJECT NO. 188305

A Section 110 Evaluation of Three Sites Associated with the Grable Test, Area 5, Nevada National Security Site, Nye County, Nevada

Prepared by

Levi Keach
Division of Earth and Ecosystem Sciences
Desert Research Institute, Las Vegas, Nevada

August 2020

Cover Photo: M65 280mm Atomic Gun on display at the National Museum of Nuclear Science & History in Albuquerque, New Mexico (Keach 2018).

DOE/NV/0003590-53

DESERT RESEARCH INSTITUTE
CULTURAL RESOURCES REPORT TR118
PROJECT NO. 188305

A Section 110 Evaluation of Three Sites Associated with the Grable Test, Area 5, Nevada National Security Site, Nye County, Nevada

Prepared by

Levi Keach
Division of Earth and Ecosystem Sciences
Desert Research Institute, Las Vegas, Nevada

Prepared for

U.S. Department of Energy
National Nuclear Security Administration
Nevada Field Office, Las Vegas, Nevada

Submitted by

Maureen L. King, Project Director
Division of Earth and Ecosystem Sciences
Desert Research Institute, Las Vegas, Nevada

August 2020

The work upon which this report is based was supported by the U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office under Contract #DE-NA0003590.

EXECUTIVE SUMMARY

This report presents the results of a Section 110 recordation of the 280mm Atomic Gun emplacement and command post (CP) (26NY16244), an associated Flash Observation Point that was used to refine the gun's firing range (26NY16243), and troop trenches used for Exercise Desert Rock V (26NY16242). All three of these resources are directly associated with the Grable test, a specific test in the Upshot-Knothole series of aboveground nuclear detonations (Figure 1). The Grable test occurred at 8:30 a.m. on May 25, 1953, in Area 5 of the Nevada National Security Site (NNSS). Desert Research Institute (DRI) recommends 26NY16244 and 26NY16242 eligible for listing in the National Register of Historic Places (NRHP) under a combination of the Secretary of the Interior's Significance Criteria A and D at the national level of significance and related to the era of Nuclear Testing and the Cold War. All three of these resources are recommended as contributing elements to the Frenchman Flat Historic District (SHPO Resource No. D204).

ACRONYMS AND GLOSSARY

ATU: Artillery Test Unit, the military organization assembled at Fort Sill responsible for the testing and development of tactical doctrine for the M65 Atomic Gun.

AEC: the Atomic Energy Commission, the predecessor agency to the Department of Energy. The agency was established in 1946 to provide civilian control over America's nascent nuclear program (Buck 1983).

FCDA: the Federal Civil Defense Administration, the predecessor agency to the Federal Emergency Management Agency (FEMA). This agency name was used formally between 1951 and 1958 until the creation of FEMA in 1979, but it is still often used informally.

kt: kiloton, a unit of explosive energy nominally equivalent to 1,000 metric tons (1,000,000 kilograms) of Trinitrotoluene or TNT. Equivalent to approximately 4.18 terajoules of energy.

LANL: Los Alamos National Laboratory.

LLNL: Lawrence Livermore National Laboratory.

Nevada Proving Ground: one of the former names of the Nevada National Security Site, used from 1952–1954 (NNSA/NFO 2015a).

NTA: the Nuclear Testing Archive. The archive that holds many of the records related to nuclear testing in the state of Nevada. It is funded by the Department of Energy, National Nuclear Security Administration and is located in Las Vegas, Nevada.

OST Round: the Operation Suitability Test round. These rounds were atomically inert dummy rounds designed to test the subcritical components of the Mk 9 round.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

The Grable event, or test, was the first and only firing of a nuclear projectile in a U.S. Army tactical nuclear weapon system. This system is commonly referred to as Atomic Annie, The Atomic Cannon, or the 280mm Gun, as well as various permutations of these names. This tactical artillery nuclear weapon system was also the first of its kind. The official designation of this weapon system was the Model 65, or M65, 280mm Gun. This system consisted of a Tube 131 (T-131) tube that was mounted on a Transport 72 (T-72) carriage and transported by two prime mover heavy trucks (Franz and Vollert 2006). Numerous locations in Area 5 were involved in this test. This resource inventory focused on the main firing site, Station F-700; one of seven outlying observation stations; and the troop trenches used for Exercise Desert Rock V (EDR-V).

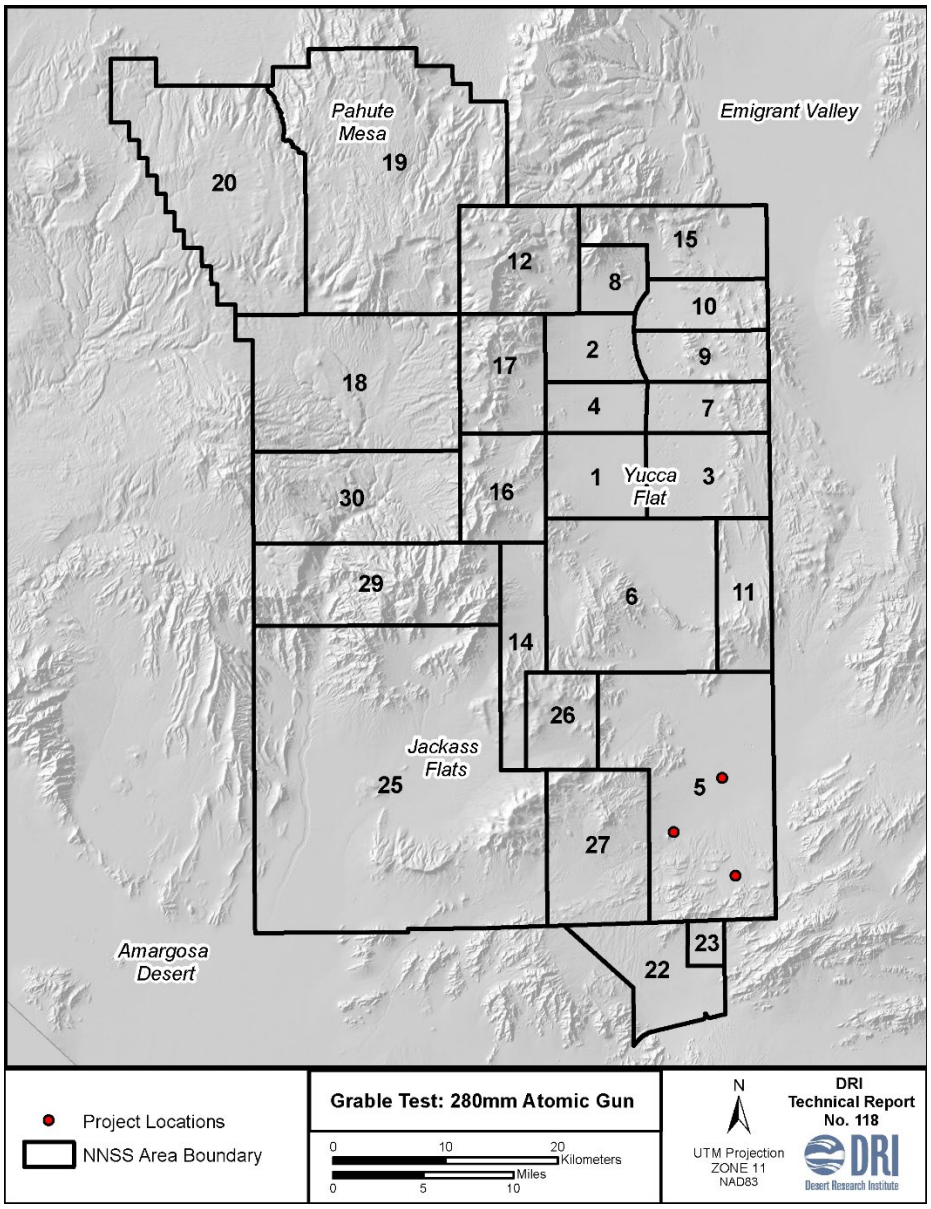


Figure 1. Location of the recorded components of the 280mm Atomic Gun Grable Test in Area 5 of the Nevada National Security Site. (More specific location information is provided in Appendix A.)

The intent of this report is twofold. First, it aims to document some of the major cultural resources associated with the Grable atmospheric nuclear test and assess whether they meet the requirements to be considered historic properties, as defined by 36 CFR § 800.16(l)(1). Second, this report will describe the importance of these resources as they represent the initial use of the tactical nuclear weapon system by the U.S. Army. To meet this second objective, this report considers the origins and development of the 280mm Atomic Gun and its associated nuclear testing projects, as well as the broader effects of the system.

II. HISTORIC CONTEXT

SETTING

The locations associated with the 280mm Atomic Gun Grable test are located on Frenchman Flat, a closed hydrographic basin located at the northern extent of the Mojave Desert (Wills and Ostler 2001). Frenchman Flat drains into Frenchman Lake, a playa located near the center of the basin. The surface geology of the area is described as alluvial deposits that grow older moving away from the playa. Some locations rest on mountain flanks, which are made up of Paintbrush Group deposits that are Miocene in age (Slate et al. 1999). Most of the substrates on which these sites are located are composed of various silty, gravelly surfaces (Figure 2).

Figure 2. Overview of southern Frenchman Flat with various soil regimes visible across the landscape, taken from 586734mE 4067439mN, view is west (DRI 2018).

According to Ostler et al. (2000), the vegetation communities in these locations include white burrobrush-Nevada jointfir (*Hymenoclea salsola-Ephedra nevadensis*) shrubland near the gun emplacement (Figure 3); creosote bush-white bursage (*Larrea tridentata-Ambrosia dumosa*) shrubland at the Flash Observation Point; and fourwing saltbush-winterfat (*Atriplex canescens-Krascheninnikovia lanata*) shrubland on the playa.

Figure 3. Overview of vegetation communities of white burrobrush (*Hymenoclea salsola*), Mojave yucca (*Yucca schidigera*), and Joshua tree (*Yucca brevifolia*) near the western edge of the gun site, taken from 592033mE 4063656mN, view southwest (DRI 2018).

THE COLD WAR

The Cold War was a global conflict between the United States and the Soviet Union and each country's respective allies that developed after World War II. After that war, the United States and the Soviet Union emerged as the only superpowers possessing intact heavy industry, large populations, and low international debt; they also possessed conflicting ideological outlooks (Gaddis 2005; Fink 2014). Although allied in World War II, fissures in this alliance between the two countries quickly grew over the political order in post-war Germany.

The United States had an advantage over the Soviet Union at the onset of the Cold War, because the United States was the world's only nuclear power. This changed on August 29, 1949, when the Soviets tested their first fission bomb (Fehner and Gosling 2006). The American response to the perceived Soviet threat was to expand production facilities and accelerate the development of nuclear weapons. On June 29, 1950, President Truman approved the development of thermonuclear weapons. However, the conflict in the Korean Peninsula began while this development was underway.

Few events in the Cold War were of greater relevance to the history of the Nevada National Security Site (NNSS) than the Korean War. Following World War II, the United States conducted its nuclear testing in the Pacific at Bikini and Enewetak Atolls. In the late 1940s, Project Nutmeg evaluated the feasibility of developing a nuclear test site within the continental United States. By March 1949, it was concluded that, barring a national emergency, the development of such a site was not realistic (Fehner and Gosling 2006). The Korean War proved to be just such an emergency. Since the reign of Tsar Alexander II, Russia had a strategic interest in the Korean Peninsula. Like Germany, Korea had been jointly occupied by American and Soviet forces at the end of World War II. Believing that the United States would not defend its stake in South Korea, Russian political leader Joseph Stalin supported Chinese and North Korean leaders Mao

Zedong and Kim Il Sung in crossing the thirty-eighth parallel (Barrass 2009; Gaddis 2005). The ensuing United States military involvement in Korea created technical and logistical problems for continued nuclear weapons testing in the Pacific. This led Atomic Energy Commission (AEC) Chair Gordon Dean to declare that it was "wise to reexamine the question of a continental site with the objective of having available a definite and specific site which could be recommended for use" (Fehner and Gosling 2000:43). On December 18, 1950, President Truman approved the choice of a continental testing site in southern Nevada on a portion of land that was already in use as the Las Vegas Bombing and Gunnery Range (Fehner and Gosling 2006).

Nuclear Testing and the Nevada National Security Site

The NNSS played a crucial role in the United States nuclear testing program during the Cold War. A key theme of the Cold War was the nuclear arms race between the United States and the Soviet Union. This led to numerous nuclear detonations worldwide, both by the United States and by other nuclear powers. The U.S. Department of Energy (DOE) and the Department of Defense (DOD) conducted these tests for the United States and most occurred at the NNSS where the operations included both atmospheric and underground tests. Of the 928 nuclear tests conducted at the NNSS, 119 were performed in the 1950s and 809 took place following a short moratorium between 1958 and 1961 agreed to by both the United States and the Soviet Union (Friesen 1995). A second self-imposed moratorium on nuclear testing by the United States was established in 1992. In 1996, the United Nations approved the Comprehensive Nuclear Test Ban Treaty prohibiting nuclear explosions and the United States agreed to this treaty, but it has never been ratified.

Nuclear weapons testing at the NNSS began with the Able atmospheric test during Operation Ranger at Frenchman Flat on January 27, 1951 (NNSA/NFO 2015a; Ogle 1985; Titus 1986). Construction of additional facilities at Mercury, the gateway to the testing site, began soon afterward (AEC 1951). After a series of name changes, the area became the Nevada Test Site in 1954, and then the NNSS in 2010 (NNSA/NFO 2015a). Currently, the NNSS encompasses an area of approximately 1,360 square miles (870,397 acres) (see Figure 1).

In the early 1950s, at the onset of the United States continental testing program, nuclear devices were dropped from airplanes. This strategy was a relatively easy and economical way of meeting the timeline for the initial test series. However, the devices had to withstand accelerations from the airdrop, and therefore needed to be close to final design rather than in the development stage (Fehner and Gosling 2006). Many of the testing program experiments also required high locational precision, which the airdrops lacked. By mid-1952, atmospheric tests at the NNSS moved to tower tests, which provided a tower cab with a stationary platform at a specified elevation. Tower platforms delivered the accuracy needed to place the device at a location relative to test instrumentation. Beginning in 1957, balloons were used to elevate nuclear devices, thereby reducing radioactive fallout from steel tower components entrained with other materials during the fireball phase. During the 1950s, large yield tests were also being performed in the Pacific. These tests were mostly conducted from towers, although a few were launched into outer space on rockets, conducted underwater, and on barges (Ogle 1985). A total of 100 atmospheric tests were conducted at the NNSS, three of which were conducted in the upper Fortymile Canyon area and the rest on Frenchman and Yucca Flats (NNSA/NFO 2015a).

Between January 1951 and July 1962, both atmospheric and underground tests were conducted at the NNSS. However, after ratification of the Limited Test Ban Treaty (LTBT) in 1963, all nuclear tests were underground (NNSA/NFO 2015a). According to the LTBT, no tests could be conducted in the atmosphere, outer space, or underwater. Beginning in the mid to late-1950s, containment of nuclear

explosions became a major concern (Carothers 1995; Johnson et al. 1959; Malik et al. 1981). Radioactive fallout was a safety and health issue for both the workers doing the tests and for the public. As a result, the DOE and DOD focused on developing underground complexes to meet their testing needs; a total of 828 underground nuclear tests occurred on the NNSS (NNSA/NFO 2015a).

Most of the nuclear tests at the NNSS were either weapons effects tests, carried out by the DOD, or weapons-related tests, conducted by Los Alamos National Laboratory (LANL) or Lawrence Livermore National Laboratory (LLNL). Atmospheric weapons effects tests evaluated the results of nuclear weapons on civilian or military targets (NNSA/NFO 2015a). In contrast, weapons-related tests evaluated the performance of the nuclear device itself (weapons diagnostics or weapons physics measurements). Although the majority of atmospheric and underground tests were weapons related, weapons effects data from weapons-related atmospheric tests were frequently collected on a noninterference basis—that is, they did not interfere with the collection of data related to the performance of the device (Jackson 1993).

From 1951 to 1992, 742 nuclear tests were conducted on Yucca Flat, which represent 80 percent of all the tests conducted on the NNSS. Testing in this area began with the Able tower atmospheric test on October 22, 1951 (NNSA/NFO 2015a). From 1951 to 1958, airdrop, surface, tower, and balloon atmospheric tests were accomplished. The Hood balloon atmospheric test in 1957 produced a 74-kiloton yield, making it the largest atmospheric test on the NNSS. The majority of the tests on Yucca Flat were underground tests that used specially drilled vertical holes, or shafts, for the devices. Many of these tests produced subsidence craters, which give the present-day landscape its distinctive character. Baneberry, a significant underground shaft test in Yucca Flat, was conducted on December 18, 1970. This 10-kiloton test inadvertently released radioactive contamination into the atmosphere, which resulted in changes to test procedures and containment practices (NNSA/NFO 2015b). Three crater tests were also conducted in Yucca Flat. For this type of underground test, the device was buried near the surface to produce a crater from a throw-out of earth. Sedan Crater, which is listed in the National Register of Historic Places, is the result of a cratering test conducted for the Plowshare Program on July 6, 1962. The detonation formed a crater that is 1,280 feet in diameter and 320 feet deep. The last nuclear test at the NNSS, named Divider, was conducted in Area 3 of Yucca Flat on September 23, 1992 (NNSA/NFO 2015a).

Frenchman Flat is considerably smaller than Yucca Flat, and therefore it is entirely within Area 5 of the NNSS. From 1951 to 1992, a mere 19 nuclear tests were conducted there, all of which were single detonations (NNSA/NFO 2015a). The majority of these tests (74 percent) were atmospheric tests. Frenchman Flat was the first area of the NNSS to see nuclear testing. The entirety of the 1951 Ranger test series consisted of airdrop detonations over Frenchman Flat (NNSA/NFO 2015a). Likewise, some of the first permanent constructions on the NNSS were built on Frenchman Flat (Fehner and Gosling 2006). One such structure is Kay Blockhouse, which was first designed underneath ground zero as the alpha recording shelter for all the Ranger tests (Jones 2003). Following Operation Ranger, Frenchman Flat would see heavy use by the DOD until the conclusion of atmospheric testing. Unlike Yucca Flat, underground testing on Frenchman Flat was rare. Only five underground tests took place, four of which were under the direction of the DOD. The last test to occur on Frenchman Flat was Milk Shake on March 25, 1968.

The U.S. Army's first tactical nuclear weapon system is associated with the 1953 Upshot-Knothole series of atmospheric nuclear tests. This series was the fifth to take place at the NNSS (Ponton et al. 1982; NNSA/NFO 2015a). All tests in this series were single detonation atmospheric tests located on either Frenchman or Yucca Flats. The series consisted of 11 detonations, nine of which were planned under the aegis of the AEC's Operation Upshot and two of which were planned as part of Operation Knothole. The planning of Operations Upshot and Knothole were combined by mutual agreement in June 1952 (Clark

1954; Ponton et al. 1982). Although construction for the tests began in late 1952, presidential approval (Figure 4) came 25 days before the detonation of the first test in the series, Annie, on March 17, 1953 (cf. Gleason 1953; Ponton et al. 1982). The series closed with the Climax test on June 4, 1953 (NNSA/NFO 2015a).

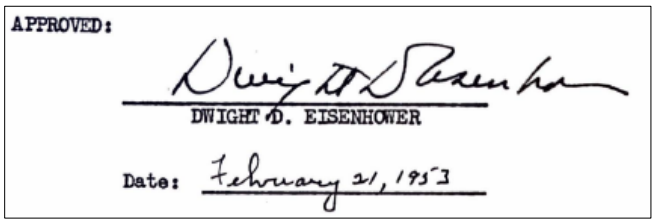


Figure 4. President Eisenhower's signature authorizing Operation Upshot-Knothole (Gleason 1953).

The end of nuclear testing started in 1991 and came about in stages. In October of 1991, the Soviet Union declared a unilateral moratorium on nuclear weapons testing and officially dissolved two months later. On October 2, 1992, with the Joint U.S.-U.K. 20-150 kiloton (kt) Icecap test in preparation, President George H. W. Bush declared that the United States was also entering into a unilateral moratorium on nuclear testing, and Icecap was subsequently canceled (NNSA/NFO 2013a, 2015a). Following the election of President Clinton, the unilateral moratorium was extended in 1993 and 1994. In 1995, President Clinton began pursuing a more permanent solution to nuclear testing in the form of the Comprehensive Test Ban Treaty (CTBT), for which negotiations began in 1993. On September 24, 1996, President Clinton signed the CTBT, which effectively ended nuclear testing by the United States. Although President Clinton signed the treaty, it remains unratified by the Senate and lacks the full legal force of a treaty (NNSA/NFO 2015a). Although the CTBT is unratified, there has been no nuclear testing at the NNSS since 1992. The NNSS has only conducted subcritical and high explosives testing to fulfill its stockpile stewardship obligation (NNSA/NFO 2013b).

ORIGINS, DEVELOPMENT, AND FIRING OF THE ATOMIC GUN

The roots of the M65 280mm Atomic Gun date to World War II and the need for a long range, very heavy, artillery piece to counter the heavier German guns, such as the Krupp K5 283mm Railway Gun, and field fortifications. In 1944, the U.S. Army began development of a 240mm heavy gun. The war ended before design work began in late 1946. In 1949, a year before the prototype gun was finished, the AEC began developing the Mk 9 round (Franz and Vollert 2006). In April 1950, based on the AEC's projected development of an artillery deliverable nuclear round, plans were made to scale up the gun to 280mm.

The political origins of the M65 280mm gun were twofold. First, and more prosaically, the political origins of the atomic gun can be found in the interservice rivalry between the U.S. Air Force and the U.S. Army for dwindling defense dollars in the post-war economy. Second, and not entirely unrelated, the political origins of the atomic gun can be found in the United States' newly won role as defender of the first world. Immediately following World War II, the U.S. Army, through the Army Air Corps, was the only fighting force in the world capable of delivering the mighty new atomic superweapon that had just won the war. The demonstrated strength of these weapons seemed to obviate the need for ground troops in the minds of many Americans (Cannon 1984). The National Security Act of 1947 separated the U.S. Air Force from the U.S. Army, which stated that "The Army Air Forces, the Air Corps, United States Army, and the General Headquarters Air Force (Air Force Combat Command), shall be transferred to the United States Air Force" (National Security Act of 1947 § 208 (a)). The result was not only a dramatic

loss of funding for the U.S. Army, but also its seat at the planning table. Between the close of World War II and the start of the Korean War, it was assumed that the next war would be fought and won with the atomic bomb, and therefore as its sole custodian, the U.S. Air Force—or more specifically, Strategic Air Command—was in charge of war planning (see Kaplan 1991: Chapter 3).

This did not sit well with the other services. From 1946–1950, U.S. Army leadership, including then Chief of Staff General Dwight Eisenhower, sought permission to develop smaller, tactical nuclear weapons for battlefield use (Midgley 1986). After the United States proposal to the United Nations for international control of nuclear power was rejected by the Soviet Union, Truman approved the development of tactical nuclear weapons by the U.S. Army (Womack 2014:43-44). With the development of these weapons, the U.S. Army was better able to compete for funds and prestige with the U.S. Air Force.

As the Cold War took shape, America's commitment to the defense of Western Europe would come into conflict with its long-held values. This is evident by Secretary of State Dean Acheson's promise to Congress that the North Atlantic Treaty did not commit the United States to deploy substantial troops to Europe (Barrass 2009:61-62). This situation was brought into sharp relief in 1950 with National Security Council policy paper 68 (NSC 68), which was an important policy statement regarding Soviet containment (see Lay 1950). Prior to NSC 68, it was assumed that the Soviet armies would overrun Europe long before the United States could counter them. Rather than try to hold off the advancing communist armies, the United States planned to retreat to the United Kingdom and North Africa to amass forces to retake Europe (Converse 2012:140). After NSC 68, the United States began increasing its forces in Europe while the U.S. Army looked for a weapon that could halt a Soviet advance. Tracy S. Voorhees, Under Secretary of the U.S. Army, and Vannevar Bush, a noted engineer, were tasked with investigating the U.S. Army's research and development needs to meet NSC 68. They recommended new antitank weapons and the development of tactical nuclear weapons, noting that the 240mm gun currently in development could be scaled up to fire an atomic projectile (Converse 2012:155). In the same year, budgeting for the U.S. Army's defense of Europe faced competition from the nascent Korean War.

Prior to Dwight Eisenhower's presidential election, plans for a nuclear-armed U.S. Army were underway. However, these plans would prove prescient of the Eisenhower Administration's national security policy, referred to as "the New Look," which sought to balance Cold War military commitments with the nation's financial resources. Although a military man, Eisenhower was deeply fiscally conservative and maintained a skepticism of large standing armies. As the first North Atlantic Treaty Organization (NATO) Supreme Allied Commander of Europe (SACEUR), he was intimate with the challenges of defending Europe and had overseen a buildup of U.S. forces to 3.6 million personnel, pushing the defense budget to $50 billion annually (Barrass 2009:71-72).

As president, Eisenhower inherited a stagnant Korean War, spreading communism, and a European community unwilling to support its own large conventional armies. Moreover, he believed that winning the Cold War required the United States to be a beacon of the free world, which necessitated a flourishing economy and investment in education, healthcare, and welfare. However, defense spending was consuming 17 percent of the gross national product (Barrass 2009:83). A creative new defense plan was needed to maintain a balanced budget, increase domestic investment, and contain the Soviets.

The 1953 Solarium Project, a national strategy developed by the Eisenhower administration to respond to Soviet expansion, sums up this New Look at defense. It was believed that any major conventional war with the Soviets would escalate to a nuclear war, which would make a large standing army a costly waste of money. Therefore, the administration determined that a massive nuclear retaliatory strike would be used as a deterrent to war. This led to increased nuclear weapons, including a tactically armed U.S. Army. Although

the costs of developing and maintaining these weapons were enormous, the estimated costs of maintaining a conventional army large enough to deter the Soviets was much higher (Barrass 2009:84-85).

The interservice rivalry for funding in the Atomic Age led to the development of a heavy artillery piece for the first tactical nuclear weapon system. This provided a proof of concept for a new way to think about the role of the U.S. Army in the Atomic Age, which supported maintaining a large standing army to defend Europe. As stated by Abrams (2006), the Cold War would eventually normalize the idea of a large standing army in the minds of the American people.

Developing the Atomic Gun

Major testing of prototypes for the Atomic Gun occurred at three locations. General testing of the systems and characteristics occurred at Aberdeen Proving Ground in Maryland beginning in 1950. Technical and tactical trials at Fort Sill, Oklahoma, occurred between March 17 and April 9, 1953. Finally, the preparations and live fire of the Mk 9 (T-124) round at the Nevada Proving Grounds occurred between May 6 and 25, 1953.

The first of the guns delivered to Aberdeen Proving Ground was a 240mm variant in the fall of 1950. Costing 1.3 million dollars to develop, the gun failed during its initial firing because its trunnions were unable to bear the stress of recoil (Converse 2012:155). By spring of 1951, the scale-up to 280mm was complete and Aberdeen Proving Ground would have three such guns by October of the same year (Franz and Vollert 2006). Some of the testing at Aberdeen Proving Ground was recorded for Episode 249 of *The Big Picture*, a television program that aired documentary films produced by the U.S. Army. Episode 249 shows personnel testing the maneuverability of the M65 system across standard army field bridges and the mutual functioning of the T-131, T-72, and T-122 High Explosive Projectile (U.S. Army 1954).

The primary purpose of the Fort Sill phase of testing was to reduce the need for registration fire from the standard six rounds used by light and medium artillery batteries. “Registration” refers to activities designed to identify a variety of errors that could affect firing accuracy and correct for those errors prior to shooting live rounds. Because the area suitable for the burst of atomic weapons is generally small, even in a combat situation, registration fire needed to be reduced to maintain surprise and limit expense. (Armstrong 1953a:11). To address this issue, the Artillery Test Unit (ATU) compared the results of a standard six-round registration with a one-round registration, a combination of accurate meteorological knowledge with muzzle velocity data obtained using a Doppler field chronograph, and a silent registration using an inert or ground burst round monitored by radar.

The major objectives of the Nevada phase of testing was to provide a proof of concept for both solutions determined at Fort Sill and the complete system using a live nuclear round. Preparations for the firing began in December 1952, at which time the Test Director, Alvin C. Graves, dictated the ground zero (GZ) location and that the angle of fire should be between 0 and 30 degrees, true north (Armstrong 1953a:14; Lyon 1953). Based on these requirements, initial locations for the gun and support locations were outlined. Final locations were decided the following month and surveyed by Silas Mason, Inc. (Armstrong 1953a:14).

