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Author(s):	Gregory, Carrie Jeannette Townsend, Cameron Dee
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April 2024

Eligibility Assessment of Items in the TA-60 Rack Assembly and Alignment Complex Legacy Storage Yard

Los Alamos National Laboratory

Historical Facilities Survey Report No. 420

Survey No. 1290

NMCRIS Activity No. 155251

Prepared for: U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office

Prepared by: Carrie J. Gregory, Cultural Resources Manager, Architectural and Landscape Historian, Environmental Stewardship Group (EPC-ES)

Cameron D. Townsend, Cultural Resources Manager, Architect, Environmental Stewardship Group (EPC-ES)

Editing and Layout by: Tamara A. Hawman, Communications Specialist
Technical Editing and Communications Group (CEA-TEC)

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EXECUTIVE SUMMARY

The U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office (NA-LA), documented and evaluated seven structures in the Technical Area 60 (TA-60) Rack Assembly and Alignment Complex (RAAC) legacy storage yard at Los Alamos National Laboratory (LANL or Laboratory) for listing in the National Register of Historic Places (National Register). This documentation and evaluation was conducted in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended; the Code of Federal Regulations (36 CFR 800); the *Programmatic Agreement among the U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office, the New Mexico State Historic Preservation Office and the Advisory Council on Historic Preservation Concerning Management of the Historic Properties at Los Alamos National Laboratory, Los Alamos New Mexico* (PA)[1]; and *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (LANL's Cultural Resources Management Plan (2017).

NA-LA makes the following National Register eligibility determinations: *la cuna*; the rack transporter (jeep, rack trailer, and steering dolly); the Mexia diagnostic rack; the Mexia device canister; the Mexia device mounting stand; and the Mexia target stand are eligible for listing in the National Register, and the second steering dolly is not eligible for listing in the National Register.

This National Register evaluation was completed because LANL proposes to develop a consolidated waste facility in TA-60 next to the former RAAC. Across 3.56 acres, LANL proposes to construct an 8,000-square-foot, pre-engineered waste storage building; a 1,500-square-foot office/warehouse building; and 28,500 square feet of covered storage. The development will also include access control features and fencing, parking spaces, and utilities. Additionally, the Laboratory will continue to use the southern part of TA-60-0017 and reuse TA-60-0086 and TA-60-0324 in the development. The consolidated waste facility will operate as a central accumulation area—storing universal waste, mixed low-level (radioactive) waste, hazardous chemicals, and New Mexico special waste—until the waste can be shipped off site.

1 The PA is available here: https://www.osti.gov/biblio/1879364.

ACKNOWLEDGMENTS

The authors would like to acknowledge the assistance of Los Alamos National Laboratory National Security Research Center research librarians Amanda DeGiorgis and John Moore in identifying images and documents pertinent to this study. Special thanks also go to former J-7 senior test director Ron Cosimi, J-6 Nevada Test Site scientist Barry Bailey, and Raffi Papazian at the National Nuclear Security Site Nuclear Testing Archive for their insights and explanations.

Acknowledgments

ACRONYMS, ABBREVIATIONS, AND TERMS

Acronym, Abbreviation, or Term	Definition
AEC	Atomic Energy Commission
BCE	before the Common Era
CE	Common Era
CFR	Code of Federal Regulations
CRMP	Cultural Resources Management Plan
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
ERDA	Energy Research and Development Administration
FY	fiscal year
J	Field Testing (Division)
Laboratory	Los Alamos Laboratory, Los Alamos Scientific Laboratory, or Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
LASL	Los Alamos Scientific Laboratory
LLNL	Lawrence Livermore National Laboratory
LRL	Lawrence Radiation Laboratory
NA-LA	(U.S. Department of Energy) National Nuclear Security Administration, Los Alamos Field Office
NASA	National Aeronautics and Space Administration
National Register	National Register of Historic Places
NHPA	National Historic Preservation Act of 1966, as amended
NMCRIS	New Mexico Cultural Resources Information System
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPS	(U.S. Department of the Interior) National Park Service
NTS	Nevada Test Site
PA	Programmatic Agreement
RAAC	Rack Assembly and Alignment Complex
TA	Technical Area
TNT	trinitrotoluene
Triad	Triad National Security, LLC
U.S.	United States
USACE	U.S. Army Corps of Engineers
WIPP	Waste Isolation Pilot Plant
WRTB	Wire Rope Technical Board