The 280mm guns were fired on seven occasions at the Nevada Proving Ground. According to the ATU commander, six T-122 rounds and one Operation Suitability Test (OST) round registration fire occurred on May 15, 1953. On May 22nd, the dress rehearsal for the Grable shot took place (Figure 5). This involved the same firing package used on May 15th (Armstrong 1953a). Other sources provide a slightly different account of these firings. On May 15th, Gun No. 1 fired five T-122 rounds and six T-123 spotting rounds, and Gun No. 2 fired four T-123 rounds. On May 22nd, Gun No. 2 fired a total of 22 T-123 rounds (Preuss 1953:67). Between the third and fourth firings on May 24th, the ATU briefed approximately 32 flag officers—including General J. Lawton Collins, the U.S. Army’s Chief of Staff—and allowed them to inspect the guns (Bullock

1953a). In the morning hours of May 25th, the ATU team fired a seven T-122 round high-burst registration volley. At 4:00 a.m., the disassembled Mk 9 atomic round (T-124) was transported to the firing site. Over the next three hours and forty-five minutes, the assembly team brought the components of the atomic round together, hidden from view within a blacked-out vehicle, under the strict observation of the AEC; the round's owner, Sandia Corporation; the round's designers; and the test's overseers, Los Alamos Scientific Laboratory. At 8:05 a.m., the assembled round was loaded into the gun to be fired by remote signal from CP-1, the command and control center for nuclear testing across the Nevada Proving Grounds, 19 seconds before 8:30 a.m. (Armstrong 1953a; Bullock 1953a; Preuss 1953). Following the firing of the Mk 9, the ATU remained in Nevada at the request of Sandia Corporation. From May 27th to 29th, the ATU fired 24 rounds modified with telemetry circuits that recorded the inner functioning of the weapons package (Preuss 1953:68).

Figure 5. The 280mm Gun firing during the dress rehearsal (NTA 1953a).

The operations order (OPORD) associated with the ATU's activities on the NNSS provides insight into the scope of activity involved in the actual firing of the 280mm guns (see Armstrong 1953b). The ATU operated as Battery A, 867th Field Artillery Battalion. The unit was composed of the gun battery, a communications platoon, a flash ranging platoon, a meteorology platoon, a radar platoon, a camera team for the Mitchell high-speed camera, a survey team, and an ordnance detachment. The communications platoon was responsible for running 39 lines of communication wire across southern Frenchman Flat that were used to connect the different teams. The flash and survey teams jointly occupied four Flash Observation Posts and were responsible for observing and reporting the detonation of registration fire. The flash ranging platoon accomplished this using M2 spotting instruments, whereas the survey crew

used M65 BC telescopes. The radar platoon worked to accomplish the same goals using AN/MPQ-10 and AN/MPQ-22 radar sets from different locations. The meteorology platoon generated the precise weather data needed to address external ballistic factors. The Mitchell camera team was stationed behind the firing gun to record the flight time for each of the conventional and dummy nuclear rounds. The gun battery was responsible for the operations of the two 280mm guns. Finally, the ordnance detachment was responsible for preparing the rounds and recovering the dummy nuclear components from the OST rounds. The full OPORD is reproduced with minor edits in Appendix C of this document.

A total of 265 personnel made up the ATU at the NNSS (Clark 1954). The majority (46 percent) of the ATU's officers came from the Artillery School at Fort Sill, whereas the majority (68 percent) of the enlisted men came from the 867th Field Artillery. This unit would later serve as one of the first atomic artillery battalions in Germany (Clark 1954; Franz and Vellert 2006; Moore 2018). Table 1 describes the full composition of the ATU at the NNSS.

Table 1. Artillery Test Unit (ATU) Composition (Clark 1954:100).

Unit	Officers	Warrant Officers	Enlisted	Civilians	Total
52nd FA Group	4	0	1	0	5
867th FA Battalion	9	2	142	2	155
136th OSWDS Company	7	0	10	0	17
Artillery School	19	1	5	7	32
653rd FA Observation Battalion	2	2	52	0	56
Total	41	5	210	9	265

Firing the Grable Shot

Beginning at 8:30 p.m. on May 24th, Battery A crews began occupying their stations for the Grable firing. The gun crew began firing three warm-up rounds at 5:30 a.m. on May 25th. Registration fire began at 6:08 a.m. and by 7:45 a.m. crews at the outlying locations began to take cover. At 8:28 a.m., after the gun crew had prepared the Mk 9 and all personnel were under cover, Colonel Armstrong notified Test Director Alvin Graves that the gun was ready to fire. At 8:29:41 a.m., Graves fired the gun remotely from CP-1. Nineteen seconds later, the Mk 9 successfully detonated 24 feet above 45 feet west and 162 feet short of its intended burst point, well within its allowed margin of error (Armstrong 1953a, 1953b; Clark 1954).

Regarding the explosion itself, Brigadier General William C. Bullock, the Exercise Director, noted that the fireball formed by the burst was "not as colorful as in previous shots and dissipated very rapidly" (Bullock 1953a: 332). According to Clark (1954), the cloud formed by the Grable detonation reached a height of nearly 35,000 feet, although it was carried away unusually quickly because of high winds in the upper atmosphere (Figure 6).

Beyond being the final proof of concept and operational feasibility for the atomic artillery system, the ATU evaluated the alternate solutions to the gun's registration and recommended changes be made prior to fielding the system. One round registration was found to be an acceptable solution, although it was prone to idiosyncratic error that could compromise the element of surprise. The best solution to correct this error was a combination of meteorological and muzzle velocity data. Finally, radar tracking proved to be untenable with contemporary radar sets.

Many problems were found with the gun's system, such as a serious issue with the fuse, insufficient range of the existing plotting boards, the need for a field-portable chronograph, and the need for various hand-

ramming tools. Despite these issues, the success of the test meant that the M65 280mm Atomic Gun would be entering service before the end of the year.

Test Grable, Beyond the Gun

In late 1951, plans were being made for what would become Operation Upshot-Knothole, which was the fifth nuclear test series to take place in Nevada. Like the two preceding tests, the hyphenated name relates to the division between the AEC-led tests and the DOD-led tests. The major objectives for DOD were to gather general weapons effects information and to test the M65 system, which was entering the stockpile (Blades 2013:91; Clark 1954; Ponton et al. 1982:32). As was typical during atmospheric testing, the Grable test supported several projects that could not interfere with the primary weapons related objective of testing the Mk 9 atomic device (NNSA/NFO 2015a).

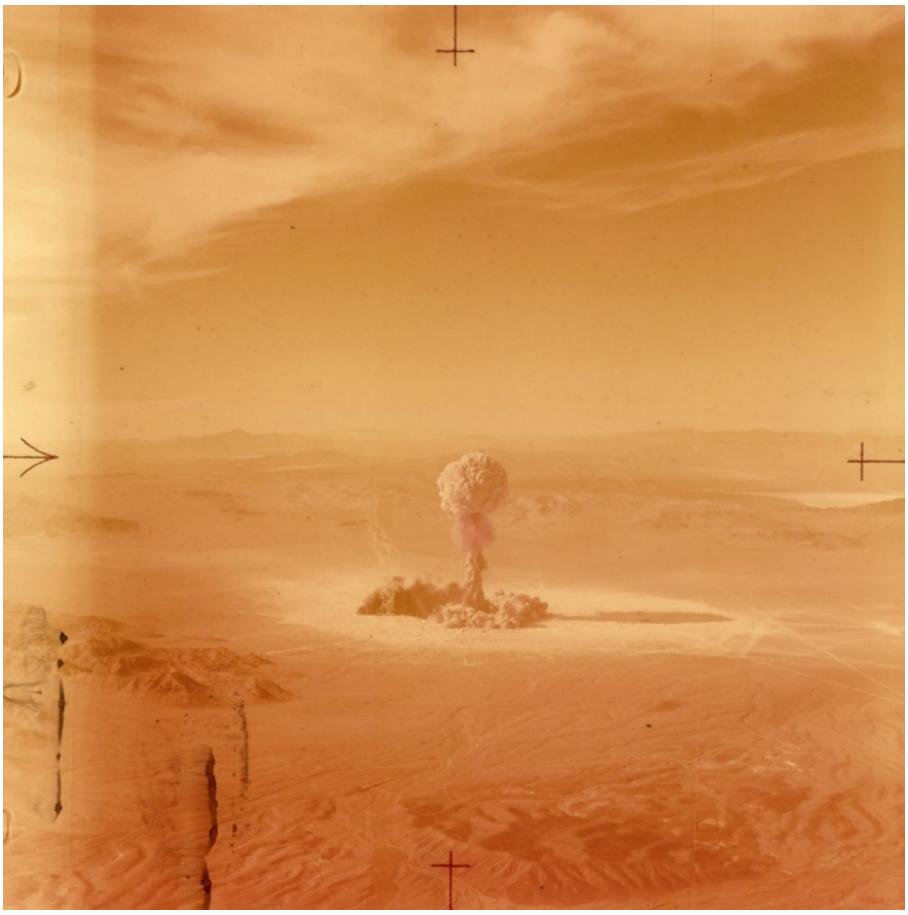


Figure 6. Development of the Grable cloud following detonation, view north (NTA 1953b).

Beyond testing the Mk 9 device, there were 65 scientific projects associated with Grable in addition to the final maneuvers of Exercise Desert Rock V (Massie et al. 1982). These projects ranged from scientific phenomenological studies (e.g., Projects 1.4 and 7.3) to military effects tests (e.g., Projects 3.11-3.16 and 8.4.1) to instrumentation development (e.g., Projects 1.1a-1 and 1.1a-2). Table 2 provides a complete list of all the projects associated with the Grable shot.

FOREST SERVICE FLAMMABILITY STUDIES

The U.S. Forest Service conducted Project 8.11a during both the Encore and Grable tests to experimentally determine the flammability of building and common interior materials that would be exposed to thermal

effects in homes within an urban environment. This objective was complicated by the second part of the project, gathering stock footage for the film *The House in the Middle* (Bruce 1953). Project 8.11b was similarly focused on the flammability of urban exterior materials, but it emphasized the different types of kindling fuel found in an outdoor urban environment. Although footage from Project 8.11b was included in the film, gathering stock footage was not an explicit goal of the project (Sauer et al. 1953).

To address the potential sources of spontaneous fires in the event of a nuclear detonation above an American city, the U.S. Forest Service surveyed several cities to determine what types of potential ignition hazards were present. They came up with a list of 90 potential kindling sources, of which 20 were selected for exposure as part of Project 8.11a during the Encore and the subsequent Grable test (Bruce 1953). Project 8.11b examined effects to 11 material types, as well as automotive seat covers (Sauer et al. 1953).

The U.S. Forest Service conducted its tests on the 246-degree blast line, which can be observed in digitized instrument station geospatial data at DRI. The test materials for Project 8.11a were mounted in 24 × 24 × 3.5-inch wooden frames and held in place between window glass and plywood or mesh screen (Bruce 1953:15). The mounting strategy for Project 8.11b was similar, but material was always sandwiched between chicken-wire-type mesh. In both cases, the frames were supported by steel angle-iron bases that held them at a normal (i.e., perpendicular) angle to the blast point (Bruce 1953:15).

In addition to the tray tests, both projects engaged in more illustrative tests that would be included in the film. For Project 8.11a, five demonstration houses were constructed for the Encore test, including the eponymous House in the Middle. Two of these houses (Station F-9.14a and e) were located 6,000 ft from GZ and were used for interior footage. They were single-room structures with a 4 × 6-foot window facing GZ. Their purpose was to demonstrate that a clean and tidy house would be less likely to catch fire as a result of thermal radiation (Bruce 1953).

The remaining three houses (Station F-9.14b) were located 8,000 ft from GZ and were used for exterior footage. House No. 1 was poorly maintained, with weathered siding and a dirty yard. House No. 2, located in the middle, was better maintained, with a fresh coat of paint and a clean yard. House No. 3 was free of trash but constructed with weathered siding. The purpose of these houses was to demonstrate that a clean yard and fresh paint would reduce the dangers presented by thermal radiation. These houses were specifically designed for Encore, but one house at Station F-9.14 and one house at Station F-9.14b (Figure 7) survived the detonation, and therefore were present for the Grable test (Bruce 1953).

Project 8.11b consisted mainly of testing the ignition and persistence of fires fed by exterior kindling fuels, such as fencing and items in the yards of houses, rather than the houses themselves. Nine sections of fencing (Station F-9.14c) were built at the 8,000 ft location and tested during both the Encore and Grable shots. Eight of these sections were constructed out of severely weathered redwood and Douglas fir salvaged from a condemned neighborhood in Oakland, California, whereas the remaining section was constructed of new Douglas fir (Sauer et al. 1953). The fences were reinforced with 4x4 posts to prevent collapse following the blast wave and kindling was held against eight of the weathered sections using chicken wire. All the remaining exposed and weathered fencing from the Encore test burned completely during the Grable test and, with the addition of newspaper kindling, the new fencing also burned completely (Sauer et al. 1953:28).

The lasting legacy of Projects 8.11a and 8.11b is the film *The House in the Middle*. This title refers to two films using the same footage. The first is a seven-minute, black-and-white film produced by the Federal Civil Defense Administration (FCDA) in 1953. The second is a 12-minute color version produced by the National Paint, Varnish, and Lacquer Association (presently, the American Coatings Association) released in 1954. The color version was enrolled in the National Film Registry in 2001 for its enduring importance to American culture. It is particularly notable for its use by the FCDA and the paint industry

Table 2. Projects Participating in the Grable Test (modified from Massie et al. 1982: Table 4-2).

Project	Title
1.1a/1.2	Air Blast Measurements
1.1a-1	Evaluation of Wiancko and Vibrotron Gauges
1.1a-2	Development of Mechanical Pressure-Time and Peak Pressure Recorders
1.1b	Air Pressure and Ground Shock Measurements
1.1d	Dynamic Pressure versus Time and Supporting Air Blast Measurements
1.4	Free-field Measurements of Earth Stress, Strain, and Ground Motion
2.2a	Gamma Radiation Spectrum of Residual Contamination
2.2b	Residual Ionizing Radiation Depth Dose Measurements in Unit-density Material
2.3	Neutron Flux Measurements
3.1	Tests on the Loading of Building and Equipment Shapes
3.1u	Shock Diffraction in the Vicinity of a Structure
3.3	Test on the Loading of Horizontal Cylindrical Shapes
3.4	Tests on the Loading of Truss Systems Common to Open-framed Structures
3.6	Test on the Loading and Response of Railroad Equipment
3.7	Air Blast Effects on Entrances and Air Intakes of Underground Installations
3.8	Air Blast Effects on Underground Structures
3.9	Field Fortifications
3.11-3.16	Navy Structures
3.18	Minefield Clearance
3.19	Blast Damage to Coniferous Tree Stands by Atomic Explosions
3.20	Blast and Thermal Effects of an Atomic Bomb on Typical Tactical Communication Systems
3.21	Statistical Estimation of Damage to Ordnance Equipment Exposed to Nuclear Blasts
3.22	Effects on Engineer Bridging Equipment
3.24	Effects of an Airburst Atomic Explosion on Landing Vehicles Tracked (LVT's)
3.26	Test of the Effects on POL Installations
3.28.1	Structures Instrumentation
3.28.2	Pressure Measurements for Various Projects of Program 3
3.28.3	Pressure Measurements on Structures
3.30	Air Blast Gauge Studies
4.2	Direct Air Blast Exposure Effects in Animals
4.7	Beta-gamma Skin Hazard in the Post-shot Contaminated Area
4.8	The Biological Effects of Neutrons
6.2	Indirect Bomb Damage Assessment (IBDA) Phenomena and Techniques
6.3	Interim IBDA Capabilities of Strategic Air Command
6.7	Measurements and Analysis of Electromagnetic Radiation from Nuclear Detonations
6.8a	Initial Gamma Exposure versus Distance
6.10	Evaluation of Rapid Aerial Radiological Survey Techniques
6.12	Determination of Height of Burst and Ground Zero
6.13	Effectiveness of Fast Scan Radar for Fireball Studies and Weapons Tracking
7.1	Electromagnetic Effects from Nuclear Explosions
7.3	Detection of Airborne Low-frequency Sound from Nuclear Explosions

Continued

Table 2. Projects Participating in the Grable Test (modified from Massie et al. 1982: Table 4-2) (continued).

Project	Title
7.1	Electromagnetic Effects from Nuclear Explosions
7.3	Detection of Airborne Low-frequency Sound from Nuclear Explosions
7.4	Seismic Measurements
7.5	Calibration and Analysis of Close-in A-bomb Debris
8.1b	Additional Data on the Vulnerability of Parked Aircraft to Atomic Bombs
8.2	Measurement of Thermal Radiation with a Vacuum Microphone
8.4.1	Protection Afforded by Operational Smoke Screens against Thermal Radiation
8.4.2	Evaluation of a Thermal Absorbing Carbon Smoke Screen
8.5	Thermal Radiation Protection Afforded Test Animals by Fabric Assemblies
8.6	Performance Characteristics of Clothing Materials Exposed to Thermal Radiation
8.9	Effects of Thermal Radiation on Materials
8.10	Physical Characteristics of Thermal Radiation from an Atomic Bomb Detonation
8.11a	Incendiary Effects on Building and Interior Kindling Fuels
8.11b	Ignition and Persistent Fires Resulting from Atomic Explosions: Exterior Kindling Fuels
8.12a	Sound Velocities near the Ground in the Vicinity of an Atomic Explosion
8.12b	Supplementary Pressure Measurements
9.1	Technical Photography
9.6	Production Stabilization
9.7	Experimental Soil Stabilization
13.1	Radiochemistry Sampling
18.1	Total Thermal and Air Attenuation
18.2	Power versus Time
18.3	Spectroscopy
18.6	Surface-brightness Investigations
23.17	Neutron Flux Measurements in AEC Group Shelters and Lead Hemispheres
29.1	Comparison and Evaluation of Dosimetry Methods Applicable to Gamma Radiation

to persuade people that tidy and recently painted homes would better withstand a nuclear blast than cluttered or poorly maintained buildings (Gilbert et al. 1953; Chisholm 2015).

EXERCISE DESERT ROCK V

Exercise Desert Rock was a series of military exercises that occurred on the NNSS beginning in 1951 and continuing intermittently through 1957. These exercises were conducted under the leadership of the Sixth Army, out of the Presidio at San Francisco through annual detachments to Camp Desert Rock, which is located immediately southwest of Mercury, Nevada (Ray 1977). Although these exercises were led by the army, all major branches of the armed forces participated in Desert Rock exercises and the Marine Corps engaged in several Marine-specific maneuvers over the course of the program. From the outset, the objectives of the exercises were to provide training to troops in the tactical use of nuclear weapons, to determine the effects of nuclear weapons on troop equipment and tactics, and to determine the psychological reaction of troops witnessing a nuclear detonation (Barrett et al. 1987). As noted by Blades and Siracusa (2014:40), the initial Desert Rock exercises demonstrated the extent to which the United States was considering the role of tactical nuclear weapons years before their viability had been determined.

Extensive activities occurred during Exercise Desert Rock V (EDR-V), which took advantage of the 1953 Upshot-Knothole tests. The U.S. Army detachment for EDR-V assumed command at Camp Desert Rock (CDR) on January 5, 1953 and conducted exercises during seven of 10 detonations that took place between the months of March and May (Bullock 1953a). U.S. Army troop maneuvers occurred at tests Annie, Nancy, Badger, Simon, Encore, Harry, and Grable, although observations took place during tests Dixie and Ray (Bullock 1953a). Regardless of the device detonated during EDR-V, all were assumed to be Mk 9 atomic artillery rounds for the purposes of the exercise.

Figure 7. House in the Middle (Station F-9.14b No. 2), view west (DRI 2018).

A major mission of EDR-V was to provide training to troops in tactical operations featuring atomic weapons. This mission was accomplished through pre-shot classes lasting either one, four, or eight hours; a field rehearsal of shot day operations, including a visit to the display area; and, during Grable, a visit to the gun area, observation of an atomic burst, and a post-shot revisit of the display area (Bullock 1953a). The one-hour course was presented to last-minute arrivals, the four-hour class was presented to the maneuver troops and presented only confidential material, and the longer eight-hour course was presented to the troop observers and included secret-level materials.

Although the detonation was assumed to be delivered by the M65 Atomic Gun on all previous EDR-V maneuvers, it was only during the final maneuver of the Grable shot that this was the case. An estimated 3,388 troops were located in the trenches during the Grable shot. Most of these (2,670) were maneuver troops preparing to assault objectives east of the GZ (Massie et al 1982). Although the exact number of troops vary by source, all agree that the Grable test exceeded the troop numbers of any other Exercise Desert Rock event (cf. Bullock 1953a; Massie et al. 1982; Ponton et al. 1982; Preuss 1953).

The maneuver elements consisted of troops drawn from every army in the continental United States (Bullock 1953a). These troops were divided into two Battalion Combat Teams (BCTs), A-BCT and B-BCT. For the purpose of the exercise, these units were together referred to as the 28th Infantry Regiment (Bullock 1953b).

Troops arrived at the trenches at 7:30 a.m. From 7:35 a.m. through 8:10 a.m., General Bullock, the EDR-V Director, and his cadre conducted the pre-shot orientation, as they had done at the preceding shots. Unlike the other EDR-V shots, from 8:10 a.m. to 8:17 a.m., the Army Chief of Staff addressed the assembled troops and observers, discussing the development of the 280mm Atomic Gun. Nineteen seconds prior to detonation, the 280mm gun fired its round while the assembled troops crouched low in the trenches. Three seconds after detonation, the assembled troops were directed to rise and view the fireball. Approximately 11 minutes later, the maneuver units began their assaults. At 9:05 a.m., the observers left the trench area for the display area. By 9:50 a.m., maneuver troops from B-BCT arrived at the display area. Because of excessively dusty conditions, the exercise was halted after B-BCT and the observers toured the display area. A-BCT did not reach the display area and neither unit reached their objectives. All units returned to Camp Desert Rock before 12:50 p.m., marking the close of EDR-V (Bullock 1953a). Appendix C provides a reproduction of the OPORD for the maneuver, with a figure of the C-2 Style Battle Map.

The trenches were constructed by the 412th Engineer Construction Battalion, who also constructed the display areas on the playa (Bullock 1953a). Per Annex 6 Appendix C of Operation Order No. 7, a total of four loudspeakers were installed within the trench area, the exercise director was located front and center of the trenches, and parking was located behind the trenches. Per Appendix B, troop observers occupied the central portion of the trenches and maneuver troops occupied the flanks (Bullock 1953b). In addition to the troops, “a group of top government and military officials” included Secretary of the Army Robert Stevens, Army Chief of Staff J. Lawton Collins, representative from the state of Florida Robert Lee Fulton Sikes, and then representative from the state of Michigan and future president Gerald Ford (Bullock 1953a: 332). The last is especially notable because no other president ever witnessed a nuclear test at the NNSS.

OTHER OBSERVERS

In addition to the military observers and two congressmen located in the EDR-V trench area, many VIP observers witnessed the test from viewing benches located approximately 2 km south of the gun site (Figure 8). Based on Rankin (1953), two senators, 76 members of the House of Representatives, and various other dignitaries were present at the VIP benches for the Grable test (see Appendix D for a complete list of individuals who attended the operation and their affiliations).

BROADER EFFECTS OF DEVELOPING THE 280MM ATOMIC GUN

Internally, the M65 280mm Atomic Gun was used to demonstrate that technology could overcome the Soviets without significantly affecting American lifeways. External audiences included both Western Bloc allies, especially within Europe, and the Soviets and the Eastern Bloc. The 280mm gun signaled to these groups the concrete resolution of the United States’ commitment to the NATO alliance and the defense of Europe.

Prior to testing, the artillery piece was being deployed to parades within the United States. Among these was the 1953 Inaugural Parade for President Eisenhower. According to pages 45–46 of the parade order, a 280mm gun was within the sixth division of the parade, between an anti-aircraft artillery battalion and the Florida Governor-Elect (Office of the Grand Marshals 1953). On May 16, 1953, another 280mm gun was in a parade in New York City (NYT 1953a). The two guns involved in the Grable test were also paraded through downtown Las Vegas on their way to the NNSS. These parades occurred before the guns were deployable and served to both show off and normalize tactical nuclear weapons.

During the development of the 280mm Atomic Gun, public speeches by government officials were used to tout the positive effect that tactical nuclear weapons would have on the U.S. Army’s effectiveness, lay

the groundwork for the reorganization of the army and dismiss charges that the system was impractical. One speech, given by Army Chief of Staff J. Lawton Collins before the Congressional Atomic Energy Subcommittee, succinctly demonstrates this, and its coverage demonstrates that the program had to overcome some public resistance. On April 3, 1952, speaking before a closed session, Collins was reported as "completely sold" on the gun and the transformative effects of tactical nuclear weapons on the defense of Western Europe. Following the speech, the subcommittee chair, Representative Melvin Price, stated that they were "never satisfied" with the state of atomic warfare. Likewise, an article covering the speech notes that the gun was criticized as being a poor field weapon due to mobility and possibly a waste of scarce fissile material (NYT 1952a).

Figure 8. Frenchman Lake from VIP benches south of the gun site, view northeast (DRI 2018).

Another speech, given by Secretary of the Army Frank Pace Jr. a year before the Grable event, highlights the use of public speeches to tout the system. Speaking before the National Association of Wool Manufacturers, he gave the public their first look at the gun. Beyond laying out the general specifications and promising that ground commanders would have "immeasurably greater power than any artillery hitherto known… at their fingertips," he foreshadowed the coming of a suite of tactical nuclear weapons and associated training that were in the works (NYT 1952b). Five months later, the public would be allowed to lay eyes on the much-touted weapons system at its public unveiling at Aberdeen Proving Ground (NYT 1953b). Shortly before the Grable event, Colonel DeVere Armstrong spoke to the press assembled at Fort Sill, Oklahoma. The speech was covered by the Associated Press and portions of it appeared in a variety of newspapers throughout the country. In this speech, Armstrong counters charges that the system is too slow for field use, calling it a hit-and-run weapon of unprecedented destructive potential (Associated Press 1953).

By September of 1953, the United States announced plans to deploy the 280mm Atomic Gun to Europe. Secretary of the Army Robert T. Stevens told the press that the United States was deploying six of the artillery pieces to Germany under NATO command and staffed by the 868th Field Artillery Battalion out of Fort Bragg, North Carolina. The purpose of the deployment was to increase NATO's capacity to defend Western Europe from communist attack. Although he stated that this would be the first of several 280mm artillery battalions to Europe, he did not clarify whether they would be equipped with atomic

rounds (Reston 1953). The following month, at the general conference of the National Guard Association of the United States, Stevens would be joined by General Charles G. Bolte in announcing that over a dozen of the guns were being sent to Europe to give field-level commanders "the capability of using atomic explosives safely and accurately should it become necessary to do so," which seemingly clarified Stevens' previous statement (Hill 1953a).

In February of the following year, the U.S. Army planned that a third 280mm artillery battalion would be joining the 868th and 269th Field Artillery Battalions in Europe. The 264th Field Artillery Battalion out of Fort Sill, Oklahoma, was scheduled to join them by May of 1954, with up to two more battalions being considered. These plans were not officially announced until March and absent from these news articles was any mention of the 59th Field Artillery Battalion, which also deployed to Germany in 1954.

The development and testing of the 280mm Atomic Gun occurred during and within the context of the United States' combat operations on the Korean Peninsula. Despite the mountainous terrain, American artillery units played a heavy role in the conflict. Mataxis and Goldberg (1958) note that prior to 1952, single enemy soldiers were subject to American artillery fire. Likewise, Schmid and Wilson (2018) note that in just 24 hours during the Pork Chop Hill battle, the U.S. Army fired more the 130,000 artillery rounds. Unsurprising, given the quantity of artillery used and the perceived need to maintain a sizable stockpile in case of Soviet action in Western Europe, artillery shortages and ammunition rationing became common. The 280mm Atomic Gun was therefore envisioned as a potential means to increase the mass of artillery within the peninsula while reducing the amount of powder and explosives being expended. However, shortly after the Grable event, the Korean War would be brought to an uneasy end with the signing of the July 1953 Armistice Agreement.

Prior to firing, it was reported that the Grable effects layout and test conditions were designed to simulate the battlespace faced by U.S. troops in Korea (Las Vegas Review Journal 1953). Following the test, Korean War veteran and Congressman Joseph F. Holt, having witnessed the event from the VIP benches, commented that he would like to see the weapon deployed to Korea, but that he would leave the final call to the president (Hill 1953b).