CHAPTER 1: INTRODUCTION

Project Description

The U.S. Department of Energy (DOE) National Nuclear Security Administration (NNSA), Los Alamos Field Office (NA-LA), documented and evaluated seven structures in the Technical Area 60 (TA-60) Rack Assembly and Alignment Complex (RAAC)[2] legacy storage yard at Los Alamos National Laboratory (LANL or Laboratory) (Figure 1-1 and Figure 1-2) for listing in the National Register of Historic Places (National Register). This documentation and evaluation were conducted in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA); the Code of Federal Regulations (36 CFR 800); the *Programmatic Agreement among the U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office, the New Mexico State Historic Preservation Office and the Advisory Council on Historic Preservation Concerning Management of the Historic Properties at Los Alamos National Laboratory, Los Alamos New Mexico* (PA)[3]; and *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (LANL's Cultural Resources Management Plan [CRMP]) (LANL 2017). This assessment was conducted by LANL Cultural Resources Managers Carrie J. Gregory and Cameron D. Townsend.

The TA-60 RAAC legacy storage yard measures 0.15 acres (approximately 110 feet long by 62 feet wide) and is located in west-central TA-60 atop a mesa (unofficially called Sigma Mesa) in the north-central part of LANL in the projected northeast quarter of Section 21, Township 19 North, Range 6 East, on the Frijoles, New Mexico, 1:24,000 quadrangle map (Figure 1-3 and Figure 1-4; Appendix A). Laboratory development of TA-60 dates to the 1960s, and the area has been used for various Laboratory activities.

This National Register evaluation was completed because LANL proposes to develop a consolidated waste facility in TA-60 next to the former RAAC. Across 3.56 acres, LANL proposes to construct an 8,000-square-foot, pre-engineered waste storage building; a 1,500-square-foot office/warehouse building; and 28,500 square feet of covered storage. The development will also include access control features and fencing, parking spaces, and utilities. Additionally, the Laboratory will continue to use the southern part of TA-60-0017 and reuse TA-60-0086 and TA-60-0324 in the development (see Figure 1-4). The consolidated waste facility will operate as a central accumulation area—storing universal waste, mixed low-level (radioactive) waste, hazardous chemicals, and New Mexico special waste—until the waste can be shipped off site.

Environmental and Cultural Setting

The Laboratory is located in north-central New Mexico on approximately 93 km^2 (36 mi^2) of land approximately 100 km (62 mi) northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe. The Laboratory is situated on the eastern flank of the Jemez Mountains along the Pajarito Plateau, which consists of a series of narrow mesas and deep canyons that trend east-southeast from the Jemez Mountains to the Rio Grande. Located at elevations ranging from 1,620 m (5,400 ft.) to approximately 2,340 m (7,800 ft.), the Laboratory includes several distinct environmental zones. The Bandelier National Monument, Santa Fe National Forest, Pueblo de San Ildefonso, and communities of White Rock and Los Alamos border the Laboratory.

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[2] TA-60-0017, TA-60-0019, and various support structures—referred to as the RAAC in this report— also have been called the Test Fabrication Facility (McGehee et. al 2005:44) and the Rack Tower Complex (Brunette et. al 2019).

[3] The PA is available here: https://www.osti.gov/biblio/1879364.