Following the Armistice, rhetoric on the atomic gun was primarily speculative, relating to either potential deployments or how the system would have changed the outcome of the war. Summarizing Eisenhower's announcement of troop drawdowns, Blair (1953) noted that the broader reduction of standing forces was based on the substitution of atomic power for troops, but that the president had carefully avoided directly mentioning nuclear weapons. At the end of 1954, General James Gavin defended the 280mm Atomic Gun saying it was a shame that it had not been available during the Korean War and that he didn't "know of a more efficient weapon from the viewpoint of a combat infantryman" (NYT 1954).

Although Article II.A.13(d) of the Armistice Agreement promised that new arms would not be introduced to the peninsula, the United States would deploy both the 280mm Atomic Gun and the Honest John Atomic Rocket System to Korea around January 1958 (The White House, Special Staff Note, dated January 16, 1958). Prior to this, President Eisenhower had authorized the deployment of nuclear weapons to the Korean Peninsula by December 1956 against the advice of the State Department (Jae-Bong 2009:9-10). By the beginning of 1961, the United States had some 600 devices stockpiled there, including newer conventionally sized nuclear artillery (Roehrig 2006:188; Womack 2014:71–73).

THE DECLINE OF THE 280MM ATOMIC GUN

The 280mm Atomic Gun was a short-lived weapons system. Although it was the first tactical nuclear weapons system to be deployable, it faced continued skepticism from some members of Congress and the

Pentagon. However, such critics would have little effect on the weapon's development and fielding. What would ultimately spell the end of the system was the rapid miniaturization of nuclear weapons technology that began the following year.

By late 1954, the U.S. Army began signaling its plans to scale down atomic artillery to a size capable of being used by conventional caliber howitzers. On October 23, Assistant Secretary of the Army George H. Roderick called the 280mm gun the "first in a series of guns capable of delivering an atomic projectile." In September 1955, the U.S. Army announced that the miniaturization of nuclear weapons technology allowed for the development of an atomic shell for the conventional eight-inch artillery guns, reducing the minimum size of the round by approximately 30 percent. Although the 280mm Atomic Gun would have greater range, the eight-inch gun was lighter, more maneuverable, and required less explosives for its charge (NYT 1955).

By late 1955, the Army's tactical weapons suite had expanded to include the Honest John rocket, the Corporal missile, and the Redstone rocket. Only the 280mm Atomic Gun and the Corporal were deployed at the time, although the Honest John was scheduled for deployment in the early months of 1956. Moreover, conventionally sized atomic artillery was nearing the testing phase (Allison 1954; Baldwin 1955). By 1963, the M65 and the Mk 9 atomic round and its successor round were withdrawn from service and replaced with 155mm and eight-inch atomic rounds that would remain in service throughout the Cold War (Womack 2014:48).

III. RESEARCH DESIGN

Because the current project is focused on the inventory and evaluation of historic resources related to the Grable atmospheric test, the research design necessarily focuses on nuclear testing at the NNSS. Nuclear weapons testing is an important theme in the history of Nevada and the nation, and it played a vital role in the national defense of the United States during the Cold War. Most of the designs and developments in nuclear weapons research were tested at the NNSS, both above and below ground. The major sites and structures associated with nuclear testing have historic and scientific significance (Tlachac 1991a, 1991b). Nuclear tests represent large-scale scientific experiments involving numerous data gathering methods, some intricate and some not so intricate, around a single point known as ground zero. The layout of the tests over the terrain is extensive and overlapping. A single resource or site could be just one of many for a test or used for multiple tests.

EVALUATION CRITERIA

Following the standards issued by the Secretary of the Interior, cultural resources are eligible for listing in the NRHP if they meet the registration requirements (National Park Service 1997). According to the requirements, the resource must be eligible under at least one of the four significance criteria. Eligibility to the National Register also depends on the integrity of the property. Thus, a property must have both significance and integrity to be considered eligible.

Federal regulation 36 CFR 60.4 outlines the significance criteria a property must meet to be eligible to the NRHP. The significance criteria for evaluation state:

> *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*

A. *are associated with events that have made a significant contribution to the broad patterns of our history; or*
B. *that are associated with the lives of persons significant in our past; or*
C. *that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
D. *that have yielded, or may likely to yield, information important in prehistory or history.*

Historic integrity is the ability of a property to convey its significance, and its assessment consists of a consideration of seven aspects: location, design, setting, workmanship, materials, feeling, and association (National Park Service 1997). A property retains historic integrity when it possesses several, if not most, of these seven aspects.

RESEARCH QUESTIONS

The following research questions are proposed to evaluate the significance of nuclear testing resources identified during this inventory. The questions are not exhaustive, and therefore do not cover all of the possible research domains associated with nuclear testing at the NNSS, but rather are tailored to the scope of this project and the resources being investigated.

Is the cultural resource associated with nuclear testing? If so, is the resource associated with a specific test or series of tests?

Data Requirements: To address this question, a resource would ideally be identified in a historic document that verifies its relationship to a particular nuclear test or series of nuclear tests. In the absence of archival information, the resource may be tied to nuclear testing based on design elements, proximity to a test location, or association with other testing resources.

What was the function of the resource and how did it relate to meeting the goals of a nuclear test or test project?

Data Requirements: The archival record is a primary source of information for identifying the precise purpose of a testing resource. These can vary from infrastructure stations to scientific instrument stations for obtaining and recording data. Detailed recording of the cultural resource would provide ancillary supporting data for the information derived from historic sources and have the potential to contribute information beyond what is available in historic documents. For cases in which archival information is not available, design elements may provide analogs to known test resources and can be used to infer use.

How does the pre-test design compare to the post-test condition?

Data Requirements: Archival sources can provide detailed information about the pre-test design of a resource that can be compared with the post-test condition. For atmospheric tests, the nuclear detonation along with the ensuing blast wave was a catastrophic post-depositional process that altered many surface structures. At underground shaft test locations, subsidence craters are a post-test feature of the testing terrain. After a nuclear test, many structures were dismantled to obtain data or demolished as part of post-test environmental restoration activities. The remains from a nuclear test provide a primary source of data about the condition and spatial distribution of post-test remains against the pre-test setup.

IV. RESULTS

This following section documents three newly recorded resources. All three are related either directly to the artillery aspect of the Grable test or, in the case of 26NY16242, to Exercise Desert Rock V, a troop maneuver event that took place during the Grable test and other detonations in the Upshot-Knothole series. Appendix E provides the resource forms for these sites. The description of each resource includes a discussion of NRHP eligibility, both individually and as a contribution to the Frenchman Flat Historic District (D204). Section 12 provides additional information about NRHP eligibility.

26NY16242
Historic-NNSS activity
Type: Troop Trenches
Date: 1953
Significance: Individually significant under Criterion A / Contributing to the eligibility of D204.

Description: Site 26NY16242 is composed of troop trenches used for EDR-V's Grable test and other maneuvers during the Upshot-Knothole series. The purpose of the Desert Rock exercises was to prepare the U.S. Army to maneuver while tactical nuclear weapons were in use on the battlefield. These trenches are located approximately 1 km from the southwest edge of Frenchman Lake, where Cane Spring Wash meets with other major drainages in the southwestern portion of the bolson. As such, the trenches have been subjected to severe alluvial processes, which have resulted in infilling and erosion to portions of trenches (Figure 9). Although they are still discernible as trenches from satellite imagery, their surface expression appears as a broken series of approximately parallel, north-south bearing swales interspersed with communications wire, wooden fragments, and nondiagnostic metal cans.

Although the site is in relatively poor condition, two features were identified. The first is a 5 × 3.5-foot concrete pad with two bolts located 1.25 feet in from the long edges and 1 foot in from the west edge. This is most likely the remains of the rear center loudspeaker described in Annex 6, Appendix C of Operation Order No. 7 (Bullock 1953b). Approximately 4.5 feet downslope from the pad are four pieces of milled lumber, two of the pieces measure 3.6 inches in length and the other two pieces measure 5 feet in length. Based on their measurements, they were likely a collar around the concrete pad that has been broken away by alluvial processes. Other cement pads may well be located within the site but are buried under the alluvium.

The second feature is a cluster of milled lumber fragments and communications wire centered in front of the swales (Figure 10). This is most likely the remains of a wooden stage from which Generals Bullock and Collins addressed the troops and observers who occupied these trenches. This would be consistent with the location suggested by Annex 6 and would be the logical location for a stage, given that it was in front of the observers.

These trenches were constructed by the 412th Engineer Construction Battalion, who also constructed the maneuver or display areas on the playa (Bullock 1953a). Per Annex 6 (Signal), Appendix C of Operation Order No. 7, a total of four loudspeakers were installed within the trench area, the exercise director was located front and center of the trenches, and parking was located behind the trenches (Bullock 1953b). Per Appendix B, troop observers occupied the central portion of the trenches and maneuver troops occupied the flanks (Bullock 1953b). In addition, the observer portion of the trenches was occupied by "a group of top government and military officials," including Secretary of the Army Robert Stevens, Army Chief of Staff J. Lawton Collins, and then representative from the state of Michigan and future president Gerald Ford (Bullock 1953a: 332). This is notable as no sitting president ever witnessed a nuclear test at the NNSS.

Figure 9. Overview of trenches with the Flash Observation Point (26NY16243) on knoll in center, view is southwest from 591030mE 4072338mN (DRI 2018).

Figure 10. Overview of 26NY16242, communications wire and wooden fragments, view is to the south toward 26NY16244 from 591030mE 4072337mN (DRI 2018).

National Register Evaluation: 26NY16242 was evaluated both for its individual significance and as a contributing element to the Frenchman Flat Historic District (D204).

Individual eligibility:
26NY16242 is individually significant at the national level under Criterion A of 36 CFR Part 60.4. Despite rather severe impacts from alluvial processes, it retains enough integrity to convey its significance.

Regarding Criterion A, the site is directly associated with the training of United States military personnel in tactical nuclear warfare as a response to perceived Cold War threats. Following EDR-V, the nearly 3,400 troops who took part in this exercise returned to their home units throughout the entire United States as subject matter experts capable of disseminating what they learned. Although the United States never engaged in a tactical nuclear war against the Soviet Union, by late 1953, the weapons systems used in this exercise were deployed to Europe and later to East Asia. The EDR-V–trained soldiers provided increased credibility to this deterrent force. Therefore, the site is significant under Criterion A.

Regarding Criterion B, a large list of personages from the political, military, and industrial spheres descended on the NNSS to witness the birth of deployable tactical nuclear weapons. Some of the more notable people include Secretary of the Army Robert T. Stevens, Army Chief of Staff J. Lawton Collins, and future president Gerald Ford, who were all present in these trenches. One cannot help but speculate that Ford's experiences at this site informed his future actions, both relating to the development of new delivery systems and in his negotiations with the Soviets. However, most of the individuals important at

the national level to the nation's nuclear programs or other programs that were tested or developed at what is now the NNSS had far more important ties elsewhere. Although many of these people spent time on the NNSS, it was often for short visits to monitor test results. Therefore, the site is not significant under Criterion B.

Regarding Criterion C, the site does not embody the distinctive characteristics of a type, period, or method of construction, nor does it represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction. Therefore, it is not significant under Criterion C.

Regarding Criterion D, this site is related to atmospheric nuclear testing and tactical nuclear weapons, which were both key themes of the Cold War. However, there are no significant features or artifact assemblages on the surface and the potential for valuable data regarding the Grable test and related events within the trenches are unlikely. Such data would be limited to the morphology of the trenches, which is known through historic documents, and serendipitous discarding of artifacts by soldiers as they waited for movement instructions. In addition, given that there are several other EDR trenches that have been recorded on the NNSS and are in better condition, the poor state of preservation precludes any likelihood of this site to yield any new important information. Therefore, this site is not significant under Criterion D.

In addition to significance under one or more of the criteria described in 36 CFR Part 60.4, an eligible property must retain sufficient integrity to communicate its significance. The site retains integrity of location, setting, association, and design, but the integrity of materials and workmanship are lost. Integrity of feeling remains only partially intact, conveying the feeling of atmospheric nuclear testing but not the feeling of a military emplacement. Although alluvial processes have filled in a large portion of the trenches, the overall integrity of the site is sufficient to convey its significance under Criterion A.

Contribution to District:
Site 26NY16242 is a contributing element to the Frenchman Flat Historic District (D204). This site is the origination point for the largest troop movement across Frenchman Flat, which took place during the Grable test, and some of the more distinctive structures of the district remain visible from the entrenchment. Although little is left of the site, its relationship with the district is clear and it contributes to the district's NRHP eligibility.

26NY16243
Historic-NNSS activity
Type: Flash Observation Point
Date: 1953
Significance: Eligible only as a contributing element of D204

Description: Site 26NY16243 is a Flash Observation Point for the Grable atmospheric nuclear test. It consists of a sign, the termination of a run of communications wire, and a piece of milled lumber. This observation point is located on the northeast spur of an unnamed hill immediately north of Pink Holes Hill (Figure 11). The Grable GZ is 10.4 km (6.5 miles) from the site at a bearing of 57 degrees.

This location was occupied by members of the flash platoon commanded by Second Lieutenant M. J. O'Connell from A Battery, 867th Field Artillery Battalion, attached to the Artillery Test Unit (Armstrong 1953a, 1953b). The purpose of this station (F-704) was to gather registration fire data to refine the targeting of the gun. This was necessary to ensure that the Grable shot would detonate within the error limits prescribed by the Test Director. This location was occupied on May 15, 21, 22, and 25, 1953. During these times, the station served as one of four Flash Observation Points, each of which also served as a Survey Information Center. Armstrong (1953a) notes that ranging procedure followed the War Department's Field Manual (FM) 6-120 and the observer team used an M2 spotting instrument and a M65 telescope (U.S. Army 1951). Per FM 6-120, an observer team consists of at least three people: an observer, an assistant observer, and a recorder (U.S. Army 1951). The personnel at this site were linked to the gun site and CP (26NY16244) by radio and field phone. At the CP, the fire ranging central operation plotted the team's results on an M5 plotting board.

Two DRI archaeologists recorded this site on June 27, 2018. They found a 2 × 4 ft board and illegible sign of the type used during the Upshot-Knothole series to mark instrument stations, and a length of communication wire that runs off in the direction of the 280mm Atomic Gun and CP area where central operations was located for the Grable test (26NY16244). The board measures seven feet in length and has no distinguishing features. The sign is an 18 × 6-inch steel plate welded to a 3.5-foot high piece of rebar. It is oxidized and unreadable but is located at the exact coordinates given for station F-704 in the Upshot-Knothole Instrument Chart, and likely read the same (F-704).

National Register Evaluation: Eligibility of site 26NY16243 was evaluated both for its individual significance and its contribution to the Frenchman Flat Historic District (D204).

Individual eligibility:
26NY16243 is not individually eligible for inclusion in the NRHP. Although it is significant at the national level under Criterion A of 36 CFR Part 60.4, the resource no longer retains sufficient integrity to convey its significance.

Figure 11. Overview of 26NY16243 with Frenchman Lake playa visible in the distance, view northeast from 586718mE 4067424mN (DRI 2018).

Regarding Criterion A, the site is directly associated with the development and fielding of tactical nuclear weapons by the United States in response to the Cold War. This is one of four locations in southern Frenchman Flat used to observe the registration fires of the gun. Not only did these ensure that the Grable shot detonated in its correct location, but they revealed errors in the equipment associated with the system, which allowed them to be corrected prior to their deployment. Therefore, it is significant under Criterion A.

Regarding Criterion B, although a large list of personages from the political, military, and industrial spheres descended on the NNSS to witness the birth of deployable tactical nuclear weapons, few if any were aware of the presence and role of small satellite sites like this one. There is no evidence to suggest that any important person is associated with this location. Therefore, it is not significant under Criterion B.

Regarding Criterion C, the site does not embody the distinctive characteristics of a type, period, or method of construction, nor does is represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction. Therefore, it is not significant under C.

Regarding Criterion D, although the site is related to atmospheric nuclear testing and the development of early tactical nuclear weapons, which were both key themes of the Cold War, there is little information present that is not available in historic documents. During its use, this site held a field phone, a radio, and two pieces of optical equipment. All of these would have been collected and removed after the test. Not surprisingly, all that remains is a sign and the wire for the field phone. As the site has not yielded and is unlikely to yield important information, it is not significant under Criterion D.

In addition to significance under one or more of the criteria described in 36 CFR Part 60.4, an eligible

property must retain sufficient integrity to communicate its significance. The location and setting of the Flash Observation Point are unchanged. However, the site no longer retains design, i.e., the combination of elements that created the space. The only remaining elements are the remains of a sign (probably an instrument station sign although there are no legible markings), a piece of lumber, and communication wire. Because the site was an ephemeral location, little to no materials or workmanship were associated with it. What remains has substantially deteriorated. Regarding feeling, the three physical elements or artifacts are ubiquitous in many areas of the NNSS and are not defining or essential physical features of a Flash Observation Point. For association, the site is the place where flash observations were made but lacks features to provide a direct link to the Grable Test. Although the natural feature of the hill including its viewshed, retains its historic appearance, this aspect of integrity alone is not sufficient to support eligibility to the NRHP. In sum, although eligible under Criterion A, the integrity of the site is no longer sufficient to convey individual significance.

Contribution to District:
Although the site is not individually eligibility, site 26NY16243 is a contributing element to the Frenchman Flat Historic District (D204). This site is part of a constellation of similar resources located at the southern end of Frenchman Flat. One of the key purposes of these sites was to ensure that the Grable test shot detonated where it needed to be for its scientific purposes. The Grable test was responsible for many of the instrument stations that comprise the district's palimpsest of atmospheric nuclear testing components. Along with the Frenchman Flat Historic District, related instrument stations are visible from this site, Stations F-703 and F-707, two neutron threshold detectors. Additionally, it appears that communications wiring from this site extends to the firing location (26NY16244), explaining at least one of the many lines of communications wire that run through Frenchman Flat.

26NY16244
Historic-NNSS activity
Type: Firing Site and Command Post
Date: 1953
Significance: Individually significant under Criteria A and D / Contributing to the eligibility of D204

Description:

Site 26NY16244 is the 280mm gun firing site and command post (CP) for the Grable atmospheric nuclear test (Figure 12). It consists of six major features, a network of dirt roads originating from the Old Short Pole Line Road, a scatter of metal artifacts, and communications lines. The gun emplacement and CP are located between Red Mountain and Mercury Ridge on a relatively steep and dissected alluvial piedmont overlooking Frenchman Flat. This location played a crucial role in the Knothole subseries of tests and in the development of tactical nuclear weapons. The DRI archaeologists located and recorded the site over two days in June 2018.

Feature 1 is an approximately 39-foot-long, 6.5-foot-wide troop trench located at the northern end of an alluvial terrace, approximately 8 feet above the height of the gun emplacements (Figure 13). It has excellent visibility of the Grable test's GZ and presumably was occupied by senior members of the Artillery Test Unit (A Battery, 867th Field Artillery Battalion) during the test. Presently, natural processes have infilled the trenches to waist level, but would have been approximately 6.5 feet deep in 1953. No artifacts are directly associated with the feature, although there is a good possibility that artifacts may be buried in the trench. In the film *The 280 mm Gun at the Nevada Proving Ground* (AFSWP 1954), one can observe two troops in this trench from minute 9:17–9:26

.

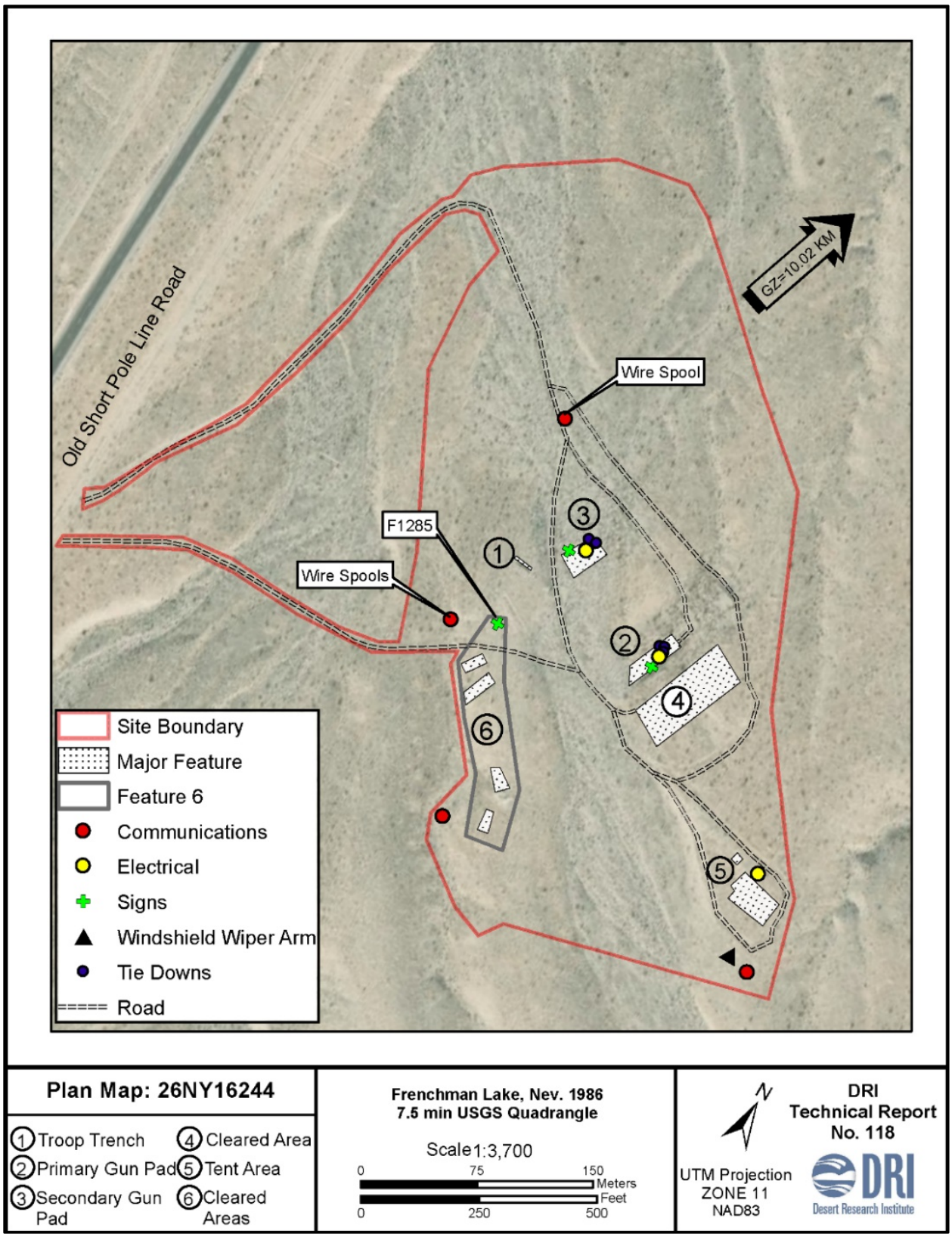


Figure 12. Site plan map of 26NY16244.

Figure 13. 26NY16244: Feature 1, troop trench, archaeologist is included for scale and to show current depth of trench, view northeast toward Grable GZ from 592123mE 4063518mN (DRI 2018).

Feature 2 is the primary gun emplacement pad or revetment (Figure 14). It is from this location that the atomic projectile was fired. It is cut through the northern end of another alluvial terrace and measures at least 141 feet long and 39 feet across, the southernmost embankment is up to 5 feet tall and braced with decaying burlap sandbags. The revetment formed by this cut is angled at approximately 19.5 degrees, or 348 NATO mils. Three 1-inch-thick steel cables are anchored to the ground in the front (facing GZ) of the revetment. At the end of each cable is a 1-foot-wide loop and most likely these cables anchored the 280mm gun during firing. Near the center of the revetment is an electrical signal box measuring 10 × 8 × 4 inches. Four 2-wire electrical cables protrude from a punch port on the bottom of the box. The 280mm gun could be fired several ways, one of these was by electrical signal, in the case of the Grable test, initiated at Control Point 1, or CP-1, in Area 6. Additionally, early M65 systems were designed to receive external 110-volt power to actuate their hydraulic systems. Therefore, most or all the wiring was likely to provide power to the gun's hydraulics, although the firing command may also have been routed through the box. Left of the emplacement pad is a T-post graduated with reflective tape that post-dates the site. Artifacts associated with this feature include several strands of communications wire, fragments of milled lumber, and a single metal can. In the film *The 280 mm Gun at the Nevada Proving Ground* (AFSWP 1954), one can observe the gun in this position from minute 5:30–5:45.

Feature 3 is the secondary gun emplacement pad or revetment. It measures at least 78 feet long and 55 feet across, but unlike Feature 2, it is not cut into the terrain. As at Feature 2, several 1-inch cable tiedowns were observed, as was an electrical signal box. The box at this feature remains attached to a wooden post embedded in the ground. A rebar and metal sign are located at the back of the pad, although it is now too faded to read. Although this pad was not used to fire an atomic round, the alternate gun at

Figure 14. 26NY16244: Feature 2, main gun emplacement pad, view southwest from 592240mE 4063518mN (DRI 2018).

this site did fire multiple high-explosive and dummy nuclear rounds during the lead up to the Grable test and during the round refinement period after the test. In the film *The 280 mm Gun at the Nevada Proving Ground* (AFSWP 1954), one can observe the gun in this position from minute 5:46–5:50.

Feature 4 is an area bladed into the alluvial terrace above the primary gun emplacement or Feature 2. It may have been a parking area or used for the multiple demonstrations and presentations of the weapons system during the lead up to the test. Based on the abovementioned film, there is no evidence to indicate its function. An angle measure constructed out of surveyor's laths and a sign noting the site as potentially historic are located at the edge of this feature. These post-date the test and are not visible in the film. Testing related artifacts associated with this feature include several runs of communications wire and a handful of indistinct metal fragments.

Feature 5 is a cluster of bladed clearings consistent with tent pads. This feature is located on the same terrace as both gun emplacements (Features 2 and 3). A semi-subterranean signal or electrical junction box is located at the northern edge of this feature. The junction box is within a plywood-lined earthen vault. The vault measures 4 × 4 feet with a depth of more than 5 feet. Inside the vault is an open panel enclosure with cabling entering through two upper and two lower ports. Four large metal busbars with 24 bays each are within the enclosure. Attached to wiring from the vault is a main breaker switch attached to a steel stand. The breaker is a Square D Model 45351. This suggests that this box was probably the tie-in between this site and its generator. Artifacts associated with this feature include a 7-inch tall metal can, a windshield wiper arm, and copious quantities of wire and cabling, some attached to stakes and others free running. Of special note is that some of the field wire, type WD-1/TT (U.S. Army 1956), runs to other locations. Various bundles of cable could probably be traced to the observation points along old Mercury Highway and further out to Site 26NY16243 near Pink Holes Hill.

Feature 6 is a series of four shallow revetments in the southwest slope of the same alluvial terrace on which the troop trench or Feature 1 is located. The purpose of these cuts is unclear. It is possible that they were outlying tent pads or parking spots for the M249/M250 prime mover trucks. The approximate dimensions of these cuts, moving from north to south, are: 50.5 × 21.5 feet, 68 × 26 feet, 53 × 33 feet, and 47.5 × 24.5 feet. A single rebar and steel plate sign is located in this feature and reads "F-1285" and eight holes pierce this sign. F-1285 is in the form of an instrument station number. However, DRI does not have a record of this station, nor is this number within the range for Upshot-Knothole instruments. Artifacts associated with this feature include metal strapping bands, milled lumber fragments, crushed ration cans, loops of communications wire, circular key opened can lids, and both metal and wooden wire stakes.

Approximately 1.9 km (1.2 miles) of unimproved dirt road are within the site. These form a loop from the old grade for Short Pole Line Road. At minute 4:20 of the film *The 280 mm Gun at the Nevada Proving Ground* (AFSWP 1954), one can observe the guns turning off an unpaved Short Pole Line Road onto the southernmost part of the loop. Within this loop is a series of subloops and access paths to the various features that make up the site.

Between and around the features are numerous runs—individual and bundled—of communications wire, communications cable, and, less frequently, electrical wiring. Several spools of both unused and recovered wire were observed, as were several metal cans and milled lumber fragments. The site boundary was determined based on the roads and a line of cleared vegetation visible on satellite imagery and in the previously mentioned film. It is believed that this marked the perimeter of the firing site and its command post.

An archival review did not find a description or plan view map of the site's layout. Some establishing shots of the gun emplacement locations are visible in *The 280 mm Gun at the Nevada Proving Ground* (AFSWP 1954) and in photographic archives. Therefore, the archaeological remains of the activities conducted at this site are crucial for understanding these activities and their use of space. This recording demonstrates that the site is arranged along a 110-degree axis (i.e., perpendicular to GZ) and makes use of two naturally occurring alluvial terraces to form two approximately parallel columns or axes of activities. The forward column (relative to GZ) housed the main business of the site (i.e., the 280mm guns and their necessary power and signal apparatuses). Along this axis, starting from the southeastern edge, was an area supporting power and communication needs, the primary gun emplacement, and the secondary gun emplacement. Beyond these features was a road leading back to Short Pole Line Road. The second column or axis housed support activities and was crossed by the main road into the site. A small troop trench may have housed high-ranking members of the ATU during the test or may have been used in filming the test because it was too small to support the full crew of even one of the guns. Massie et al. (1982) note that during the shot, gun crews were either in trenches or behind barricades.

National Register Evaluation:
Site 26NY16244 is eligible for inclusion in the National Register of Historic Places. It is individually significant at the national level under Criteria A and D of 36 CFR Part 60.4 and retains sufficient integrity to convey its significance.

Individual eligibility:
Site 26NY16244 is eligible for inclusion in the National Register of Historic Places. It is individually significant at the national level under Criteria A and D of 36 CFR Part 60.4 and retains sufficient integrity to convey its significance.

Regarding Criterion A, the site is directly associated with the development and fielding of tactical nuclear weapons by the United States in response to the Cold War. Following this test, the M65 280mm gun system would be deployed to Europe and East Asia as a deterrent to the numerically superior enemy forces and contributed to a new generation of nuclear warfare doctrine that came into being. Therefore, it is significant under Criterion A.

Regarding Criterion B, whereas a large list of personages from the political, military, and industrial spheres descended on the NNSS to witness the birth of deployable tactical nuclear weapons, the Grable test itself is not illustrative of any single person's important historic achievements. Therefore, the site is not significant under Criterion B.

Regarding Criterion C, the site does not embody the distinctive characteristics of a type, period, or method of construction, nor does it represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction. Although the layout communicates a distinctly military use of space, there is nothing especially significant about it, and therefore it is not significant under Criterion C.

Regarding Criterion D, the site is eligible for its potential to yield important information about atmospheric nuclear testing and early tactical nuclear weapons, which were both key themes of the Cold War. As historical documentation regarding the layout and specifics of activities at this site have not been located, archaeological remains provide the best available evidence for understanding the final testing phase of the Army's first tactical nuclear weapons system. This recordation has demonstrated that spatial layout remains largely intact, surface and subsurface artifacts and features are present, and these artifacts and features may address research questions about historic Cold War nuclear testing. Therefore, the site is significant under Criterion D.

In addition to significance under one or more of the criteria described in 36 CFR Part 60.4, an eligible property must retain sufficient integrity to communicate its significance. A property's integrity is possessed across seven aspects. The site retains integrity of setting, location, design, feeling, and association. The location of Feature 2 matches the gun and command post coordinates listed in the Upshot-Knothole instrument chart, this location retains the feeling of atmospheric nuclear testing, bolstered by its association with the Frenchman Flat Historic District, which is visible from the site. Integrity of design is retained in the broad spatial layout of the site and its orientation with the intended GZ on Frenchman Lake. Integrity of materials and workmanship have been compromised; much of the site's materials, excepting earth and wire, were either cleared away after the test (e.g., tents) or have decayed because of time and alluvial processes. As such, the quality of the site's workmanship cannot readily be observed. What materials that remain are original (e.g., the electrical infrastructure) but have been compromised. Overall, the integrity of the site is sufficient to convey its significance under Criteria A and D.

Contribution to District:
In addition to its individual eligibility, site 26NY16244 is a contributor to the Frenchman Flat Historic District (D204). This site is the firing location for the Grable test, the first and only atomic artillery round ever fired by the United States. According to DRI records, at least 50 instrument stations across Frenchman Flat were constructed for this test. Additionally, it appears that communications wiring from this site extends to other locations that would also contribute to the district if and when they are recorded.

V. CONCLUSIONS

NATIONAL REGISTER ELIGIBILITY SUMMARY

Following the standards set by the Secretary of the Interior, and codified through regulation, cultural resources are considered historic properties if they are eligible for inclusion in the NRHP (36 CFR § 800.16(I)(1)). The requirements for inclusion are codified in 36 CFR § 60.4 and through a series of National Register Bulletins, the most prominent of which being National Register Bulletin 15 (National Park Service 1997). According to these requirements, the resource must be eligible under at least one of the four Significance Criteria. Eligibility for the NRHP also requires that the resource maintain sufficient integrity to convey its significance. If a resource is significant under one or more criteria and maintains integrity it is considered eligible for inclusion in the NRHP, and therefore is a historic property regardless of listing status.

Federal regulation 36 CFR § 60.4 outlines the significance criteria that a resource must meet to be considered eligible for the NRHP. The criteria are:

A. association with events that have made a significant contribution to the broad pattern of our history;
B. associated with the lives of persons significant in our past;
C. that embody the distinctive characteristics of a type, period, or method of construction, or that represents the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
D. that have yielded, or may be likely to yield, information important in prehistory or history.

Historic integrity is the ability of a property to convey its significance, it is assessed across seven aspects: location, design, setting, workmanship, materials, feeling, and association. The aspects of location and association pertain to the relationship between a potential property and its environment, they are especially important for Criterion A. Design, materials, and workmanship are related to its engineering plan, construction, and design and they are especially important for Criterion C. The elements of feeling and association are somewhat subjective and relate to a potential property's ability to convey a sense of historic time and place. All historic properties must retain aspects of integrity beyond feeling and association, but the essential aspects vary by eligibility criteria and property type.

The cultural resources documented in this report were evaluated using the above framework and within the historic context of nuclear testing. Site 26NY16242 was found to be significant under Criterion A and retains the aspects of integrity necessary to convey its significance. Therefore, it is individually eligible for the NRHP. Site 26NY16243 was also found significant under Criterion A but lacks enough integrity necessary to convey its significance. Therefore, the site is not individually eligible for the NRHP. Site 26NY16244 was found significant under Criteria A and D and retains the aspects of integrity necessary to convey its significance. Therefore, it is individually eligible for the NRHP. All resources were found to contribute to the eligibility of the Frenchman Flat Historic District (D204) and are eligible for the NRHP as contributing elements of the district.

This Section 110 recordation demonstrates that the role the Grable test played in the development of the 280mm Atomic Gun and tactical nuclear weaponry was important to our history through its relationship to the Cold War and that historic properties related to these events remain intact on the NNSS. Beyond their individual importance, these historic properties explain significant portions of the atmospheric nuclear testing palimpsest that is the Frenchman Flat Historic District. They are unique parts of America's cultural heritage stewarded by the National Nuclear Security Administration Nevada Field Office at the NNSS, and their preservation and further study should be considered in the management of the NNSS.

VI. REFERENCES

Abrams, Richard M.
2006 *America Transformed: Sixty Years of Revolutionary Change, 1941–2001*. Cambridge University Press, Cambridge, England.

AEC, See U.S. Atomic Energy Commission

AFSWP, See Armed Forces Special Weapons Project

Allison, H. C.
1954 News Roundup. *Bulletin of the Atomic Scientists* 11(1):38-40f

Armed Forces Special Weapons Project
1954 *The 280 mm Gun at the Nevada Proving Ground* video. Lookout Mountain Laboratory, Hollywood, California. Electronic document, https://www.youtube.com/watch?v=B9F-l_3eLcE.

Armstrong, DeVere
1953a *Activities of the Artillery Test Unit.* Report WT-709. Artillery Center. Fort Sill, Oklahoma. On file, Defense Technical Information Center, Accession No. ADA304517.

1953b *Operation Order No. 1, Battery A, 867th FA Battalion. Artillery Test Unit.* Camp Desert Rock, Nevada. On file, Nuclear Testing Archive, Accession No. NV0038935.

Associated Press
1953 "Atomic Cannon Being Tested" in *The Gettysburg Times*, 27 March 1953.

Baldwin, Handon W.
1955 "LIMITED ATOMIC WAR: A NEW U. S. STRATEGY: Weapons and Uses of Manpower Are Designed for Changed Concepts HOW ATOMIC WEAPONS HAVE CHANGED MILITARY TACTICS" in *New York Times*, 20 March 1955:E-4.

Barrass, Gordon S.
2009 *The Great Cold War: A Journey Through the Hall of Mirrors*. Stanford Security Studies. Stanford University Press, Stanford, California.

Barrett, M, J. Goetz, J. Klemm, E. Ortlieb, and C. Thomas
1987 *Analysis of Radiation Exposure for Military Participants: Exercise Desert Rock I, II, and III—Operation Buster-Jangle*. Report No. DNA-TR-87-116. On file, Defense Threat Reduction Agency.

Blades, David M.
2013 *This Awesome Field.* Dissertation. School of Global, Urban, and Social Studies, RMIT University, Melbourne.

Blades, David M., and Joseph Siracusa
2014 *A History of U.S. Nuclear Testing and Its Influence on Nuclear Thought,* 1945–1963. Rowman & Littlefield Publishers, Lanham, Maryland.

Blair Jr., Felix
1953 "U. S. TO WITHDRAW 2 KOREA DIVISIONS, BUT WARNS ENEMY: EISENHOWER FIRM Pledges Harsher Blows to Meet Aggressors -- Cut Tied to Atom Gun U. S. TO WITHDRAW 2 KOREA DIVISIONS" in *New York Times*, 27 December 1953:1–2.

Briley, Ron
2003 *Class at Bat, Gender on Deck and Race in the Hole: A Line-up of Essays on Twentieth Century Culture and America's Game*. McFarland & Co. Jefferson, North Carolina.

Brimner, Larry D.
2018 *Blacklisted!: Hollywood, the Cold War, and the First Amendment.* Calkins Creek. Honesdale, Pennsylvania.

Bruce, H. D.
1953 *Incendiary Effects on Building and Interior Kindling Fuels*. Report WT-774. On file, Nuclear Testing Archive, Accession No. NV0049294.

Buck, Alice
1983 *The Atomic Energy Commission*. U.S. Department of Energy. Washington, DC.

Bullock, William C.
1953a *Exercise Desert Rock V.* Volume 1, Operations. U.S. Army. Camp Desert Rock, Nevada. On file, Defense Technical Information Center, Accession No. ADA078559.

1953b *Exercise Desert Rock V Operation Order No 7.* U.S. Army. Camp Desert Rock, Nevada. On file at the Nuclear Testing Archive, Accession No. NV0039313.

Cannon, Michael W.
1984 *The Development of FM 100-5 from 1945 until 1976*. MA Thesis. University of Iowa. On File, Defense Technical Information Center, Accession No. ADA147039.

Carothers, James
1995 *Caging the Dragon: The Containment of Underground Nuclear Explosions.* Report DOE/NV—388. Nevada Operations Office, Las Vegas.

Chisholm, Kelly
2015 *The House in the Middle.* Electronic document, https://www.loc.gov/programs/static/national-film-preservation-board/documents/house_in_middle.pdf Library of Congress, Washington, DC.

Christensen, Lawrence O., William E. Foley, Gary R. Kremer, and Kenneth H. Winn (eds.)
1999 *Dictionary of Missouri Biography.* University of Missouri Press. Columbia, Missouri.

Clark, John C.
1954 *Report of the Deputy Test Director:* Operation Upshot-Knothole. Report WT-816. On file, Nuclear Testing Archive, Accession No. NV0306227.

Cobb, Daniel M. (ed.)
2015 *Say We Are Nations: Documents of Politics and Protest in Indigenous America since 1887.* University of North Carolina Press. Chapel Hill.

Converse, Elliott V., III
2012 *Rearming for the Cold War 1945-1960.* History of Acquisition in the Department of Defense Vol. 1. Historical Office, Secretary of Defense, Department of Defense, Washington, DC.

Dorn, William Jennings Bryan and Scott Derks
1988 *Dorn: Of the People, a Political Way of Life*. Bruccoli Clark Layman. Columbia, South Carolina.

Fadderman, Lillian
2015 *The Gay Revolution*: The Story of Struggle. Simon & Schuster, New York.

Fehner, Terrence R. and F.G. Gosling
2000 *Origins of the Nevada Test Site*. Report DOE/MA-0518. U.S. Department of Energy, History Division, Washington, D.C.

2006 *Atmospheric Nuclear Weapons Testing: 1951-1963*. Report DOE/MA-003. U.S. Department of Energy, Office of History and Heritage, Washington, D.C.

Fink, Carole K.
2014 *Cold War: An International History*. Westview Press, Boulder, Colorado.

Flynt, J. Wayne
2004 *Alabama in the Twentieth Century*. University of Alabama Press, Tuscaloosa.

Friesen, H.N.
1995 A *Perspective on Atmospheric Nuclear Testing in Nevada: Fact Book*. Report DOE/NV 296. U.S. Department of Energy, Nevada Operations Office, Las Vegas.

Franz, Michael and Jochen Vollert (eds.)
2006 *U.S. Army Gun, Heavy, Motorized, 280mm, M65 Atomic Annie*. Technical Manual Series No. 6008. Tankograd Publishing, Erlangen, Germany.

Gaddis, John L.
2005 *The Cold War: a New History*. Penguin, New York.

Gilbert, H. K., W. L. Carlson, E. Pinson, K. H. Stefan, W. R. Hedrick, R. G. Preston, R. A. Burgin, J. Kelso and F. H. Shelton
1953 *Summary Report of the Technical Director Programs 1 - 9.* Operation Upshot Knothole. Report No. WT-782. On File, Nuclear Testing Archive. Accession No. NV0306225.

Gleason, S. Everett
1953 "Memorandum for the President" dated February 20, 1953. On file in the National Security Council Collection, Eisenhower Presidential Library, Abilene, Kansas.

Heale, M.J.
1998 *McCarthy's Americans: Red Scare Politics in State and Nation, 1935–1965*. University of Georgia Press, Athens.

Herzog, Jonathan P.
2011 *The Spiritual-Industrial Complex: America's Religious Battle against Communism in the Early Cold War.* Oxford University Press, Oxford.

Hill, Gladwin
1953a "ATOM CANNON ROLE HAILED BY STEVENS: Gun Will Bolster U.S. Defenses in Europe, Secretary Tells National Guard Meeting" in *New York Times*, 23 October 1953:4.

1953b "Cannon Fires Atomic Shell; Target 7 Miles Away Blasted" in *New York Times*, 26 May 1953:1, 18.

Holland, Max., and David M. Barrett
2012 *Blind Over Cuba: The Photo Gap and the Missile Crisis*. Texas A&M University Press, College Station.

Irvine, Janice M.
2002 Talk About Sex: *The Battles over Sex Education in the United States*. University of California Press, Los Angeles.

Jae-Bong, Lee
2009 "US Deployment of Nuclear Weapons in 1950s South Korea & North Korea's Nuclear Development: Toward Denuclearization of the Korean Peninsula" in *The Asia-Pacific Journal*, Vol 17-8(3):1-17.

Jackson, Robert E.
1993 *Guide to U.S. Atmospheric Nuclear Weapon Effects Data*. Report DASIAC SR-92-007. Defense Nuclear Agency, Alexandria, Virginia. On file, Nuclear Testing Archive, Accession No. NV0340811.

Johnson, Gerald W., Gary H. Higgins, and Charles E. Violate
1959 *Underground Nuclear Detonations*. Report UCRL-5626. Lawrence Radiation Laboratory, University of California, Livermore.

Jones, Robert C.
2003 *Historical Evaluation of Kay Blockhouse, Frenchman Flat, Area 5, Nevada Test Site, Nye County, Nevada*. Desert Research Institute Short Report SR030703-1. Desert Research Institute, Las Vegas.

Kaplan, Fred
1991 *The Wizards of Armageddon.* Stanford University Press, Stanford, California.

Kunzel, Regina
2017 "Sex Panic, Psychiatry, and the Expansion of the Carceral State." In *The War on Sex*, Halperin, David M. and Trevor Hoppe (eds.), 229–246. Duke University Press, Durham, North Carolina.

Las Vegas Review-Journal
1953 "Stage Is Set for First Firing of Atomic Cannon" in the *Las Vegas Review Journal* XLV:144, 1. On file, Clark County Library: Microfilm 1953 May-June.

Lay, James S.
1950 *A Report to the National Security Council - NSC 68*, April 12, 1950. President's Secretary's File, Truman Papers. On file, Truman Presidential Library.

Lyon, B.C.
1953 "Master Distribution List for UPSHOT/KNOTHOLE," memorandum, Los Alamos Scientific Laboratory. On file, Nuclear Testing Archive, Accession No. NV16135408.

Malik, J.S., Robert R. Brownlee, C.F. Costa, H.F. Mueller, and R.W. Newman
1981 *Radiological Criteria for Underground Nuclear Tests*. Report LA-8776-MS. Las Alamos Scientific Laboratory. Las Alamos, New Mexico.

Massie, Jean, Carl Maag, and Robert Shepanek
1982 *SHOTS ENCORE TO CLIMAX The Final Four Tests of the UPSHOT-KNOTHOLE Series, 8 May - 4 June 1953*. Electronic document, https://www.dtra.mil/Portals/61/Documents/NTPR/2-Hist_Rpt_Atm/1953_DNA_6018F.pdf.

Mataxis, Theodore C., and Seymour L. Goldberg
1958 *Nuclear Tactics: Weapons, and Firepower in the PENTOMIC Division, Battle Group, and Company*. Military Services Publishing Company, Harrisburg, Pennsylvania.

McCartin, Joseph A.
2011 *Collision Course:Ronald Reagan, the Air Traffic Controllers, and the Strike that Changed America*. Oxford University Press, Oxford.

McGirr, Lisa
2001 *Suburban Warriors: The Origins of the New American Right (Updated Edition)*. Princeton University Press, Princeton, New Jersey.

Midgley, John J.
1986 *Deadly Illusions: Army Policy for the Nuclear Battlefield*. Westview Special Studies in National Security and Defense Policy. Westview Press, Boulder, Colorado

Moore, Don
2018 "North Port man fired atomic cannon" in *Port Charlotte* Sun, May 21, 2018, A5.

Moore, William V
2016 "Dorn, William Jennings Bryan" in *South Carolina Encyclopedia*. University of South Carolina, Institute for Southern Studies. Electronic document, http://www.scencyclopedia.org/sce/entries/dorn-william-jennings-bryan/.

National Paint, Varnish, and Lacquer Association (NPVaLA)
1954 *The House in the Middle*, video. Electronic document, https://www.loc.gov/item/mbrs02034317/.

National Park Service
1997 How to Apply the National Register Criteria for Evaluation. *National Register Bulletin* No. 15. U.S. Department of the Interior, National Park Service, Washington, D.C.

National Security Act of 1947
1947 *The National Security Act of 1947 – July 26, 1947*. Public Law 253, 80th Congress; Chapter 343, 1st Session; S. 758. Electronic document, https://www.cia.gov/library/readingroom/docs/1947-07-26.pdf.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration, Nevada Field Office

NPVaLA, see National Paint, Varnish, and Lacquer Association

NTA, see Nuclear Testing Archive

Nuclear Testing Archives (NTA)
1953a Photograph of the 280 mm Gun firing during the dress rehearsal, Grable Event. Photograph Accession No. UK-53-162.

1953b Project 30-18 – Operation Upshot/Knothole (Nevada Test Site) Detonation. GRABLE detonation: series of 14 aerial photos showing fireball and cloud (7 of 14). National Archives Identifier: 146764446; Local Identifier: 374-ANT-30-18-APB-17-07.

New York Times (NYT)
1952a "Collins Called Sold on New Atom Gun" in *New York Times*, 4 April 1952:15.

1952b "Pace Hails Army's Atomic Gun, Cites U.S. Power in New Weapons" in *New York Times*, 9 May 1952:1,9.

1953a "CITY TO SEE ATOM GUN IN PARADE ON MAY 16" in *New York Times*, 15 April 1953:16.

1953b “ATOM CANNON TEST ANNOUNCED BY U.S.: 280-mm. Gun to Fire Warhead in Nevada—Dummies in Cars to Test Blasts Impact” in *New York Times*, 8 March 1953:35.

1954 “MORE ATOM GUNS GOING TO EUROPE: U.S. to Bolster NATO Defenses With 6 Cannon – 12 May Be Overseas Now” in *New York Times*, 23 November 1954:5.

1955 “ARMY MAY SCRAP BIG CANNON” in *New York Times*, 11 September 1955:30.

Office of the Grand Marshalls
1953 *General Order No. 1, Inaugural Parade*. On file in the Couch collection at the Eisenhower Presidential Library, Abilene, Kansas. https://www.dwightdeisenhower.com/DocumentCenter/View/3065/1953_inaugural_parade_procession-Identification-PDF?bidld=.

Ogle, William E.
1985 *An Account of the Return to Nuclear Weapons Testing by the United States after the Test Moratorium 1958–1961 (Redacted Version).* U.S. Department of Energy, Nevada Operations Office, Las Vegas.

Olasky, Marvin
2006 *The Politics of Disaster: Katrina, Big Government, and A New Strategy for Future Crises*. W Publishing Group, Nashville, Tennessee.

Ostler, W. Kent, Dennis J. Hansen, David C. Anderson, and Derek B. Hall
2000 *Classification of Vegetation on the Nevada Test Site*. Report DOE/NV/11718-477. U.S. Department of Energy, Nevada Operations Office, Las Vegas.

Ponton, Jean, Jean Massie, Carl Maag, Robert Shepanek, and Stephen Rohrer.
1982 *Operation Upshot-Knothole*, 1953. Electronic document, https://qqq.dtra.mil/Portals/61/Documents/NTPR/2-Hist_Rpt_Atm/1953_DNA_6014F.pdf.

Preuss, Paul T.
1953 *Operation Upshot-Knothole: Operational Summary. Nevada Proving Grounds, 1 March – 9 June 1953*. 1982 Extracted Version. Defense Nuclear Agency. Washington, DC. On file, Defense Technical Information Center, Accession No. ADA995176.

Rankin, H.H.
1953 *Official Rosters and Changes Thereof, for Desert Rock Upshot/Knothole (16 March 1953 - 28 May 1953)*. On file, Nuclear Testing Archive, Accession No. NV0767788.

Ray, Roger
1977 Letter to Mr. C.M. Gilmour pertaining to his inquiry into Exercise Desert Rock VII and VIII. On file, Nuclear Testing Archive, Accession No. NV0705808.

Reston, James
1953 “U. S. to Send 6 Atomic Guns to Bolster NATO's Defenses: U. S. TO SEND NATO 6 HUGE ATOM GUNS” in *New York Times*, 16 September 1953:1, 21.

Roehrig, Terence
2006 *From Deterrence to Engagement: The U.S. Defense Commitment to South Korea*. Lexington Books, Lanham, Maryland.

Sauer, F. M., K. Arnold, W. L. Fons and C. C. Chandler
1953 *Ignition and Persistent Fires Resulting from Atomic Explosions-Exterior Kindling Fuels*. Report WT-775. U.S.D.A. Forest Service. On file, Defense Technical Information Center, Accession No. AD0460310.

Schmid, Joseph and Adam Wilson
2018 "U.S. artillery on the Korean Peninsula then and now: Incorporating past lessons to posture future operations" in *Fires Bulletin*, Vol. 18-3: 67–73. Electronic document, https://sill-www.army.mil/firesbulletin/archives/2018/may-jun/articles/18-3_15_Schmid.pdf.

Sietzen, Frank Jr.
2003 How Jim Fulton Saved the Space Shuttle. Electronic document, http://www.spaceref.com/news/viewnews.html?id=869.

Slate, Janet L., Margaret E. Berry, Peter D. Rowley, Christopher J. Fridrich, Karen S. Morgan, Jeremiah B. Workman, Owen D. Young, Gary L. Dixon, Van S. Williams, Edwin H. McKee, David A. Ponce, Thomas G. Hildenbrand, W. W. Swadley, Scott C. Lundstrom, E. Bartlett Ekren, Richard G. Warren, James C. Cole, Robert J. Fleck, Marvin A. Lanphere, David A. Sawyer, Scott A. Minor, Daniel H. Grunwald, Randell J. Lacznaik, Christopher M. Menges, James C. Yount, and Angela S. Jayco
1999 *Digital Geologic Map of the Nevada Test Site and Vicinity, Nye, Lincoln, and Clark Counties, Nevada; and Inyo County, California*. U.S. Department of the Interior, Washington, D.C.

Titus, A.C.
1986 *Bombs in the Backyard: Atomic Testing and American Politics*. University of Nevada Press, Reno.

Tlachac, Eve M.
1991a Nuclear Testing. In *Nevada Comprehensive Preservation Plan*, edited by W.G. White, R.M. James, and R. Bernstein, pp. 25/13–25/24. Division of Historic Preservation and Archaeology, Department of Conservation and Natural Resources, Nevada Historical Society, Department of Museums and History, Carson City.

1991b Operating Plan. In *Nevada Comprehensive Preservation Plan*, edited by W.G. White, R.M. James, and R. Bernstein, pp. 25/13–25/24. Division of Historic Preservation and Archaeology, Department of Conservation and Natural Resources, Nevada Historical Society, Department of Museums and History, Carson City.

U.S. Army
1951 *Field Manual (FM) 6-120: The Field Artillery Observation Battalion and Batteries*. Electronic document, http://www.archive.org/details/FM6-120/mode/2up.

1954 *The Big Picture: Aberdeen*. Episode TV-249, video. Electronic document, https://www.youtube.com/watch?v=AGOGLvInOmQ.

1956 *Field Manual (FM) 24-20: Field wire Techniques*. Electronic document, https//www.archive.org/details/FM24-201956/mode/2up.

U.S. Atomic Energy Commission (AEC)
1951 Alternate Test Site -- Mercury. U.S. Atomic Energy Commission, Santa Fe Operations Office, Albuquerque. On file, Nuclear Testing Archive, Accession No. NV0029351.

U.S. Department of Energy, National Nuclear Security Administration, Nevada Field Office (NNSA/NFO)

2013a *Icecap*. Report DOE/NV--1212. U.S. Department of Energy, National Nuclear Security Administration, Nevada Field Office, Las Vegas.

2013b *Stockpile Stewardship Program*. Report DOE/NV--1017. U.S. Department of Energy, National Nuclear Security Administration, Nevada Field Office, Las Vegas, Nevada

2015a *United States Nuclear Tests July 1945 through September 1992*. Report DOE/NV--209-REV 16. U.S. Department of Energy, National Nuclear Security Administration, Nevada Field Office, Las Vegas.

2015b "Firsts and Other Significant Tests". *One Voice* 4(3):8-9.

White House, The
Special Staff Note, dated January 16, 1958. Document 573, U.S. Department of State, Foreign Relations of the United States, 1958-1960, Volumes XVII/XVIII, Indonesia; Japan; Korea. Microfiche Supplement (Washington, D.C., Government Printing Office, 1994) (nsaarchive2.gwu.edu??dc.html?doc=6549607-national-security-archive-doc-22-white-house, accessed January 9, 2020).

Wills, C.A., and W. Kent Ostler
2001 *Ecology of the Nevada Test Site: An Annotated Bibliography, with Narrative Summary, Keyword Index, and Species List*. DOE/NV/11718—594. Bechtel Nevada, Ecological Services, Las Vegas.

Womack, Seth M.
2014 *Atomic Army: The Roles of the U.S. Army in America's Nuclear Endeavors*, Master's thesis. National Security Affairs, Naval Postgraduate School, Monterey, California.