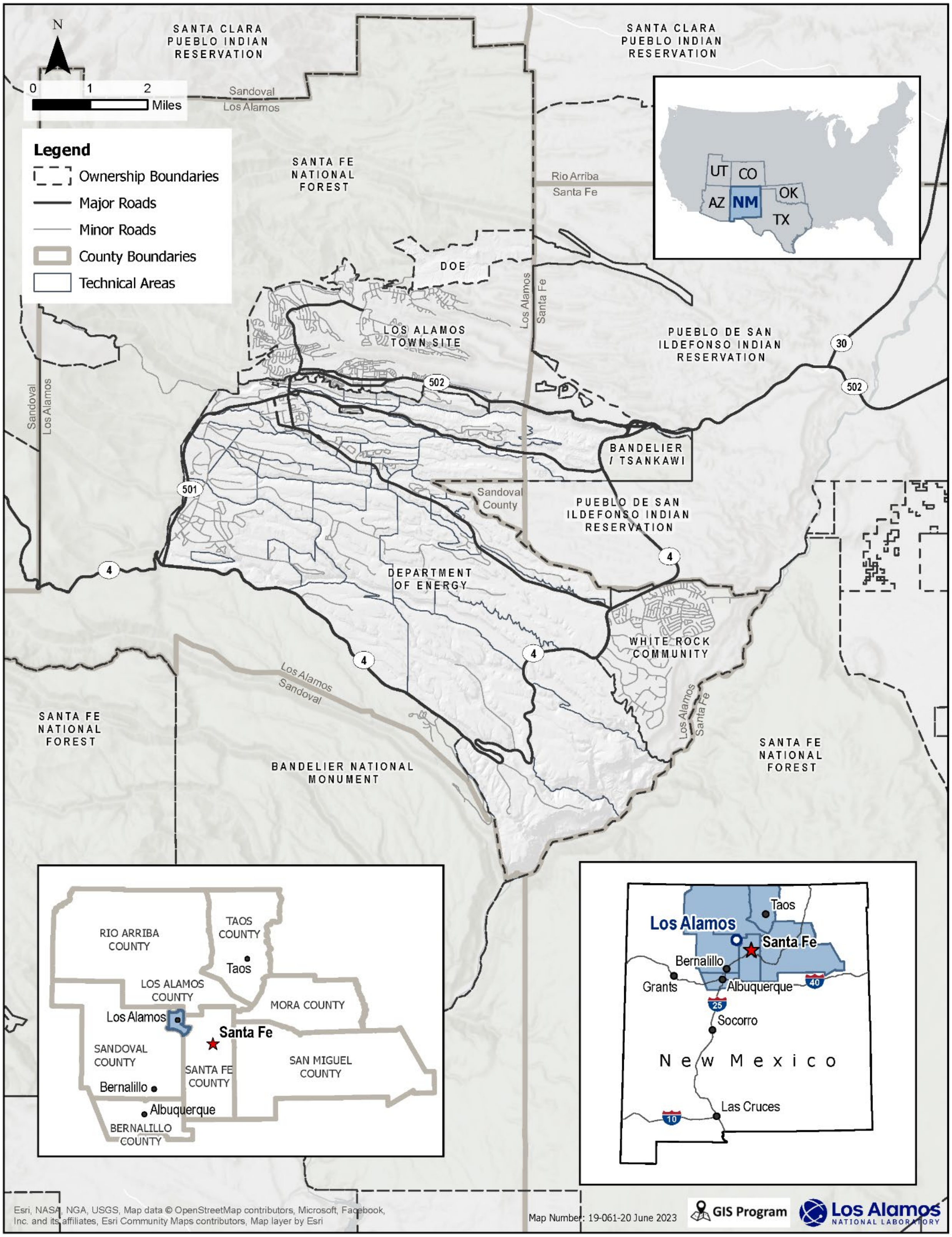

Figure 1-1. Location map of Los Alamos National Laboratory in context of the region, state, and Los Alamos County.