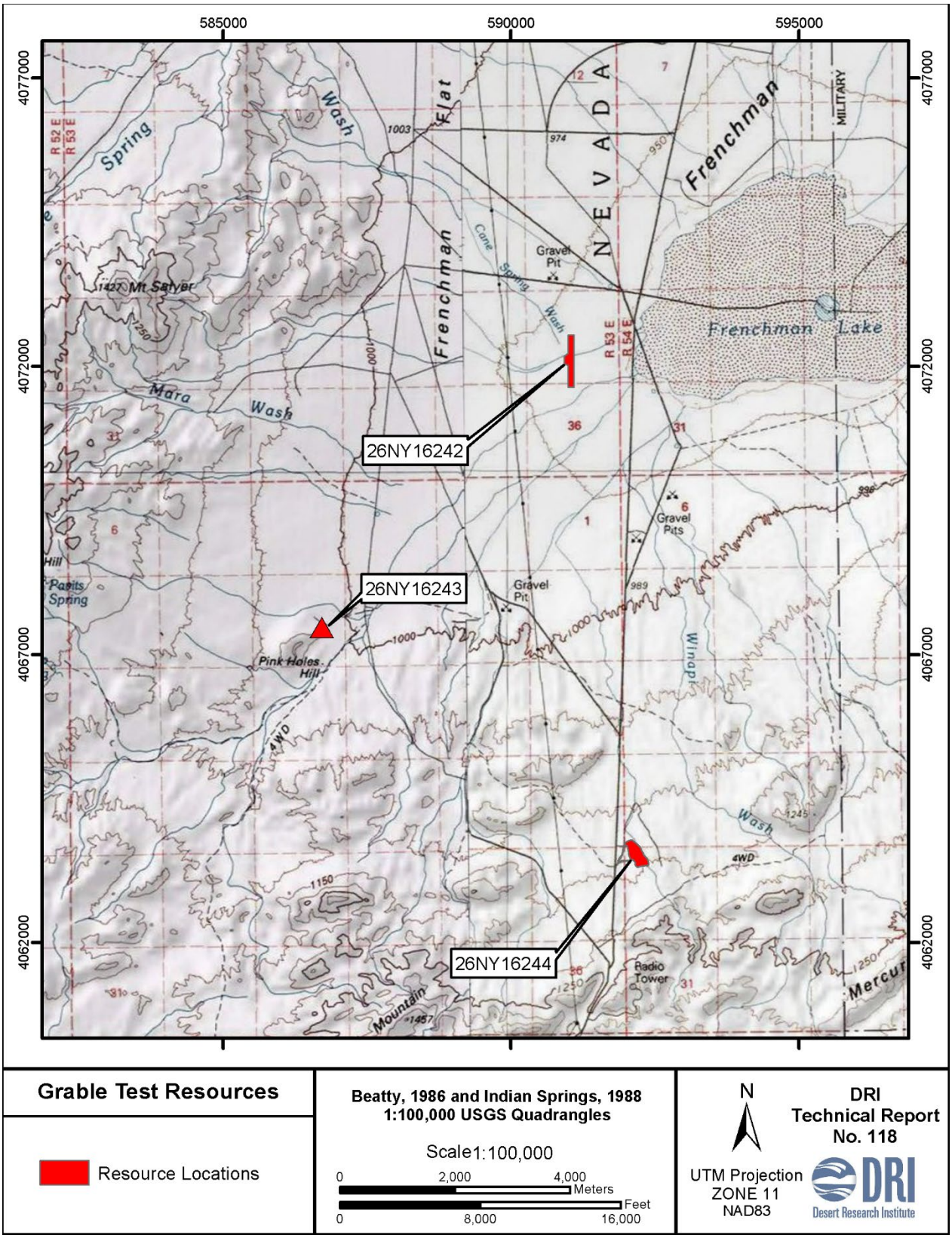
APPENDIX A

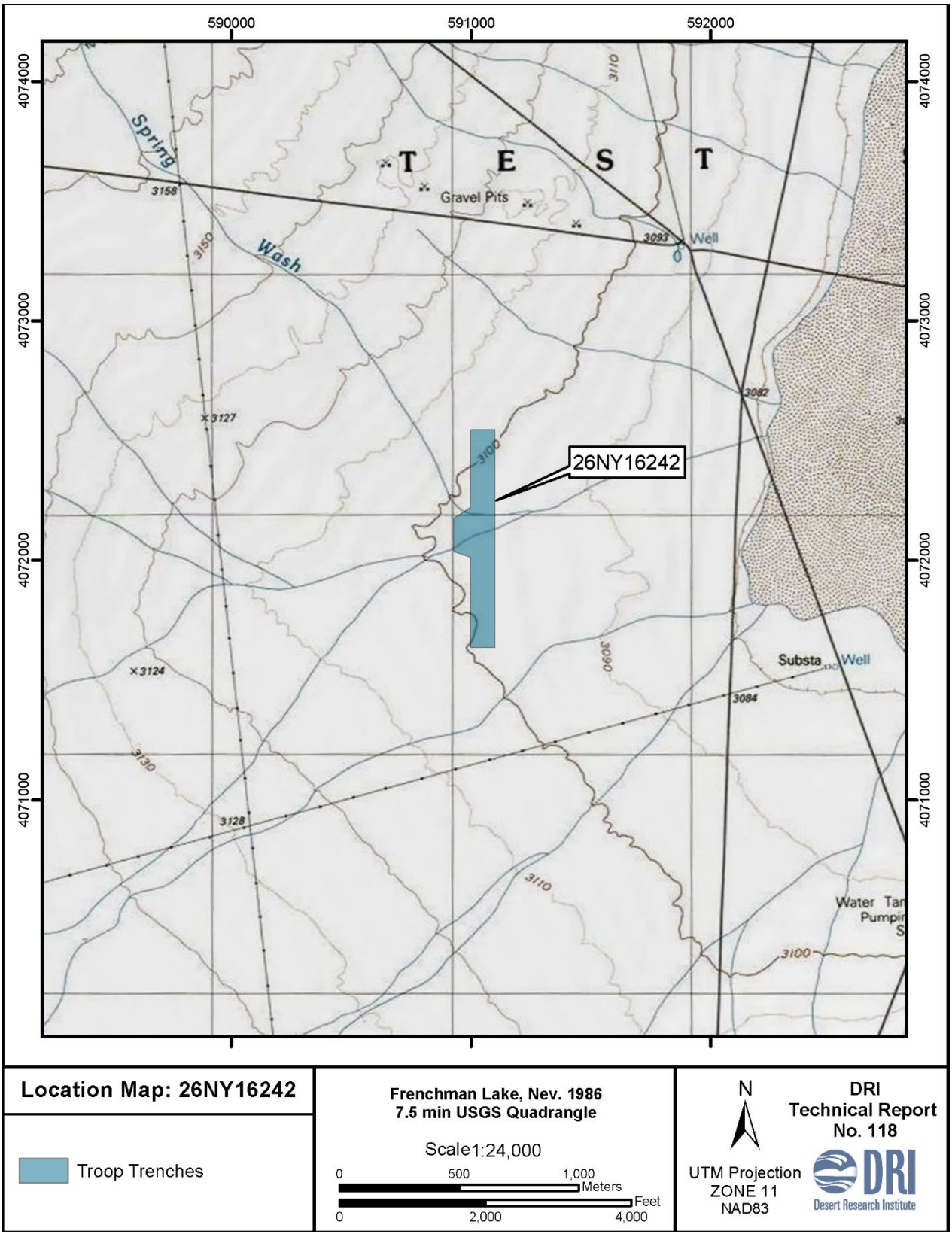
Project Location Coordinates and Maps

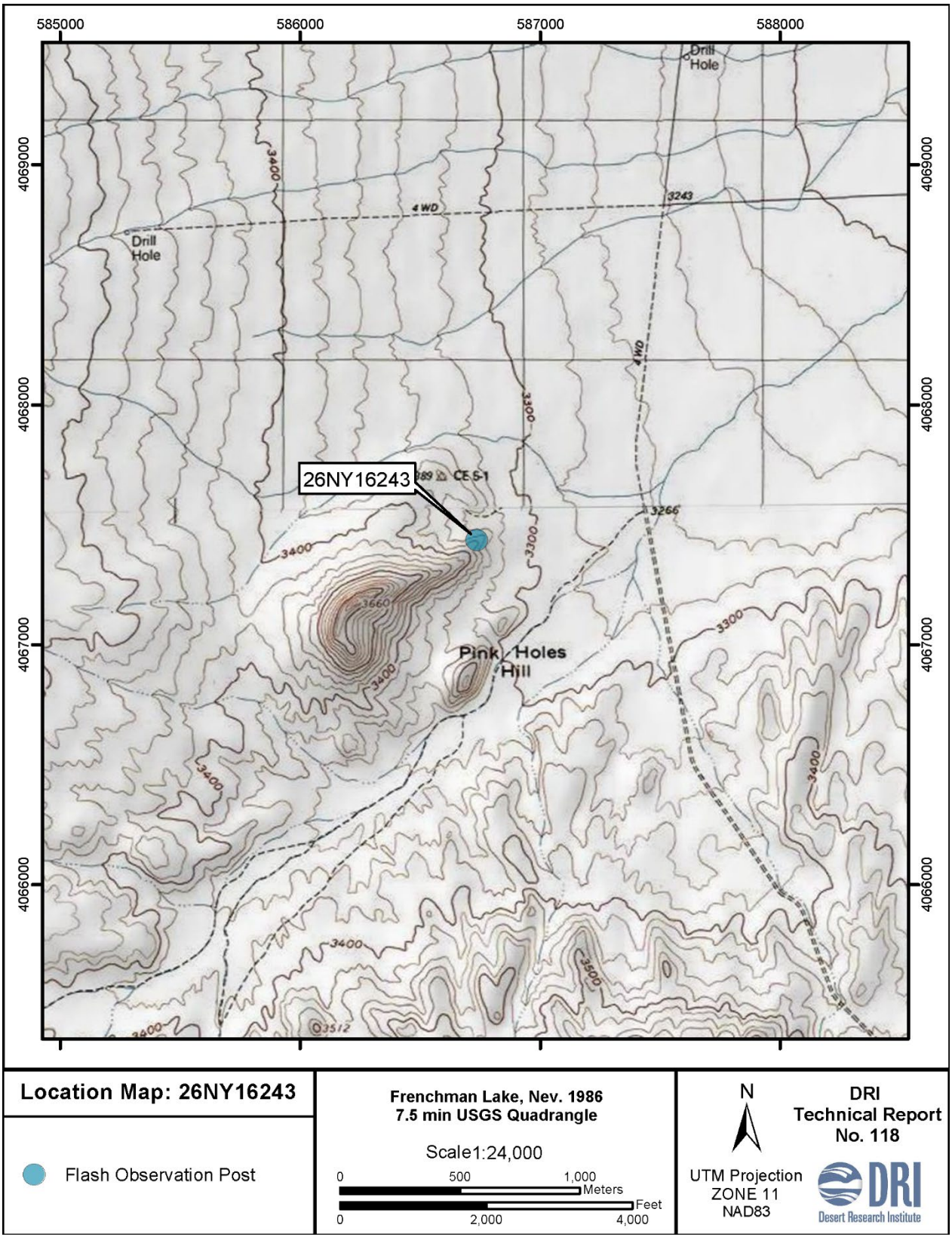
THIS PAGE INTENTIONALLY LEFT BLANK

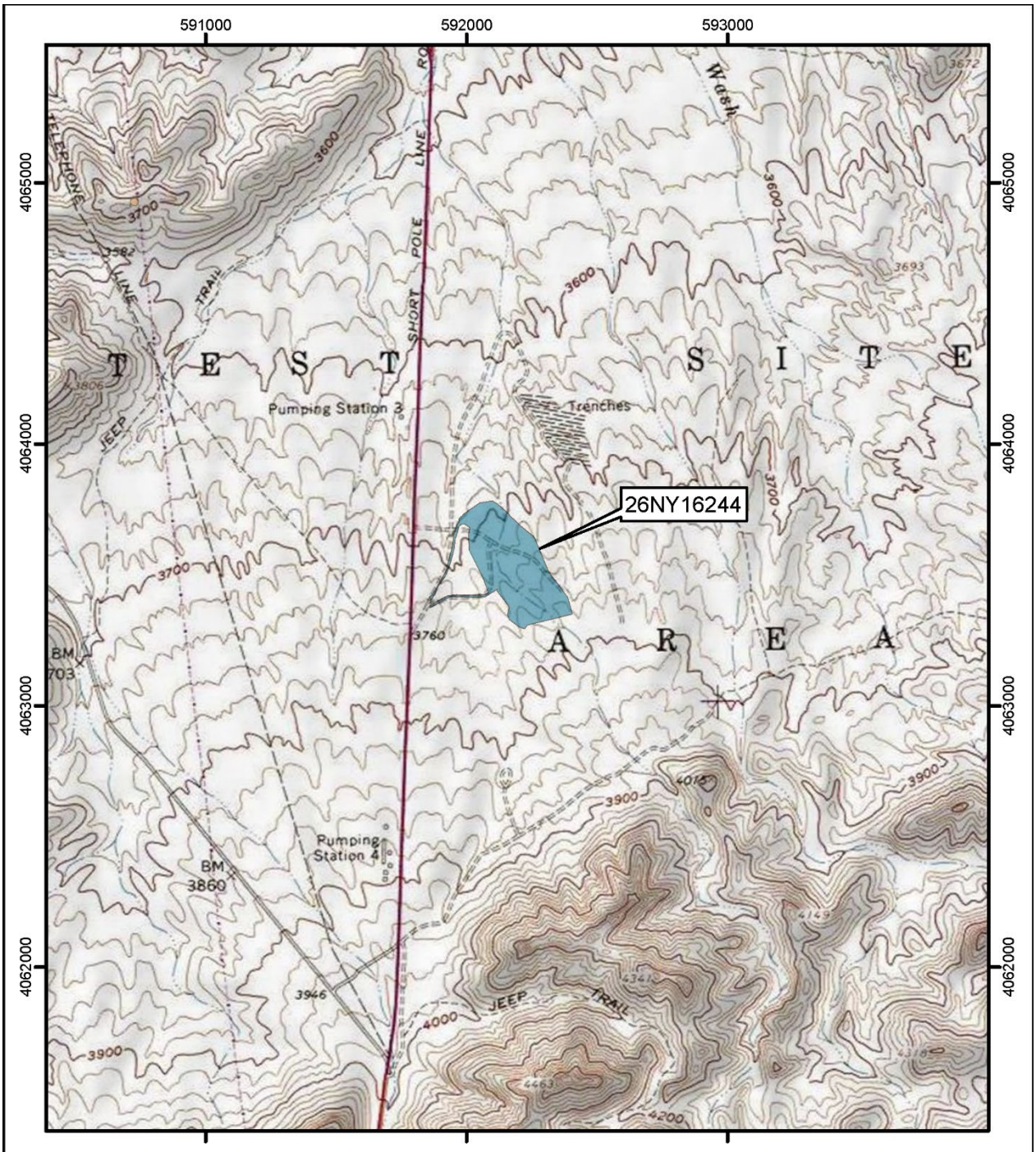
Project Location Coordinates:
The UTM coordinates for the resources described in this report are listed below (UTM Zone 11, NAD83):

Location	Easting	Northing
26NY16242	592084	72147
26NY16243	586734	67439
26NY16244	592232	63510


585000
590000
595000
4077000
4072000
4067000
4062000
26NY16242
26NY16243
26NY16244
Frenchman Flat
Frenchman
NEVADA
Frenchman Lake
Gravel Pit
Gravel Pits
Mara Wash
Pink Holes Hill
Radio Tower
Mountain
Wash
4WD
MILITARY
R 52 E
R 53 E
R 54 E
Grable Test Resources
Resource Locations
Beatty, 1986 and Indian Springs, 1988
1:100,000 USGS Quadrangles
Scale1:100,000
0 2,000 4,000 Meters
0 8,000 16,000 Feet
N
UTM Projection
ZONE 11
NAD83
DRI
Technical Report
No. 118
Desert Research Institute


590000
591000
592000
4074000
4073000
4072000
4071000
Spring
Wash
T E S T
Gravel Pits
Well
26NY16242
Substa
Well
3158
3150
3127
3124
3130
3128
3110
3100
3090
3084
3082
3093
Location Map: 26NY16242
Troop Trenches
Frenchman Lake, Nev. 1986
7.5 min USGS Quadrangle
Scale1:24,000
0 500 1,000 Meters
0 2,000 4,000 Feet
N
UTM Projection
ZONE 11
NAD83
DRI
Technical Report
No. 118
Desert Research Institute


585000
586000
587000
588000
4069000
4068000
4067000
4066000
Drill Hole
Drill Hole
4WD
4WD
3243
3400
3300
3266
3660
26NY16243
CE 5-1
Pink Holes Hill
3512
Location Map: 26NY16243
Flash Observation Post
Frenchman Lake, Nev. 1986
7.5 min USGS Quadrangle
Scale1:24,000
0
500
1,000
Meters
0
2,000
4,000
Feet
N
UTM Projection
ZONE 11
NAD83
DRI
Technical Report
No. 118
Desert Research Institute


591000
592000
593000
4065000
4064000
4063000
4062000
T E S T
S I T E
A R E A
26NY16244
Pumping Station 3
Trenches
Pumping Station 4
BM 3860
BM 703
SHORT POLE LINE
JEEP TRAIL
Wash
3600
3700
3760
3900
4000
4200
3946
Location Map: 26NY16244
Gun Emplacement
Frenchman Lake, Nev.1986
7.5 min USGS Quadrangle
Scale1:24,000
0 500 1,000 Meters
0 2,000 4,000 Feet
N
UTM Projection
ZONE 11
NAD83
DRI
Technical Report
No. 118
Desert Research Institute

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B

Newspaper Clippings

THIS PAGE INTENTIONALLY LEFT BLANK

ATOMIC CANNON BEING TESTED

FT. SILL, Okla. (AP) — If the Army's new atomic cannon is to be a complete success in actual combat, it will have to be used as a hit-and-run weapon despite its tremendous size.

This is the opinion of Col. Devere Armstrong of Gladwin, Mich., commanding officer of the 52nd Field Artillery Group, who will soon superintend the firing of the first atomic projectile from the Army's new 280 millimeter gun on the Nevada Proving Grounds.

Armstrong brought out the hit-and-run idea yesterday as a crew from his 955th Field Artillery Battalion fired 11 rounds of conventional ammunition in a preview of the Nevada tests for visiting newsmen.

"This is a great big gun, physically speaking," Armstrong said of the 85-ton weapon "and when you combine that with its unprecedented destructive potential when it shoots an atomic round you will appreciate how vitally the enemy will want to locate it on the battlefield and then do everything possible to knock it out before it sends an atomic round into a critical target within his lines."

Associated Press 1953

Stage Is Set for First Firing of Atomic Cannon

The stage was set today in all except the final details of the firing of the first atomic artillery shell and most of the star-studded audience already has arrived in Nevada for the big show.

The show will be witnessed by some of the biggest "bigs" in the military, industrial and legislative circles, including Secretary of Defense Charles R. Wilson, General Joseph Collins and Lieutenant General Joseph M. Swing.

President Dwight D. Eisenhower is not expected to attend, it was learned reliably.

Military and industrial leaders started arriving for the big spectacle Friday and congressmen started arriving by plane Saturday, landing at Indian Springs.

The historic event, described by nuclear experts as emphasizing "the long way we have come since Hiroshima and Nagasaki in the development of the bomb," takes place Monday at the Nevada proving ground, 75 miles northwest of Las Vegas.

The atomic missile is to be fired over Frenchman flat from a huge 280-millimeter cannon especially developed to shoot a nuclear warhead.

The experts say the shot will usher in a new era in warfare — the era in which the atom's devastating might will be used in close support of the infantry.

Twenty-four hundred troops and 575 staff officers of the various military commands are on hand to take part in the big test.

Two battalion combat teams will be entrenched 4500 yards from ground zero — the point of the atomic shell explosion—and will execute an assault maneuver shortly after the blast.

The test has been set up to approximate military situations encountered in Korea daily. The target for history's first atomic shell will be military installations and objectives, including a 15-car freight train.

The atomic cannon has a range of 20 miles. It already has been tested extensively with conventional ammunition.

The AEC said that the atomic shell would be fired electrically. It announced:

"After the shell has been loaded into the cannon and before an electrical impulse detonates the propelling charge, the army gun crew will retire behind revetments a safe distance from the weapon. Actual firing will be by the sequence timer in the control point, 10 miles away."

Las Vegas Review-Journal 1953

COLLINS CALLED 'SOLD' ON NEW ATOM CANNON

WASHINGTON, April 3 (UP) — Gen. J. Lawton Collins, Army Chief of Staff, gave Congressional Atomic Energy Committee members an optimistic report today on a new and controversial atomic cannon.

Informed sources said General Collins had described the cannon as a practical weapon well suited to the defense of Western Europe. He was said to have made the statement at a closed session of an Atomic Energy subcommittee.

The subcommittee issued a statement after the meeting that said that General Collins had discussed the "defensive and offensive role of atomic firepower in land warfare, partly in the defense of Western Europe."

Representative Melvin Price, Democrat of Illinois and subcommittee chairman, said General Collins had discussed the "broad picture of atomic weapons." Mr. Price did not mention the atomic cannon.

He said General Collins believed the atomic weapons program was "improved" but Mr. Price said the subcommittee was "never satisfied" in the field of atomic warfare.

General Collins was reported to be "completely sold" on the atomic cannon for use as a tactical weapon. The Army has ordered twenty of them from the Baldwin Locomotive Works.

The cannon has been criticized by some defense officials because they believe its large size will make it comparatively immobile and hence a poor field weapon. Others have questioned whether it would not be better to use the limited supplies of atomic explosives in aerial bombs and guided missiles.

NYT 1952a

CITY TO SEE ATOM GUN IN PARADE ON MAY 16

New Yorkers will get their first view of the Army's new 280-mm. atomic cannon at the Armed Forces Day Parade down Fifth Avenue on Saturday, May 16.

Lieut. Gen. Withers A. Burress, commanding general of the First Army, told an organization meeting at the University Club, 1 West Fifty-Fourth Street, yesterday, that the giant gun would appear in the parade. Under the theme "Power for Peace," the parade will start down Fifth Avenue from Ninety-fifth Street at 2 P. M. and will end at Sixty-fourth Street. It is estimated that 20,000 members of the armed services will march with veteran, civic and patriotic organizations. The Air Force will put 200 aircraft aloft in a flyover covering the parade route.

The gun has been fired at the Nevada proving ground with projectiles using an atomic warhead, but not yet with an atomic-loaded shell.

Rear Admiral Roscoe H. Hillenkoetter, U.S.N., told the meeting that the Navy would have ships of various types in port for an open-house inspection by the public. The open house, he said, will extend to the naval shipyard in Bayonne, N. J., where salvage and diving operations will be demonstrated.

NYT 1953a

ATOM CANNON TEST ANNOUNCED BY U. S.

280-mm. Gun to Fire Warhead in Nevada—Dummies in Cars to Test Blast's Impact

WASHINGTON, March 7 (AP)—The Government announced tonight that it would fire an atomic projectile from what is probably the world's first atomic cannon during the series of nuclear experiments that will start soon at the Nevada proving ground.

The huge 280-mm. guns, of which several have been made, were fired frequently during the last year, but never with an atomic-loaded shell.

A joint announcement by the Defense Department and the Atomic Energy Commission said a unit from the Fort Sill, Okla., team of the Army's artillery service would fire the gun. The unit will be "using a projectile armed with an atomic warhead."

The announcement also said the firing would not take place at the public demonstration for civil defense officials and news men on March 17. The assumption is that the atomic cannon will be used later in the series, which usually runs for more than a month.

"The 280-mm. gun, capable of firing both conventional and atomic shells under all-weather conditions," the announcement said, "was unveiled to the public at Aberdeen Proving Ground, Md., on Oct. 15, 1952. Since that time units of the Fifty-second Field Artillery Group have been undergoing intensive training with the weapon at Fort Sill."

The gun has a range of about twenty miles. The Army demonstrated at Aberdeen that, despite its eighty-five-ton weight, the gun was mobile. It is carried between two motor tractors and can move across fields as well as along highways.

The series of tests at the proving ground will include about ten atomic explosions. The majority will be detonated from devices atop steel towers, with one or two bombs dropped from planes. More than one experimental shot from the cannon may be made, it was believed.

NYT 1953b

MORE ATOM GUNS GOING TO EUROPE

U.S. to Bolster NATO Defenses With 6 Cannon—12 May Be Overseas Now

Special to THE NEW YORK TIMES.

WASHINGTON, Feb. 4 — The United States is sending six more atomic cannon to Europe to stiffen the defensive power of the North Atlantic Treaty Organization, the Army said today.

Two field artillery battalions, each equipped with six of the 280-mm. guns, already are in Europe, according to reliable though unofficial reports.

The Army said that the 264th Field Artillery Battalion, now at Fort Sill, Okla., had been alerted for movement to Europe within the next three months.

The 280-mm. cannon can fire conventional as well as atomic shells. Its range, when firing a full-size projectile, is about twenty miles. Fitted with an adapting device, it can hurl a smaller shell about thirty miles.

It fired a nuclear shell for the first time last spring in a test conducted at the Atomic Energy Commission's Nevada Proving Ground near Las Vegas, Nev.

5 Battalions May Be Sent

Present Defense Department plans, it was reported, call for the eventual dispatch to Gen. Alfred M. Gruenther, Supreme Allied Commander in Europe, of five atomic artillery battalions altogether, a total of thirty guns.

The Air Force also is building up its atomic capabilities on the Continent with the assignment to West Germany of two guided missile squadrons. Its units will be equipped with the Matador, an expendable ground-to-ground missile that can be fitted with a nuclear warhead.

Defense officials have said the planned increase in atomic firepower would not, in the foreseeable future, be offset by a reduction of ground forces in the NATO command. The United States now has five Army divisions and three regimental combat teams in that theatre.

That combat force is to remain overseas, despite President Eisenhower's announced intention to withdraw two divisions from Korea as an initial step toward the creation in the United States of a central, strategic reserve.

It will not, for the present, be reduced, although the Administration's revised defense policy is based on the substitution of atomic firepower for Army manpower. Some reduction in the number of support troops, however, is expected during the next year.

Plans to dispatch the third atomic artillery battalion to Europe became known in the Pentagon today and were confirmed by Army spokesmen.

No formal announcement was made in deference, perhaps, to the statement of Charles E. Wilson, Secretary of Defense, that he wished "we could quit rattling the atomic bomb."

NYT 1954

ARMY MAY SCRAP BIG ATOM CANNON

8-Inch Gun Would Replace Unwieldy Weapon—New Small Shells a Factor

WASHINGTON, Sept. 10 (AP)—The Army plans to use its conventional eight-inch gun as an eventual replacement for the heavy and cumbersome 280-millimeter atomic cannon.

Atomic shells, until recently, could be fired from nothing smaller than the approximate eleven-inch diameter used for the specially built atomic cannon.

But the "miniaturization" efforts of Army ordnance and Atomic Energy Commission designers now is understood to be directed at scaling down nuclear shells to fit one of the Army's standard artillery pieces, the eight-inch, long-range gun.

The atomic cannon, with its twenty-mile range, has advantages. But balance against the range are the following disadvantages:

¶Mobility trouble, exemplified in Europe where several of the eighty-five-ton gun-tractor combinations have overturned or become bogged down while moving along roads.

¶The ammunition, even the conventional high explosive charges that the gun can use as well as nuclear shells, are special calibers.

The eight-inch gun, together with its carriage, weighs only thirty-five tons. And, at maximum range, it can reach out nearly as far as the atomic cannon. Data shows the range of the eight-inch gun as running from 22,000 to 35,000 yards, the latter close to the twenty-mile reach of the specially built A-gun. Standard explosive ammunition for the eight-inch is readily available.

The range of the newest 4.2-inch mortar is about 6,400 yards, enough so that an atomic shell could be used without endangering friendly forces. However, those familiar with the miniaturization program say that point in development is still in the future.

The standard caliber atomic shell program, first publicly hinted at about a year ago by an Army official, is part of the broad program to put the massive, destructive firepower of nuclear explosive into the general arsenal of Army weapons.

Several 280-millimeter atomic cannon outfits already are on station in Europe. Others are being deployed in the Far East. The Army also has announced that units using the "Honest John" long range rocket, capable of atomic fire, are going overseas.

Some of the Army planning looks to the day when large forces of United States troops no longer can be maintained in Europe as part of the Western defense system there. This planning foresees the appearance of highly specialized, comparatively small task forces—armed with a whole family of nuclear weapons and capable of moving about swiftly. These atomic-punch outfits would back up the conventional large armies of the European members of the North Atlantic treaty organization.

NYT 1955

ATOM CANNON ROLE HAILED BY STEVENS

Gun Will Bolster U.S. Defenses in Europe, Secretary Tells National Guard Meeting

By GLADWIN HILL
Special to THE NEW YORK TIMES.

SAN DIEGO, Calif., Oct. 22—More than a dozen atomic cannon are being shipped to United States forces in Europe, top Army officials reported today.

It is part of a program to give field commanders "the capability of using atomic explosives safely and accurately if it should become necessary to do so," they explained to the seventy-fifth general conference of the National Guard Association of the United States. The four-day convention ended today.

Robert K. Stevens, Secretary of the Army, in discussing the 280-mm. cannon, which last spring fired an atomic projectile for the first time, said:

"This gun will greatly enhance our defensive capabilities, which is why we have shipped some of them to Europe.

"Ultimately, as Army guided missiles are perfected, they too will aid in delivering fissionable materials or conventional explosives in close support of Army ground forces."

Gen. Charles G. Bolte, Vice Chief of Staff and recent commander of United States forces in Germany, specified that "the first of several 280-millimeter battalions scheduled for Europe has just arrived there."

On Sept. 15, when Mr. Stevens made the first announcement concerning the atomic cannon, he said that one battalion, comprising six guns, was being shipped to Europe.

"The important thing," Secretary Stevens observed, "is that we have the gun now and can give our field commanders the capability of using atomic explosives safely and accurately in darkness or in any kind of weather, if it should become necessary to do so."

Under present law, atomic devices cannot be detonated without express authorization of the President of the Unitied States.

Mr. Stevens mentioned the gun as one item of the Army's continuing effort to develop "firepower to offset manpower."

However, he noted, "no substitute has yet been found for well-trained ground forces. The era of push-button warfare is not yet here."

He reported that "the state of the Army today is good and is steadily growing better. * * * Although the personnel strength of the Army is slightly less than it was a year ago, we have maintained the same major unit strength, and our combat capability has been increased. This increase is due in part to improved training methods."

General Bolte, in his speech, declared:

"I can assure you without qualification that the state of readiness of United States forces in Europe is of a very high order.

"That is not to say there is no room for improvement. But * * * American forces in Europe are tough, well-trained and ready for any emergency."

Outlining a tentative plan for National Guard "to take a more active part in our air defenses," Secretary Stevens said:

"National Guard anti-aircraft guns would be located in positions around important industrial areas and other vital installations. Civilian caretaker personnel would be on duty in each unit on a twenty-four-hour-a-day basis to guard and maintain the equipment.

"Guard members of these units would be on call in the event of an enemy attack in much the same way that members of a volunteer fire department are on call to answer fire alarms .They would be 'minute men' in every sense of the word."

Hill 1953a

Cannon Fires Atomic Shell; Target 7 Miles Away Blasted

By GLADWIN HILL
Special to THE NEW YORK TIMES.

LAS VEGAS, Nev., May 25—An atomic shell was shot from a gun for the first time today. A projectile eleven inches in diameter, touched off electrically by remote control, hurtled seven miles from the muzzle of one of the Army's 85-ton 280-mm. cannons, across the sagebrush-dotted sands of Frenchman Flat at the Atomic Energy Commission's Nevada Proving Ground.

The shell's nuclear warhead, detonated by a time fuse, exploded 500 feet above the ground over a target area dotted with trees, railroad engines and freight cars and other military equipment, to test the new weapon's potentialities for the battlefield.

The burst, at 8:30 A. M. Pacific daylight time (11:30 New York time), was like the sudden birth of another sun close to the desert floor.

The explosive power of the shell was unofficially but authoritatively indicated to be approximately half of that of the atomic bomb loosed at Hiroshima, Japan, in 1945, which was equivalent to 20,000 tons of TNT.

Follows Years of Research

The successful compression of this much power into a conventionally "delivered" artillery shell —in contrast to the big B-29 plane required to deliver the Hiroshima bomb—represented the culmination of a decade's intensive scientific and engineering work.

It presaged the eventual demonstration of the whole repertoire of atomic bombs "packaged" for tactical (battlefield) use that the United States was authoritatively reported to have developed—ranging down to a small shell equivalent to only 2,000 tons of TNT.

The test was watched by some 2,500 troops and 575 participating observers from the armed services crouched in trenches two and a half miles from the burst area. About 100 members of Congress and governmental officials watched from a knoll nine miles from the test range.

They included Charles E. Wilson, Secretary of Defense; Admiral Arthur W. Radford, Chairman-designate of the Joint Chiefs of Staff; Gen. J. Lawton Collins, Army Chief of Staff; Thomas E. Murray, Commissioner of the A. E. C., and Representative W. Sterling Cole, Republican of upstate New York, Chairman of the Joint Congressional Committee on Atomic Energy.

Stevens With Troops

Robert T. Stevens, Secretary of the Army, watched the test with the troops in the forward trenches. Reporters were not admitted to the test reservation, and watched from mountains overlooking the site.

Secretary Wilson was quoted by the Atomic Energy Commission in a formal statement as saying that he "considered the test extremely interesting and was pleased with its success." Mr. Wilson arrived by plane from Washington last night. Admiral Radford called the test "a milestone in the history of atomic weapons."

Mr. Cole said the test marked the addition of "another major weapon to our atomic stockpile."

Referring to the successful reduction of the nuclear weapon to "capsule" size, he said:

"I want to take off my hat to the scientists and engineers in the atomic energy program who spent so many hours and weeks of labor devising this marvelous new gadget, and to the military men who support and assist them."

The thirtieth atomic explosion in twenty-eight months of experiments at the test site, seventy-five miles north of Las Vegas, was the first to involve what was acknowledged to be a finished weapon. Previous tests had involved only what the atomic commission described as "nuclear devices"—presumably, in the main, fissionable ingredients assembled in rudimentary casings for experimental purposes. However, it also was presumable that a finished version of today's projectile had been experimentally detonated outside of a gun.

Today's test was the first of the Nevada series in which one of the military services occupied the primary role. In all previous test explosions, the Atomic Energy Commission had classified military and civilian defense aspects as collateral to its own studies of nuclear phenomena. Today a spokesman acknowledged that the commission's scientific observations were incidental to trial of the weapon, with its far-reaching implications for warfare.

Controversy Over Weapon

The Army's assumption of the primary role bulked significantly in the subtle but pervasive current controversy over the employment of the new weapon of nuclear fission in battle. The Army views it as a means of giving ground forces unmatched "fire power."

Critics of this viewpoint, noting the cumbersome equipment necessary to "deliver" such a projectile no more than twenty miles (the gun's maximum range), have suggested that such missiles can be applied far more effectively by air. Secretary Wilson this month declared himself in favor of increasing production of atomic artillery.

Today's blast was the tenth and last of the A. E. C.'s scheduled spring test series. However, Carroll Tyler, test director, announced late today that an additional firing "to speed weapons development" was under consideration for late this spring or early in the summer.

The gun that fired the shell was one of two brought from the Army's field artillery center at Fort Sill, Okla., for the experiment. Forty-four feet long, the guns can be transported cross-country on dual tractor-trailers. The gun is the largest in the Army's arsenal, and about a dozen of them are supposed to have been built. The designing was started in 1944 for the firing of ordinary high explosive shells. In 1949 it was decided they could be adapted to handle atomic missiles.

Two guns were brought here, a Defense Department spokesman said, as a precaution in case one broke down.

Today's shell probably weighed in the neighborhood of half a ton. The gun's conventional shells weigh 800 pounds.

The gun was loaded by a nine-man crew from the Fifty-second Field Artillery Group at Fort Sill, supervised by Col. DeVere Armstrong and Capt. Richard A. Erickson, battery commander. The Army would not disclose the identities of the crew members, and said they could not be interviewed.

A. E. C. personnel stood by during the loading operation. Then the gun crew moved back to trenches at a safe but undisclosed distance, in case the shell jammed and exploded in the gun.

The time it took the shell to traverse the seven miles was not disclosed, but was believed to be around twenty seconds. The firing of the gun itself, done by an electrical contact in a timing device in the Atomic Commission's test site control blockhouse, was not discernible to off-reservation observers.

Fireball Is Brilliant

In the target area were an old Diesel locomotive and fifteen freight cars, bridges, tanks and an assortment of what was called "military hardware." In the past this has included amphibious landing craft, airplanes and equipment ranging down to items as small as rifles. Some experimental sheep, pigs, rabbits and mice were the only living things in the target area. The shell's damage to the area was not immediately disclosed.

The shell burst closely resembled several of the medium power nuclear detonations set off at the proving ground in previous tests.

The fireball flared with dazzling brilliance for a few seconds, then faded into a rolling white-orange cloud that rose quickly to a height of 20,000 or 30,000 feet, sucking up behind it a thick gray and white column of smoke and dust to form the customary "mushroom."

Four minutes after the explosion, observers about forty miles away on 11,000-foot Mount Charleston heard the blast as a dull rumble.

After about ten minutes, the atomic cloud broke away from its "stem" and was slowly swept away by winds in the upper air. The column of smoke and dust broadened and slowly settled in a pall several miles wide over the test area.

Before the atomic firing, several routine "ranging" shots of high explosive shells were fired to determine wind drift and other trajectory factors.

The 280-mm. gun was first demonstrated publicly at the Aberdeen, Md., Proving Ground last Oct. 15. A slightly smaller gun, shooting 360-pound high explosive shells, is being used in Korea.

The atomic cloud passed over Salt Lake City about four hours after the explosion, the A. E. C. reported, and was moving toward the Canadian border in the vicinity of the North Dakota-Montana state line. The cloud prompted temporary orders stopping or affecting plane flights over a large area northeast of Nevada.

Taking cognizance of complaints last week that Utah was being unduly peppered with radioactive "fall-out" dust from Nevada test clouds, the commissioner reported that the only "fall-out" today had been just on the edge of the test site, and that no "fall-out" had been detected in Utah. The agency said experts from its New York office had been sent to monitor radioactivity in Salt Lake City, Ogden, and other Utah centers, along with personnel of the University of Utah.

A sampling of the seventy-nine members of Congress who observed the test yielded general concurrence with Representative Cole's enthusiasm.

Clipping Continued on Next Page

Would Favor Use in Korea

Representative Joseph F. Holt, Republican of California and a Marine veteran of the Korean war, said he would like to see the atomic cannon in use in Korea, but that he was not "advocating" this because it was in the realm of Presidential discretion.

Representative Douglas R. Stringfellow, Republican of Utah, who had expressed concern about the atomic-cloud "fall-out" in a letter to the commission, said he thought today's demonstration would help ameliorate public misapprehensions he attributed to the A. E. C.'s "antiquated security regulations and poor public relations."

He cited as an example of this the warning and stopping of motorists in the Nevada-Utah area last week, and the washing-down of several cars that had become slightly radioactive from "fall-outs," when "the scientists knew there wasn't enough radioactivity to hurt the human body." He criticized this as "a negative approach."

He said he was convinced the A. E. C. now was doing everything possible to protect the public, but that the agency "has got to regard this as just another weapon and lift the guilt complex and the fear complex that has surrounded it."

He said he thought the consensus of his colleagues on the question of atomic artillery versus atomic bombardment was an attitude of open-mindedness and that the completion of a test of the artillery shell opened the way to calculation of the prospective comparative costs of the two techniques.

Hill 1953b

U. S. to Send 6 Atomic Guns To Bolster NATO's Defenses

By JAMES RESTON
Special to THE NEW YORK TIMES.

WASHINGTON, Sept. 15—The United States will send six atomic cannon to Germany soon to bolster the North Atlantic Treaty Organization's defense of Western Europe.

This was announced today by Robert T. Stevens, Secretary of the Army. He added that this was "the first of several" 280-mm. battalions planned for deployment to Europe.

The 280-mm. gun is the Army's largest caliber artillery piece having complete mobility. It weighs about eighty-five tons when it is ready for the road, and can fire an atomic shell approximately twenty miles.

Nothing was said in the official announcement about atomic ammunition for the gun—which also fires conventional shells—but President Eisenhower has authority to order atomic weapons sent outside of the United States. United States aircraft carriers, for example, have from time to time carried atomic bombs overseas since the end of the war.

For some time, United States officials have been saying that "new weapons" would increase the capacity of the NATO forces to defend Western Europe. One official said today that this was "merely one" of the weapons official Washington had in mind.

It was noted here that the announcement had been made simultaneously with the keel-laying for the second United States atomic submarine at New London, Conn., and that both events coincided with the opening of the United Nations General Assembly meeting in New York.

This could, of course, have been a coincidence, but on the other hand, some officials in Washington have been eager to make clear that the American atomic program was going forward ever since the announcement that a hydrogen bomb had been exploded by the Soviet Union.

President Eisenhower, it also was noted, is considering Administration television and radio broadcasts to increase public awareness of the growing threat of the Soviet Union's atomic and air power.

Though the atomic cannon will be under the control of the NATO'S international command under Gen. Alfred M. Gruenther, they will be sent to one of the six United States divisions now in Germany. The 868th Field Artillery Battalion, Fort Bragg, N. C., will be assigned to man the guns in Europe.

Mr. Stevens said shipment of the big guns to Europe "is part of established United States policy to make available for the support of the NATO coalition highly trained and well equipped balanced forces."

Continued on Page 21, Column 5

The Army Secretary cautioned, however, that the cannon could not be regarded as a substitute for other weapons and forces required to guard against Communist attack.

"No single weapon will solve the military problems of Western defense or deter aggression," he said.

The first atomic shell was fired from the 280-mm. cannon several months ago. This followed many months of experimentation with ways and means of adapting the cannon to atomic shells, and it was said at the time that the experimental shell had exploded with remarkable accuracy.

The Department of Defense would not elaborate on the official announcement, nor would officials discuss the new weapon or whether atomic shells would be sent along with it.

On Oct. 15, of last year, however, when the new gun was discussed in public for the first time, the following facts about it were divulged in an official statement.

¶This 280-mm. gun is the Army's largest caliber artillery piece having complete mobility.

¶It is an artillery piece for firing both conventional and atomic shells.

¶It can deliver an atomic shell on target in all kinds of weather, day or night, unlike an air-delivered atomic bomb.

¶It can fire with accuracy comparable to conventional artillery in the shorter ranges and is considered to be much more accurate at long ranges—four times more accurate at long ranges than any mobile artillery pieces developed prior to World War II.

¶It is carried suspended between two engine cabs, front and rear, which can transport their load on highways at a speed of about thirty-five miles an hour.

¶It is equipped with telephones to permit communication between front and rear drivers while on the move, with the leading transporter driver having control of throttle and brakes of both units, although both can be operated independently.

¶It can travel cross-country as well as on the highways and can fit into a landing ship designed for amphibious operations.

¶It can be emplaced and put into action with greater speed than any other heavy field artillery piece now in use.

Facts and figures on the gun follow:

¶Range—about twenty miles.

¶Ammunition — high explosive and other conventional types in addition to atomic shell.

¶Elevation—0 to 55 degrees.

¶Traverse—360 degrees.

¶Length of carriage . (without transporters)—38.5 feet.

¶Length overall (including transporters)—84 feet, 2 inches.

¶Weight—approximately eighty-five tons—complete unit.

Reston 1953

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C

Operations Orders

THIS PAGE INTENTIONALLY LEFT BLANK

Operations Order 1, Battery A, 867th FA Battalion
Artillery Test Unit (ATU) Camp Desert Rock
12 May 1953

1. Task Organization:

a.	280 mm Gun Battery	Capt. R. A. Erickson
b.	Communications Platoon	Lt. H. E. Callaghan
c.	Flash Platoon	Lt. M. J. O'Connell
d.	Meteorological Platoon	Capt. R. C. Carnes
e.	RADAR Platoon	Lt. D. D. Luce
f.	Mitchell Camera Team	Lt. D. E. Black
g.	Survey Information Center (SIC)	Maj. C. R. Hill
h.	Ordnance Detachment (SWDS)	Lt. N. G. Christensen

2. Mission:
    a. To test the doctrine associated with the 280 mm Field Artillery Battalion and Ordnance Company (SWDS), to include gunnery techniques, logistical support, delivery and handling of nuclear components, and observation of shell bursts.
    b. To proof-fire the shell, Atomic Explosive, 280 mm, MK 9.
3. Mission, Subordinate Units:
    a. Gun Battery: Prepare position (Incl. #1) and be ready to fire atomic projectile MK 9 on 48 hour notice after occupation of position.
    b. Communications Platoon: Install, provide, and maintain necessary wire and radio communications (Incl. #1 & #2).
    c. Flash Platoon: Occupy positions (Incl. #1) and observe, locate, and report locations of all rounds other than atomic projectile MK 9 to fire direction center (FDC).
    d. Meteorological Platoon: Furnish meteorological data (Metro) requested by FDC.
    e. RADAR Platoon: Occupy positions (Incl. #1) and observe, locate, and report locations of all rounds including atomic projectile MK 9 to FDC.
    f. Mitchell Camera Team: Occupy position (Incl. #1) and photograph all rounds except those fired on D-day.
    g. SIC Observers: Occupy positions (Incl. #1) and observe, locate, and report locations of all rounds other than atomic projectile MK 9 to FDC.
    h. Ordinance Detachment (SWDS): Provide necessary support to gun battery in preparation of Operational Suitability Test (OST) and atomic projectile MK 9. Recover all vital components of OST rounds after firing.
    x. [Instructions applicable to two or more subordinate units]

(1). Safety precautions as directed by Test Director, Nevada Proving Ground.

(2). Schedule of events, see Incl. #3.

(3). Draft report of all activities will be submitted through Deputy Commander, ATU, prior to 10 June 53.

4. Administration: Admin. 0 1.

5.

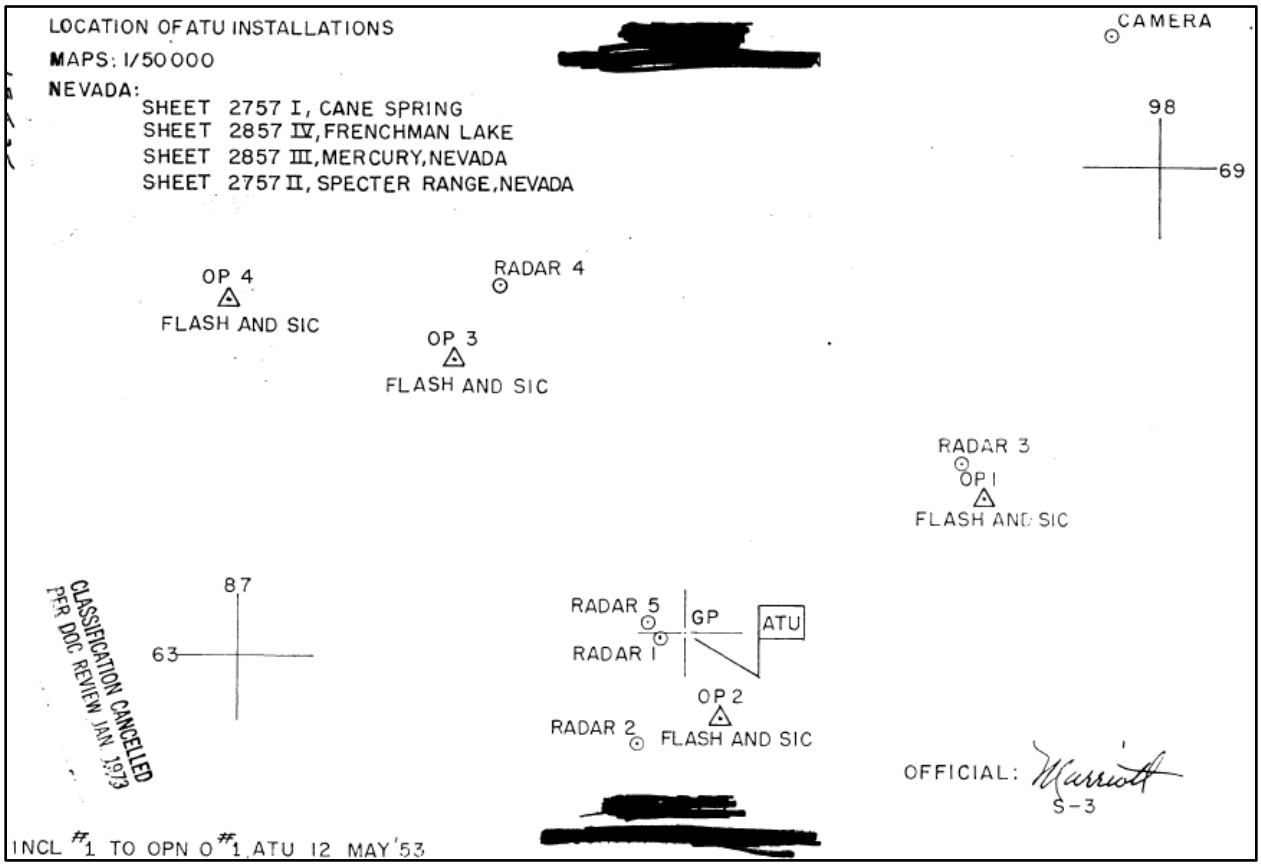
a. Command Posts:

(1). Field: vicinity of Gun Position 592234E 4063510N [Coordinates converted to UTM zone 11, NAD 83]

(2). Administrative: Camp Desert Rock, Block 8.

b. Communications Plan (Incl. 2)

ARMSTRONG
Colonel



Inclusion #2

Communications Plan

1. The following communications will be established and maintained by the Communications Platoon, ATU.
    a. Wire
        (1). Two (2) direct lines from each Flash Observation Point (O.P.) to the flash switchboard at the ATU Field Command Post.
            (a) BC Scope O.P.s will utilize communications nearest respective Flash O.P. Lines being so utilized to be party lined from switchboard at the Flash Control to SIC
        (2). Two (2) direct lines from each of the following RADARs to RADAR Control.
            (a) RADAR 1.
            (b) RADAR 2.
            (c) RADAR 3.
            (d) RADAR 4.
            (e) RADAR 5.
        (3). Two (2) direct lines from the following installations to the main ATU switchboard.
            (a) Flash Control
            (b) RADAR Control
            (c) Chronograph
            (d) Camera
            (e) Metro Station
        (4). Six (6) local lines from the main ATU switchboard to the FDC.
            (a) These 6 lines to be manned by 6 telephone operators designated as follows and to handle from the following installations:
                (1) Metro
                (2) SIC
                (3) RADAR Control
                (4) Flash Control
                (5) Chronograph
                (6) All other calls
        (5). One (1) local line from the main ATU switchboard to the following:

(a) Briefing Tent

(b) Command Tent

(c) Both gun positions

(d) Gate to enclosure

(6). Two (2) class "A" trunks to be installed into main ATU switchboard from Camp Mercury. These trunks to be laid by Camp Mercury.

(7). One (1) direct line between FDC and each gun position. Special Gun Fire Direct Operator to be at FDC.

b. Radio

(1). RADAR Net Each RADAR and RADAR Control will operate in this net.

(2). Flash Net Each Flash OP and Flash Control will operate in this net.

(3). Control Net FDC and the following stations will operate in this net:

(a) ATU Commander

(b) RADAR Control

(c) Flash Control

(d) Ordnance Control

Inclusion #3

Schedule of Events

D Minus 5 Days
[May 20, 1953]

ITEM NO.	HOUR	EVENT
1.	0850	Gun and camera report "READY" to FDC Duty Operator
2.	0900	FDC Duty Operator report, by phone, to CP that ATU is ready to check firing and camera circuits.
3.	1000	Fire primer, check circuits.
4.	1350	Gun and camera report "READY" to FDC Duty Operator
5.	1400	FDC Duty Operator report, by phone, to CP that ATU is ready to check firing and camera circuits.
6.	1500	Fire primer, check circuits.
		D Minus 4 Days **[May 21, 1953]**
7.	0850	Gun and camera report "READY" to FDC Duty Operator
8.	0900	FDC Duty Operator report, by phone, to CP that ATU is ready to check firing and camera circuits.
9.	1000	Fire primer, check circuits.
10.	1350	Gun and camera report "READY" to FDC Duty Operator
11.	1400	FDC Duty Operator report, by phone, to CP that ATU is ready to check firing and camera circuits.
12.	1500	Fire primer, check circuits.
13.	2030	Necessary personnel occupy stations.
14.	2045	1st communications check.
15.	2100	Communications officer reports status of communications to Operations Officer.
16.	2105	Flash, Metro, RADAR, Ordnance detachment, SIC, Gun, Camera, and Chronograph report installations ready to Operations Officer.
17.	2110	Operations Officer report installations ready to ATU Commander
18.	2200	2nd communications check.
19.	2300	3rd communications check.
20.	2359	4th communications check.

D Minus 3 Days
[May 22, 1953]

21.	0100	5th communications check.
22.	0200	6th communications check.
23.	0300	7th communications check.
24.	0330	Nuclear component brought to building CP10.
25.	0345	All personnel move to Gun position for breakfast.
26.	0350	Load M-102 carrying cases with nuclear into ¾ ton delivery vehicle [probably an M-37].
27.	0400	8th communications check.
28.	0415	Assemble nuclear delivery convoy.
29.	0430	Nuclear convoy departs building CP10-access road, Mercury Highway, Pumphouse [Short Pole Line] Road, and Gun access road to assembly van.
30.	0430	Metro center delivers 1st Metro to Operations Officer.
31.	0445	All personnel return to positions and report "READY" to Operations Officer.
32.	5020	Nuclear delivery convoy arrives at Gun position.
33.	0530	Ordnance detachment starts to assemble shells; ordnance recovery crew in standby positions
34.	0530	Metro center delivers 2nd Metro to Operations Officer.
35.	0532	Fire 1st warm-up round. [Actual time: 0544]
36.	0544	Fire 2nd warm-up round. [Actual time: 0601]
37.	0556	Fire 3rd warm-up round. [Actual time: 0615]
Note for Flash and SIC:		During the following high burst registration, Flash and/or SIC will report immediately to Operations Officer, any round which in their opinion is erratic. The report will include the variation in dE, dN, and dH of the erratic round from the desired point. Otherwise, no reports of round locations will be made until the completion of the registration.
38.	0608	Fire 1st High burst [HB] round. [Actual time: 0642]
39.	0620	Fire 2nd HB round. [No notes]
40.	0630	Metro center delivers 3rd Metro to Operations Officer.
41.	0632	Fire 3rd HB round. [No notes]
42.	0644	Fire 4th HB round. [No notes]
43.	0656	Fire 5th HB round. [Actual time: 0654]

44.	0708	Fire 6th HB round. [Actual time: 0703]
45.	0720	Fire 7th HB round (if required). [Actual time: 0654]
46.	0730	Metro center delivers 4th Metro to Operations Officer.
47.	0735	Flash and SIC report mean location of HB to Operations Officer.
48.	0737	RADAR report location data to Operations Officer.
49.	0745	Unless notified otherwise, Flash, RADAR, Metro, SIC, and Chronograph Personnel start taking cover.
50.	0745	Operations Officer calls Mr. Greer (8226) and informs him of the Time of Flight for the OST round.
51.	0748	Operations Officer report "FIRE DATA READY" to ATU Commander.
52.	0750	Fuze setting to Ordnance detachment.
53.	0755	Flash, RADAR, and Metro report to Operations Officer, "ALL PERSONNEL UNDER COVER."
54.	0758	SI, and Chronograph report to Operations Officer, "ALL PERSONNEL UNDER COVER."
55.	0800	Communications officer report to Operations Officer, "ALL COMMUNICATION PERSONNEL UNDER COVER."
56.	0802	Operations Officer report "ALL PERSONNEL EXCEPT GUN AND ORDNANCE DETACHMENT UNDER COVER" to ATU Commander.
57.	0805	Fire commands to Gun, "LOAD PROJECTILE ONLY."
58.	0810	After projectile is loaded and properly rammed, all personnel not required for loading the propellant and laying the gun will take cover.
59.	0812	Ordnance Commander reports to Operations Officer "ALL PERSONNEL UNDER COVER."
60.	0824	Operations Officer to Gun "LOAD PROPELLANT AND COMPLETE LAYING."
61.	0826	Battery Commander reports to Operations Officer "GUN IS READY TO FIRE, ALL GUN PERSONNEL UNDER COVER."
62.	0827	Operations Officer report "GUN IS READY TO FIRE ALL OPERATIONAL ATU PERSONNEL UNDER COVER" to ATU Commander.
63.	0828	ATU Commander notifies Test Director by light signal ands telephone "GUN IS READY" and closes firing circuit.

64.	0830 minus flight time	OST Round is Fired
65.	0830	Burst.
66.	0832	Ordnance recovery crew moves into impact area.
67.	0845	Metro center delivers 5th Metro to Operations Officer.
68.	0845	ATU Commander announces release of ATU personnel not required for circuit check.
69.	0850	Gun report "READY" to FDC Duty Officer.
70.	0900	FDC Duty Officer report, by phone, to Command Post that ATU is ready to check firing and camera circuits.
71.	0930	Metro center delivers 6th Metro to FDC Duty Officer.
72.	1000	Fire primer, check circuits.
73.	1350	Gun report "READY" to FDC Duty Officer.
74.	1400	FDC Duty Officer report, by phone, to Command Post that ATU is ready to check firing and camera circuits.
75.	1500	Fire primer, check circuits.
		D Minus 2 Days [May 23, 1953]
76.	0850	Gun report "READY" to FDC Duty Officer.
77.	0900	FDC Duty Officer report, by phone, to Command Post that ATU is ready to check firing and camera circuits.
78.	1000	Fire primer, check circuits.
79.	1350	Gun report "READY" to FDC Duty Officer.
80.	1400	FDC Duty Officer report, by phone, to Command Post that ATU is ready to check firing and camera circuits.
81.	1500	Fire primer, check circuits.
		D Minus 1 Day [May 24, 1953]
82.	0850	Gun report "READY" to FDC Duty Officer.
83.	0900	FDC Duty Officer report, by phone, to Command Post that ATU is ready to check firing and camera circuits.
84.	1000	Fire primer, check circuits.
85.	1350	Gun report "READY" to FDC Duty Officer.