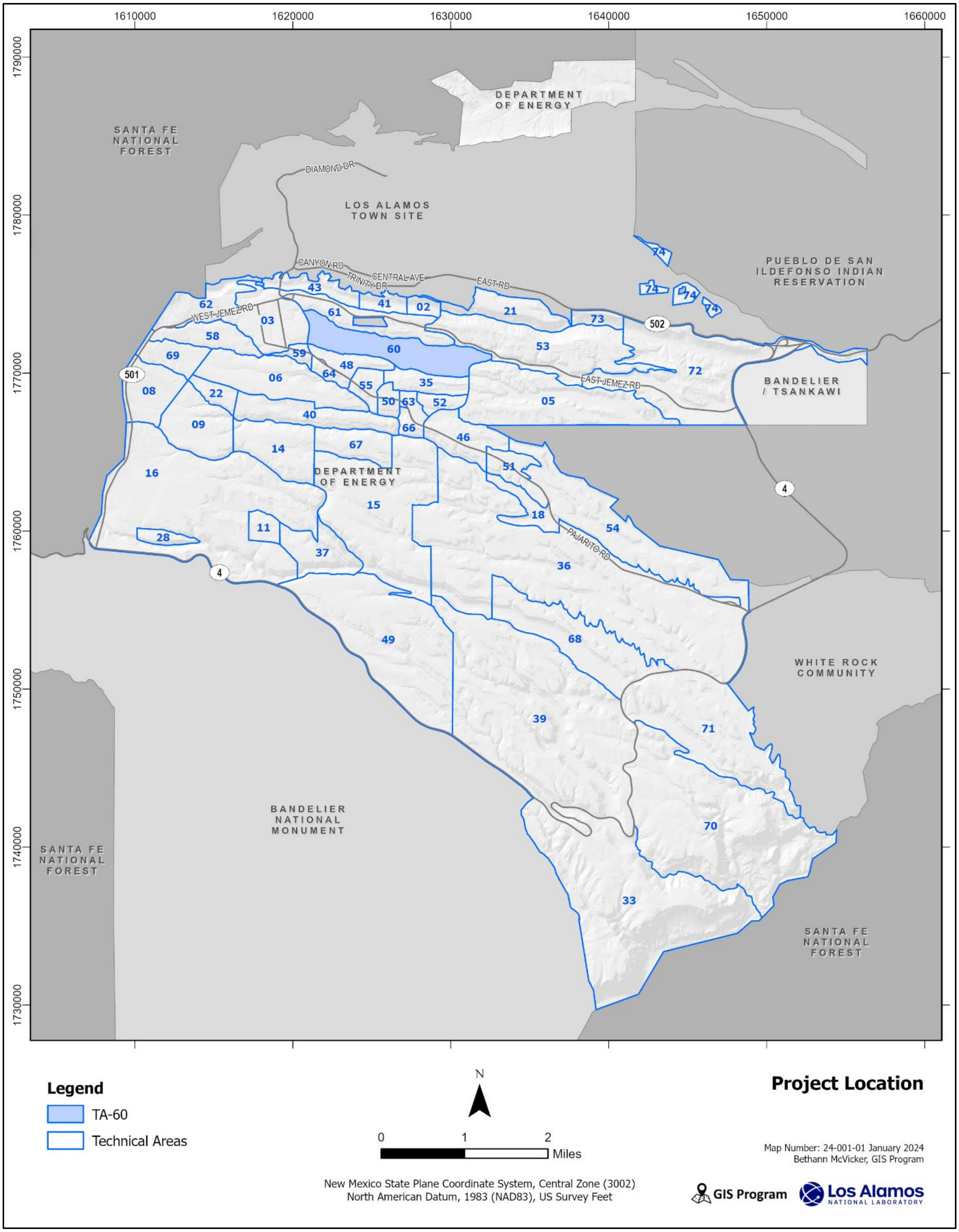

Figure 1-2. TA-60 location map.

Figure 1-3. Aerial photograph of the former RAAC vicinity, 2022.

Archaeological and ethnohistoric documentation of the Pajarito Plateau indicates a cultural record of more than 10,000 years. The cultural historical chronology comprises Paleoamerican (9500–5500 BCE) hunter-gatherers; Archaic (5500 BCE–600 CE) hunter-gatherer groups; Ancestral Pueblo (600–1600 CE) forager-farmers; and historical Pueblo, Hispanic, and Euro-American peoples (1600 CE–present). Formal homesteading on the Pajarito Plateau began in the late 1880s, with the first homestead application filed in 1887 (McGehee et al. 2006:132; Vierra and Hoagland 2000:3.1).[4]

[4] Homestead patents can be researched online through the Bureau of Land Management's website for General Land Office Records: https://glorecords.blm.gov/search/.