86.	1400	FDC Duty Officer report, by phone, to Command Post that ATU is ready to check firing and camera circuits.
87.	1500	Fire primer, check circuits.

D Day
[May 24-25, 1953]

1.	H-12 [2030]	Necessary personnel occupy stations.
2.	H-11:45 [2045]	1st communications check.
3.	H-11:30 [2100]	Communications officer reports status of communications to Operations Officer.
4.	H-11:25 [2105]	Flash, Metro, RADAR, Ordnance detachment, SIC, Gun, Camera, and Chronograph report installations ready to Operations Officer.
5.	H-11:20 [2110]	Operations Officer report installations ready to ATU Commander
6.	H-10:30 [2200]	2nd communications check.
7.	H-9:30 [2300]	3rd communications check.
8.	H-8:30 [0001]	4th communications check.
9.	H-7:30 [0100]	5th communications check.
10.	H-6:30 [0200]	6th communications check.
11.	H-5:30 [0300]	7th communications check.
12.	H-5 [0330]	Nuclear component brought to building CP10.
13.	H-4:45 [0345]	All personnel move to Gun position for breakfast.
14.	H-4:40 [0350]	Load M-102 carrying cases with nuclear into ¾ ton delivery vehicle.
15.	H-4:30 [0400]	8th communications check.
16.	H-4:15 [0415]	Assemble nuclear delivery convoy.

17.	H-4 [0430]	Nuclear convoy departs building CP10-access road, Mercury Highway, Pumphouse [Short Pole Line] Road, and Gun access road to assembly van.
18.	H-4 [0430]	Metro center delivers 1st Metro to Operations Officer.
19.	H-3:45 [0445]	All personnel return to positions and report "READY" to Operations Officer.
20.	H-3:10 [5020]	Nuclear delivery convoy arrives at Gun position.
21.	H-3 [0530]	Ordnance detachment starts to assemble shells; ordnance recovery crew in standby positions
22.	H-3 [0530]	Metro center delivers 2nd Metro to Operations Officer.
23.	H-2:58 [0532]	Fire 1st warm-up round.
24.	H-2:46 [0544]	Fire 2nd warm-up round
25.	H-2:34 [0556]	Fire 3rd warm-up round
Note for Flash and SIC:		During the following high burst registration, Flash and/or SIC will report immediately to Operations Officer, any round which in their opinion is erratic. The report will include the variation in dE, dN, and dH of the erratic round from the desired point. Otherwise, no reports of round locations will be made until the completion of the registration.
26.	H-2:22 [0608]	Fire 1st HB round.
27.	H-2:11 [0619]	Fire 2nd HB round.
28.	H-2 [0630]	Metro center delivers 3rd Metro to Operations Officer.
29.	H-1:58 [0632]	Fire 3rd HB round.
30.	H-1:46 [0644]	Fire 4th HB round.
31.	H-1:34 [0656]	Fire 5th HB round.
32.	H-1:22 [0708]	Fire 6th HB round.

33.	H-1:10 [0720]	Fire 7th HB round (if required).
34.	H-1hr [0730]	Metro center delivers 4th Metro to Operations Officer.
35.	H-0:55 [0735]	Flash and SIC report mean location of HB to Operations Officer.
36.	H-0:53 0737	RADAR report location data to Operations Officer.
37.	H-0:45 [0745]	Unless notified otherwise, Flash, RADAR, Metro, SIC, and Chronograph Personnel start taking cover.
38.	H-0:45 [0745]	Operations Officer calls Mr. Greer (8226) and informs him of the Time of Flight for the OST round.
39.	H-0:42 [0748]	Operations Officer report "FIRE DATA READY" to ATU Commander.
40.	H-0:40 [0750]	Fuze setting to Ordnance detachment.
41.	H-0:35 [0755]	Flash, RADAR, and Metro report to Operations Officer, "ALL PERSONNEL UNDER COVER."
42.	H-0:32 [0758]	SI, and Chronograph report to Operations Officer, "ALL PERSONNEL UNDER COVER."
43.	H-0:30 [0800]	Communications officer report to Operations Officer, "ALL COMMUNICATION PERSONNEL UNDER COVER."
44.	H-0:28 [0802]	Operations Officer report "ALL PERSONNEL EXCEPT GUN AND ORDNANCE DETACHMENT UNDER COVER" to ATU Commander.
45.	H-0:25 [0805]	Fire commands to Gun, "LOAD PROJECTILE ONLY."
46.	H-0:20 [0810]	After projectile is loaded and properly rammed, all personnel not required for loading the propellant and laying the gun will take cover.
47.	H-0:18 [0812]	Ordnance Commander reports to Operations Officer "ALL PERSONNEL UNDER COVER."
48.	H-0:06 [0824]	Operations Officer to Gun "LOAD PROPELLANT AND COMPLETE LAYING."
49.	H-0:04 [0826]	Battery Commander reports to Operations Officer "GUN IS READY TO FIRE, ALL GUN PERSONNEL UNDER COVER."
50.	H-0:03 [0827]	Operations Officer report "GUN IS READY TO FIRE ALL OPERATIONAL ATU PERSONNEL UNDER COVER" to ATU Commander.

51.	H-0:02 [0828]	ATU Commander notifies Test Director by light signal and telephone "GUN IS READY" and closes firing circuit.
52.	H-flight time [0829:41]	MK 9 Round is fired
53.	H [0830]	Burst.
54.	H+1 hr [0845]	Metro center delivers 5th Metro to Operations Officer.

End of Operations Order 1, Battery A, 867th FA Battalion Artillery Test Unit (ATU), with minor edits.

Operations Order 7, Exercise Desert Rock V
Head Quarters, Camp Desert Rock
171200 May 1953

Task Organization:

Exercise Director — Brig. Gen. W. C. Bullock

Control Group — Col. E.F. Thelon, Commanding

CDR [Camp Desert Rock] Staff and Control Personnel

Observer Group — Capt. E.A. Ditzel, Commanding

Approximately 700 observers from all services.

BCT ABLE (1200 Troops)

1 BCT (1 Infantry Company, 1 Artillery Battery, and 1 Armored Company) from Fourth Army

1 Infantry Company and 1 Armored Company from Third Army

1 Artillery Battery from Sixth Army

BCT BAKER (1200 Troops)

1 BCT (1 Infantry Company, 1 Artillery Battery, and 1 Armored Company) from Fifth Army

1 Infantry Company and 1 Armored Company from Second Army

1 Artillery Battery from First Army

9th Ordnance Battalion (SWS) and Attachments — Lt. Col. Kloos, Commanding

160 Officers and EM from Sandia Base, New Mexico.

1. [GENERAL SITUATION]
   a. [Enemy forces] None.
   b. [Friendly forces] See Annex I (Tactical Situation)
   c. [Assumptions] Atomic Energy Commission detonates KNOTHOLE 2 [Grable] Nuclear Explosion, 23 May 1953, in which approximately 3,300 Army Troops and special observers will participate.
2. [MISSION]
   a. HQ Camp Desert Rock will conduct Exercise Desert Rock V-10, 23 May at Nevada Proving Grounds [NNSS] to:
      (1). Provide indoctrination training in the tactical employment of atomic weapons and the effects of such weapons on personnel and equipment.
      (2). Provide realistic training for tactically disposed units supported by atomic weapons (artillery).
      (3). Provide realistic training in essential protective measures.
      (4). Determine psychological reaction of participating troops.

(5). Demonstrate the effects of the explosion on animals at selected distances from ground zero.
(6). Demonstrate the effects of the explosion on many types of ground force equipment at varying distances from ground zero.

b. 867 Field Artillery Battalion (280 mm Atomic) supports attack with 1 battery.
c. H-Hour: 0830 (PDT)
d. Artillery gun position located at 592234E 4063510N [Coordinates converted to UTM zone 11, NAD 83]
e. Troops and observers will occupy positions in Frenchman Flat, 5000 yards from ground zero.

3. [TASKS FOR SUBORDINATE UNITS]
   a. CONTROL GROUP
      (1). Consists of personnel and vehicles as indicated in Annex 3 (Personnel and Vehicles).
      (2). Move to forward area in accordance with Annex 2 (March Table).
      (3). Provide commentary of events over PA system at entrenchment area from H-60 [0730] to H- 5 [0825] minutes.
      (4). Implement provisions of Annexes 1, 5, 6, 7, 8, and 9.
      (5). Participate in exercise in accordance with Annex 4 (Schedule of Events).
   b. OBSERVER GROUP
      (1). Consists of personnel and vehicles as indicated in Annex 3.
      (2). Move to forward area in accordance with Annex 2.
      (3). Participate in exercise in accordance with Annex 4
   c. BCT ABLE
      (1). Familiarize all personnel with the general and special situation and special maneuver exercise, Annex 1 (Tactical Situation).
      (2). Move to entrenchment area in accordance with Annex 2, occupy previously prepared positions. Attack on order, seize Objective 2.
      (3). Participate in exercise in accordance with Annexes 1 thru 9.
   d. BCT BAKER
      (1). Same as c. (1) and (3) above.
      (2). Move to entrenchment area in accordance with Annex 2, occupy previously prepared positions. Attack on order, seize Objective 4. Prepare to continue attack on order.
   e. 9TH ORDNANCE BATTALION (SWS) AND ATTACHMENTS
      (1). Same as Paragraph 3 b. above.
   x. [Instructions applicable to two or more subordinate units]
      (1). Muster as directed in Annex 4.
      (2). All personnel will carry gas masks and be familiar with provisions of Annex 7 (Rad-Safe Plan).
      (3). One (1) individual per platoon or vehicle in BCTs will be issued a film badge to be taken into the forward area. Observer monitors will wear film badges.
      (4). All personnel will be familiar with provisions of Annex 9 (Evacuation Plan).
      (5). All personnel will enter trenches at H-10 minutes [0820] on order of the Exercise Director.

(6). All personnel will be informed that two (2) minutes prior to H-Hour [0828], a 30 second siren signal will be sounded. At this time the Exercise Director will order all participants to crouch in the trenches well below the surface of the ground and remain in that position until the announcement to rise is made over the PA System.

(7). Positive control measures will be exercised by officers in charge of vehicles and march units during movement to and from the forward area. During foot movements, personnel control will be exercised by BCT and company commanders.

(8). The officer(s) in charge of the observation group(s) will maintain control of this (theses) group(s) during motor movement and walk through exercise area.

(9). Personnel will be cautioned not to pick up items in the equipment display area or in vicinity of ground zero.

(10). [REDACTED]

(11). Scientific instrumentation in the maneuver area will not be disturbed. Troops will bypass or maneuver around installations.

4. [ADMINISTRATIVE AND LOGISTICAL MATTERS]

a. Current Administrative instructions apply.

b. Transportation

(1). Vehicles and drivers name, as required, will be furnished by AC of S, G4 [Assistant Chief of Staff, General Staff Logistics Shop]

(2). Vehicles will bear numbers, signs, and colored flags as indicated in Annex 3.

(3). One (1) water trailer (full of water) will be located at the end of the second march unit of each BCT. This vehicle is an auxiliary in event of a breakdown in order that personnel may continue to or from test area.

(4). Each march unit, other than units mentioned in (3) above, mill have a spare (empty) bus or 2 ½ ton truck moving at end of same.

(5). Two wreckers will be located at the rear of the observer march unit during move to forward area and in rear of control group for return trip. Vehicles breaking down during movement to test area will be moved to side of road until return trip to Camp Desert Rock. At this time wreckers will tow all non-operational vehicles to camp only after all march units have started return trip to camp.

(6). Vehicles in march units will have headlights turned on during movement. Motors will be turned off at H-30 [0800] minutes.

c. Medical – See Annex 8

(1). Aid Station will be established in Parking Area D (875E 687N)

(2). Litter equipped helicopter will be available for evacuation purposes in vicinity of aid station.

d. Uniform and Equipment

(1). Individual participants and non-tactical troops.

HBT Jacket and trousers
Combat Boots or Service Shoes
Field Jackets (as necessary)
Pistol Belt
Canteen w/cover and cup (containing water)
First aid packet and pouch

Gas mask
Helmet, steel with liner.

(2). Troops
Same as (1) above. Carry individual weapons.

e. AC of S, G4 will distribute sandwich lunches to participating troops in the forward area prior to H-60 minutes [0730]. No lunches necessary for observer personnel. Eating is not permitted in contaminated areas.

5. [COMMAND AND SIGNAL]
   a. SOI #1, Annex 6.
   b. Forward Command opens H-60 minutes [0730] at entrenchment area control trench.

BULLOCK
Brig. Gen.

ANNEXES:
1. Tactical Situation
2. March Table
3. Personnel and Vehicles
   (To be published)
4. Schedule of Events
5. MP Control
6. Signal
7. Rad-Safe
8. Medical
9. Evacuation Plan
10. Evaluation Plan

DISTRIBUTION: Special

OFFICIAL:
/s
SHOOKUS
G3

Annex 1 (TACTICAL SITUATION) to OPORD 7
EXERCISE DESERT ROCK V

1. General Situation:
   a. Enemy
      (1) After a successful airborne landing in Southern Nevada during mid-December, Aggressor Forces, and airborne army consisting of three (3) airborne corps, forced Third Army to take up the defense in the vicinity of Las Vegas.
      (2) By 1 Jan 1953, Aggressor's overwhelming strength caused a weakened Third Army to conduct a retrograde movement southward along Highway 91 towards Barstow, California. A rapid buildup by Third Army in the Barstow area was completed by 15 January, causing the Aggressor Forces to assume the defensive.
      (3) By 12 May, Aggressor Forces had fallen back to an organized defensive position in Frenchman Flat. A second defensive line was being prepared in the Yucca Pass (See Annex 1, Situation Overlay). Aggressor launched a counterattack on 15 May and a salient [AKA bulge] in the sector of V Corps.
   b. Friendly
      (1) On 1 Feb 1953, after a buildup in the Barstow area, Third Army launched a counter offensive with the mission of recapturing Las Vegas and continuing the attack north to destroy the enemy forces.
      (2) Aggressor Forces opposing Third Army have been executing a delaying action and by 12 May had fallen back to an organized defensive position in Frenchman Flat, anchored on the Ranger Mountain Ranges on the east and extending to the west and east thereof.
      (3) After being forced to give ground to Aggressor counterattack, CG [Commanding General] Third Army plans to resume the attack on 23 May, using atomic missiles to support the attack, to reduce the salient in the west of his zone and drive Aggressor Forces to the north.
2. Special Situation:
   a. V Corps, west (L) Corps of Third Army, consisting of the 10th and 40th Infantry Divisions on line and 13th Armored and 45th Infantry Divisions in reserve, will make the main effort of the Third Army to breach enemy defenses in Frenchman Flat, after the salient has been reduced, and be prepared to continue the battle to the north. V Corps regrouping for the attack will be completed night of 22–23 May.
   b. During the past 96 hours, Aggressor has been forcing V Corps to give ground in the sector of 10th Infantry Division. Friendly forces have halted Aggressor's breakthrough in Frenchman Lake (dry) and the present situation is as indicated on Situation Overlay. Intelligence sources indicate Aggressor is planning to resume the attack and a force, estimated to be a rifle division, is assembling in vicinity of Frenchman Forrest [593600E 4072680N]. V Corps has been allotted nine (9) atomic weapons to support the attack. Four (4) MK 9 (Artillery), three (3) MK 6 (Airdrop), and two (2) MK 7 (SSM) {surface-to-surface missile] missiles are included in the allotted number. Battery A, 867th Field Artillery Battalion and a Corporal Missile Battery will support the attack.
3. Scheme of Maneuver:

a. V Corps conducts offensive 230830 May [08:30 AM, May 23rd]. The attack will be preceded by an artillery preparation followed by shelling of Aggressor's Rifle Division with two (2) atomic projectiles.
b. V Corps will breach the first defensive zone and seize objectives short of Aggressor's second defensive line. On seizer of these objectives, V Corps will use additional atomic weapons at points against the second defensive zone where a rupture is desired and make maximum use of the atomic fire support with a rapid continuation of the attack by infantry divisions to seize objectives which will insure the penetration of the final defensive line. At this time, V Corps will pass the 13th Armored Division and the 45th Motorized Infantry through the Yucca Pass to seize Corp objectives to the north.
c. The 10th Infantry Division on the east (R) will make the main effort of the V Corp. In mapping this scheme of maneuver, CG 10th Infantry Division will organize a hard-striking force (28th Motorized Infantry Regiment, reinforced with armor and other necessary combat service attachments), capable of independent action to attack deep objectives. The initial attack to reduce the salient will be made by the 29th Infantry Regiment, When the salient is reduced, the 28th Infantry Reinforcements on the west (L). Upon breaching the final defensive line and seizure of Objectives 3, 8, and 10, the 10th Infantry Division will assist the passage of the armored and motorized infantry divisions through Yucca Pass and mop up enemy pockets of resistance bypassed by the exploiting force.

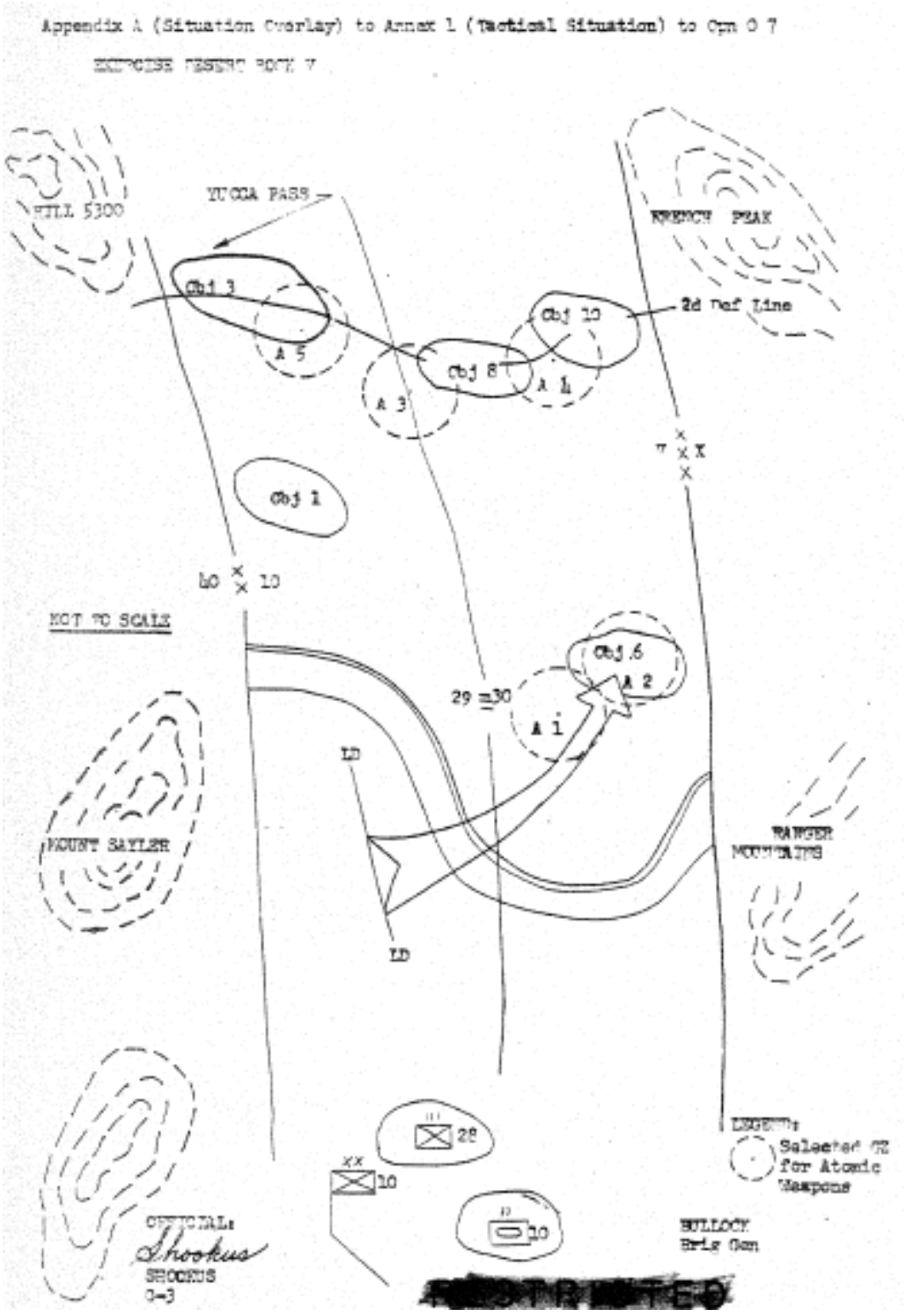
4. Special Exercise:
a. Participation troops, BCT ABLE and BCT BAKER are attached to 10th Infantry Division and will be identified as the 29th Infantry Regiment.
b. BCTs will occupy prepared positions west of Frenchman Lake, 5,000 yards from Ground Zero, prior to 230830 May 1953.
c. Following the atomic shelling, and on order of the Exercise Director, BCTs will attack to seize Objectives 2 and 4. On seizure of Objectives and/or order of the Exercise Director, BCTs will move through the equipment and animal display area where members of the CDR Instructor Group will provide a commentary on damage caused by the atomic shelling of the area. Upon completion of this phase of the exercise, troops will be marched to transportation for return journey to Camp Desert Rock.
d. Immediately following the attack, observer personnel (to include 9th Ordnance Battalion and Attachments) will be transported to the display area to observe damaged equipment and animals. Observers will be given an opportunity to view a 280mm Gun, in position, on return journey to Camp Desert Rock.

BULLOCK
Brig Gen

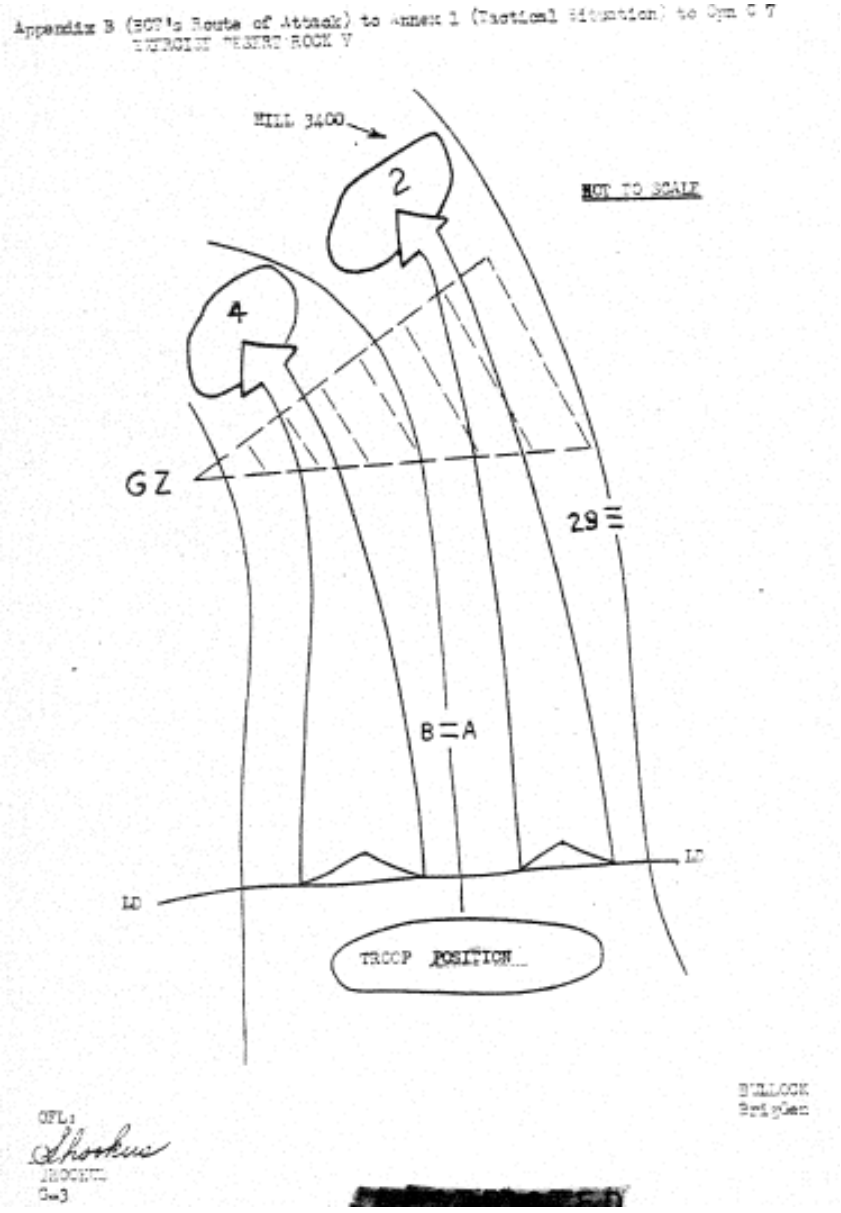
Appendix:
A – Situation Overlay
B – BCTs Route of Attack

DISTRIBUTION: Special

OFFICIAL: /s
SHOOKUS, G3
Appendix A
Annex 1 (TACTICAL SITUATION) to OPORD 7
EXERCISE DESERT ROCK V



Appendix B
Annex 1 (TACTICAL SITUATION) to OPORD 7
EXERCISE DESERT ROCK V



Annex 2 to OPORD 7 EXERCISE DESERT ROCK V – Not here reproduced
Annex 3 to OPORD 7 EXERCISE DESERT ROCK V – Not present in archive

Annex 4 (SCHEDULE OF EVENTS) to OPORD 7
EXERCISE DESERT ROCK V

1. Control Group

TENTATIVE TIME	ADJUSTED TIME	EVENT
0412	H-256 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0452	H-218	Depart Camp Desert Rock
0456	H-214	Arrive IP
0501	H-209	Arrive Control Gate #1
0506	H-204	Arrive Control Gate #2
0509	H-201	Arrive RJ 50 [ ]
0518	H-192	Arrive RJ 74 [ ]
0523	H-187	Arrive RJ 67 [ ]
0532	H-178	Arrive RJ 68
0536	H-174	Arrive RJ 69
0538	H-172	Arrive RJ 70
0543	H-167	Vehicles depart for Parking Area D [ ]
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0850	H+20	Control Group depart entrenchment area for forward area. One officer to remain at CP at all times, keep in constant touch with CP of AEC
1220	H+230	Control Group returns to entrenchment area.
1230	H+240	Vehicle commanders will muster and have personnel entruck.
1305	H+275	Depart for Camp Desert Rock
1340	H+310	RJ 52
1345	H+315	RJ 50

1348	H+318	Control Gate #2
1353	H+323	Control Gate #1
1358	H+328	IP
1402	H+332	Camp Desert Rock, Detruck and return film badges to issuing party

2. a. BCT BAKER (1)

TENTATIVE TIME	ADJUSTED TIME	EVENT
0427	H-243 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0507	H-203	Depart Camp Desert Rock
0511	H-199	Arrive IP
0516	H-194	Arrive Control Gate #1
0521	H-189	Arrive Control Gate #2
0524	H-186	Arrive RJ 50
0533	H-177	Arrive RJ 74
0538	H-172	Arrive RJ 67
0547	H-163	Arrive RJ 68
0551	H-178	Arrive RJ 69
0555	H-155	Arrive RJ 70 (Control Point for Detrucking)
0600	H-150	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0840	H+10	Attack on order from Exercise Director to seize Objective as outlined in Annex 1. The BCT Commander will be equipped with radio and will be in constant contact with Rad-Safe Control Officer and Exercise Director.
1055	H+145	Depart Objective for walk through of equipment display area.