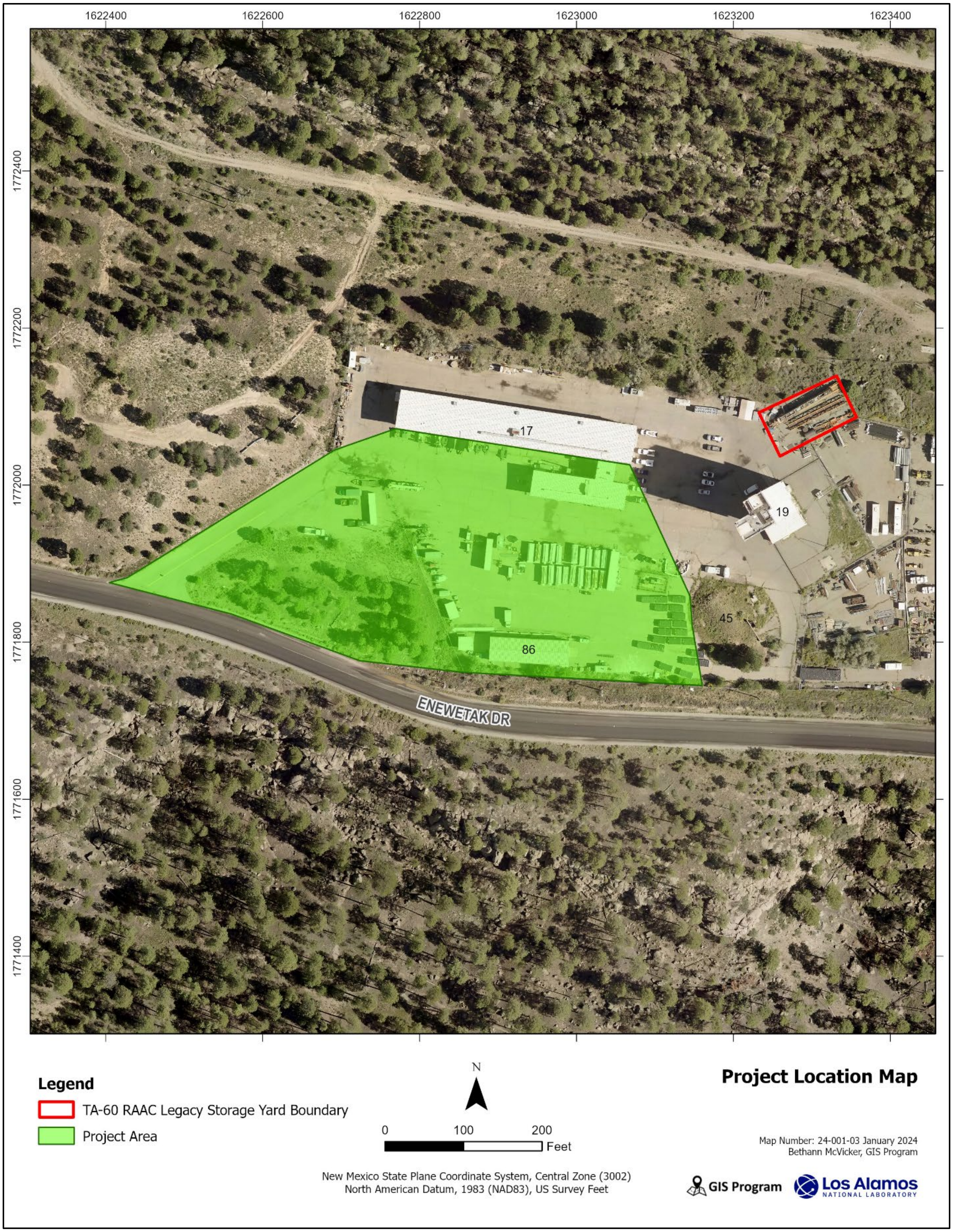

Figure 1-4. Project location map.

Methods

Investigations for this project included extensive archival research, intensive field surveys of the TA-60 RAAC legacy storage yard, and an analysis of findings. Archival research was conducted to develop the historical themes; outline the historic context; and collect information related to the design, fabrication, and modification of the items under study. Field surveys were conducted to record, photograph, and assess properties within the TA-60 RAAC legacy storage yard. An analysis was performed to fully develop the engineering and historic context, identify appropriate themes and property types, and assess the significance of the inventoried properties.

Report Organization

This document consists of six chapters, a references section, and two appendices. Following this introductory chapter, Chapter 2 provides a historical overview of the Laboratory, from its inception to 2020. The historic context of nuclear testing by the United States, which details pertinent historical events and themes, is supplied in Chapter 3. Chapter 4 details the evaluation criteria for listing a property in the National Register, and Chapter 5 provides the structure descriptions and National Register–eligibility statements. Chapter 6 provides a summary of the assessment and recommendations. Appendix A provides a project location and TA-60 RAAC legacy storage yard map, and Appendix B presents LANL structure forms.

CHAPTER 2: HISTORICAL OVERVIEW

In the time leading up to the Manhattan Project, physics was making great strides, and world politics were changing.

- 1932: Sir James Chadwick discovered the neutron.
- 1933: Leo Szilard conceived the nuclear chain reaction.
- 1935: Frédéric and Irène Joliot-Curie discovered artificial radioactivity.
- 1938: Otto Hahn and Fritz Strassmann discovered fission.
- 1938: Enrico Fermi won the Nobel Prize for physics for his work with new radioactive elements.
- 1939: Albert Einstein sent a letter to President Franklin D. Roosevelt advising him that Germany may have started developing a bomb of immense destructive powers.
- 1939: Niels Bohr made a worldwide announcement about the discovery of fission.
- 1939: President Roosevelt appointed the Advisory Committee on Uranium.
- 1941: President Roosevelt gave approval to pursue the development of an atomic bomb.
- December 7, 1941: Japan bombed Pearl Harbor in Hawaii, and the United States entered into World War II.
- 1942: The first self-sustaining nuclear chain reaction was produced under Stagg Field at the University of Chicago in Illinois (LANL 2002).

In 1942, University of California physicist J. Robert Oppenheimer organized a study conference that concluded that a fission bomb was feasible; however, problems still existed regarding the development of a nuclear weapon. Research efforts by universities and industry were not coordinated, and a process to produce sufficient fissionable material had not been developed. Colonel (soon to be Brigadier General) Leslie Groves was appointed commanding officer of the U.S. Army Corps of Engineers (USACE) Manhattan Engineer District. Subsequently known as the Manhattan Project, the weapons development effort was placed under the purview of this District. Groves chose Oppenheimer to coordinate weapons design (Benegas 1995a:6–7; LANL 2002; Machen et al. 2010:7; Rothman 1992:214–216).

Manhattan Project Period (1942–1946)

In addition to other Manhattan Project sites, Groves wanted a single, secure research facility to coordinate scientific development. His criteria included security, isolation, a good water supply, an adequate transportation network, a suitable climate, and an available labor force. He wanted a locale that was west of the Mississippi River and more than 200 miles away from any international border or the Pacific Ocean. In 1942, Oppenheimer—who had visited the Pajarito Plateau on a horseback trip—suggested the Los Alamos Ranch School in New Mexico. The school had been in operation since 1918, and the existing school buildings and structures could very easily support the small-scale facility Oppenheimer had in mind. The University of California agreed to operate the site—code-named Project Y (or Manhattan Project Site Y)—under contract with the government. In 1943, staff members of the Los Alamos Ranch School evacuated, and Director Oppenheimer and his staff moved to Los Alamos to run the newly established weapons laboratory, Los Alamos Laboratory. The school's setting was indeed remote and afforded natural physical barriers for security (i.e., numerous canyons and cliffs) (Carr 2020a; Hewlett and Duncan 1972:4; LANL 1984:8–10; 2002; Machen et al. 2010:7; Rothman 1992:215–216). From these beginnings, recruitment of the country's "best scientific talent" and the construction of technical facilities were top priorities (Benegas 1995a:8).

Although the fission bomb was conceptually attainable, many difficulties stood in the way of producing a usable weapon. Technical problems included how to time the release of energy from fissionable material and how to overcome engineering challenges related to producing a deliverable weapon. Nuclear material and high-explosives studies were of immediate importance. Two bomb designs appeared to be the most promising: a uranium "gun" device and a plutonium "implosion" device. The gun device involved shooting one subcritical mass of uranium-235 into another at sufficient speed to avoid pre-detonation. Together, the two subcritical masses would form a supercritical mass, which would release a tremendous amount of nuclear energy. This method led to the development of the Little Boy device. Scientists were less confident about the plutonium implosion design, which used shaped high explosives to compress a subcritical mass of plutonium-239. The symmetrical compression would increase the density of the fissionable material and cause a critical reaction. In early 1944, it was determined that plutonium was unsuitable for the gun design, bringing about the "crisis of '44," during which the Laboratory underwent a major reorganization to focus on the implosion design (Benegas 1995a:9–10; Hoddeson et al. 1993; Machen et al. 2010:9–10). Ultimately, both designs were developed.

The uncertainties surrounding the plutonium-implosion device necessitated testing. In 1944, Manhattan Project personnel chose the Alamogordo Bombing Range (present-day White Sands Missile Range) in south-central New Mexico for the location of the test. They first conducted a trial run that involved 100 tons of trinitrotoluene (TNT) at the test site (Trinity Site). This dress rehearsal provided measurement data and simulated the dispersal of radioactive products (Benegas 1995a:10; Machen et al. 2010:10). Planned for July 1945, the objectives of the Trinity test were "to characterize the nature of the implosion, measure the release of nuclear energy, and assess the damage" (Benegas 1995a:11). The world's first atomic device, Trinity, was successfully detonated in the early morning of July 16, 1945. Little Boy, the untested uranium gun device, was detonated on August 6 over the Japanese city of Hiroshima. Then on August 9, the United States detonated Fat Man (an implosion device like Trinity) over Nagasaki. These bombings helped end the war with Japan, who surrendered on August 14, 1945 (Benegas 1995a:11–12; LANL 2002; Machen et al. 2010:11).