1155	H+205	March Unit Commanders will muster and entruck personnel. Radio contact, via MP Jepp, will notify CP when all personnel have been accounted for and entrucked. CP will give order to depart.
1225	H+235	Depart for Camp Desert Rock
1300	H+270	RJ 52
1305	H+275	RJ 50
1308	H+278	Control Gate #2
1313	H+283	Control Gate #1
1318	H+288	IP
1322	H+292	Camp Desert Rock, Detruck and return film badges to issuing party

2. b. BCT BAKER (2)

TENTATIVE TIME	ADJUSTED TIME	EVENT
0437	H-233 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0517	H-193	Depart Camp Desert Rock
0521	H-189	Arrive IP
0526	H-184	Arrive Control Gate #1
0531	H-179	Arrive Control Gate #2
0534	H-176	Arrive RJ 50
0533	H-167	Arrive RJ 74
0548	H-162	Arrive RJ 67
0557	H-153	Arrive RJ 68
0601	H-149	Arrive RJ 69
0605	H-145	Arrive RJ 70 (Control Point for Detrucking)
0610	H-140	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area

0840	H+10	Attack on order from Exercise Director to seize Objective as outlined in Annex 1. The BCT Commander will be equipped with radio and will be in constant contact with Rad-Safe Control Officer and Exercise Director.
1055	H+145	Depart Objective for walk through of equipment display area.
1155	H+205	March Unit Commanders will muster and entruck personnel. Radio contact, via MP Jepp, will notify CP when all personnel have been accounted for and entrucked. CP will give order to depart.
1235	H+245	Depart for Camp Desert Rock
1310	H+280	RJ 52
1315	H+285	RJ 50
1318	H+288	Control Gate #2
1323	H+293	Control Gate #1
1328	H+298	IP
1332	H+302	Camp Desert Rock, Detruck and return film badges to issuing party

3. a. BCT ABLE (1)

TENTATIVE TIME	ADJUSTED TIME	EVENT
0452	H-218 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0532	H-178	Depart Camp Desert Rock
0536	H-174	Arrive IP
0541	H-169	Arrive Control Gate #1
0546	H-164	Arrive Control Gate #2
0549	H-161	Arrive RJ 50
0558	H-152	Arrive RJ 74
0603	H-147	Arrive RJ 67
0612	H-138	Arrive RJ 68
0616	H-134	Arrive RJ 69
0620	H-130	Arrive RJ 70 (Control Point for Detrucking)

0625	H-125	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0840	H+10	Attack on order from Exercise Director to seize Objective as outlined in Annex 1. The BCT Commander will be equipped with radio and will be in constant contact with Rad-Safe Control Officer and Exercise Director.
1055	H+145	Depart Objective for walk through of equipment display area.
1155	H+205	March Unit Commanders will muster and entruck personnel. Radio contact, via MP Jepp, will notify CP when all personnel have been accounted for and entrucked. CP will give order to depart.
1245	H+255	Depart for Camp Desert Rock
1320	H+290	RJ 52
1325	H+295	RJ 50
1328	H+298	Control Gate #2
1333	H+303	Control Gate #1
1338	H+308	IP
1342	H+312	Camp Desert Rock, Detruck and return film badges to issuing party

3. b. BCT ABLE (2)

TENTATIVE TIME	ADJUSTED TIME	EVENT
0502	H-208 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0542	H-168	Depart Camp Desert Rock
0546	H-164	Arrive IP
0551	H-159	Arrive Control Gate #1
0556	H-154	Arrive Control Gate #2
0559	H-151	Arrive RJ 50
0608	H-142	Arrive RJ 74

0613	H-137	Arrive RJ 67
0622	H-128	Arrive RJ 68
0626	H-124	Arrive RJ 69
0630	H-120	Arrive RJ 70 (Control Point for Detrucking)
0636	H-115	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0840	H+10	Attack on order from Exercise Director to seize Objective as outlined in Annex 1. The BCT Commander will be equipped with radio and will be in constant contact with Rad-Safe Control Officer and Exercise Director.
1055	H+145	Depart Objective for walk through of equipment display area.
1155	H+205	March Unit Commanders will muster and entruck personnel. Radio contact, via MP Jepp, will notify CP when all personnel have been accounted for and entrucked. CP will give order to depart.
1255	H+265	Depart for Camp Desert Rock
1330	H+300	RJ 52
1335	H+305	RJ 50
1338	H+308	Control Gate #2
1343	H+313	Control Gate #1
1348	H+318	IP
1352	H+322	Camp Desert Rock, Detruck and return film badges to issuing party

4. 9th Ordnance Battalion (SWS)

TENTATIVE TIME	ADJUSTED TIME	EVENT
0517	H-193 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0557	H-153	Depart Camp Desert Rock
0601	H-149	Arrive IP

0606	H-144	Arrive Control Gate #1
0611	H-139	Arrive Control Gate #2
0614	H-136	Arrive RJ 50
0623	H-127	Arrive RJ 74
0628	H-122	Arrive RJ 67
0637	H-112	Arrive RJ 68
0641	H-109	Arrive RJ 69
0645	H-105	Arrive RJ 70 (Control Point for Detrucking)
0650	H-100	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0910	H+40	Leave entrenchment area for walk through display area.
1032	H+122	Depart Objective for walk through of equipment display area.
1102	H+152	Depart for Camp Desert Rock
1134	H+184	RJ 52
1139	H+189	RJ 50
1142	H+192	Control Gate #2
1147	H+197	Control Gate #1
1152	H+202	IP
1156	H+206	Camp Desert Rock, Detruck and return film badges to issuing party

5. Observers

TENTATIVE TIME	ADJUSTED TIME	EVENT
0532	H-178 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0612	H-138	Depart Camp Desert Rock
0616	H-134	Arrive IP

0621	H-129	Arrive Control Gate #1
0626	H-124	Arrive Control Gate #2
0629	H-121	Arrive RJ 50
0638	H-112	Arrive RJ 74
0643	H-107	Arrive RJ 67
0652	H-98	Arrive RJ 68
0656	H-94	Arrive RJ 69
0700	H-90	Arrive RJ 70 (Control Point for Detrucking)
0705	H-85	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0855	H+25	Leave entrenchment area for walk through display area.
1017	H+107	Depart Objective for walk through of equipment display area.
1047	H+137	Depart for Camp Desert Rock
1119	H+169	RJ 52. Observer Group will enter parking area and observe 280mm Gun.
1154	H+204	RJ 50
1157	H+207	Control Gate #2
1202	H+212	Control Gate #1
1207	H+217	IP
1211	H+221	Camp Desert Rock, Detruck and return film badges to issuing party

5. VIPs

TENTATIVE TIME	ADJUSTED TIME	EVENT
0558	H-152 min	March Unit Commanders will muster, check film badges. Check to see individuals do not have cameras or binoculars and have personnel entruck. Make fine (5) copies of Annex 3 and give to messenger. Messenger will leave 10 minutes before March Unit departs.
0638	H-112	Depart Camp Desert Rock
0640	H-110	Arrive IP

0642	H-108	Arrive Control Gate #1
0646	H-104	Arrive Control Gate #2
0649	H-101	Arrive RJ 50
0655	H-95	Arrive RJ 74
0658	H-92	Arrive RJ 67
0707	H-83	Arrive RJ 68
0711	H-79	Arrive RJ 69
0715	H-75	Arrive RJ 70 (Control Point for Detrucking)
0720	H-70	Vehicles depart for Parking Area D
0730	H-60	Indoctrination and Orientation talk over PA System.
0830	H	SHOT
0835	H+5	Rad-Safe Team departs to comply with Annex 7
ON CALL		Vehicles will return to entrenchment area
0850	H+20	Leave entrenchment area for walk through display area.
1012	H+102	Personnel will be brushed off, muster, and entrucked. Radio contact, via MP jeep, with CP will notify same when all personnel are accounted for and entrucked. CP will give order to depart the test area.
1022	H+112	Depart for Camp Desert Rock
1057	H+147	RJ 52
1100	H+150	RJ 50
1103	H+153	Control Gate #2
1107	H+157	Control Gate #1
1109	H+159	IP
1113	H+163	Camp Desert Rock, Detruck and return film badges to issuing party

BULLOCK
Brig Gen

Appendix:
A – Movement Plan to Entrenchment Area [Not here reproduced]
B – Movement Routes Following Walk Through [Not here reproduced]

DISTRIBUTION: Special

OFFICIAL:
/s
SHOOKUS, G3

Annex 5–10 of OPORD 7 EXERCISE DESERT ROCK V – Not here reproduced

APPENDIX D

VIP Observers

THIS PAGE INTENTIONALLY LEFT BLANK

The following table describes the full U.S. House delegation present at the VIP viewing benches during the Grable test. Attendance has been extracted from the itineraries collection archived as Rankin (1953). Most of the data related to party affiliation, dates in office, and military service and some of the significance information are drawn from the official congressional biographies (http://bioguide.congress.gov); these have been supplemented by a cursory literature review. The significance field should be understood as suggestive only and not a definitive evaluation of the historical importance of any listed individual. Representative Robert Lee Fulton Sikes is included in the Rankin documents but is not presented on the table below because, as noted by Bullock (1953a), he was ultimately present at the troop trenches rather than the benches. In addition, then Representative Gerald R. Ford, later president of the United States, as well as Secretary of the Army Robert T. Stevens, and Army Chief of Staff J. Lawton Collins, are not listed below, as noted by Bullock (1953a), but were present at the troop trenches rather than the benches.

Table 3. Members of the U.S. House of Representatives Present at the VIP Benches for the Grable Test.

Member of the House	Affiliation	Date	Military Service	Historical Significance
Abernathy, Thomas G.	Dem, MS	1943-1973	None	Opposed Brown V. Board of Education, civil rights, and argued against women in the military.
Adair, E. Ross	Rep, IN	1951-1971	None	Ambassador to Ethiopia (1971-74); namesake of Fort Wayne Indiana Federal Building.
Angell, Homer D.	Rep, OR	1939-1955	None	Influential in adding the "under God" provision to the Pledge of Allegiance (Herzog 2011).
Aspinall, Wayne N.	Dem, CO	1949-1973	WWI and WWII; Capt.	Chair House Interior and Insular Affairs Committee 1959-1973 Opposed environmentalism. Influential in US water and land policy.
Baker, Howard H.	Rep, TN	1951-1964	None	Best remembered as father of the vastly more influential representative Howard H. Baker Jr.
Bartlett, Edward Lewis (Bob)	Dem, AK	1949-1959	None	Senator (1959-1968); responsible for the Bartlett Act requiring handicapped entrances on all federally funded buildings. Subject: Edward Lewis Bob Bartlett of Alaska: a life in politics.
Bishop, Cecil W. (Runt)	Rep, IL	1941-1955		Post Office congressional Liaison assistant (1955-1957).
Bonner, Herbert C.	Dem, NC	1940-1965	WWI; SGT	Strong anti-communist, anti-Civil Rights, anti-Labor, strong supporter of American maritime industry; namesake of a bridge, a ferryboat, and a boy scout camp.
Bolton, Frances P.	Rep, OH	1940-1969	None	First female congressional delegate to the UN; First congresswoman from Ohio; introduced the Bolton Act of 1955, though first introduced in 1949, allowing male nurses in the US Military. Unsuccessfully pushed against WWII and for conscription of women into the armed services.
Boykin, Frank W.	Dem, AL	1935-1963	None	left house after conviction on charges of conspiracy and conflict of interest, pardoned by Pres. Johnson. Opponent of civil Rights, prolific womanizer (Flynt 2004).
Buchanan, Vera D.	Dem, PA	1951-1955	None	First woman to die while holding congressional office; active in Blue Collar Social issues.

Member of the House	Affiliation	Date	Military Service	Historical Significance
Byrne, James A.	Dem, PA	1953-1973	None	Namesake Federal Courthouse in Philadelphia
Canfield, Gordon	Rep, NJ	1941-1961	WWI (PVT) and WWII (MM)	Spearheaded push to create Coast Guard Reserve.
Carlyle, F. Ertel	Dem, NC	1949-1957	WWI (USN)	Pushed for the Lumbee Act of 1956, recognizing the tribe, while paradoxically denying them the rights of a federally recognized tribe (see Cobb 2015: Cp 22). This was eventually reconciled by the Lumbee Recognition Act of 2006, sponsored by John McCain.
Chudoff, Earl	Dem, PA	1949-1958	WWII; BM (USCGR)	None noted
Cole, W. Sterling	Rep, NY	1935-1957	None	First Director General IAEA 1957-1961
Corbett, Robert J.	Rep, PA	1939-1941; 1945-1971	None	None noted
Crumpacker, Shepard J. Jr.	Rep, IN	1951-1957	WWII; MAJ	Part of the minor Crumpacker representative dynasty, along with Maurice and Edgar
Cunningham, Paul H.	Rep, IA	1941-1959	WWI; 1LT	None noted
Davis, James C.	Dem, GA	1947-1963	WWI; Capt. (USMC)	Opposed Brown V. Board of Education, civil rights. Attempted to paint NAACP and Civil Rights movement as communist agitation (see Heale 1998).
Dawson, William A.	Rep, UT	1947-1949; 1953-1959	None	None noted
Derounian, Steven Boghos	Rep, NY	1953-1965	WWII; Capt. (USA)	Notable for service on the House Subcommittee on Legislative Oversight that investigated the 1950s Quiz show scandals.
Dorn, W.J. Bryan	Dem, SC	1947-1949; 1951-1974	WWII; CPT	Opposed Brown V. Board of Education but evolved into a progressive populist supporting civil rights (Dorn and Derks 1988; Moore 2016); chair, House Veterans' Affairs Committee.
Dowdy, John D.	Dem, TX	1952-1973	None	Opposed Brown V. Board of Education; While serving on the DC judicial subcommittee, indicted for bribery, found guilty on two counts of conspiracy, one count of transporting a bribe across state lines, and five counts of perjury, all but the latter were overturned on appeal.
Doyle, Clyde G.	Dem, CA	1945-1947; 1949-1963	None	Chair, House Un-American Activities Committee (HAUC) 1962

Member of the House	Affiliation	Date	Military Service	Historical Significance
Eberharter, Herman P.	Dem, PA	1937-1958	WWI; Capt. (USA)	Introduced H.J.Res. 303 in 1942 leading to the US Flag code. Opposed Japanese internment and the HAUC-despite siting on the committee (cf. Brimner 2018 Hayayshi 2004)
Edmondson, Edmond A.	Dem, OK	1953-1973	WWII; LT (USN)	None noted
Fernós-Isern, Antonio	NP, PR	1946-1965	civilian service, WWII	Longest serving Resident Commissioner of Puerto Rico, first Puerto Rican cardiologist, Action Governor Puerto Rico (1943-1946), President of constitutional convention drafting Puerto Rican Commonwealth constitution.
Fulton, James G.	Rep, PA	1945-1971	WWII; LT (USN)	Served multiple delegations to the UN, Vigorous proponent of the Space Shuttle program (Sietzen 2003); active in desegregation (see Briley 2003); namesake Post office building in Pittsburgh
Garmatz, Edward A.	Dem, MD	1947-1973	None	Chair Committee on Merchant Marine and Fisheries; namesake of Baltimore Federal Courthouse; influential in US Merchant Marine policy.
Goodwin, Angler L.	Rep, MA	1943-1955	None	None noted
Gordon, Thomas S.	Dem, IL	1943-1959	None	None noted
Hagen, Herold C.	F-L, MN	1943-1955		Introduced the Disaster Relief Act of 1950 giving the president authority to issue disaster declarations (see Olasky 2006).
Hardy, Porter Jr.	Dem, VA	1947-1969		Opposed Brown V. Board of Education.
Herlong, Albert Jr.	Dem, FL	1949-1969	None	None noted
Heselton, John W.	Rep, MA	1945-1959	WWI Era.	None noted
Hess, William E.	Rep, OH	1929-1937; 1939-1949; 1951-1961	WWI; PVT (USA)	None noted
Hiestand, Edgar W.	Rep, CA	1953-1963	None	Member of the John Birch Society, active in business and labor policy.
Hillings, Patrick J.	Rep, CA	1951-1959	WWII; SGT (USA)	None noted
Holt, Joseph F. III	Rep, CA	1953-1961	WWII and Korea; LT (USMC)	Awarded Purple Heart. Held at gunpoint for taking photos of a church in USSR (Time Sept. 19, 1955).
Hosmer, Craig	Rep, CA	1953-1974	WWII; RADM (USNR)	Influential in nuclear energy policy.
Jarman, John	Dem & Rep, OK	1951-1977	WWII; MSG (USA)	Protested increasingly liberal leadership of Democratic Party, changing to republican in 1975.

Member of the House	Affiliation	Date	Military Service	Historical Significance
Jones, Paul C.	Dem, MO	1948-1969	None	None noted
Kersten, Charles J.	Rep, WI	1951-1955	None	Chair select committee on Communist Aggression (1953-1954) investigating USSR annexation of Baltic States
Kluczynski, John C.	Dem, IL	1951-1975	WWI; CPL (USA)	Namesake: Chicago Federal Building. Chair of the House Restaurant Committee 1970. Influential in US Transportation and Infrastructure Policy.
Lovre, Harold O.	Rep, SD	1949-1957	None	None noted
Mack, Peter F. Jr.	Dem, IL	1949-1963	WWII; CDR (USN)	Sponsored legislation banning Switchblades (The Switchblade Knife Act of 1958).
Mailliard, William S.	Rep, CA	1953-1974	WWII; RADM (USNR)	None noted
Meader, George	Rep, MI	1951-1965	None	None noted
Metcalf, Lee W.	Dem, MT	1953-1961	WWII; 1LT (USA)	Subsequently Senator Dem, MT (1961-1978). Influential in conservation issues. Namesake National Wildlife Refuge in Montana. Ranked 15th most influential Montanans of the 20th Century (Missoulian 1999). Subject: "Mavericks: The Lives and Battles of Montana's Political Legends", "Metcalf of Montana: How a Senator Makes Government Work" Author: "Overcharge."
Miller, Arthur Lewis	Rep, NE	1943-1953	None	Advocated for homosexuality as criminal mental illness, authored "The Miller Act" in DC making sodomy punishable by up to 20 year or institutionalization (Fadderman 2015; Kunzel 2017).
Mollohan, Robert H.	Dem, WV	1953-1957; 1969-1983	None	Father of Representative Alan Mollohan
Morrison, James "Jimmy" H. Sr.	Dem, LA	1943-1967	None	Opposing Brown V. Board of Education and expansion of civil rights.
Mumma, Walter, M.	Rep, PA	1951-1961	None	None noted
Neal, William Elmer	Rep, WV	1953-1955; 1957-1959	None	None noted
Norblad, Albin W. Jr.	Rep, OR	1946-1964	WWII; Officer (USA)	None noted
Osmers, Frank C. Jr.	Rep, NJ	1939-1943; 1951-1965	WWII; MAJ (USA)	Member of the Armed Services Committee CIA subcommittee during the Cuban Missile Crisis (Holland and Barrett 2012).

Member of the House	Affiliation	Date	Military Service	Historical Significance
Patten, Harold A.	Dem, AZ	1949-1955	WWII; LTC (USAFR)	None noted
Pfost, Gracie B.	Dem, ID	1953-1963	None	First female congressperson from Idaho, Chair Interior and Insular Affairs committee.
Pilcher, John L.	Dem, GA	1953-1965	None	Opposed Brown V. Board of Education.
Rhodes, George M.	Dem, PA	1949-1969	WWI; unknown rank (USA)	Active in labor and socialism, attempted to extend collective bargaining rights to federal workers through the Rhodes-Johnston bill, but was crushed by Eisenhower (McCartin 2011).
Robsion, John M. Jr.	Rep, KY	1953-1959	WWII; MAJ (USA)	Namesake of a park in metropolitan Louisville, Kentucky
Sadlak, Antoni	Rep, CT	1947-1959	None	None noted
Scherer, Gordon H.	Rep, OH	1953-1963	None	Representative to UN 1972-3; Active in HUAC.
Smith, Frank E.	Dem, MS	1951-1962	WWII; MAJ (USA)	Worked against racism and racial politics. Appointed to the Tennessee Valley Authority (1962-1972); Author "Congressman From Mississippi", "Land Between the Lakes", and "The Yazoo River." Subject "Mississippi Liberal"
Stringfellow, Douglas R.	Rep, UT	1953-1955	WWII; PVT (USA)	Ousted for inflating his WWII service record, Stringfellow is best known for this scandal.
Sullivan, Leonor K.	Dem, MO	1953-1977	None	Chair Committee on Merchant Marine and Fisheries 1972-77; Spearheaded the Food Stamp Act as H.R. 10222 1964. Influential in consumer protection policy (Christensen et al. 1999)
Utt, James B.	Rep, CA	1953-1970	None	Opposed UN. Consistently voted against civil rights. Noted for his 1963 claim that the UN was training "a large contingent of barefooted Africans" in George for a military takeover of the United States (McGirr 2001:7). Claimed sex education and rock music were parts of a communist conspiracy to destroy America (Irvine 2002).
Van Pelt, William K.	Rep, WI	1951-1965	None	None noted
Vorys, John M.	Rep, OH	1939-1959	WWI; LT (USN)	Subject of "Swallowed by Globalism: John M. Vorys and American Foreign Policy"
Warburton, Herbert B.	Rep, DE	1953-1955	WWII; MAJ (USA)	None noted
Whitten, Jamie L.	Dem, MS	1941-1995	None	Opposed Brown V. Board of Education expanded Civil Rights until 1991; namesake of USDA HQ building in DC. Influential in US Agricultural Policy.

Member of the House	Affiliation	Date	Military Service	Historical Significance
Widnall, William B.	Rep, NJ	1950-1974	None	None noted
Willis, Edwin E.	Dem, LA	1949-1969	None	Chair House Committee on Un-American Activities 1963-1967, notable for his staunch opposition of the Civil Rights movement.
Wilson, Bob	Rep, CA	1953-1981	WWII; LTC (USMCR)	None noted
Zablocki, Clement J.	Dem, WI	1949-1983	None	Chair House Foreign Affairs 1977-83, Introduced H.J.Res.542 , The War Powers Act.

The following table describes the non-congressional observers present at the VIP viewing benches during the Grable test. Attendance has been extracted from the itineraries collection archived as Rankin (1953). As in the previous table, persons known to be present at the trenches are included in Rankin but excluded from the table below. No attempt has been made to assess the historical significance of these observers.

Table 4. Non-congressional Observers Present at the VIP Benches for the Grable Test.

Official Observer	Title	Association
Twice, J. Mark	Secretary of State	State Department
Merchant, Livingston	Asst. Secretary of State	State Department
Bowie, Robert	Policy Director	State Department
Chase, Joseph	Dep to Spec Asst to Sec/State	State Department
Casberg, Melvin A. (Dr.)	Asst. Secretary of Defense	Defense Department
Clarkson, Percy W.	MG, Army	JTF-7
Cummings, Emerson L.	MG, Army	Office of Chief of Ordnance
Ford, Elbert L.	MG, Army	Chief of Ordnance
Matejka, Jerry V.	MG, Army	Special Asst. Secretary State
Reber, Miles	MG, Army	Legislative Liaison
Simon, Leslie E.	MG, Army	Office of Chief of Ordnance
Eckert, William D.	MG, AF	DCS/M
Lee, Robert M.	MG, AF	AFOPD
Garland, William M.	BG, AF	AFOIN
Thurman, William T.	BG, AF	Norton AFB
Fields, Kenneth E.	BG, Army	Director of Military Application, AEC
Roper, Harry M.	BG, Army	Dep. ACS, G3
Davis, Burton	RADM, Navy	COMPHIBTRACOMPAC
Hickey, Robert F.	RADM, Navy	COMCARDIV 5
Robbins, Thomas H.	RADM, Navy	COMCARDIV 2
Watkins, Frank T.	RADM, Navy	COMINLANT
Knickerbocker, William L.	Capt, Navy	JTF-7
Russell, James S.	Capt, Navy	MLC
Winant, Frank I.	Capt, Navy	AFSWP
Browning, William E.	Col, AF	Lowery AFB
Drysdale, Taylor	Col, AF	AFOAT
Gammon, Edgar G. Jr.	Col, AF	AF/HQ
Kline, Richard W.	Col, AF	Norton AFB
Little, Robert R.	Col, AF	DCS/O
Meintz, Leo H.	Col, AF	AFSWP
Powell, Kenneth R.	Col, AF	AFSWP
Russell, E.A. Jr.	Col, AF	DCS/D
Smith, Stanten T. Jr.	Col, AF	Randolph AFB
Thomas, Jack E.	Col, AF	AFOIN
White, John W.	Col, AF	ATRC
Adams, Rellio W.	Col, Army	AFSWP
Clark, Chester W.	Col, Army	Picatinny Arsenal

Official Observer	Title	Association
Cole, John D.	Col, Army	Office of Legislative Liaison
Conner, Steven L	Col, Army	Office of Chief of Ordnance
Conway, Harold J.	Col, Army	Chair, AFLSB, OSD
Crane, Richard Z	Col, Army	CO, Watervliet Arsenal
Del Campo, Angelo R.	Col, Army	Industrial College of Armed Forces
Franklin, Robert B.	Col, Army	AFSWP
Medaris, John B.	Col, Army	Office of Chief of Ordnance
Sampson, John H. Jr.	Col, Army	AFSWP
Sims, James D.	Col, Army	Office of Chief of Ordnance
Smith, William H	Col, AF	Congressional Escort
Beauchamp, William A.	LTC, AF	AF/HQ
Dedrickson, Lorin R.	LTC, AF	DMA, AEC
Korges, Woodrow W.	LTC, AF	AF/HQ
Larson, Carl H.	LTC, AF	Air Univ
Rogers, Ralph B.	LTC, AF	AF/HQ
Shy, William M.	LTC, AF	Congressional Escort
Stiles, Joseph E.	LTC, AF	Air Univ
Campbell, Raymond P. Jr.	LTC, Army	DMA, AEC
Corbin, Francis J.	LTC, Army	Office of Legislative Liaison
Demint, Thomas W.	LTC, Army	Office of Chief of Ordnance
O'Conner, John F.	LTC, Army	DMA, AEC
Pay, Charles E. Jr.	LTC, Army	AFSWP
Shoss, Morris L.	LTC, Army	MLC
Stevens, Wilbur A.	LTC, Army	AFSWP
Talbott, Orwin C.	LTC, Army	Office Sec/Army
Lyle, Vernon J.	Maj, AF	Congressional Escort
Summers, Clifford G.	Maj, AF	AF HQ
Turk, Wilbert	Maj, AF	Congressional Escort
White, William T.	Maj, AF	Tour Officer
Prince, Altus E	Maj, Army	Tour Officer
Tyson, Charles M.	Maj, Army	JTF-7
Warren, Robert	Maj, Army	DMA, AEC
Wreidt, Niel M.	Maj, Army	MLC
Mehagen, James D.	Capt, AF	Norton AFB
Keitt, Thomas W.	Capt, Army	AFSWP
Higgins, Helena A	Escort to congresswomen	Congressional Escort
Sourwine, J.G.	Asst. Counsel Leader, Committee on Internal Security	Accompanying Sen. McCarran
Jacques, Keith	Aide to Rep. Stringfellow	
Donkin, McKay	Special Asst. to Chairman	AEC
Evans, Dale N.	Technical Information Service	AEC
Gorman, Arthur E.	Division of Engineering	AEC

Official Observer	Title	Association
Lieberman, Joseph A.	Sanitary Engineer	AEC
McLain, Stuart	Director of Reactor Development	AEC
Trapnell, Edward R.	Congressional Liaison	AEC
Christy, Joseph T.	Chief of Production	Hanford Works, AEC
Auer, J. L.	President	R. Hoe and Company
Gramm, Frank	President	Treadwell Construction Company
Jansen, Carl B.	President	Dravo Corporation
Nalle, Richard T.	President	Midvale Company
Pigott, Paul	President	Pacific Car & Foundry
Allen, Henry B.	Vice President	Franklin Institute
McMammon, James F.	Consultant to Watertown Arsenal	VP Pilgrim Trust Company
Struble, George W.	Asst. Vice President	Bethlehem Steel Company
Liston, Andrew	Senior Manager	Baldwin-Lima-Hamilton
Brown, Wayne G.	Special Asst. to Administration	Defense Transport Administration
Wolman, Abel	Professor	Johns Hopkins
Stevenson, William F.		Office of Chief of Ordnance
Hamilton, Walter A.	Staff JCAE	

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E

Cultural Resources Forms

NNSS Site Forms

SHPO Resource # 26NY16242, Troop Trenches*

SHPO Resource # 26NY16243, Flash Observation Point*

SHPO Resource # 26NY16244, Gun and Control Point*

*On file at Desert Research Institute, Las Vegas; the Nuclear Testing Archive, Las Vegas; and the Nevada State Historic Preservation Office.

THIS PAGE INTENTIONALLY LEFT BLANK