The future of the early Laboratory was in question at the end of World War II. Many scientists and workers left the Laboratory and went back to their pre-war livelihoods. Groves appointed wartime Group Leader Norris E. Bradbury as Laboratory Director in 1945, following Oppenheimer's departure. Bradbury's mission was to conceive a postwar mission for the Laboratory that included feasibility studies on the hydrogen bomb and peaceful applications of nuclear energy. During this period, Los Alamos Laboratory became the Los Alamos Scientific Laboratory (LASL). In late 1945, Groves directed the Laboratory to begin stockpiling and developing additional atomic weapons while he tasked the Laboratory's Z Division (present-day Sandia National Laboratories) with weapons assembly work. Z Division was relocated to Sandia Base at Kirtland Army Air Field (present-day Kirtland Air Force Base) in nearby Albuquerque (Gosling 2010:99; Hewlett and Duncan 1972:32; Hoddeson et al. 1993:399–400; Machen et al. 2010:11, 68; Rothman 1992:236–237; Whitacre 2020:26).

Actual weapons testing continued during the tail end of the Manhattan Project period. In 1946, the Laboratory hosted the "Super Conference," where attendees explored the feasibility of developing a hydrogen bomb. Later that year, the Operation Crossroads test series in the Pacific saw the detonation of two plutonium bombs of the Fat Man type. These tests inaugurated the nuclear testing program by the United States and were the first of many tests directed by the Laboratory. During this same year, the Laboratory's Clementine, the world's first plutonium-fueled reactor, achieved criticality. For all practical purposes, the termination of Manhattan Project activities in Los Alamos came in late 1946 when President Harry S. Truman signed the Atomic Energy Act. The legislation confirmed the civilian control of atomic technology and transferred all atomic energy activities in January 1947 from the USACE Manhattan Engineer District to the newly created U.S. Atomic Energy Commission (AEC). The AEC formally took over the Laboratory and made a commitment to retain it as a permanent weapons facility. The Laboratory became one of the AEC's centers of research (AEC 1948:66–67; Buck 1983:1; LANL 2002; Machen et al. 2010:12; Mitchell 2003:62).

Early Cold War Era (1947–1956)

The term *Cold War* was first used during a congressional debate by a presidential advisor. During the early part of this era, weapons research was a national priority. At the Laboratory, Edward Teller and Stanislaw Ulam spearheaded the effort and focused on the development of the hydrogen bomb. The simmering Cold War came to a full boil in late 1949 with the successful test of Joe I, the Soviet Union's first atomic bomb. In January 1950, President Truman ordered the AEC to develop the hydrogen bomb—a decision that led to the remobilization of the country's weapons laboratories and production plants. This year also marked the initial meeting of the Laboratory's "Family Committee," who was tasked with developing the first two thermonuclear devices in response to President Truman's directives (LANL 2002; Machen et al. 2010:12).

In December 1950, President Truman approved of a continental test site in Nevada. Subsequently established as the Nevada Proving Ground (renamed Nevada Test Site [NTS] in 1955 and Nevada National Security Site [NNSS] in 2010) for nuclear testing, development of the site proceeded quickly. The detonation of the Able device on January 27, 1951, during Operation Ranger was the first atmospheric test conducted in the continental United States since the 1945 Trinity test. That same year, the Laboratory directed Operation Greenhouse in the Pacific and successfully conducted the first test of the thermonuclear principle with the George device. The Item device was the first detonation of a fission weapon boosted by a fusion reaction. In 1952, the United States detonated the first full-scale thermonuclear device (Mike) at Eniwetok (now spelled Enewetak) Atoll in the Pacific. The Soviet Union responded with a successful fusion demonstration in August 1953, followed by a test of a hydrogen bomb in 1955. Both signaled an acceleration in the arms race between the United States and the Soviet Union (Atomic Heritage Foundation 2023; DOE 2015; Fehner and Gosling 2006; LANL 2002).

In 1955, the Laboratory began participating in a demonstration program to incorporate a nuclear-powered reactor into a rocket engine. Subsequently named Project Rover, the program would become a collaboration with the National Aeronautics and Space Administration (NASA) and continue until 1972. Although weapons research and development had always played a major role in the history of the Laboratory, other key themes for the years 1942 to 1956 included supercomputing advancements, fundamental biomedical and health physics research, high-explosives and reactor research and development, pioneering physics research, and the development of the field of high-speed photography. The early Cold War era at the Laboratory ended in 1956, a date that marked the completion of all basic nuclear weapons design. Later research focused on the engineering of nuclear weapons to fit specific delivery systems (Benegas 1995b:29; Machen et al. 2010:13; McGehee and Garcia 1999:43–46).

Late Cold War Era (1957–1990)

The beginning of the late Cold War–era marked the last year that the Laboratory was a closed facility; access controls into the Los Alamos townsite were removed in 1957. During this era, the Laboratory experienced a great diversification in scientific pursuits, even as staff continued to direct and support nuclear testing in the Pacific and in Nevada and testing for NASA's Project Rover. In 1956, the Laboratory successfully tested a new generation of high (plastic-bonded) explosives and began to make improvements to the primary stage of a nuclear weapon. Additionally, Laboratory scientists Frederick Reines (later Nobel Prize winner) and Clyde Cowan definitively detected the free neutrino, a subatomic particle. This discovery was critical to the development of the whole-body radiation counters pioneered at the Laboratory. In 1957, the Laboratory, along with the U.S. Department of Defense (DOD), conducted the first of many underground tests at NTS (present-day NNSS). The end of the decade saw another defense mission with the initiation of treaty and test ban verification programs (Benegas 1995b:29–31; DOE 2015:2–3; LANL 2002; Machen et al. 2010:13; McGehee and Garcia 1999:15–16).

In the 1960s, the Laboratory expanded its research endeavors. Key activities included the completion of a diagnostic tool to study the process of implosion and the development of the heat pipe; the latter was a passive heat transfer device that would have numerous future applications (Benegas 1995b:31; Machen et al. 2010:13). In 1963, Laboratory scientists developed Vela satellite sensors—international "eyes in the sky" (Benegas 1995b:32). These sensors detected nuclear explosions and were part of an effort to monitor international compliance with the recently signed Limited Test Ban Treaty. Also in this decade, the Laboratory completed the world's highest-voltage Van de Graaff accelerator and initiated research on radioisotope thermoelectric generators to provide electrical energy to NASA spacecraft (Benegas 1995b:31–32; LANL 2002; Machen et al. 2010:13, 69–70; McGehee and Garcia 1999:36).

New capabilities and organizational reforms dominated activities at the Laboratory during the 1970s. The Los Alamos Meson Physics Facility (present-day Los Alamos Neutron Science Center [LANSCE]) achieved a full-energy beam, and scientists shipped out the first medical radioisotope. The Laboratory also established both a Technology Transfer Office and the National Stable Isotope Resource. In 1974, the U.S. Congress passed the Energy Reorganization Act. The legislation abolished the AEC and established the U.S. Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission. ERDA became the federal government's hub for energy research and development and took over the former AEC centers of research and laboratories. Notably, the Laboratory was designated a National Historic Landmark in 1975 and a National Environmental Research Park in 1976. The latter was an ERDA designation and provided opportunities to conduct environmental research at the Laboratory. The Department of Energy Organization Act of 1977 abolished ERDA and established DOE, which provided a framework for a national energy plan. The later part of the 1970s also saw the Laboratory's Weapons Neutron Facility and the Plutonium Processing Facility become operational (Benegas 1995b:33–37; Buck 1982:1–2; DOE 2023; Greenwood 1977; LANL 2002; Machen et al. 2010:71–73; Petersen and Sullivan 1977:91).

A resurgence of groundbreaking research and development occurred in the 1980s, in addition to a name change; in 1981, LASL became LANL. In this decade, the Laboratory established a branch of the Institute of Geophysics and Planetary Physics, a Center for Materials Science, the National Flow Cytometry Resource, an acquired immunodeficiency syndrome (or AIDS) database, a Center for Nonlinear Studies, an Advanced Computing Laboratory, and a Superconductivity Technology Center. Also during this decade, the Los Alamos Meson Physics Facility was dedicated; the Antares laser fusion facility became operational; and the Hot Dry Rock Project, started in the early 1970s, finally produced electricity. The Laboratory's establishment in the early 1980s of GenBank—a national repository for genetic sequence information—and the National Laboratory Gene Library Project led to the establishment of the first Center for Human Genome Studies at the Laboratory in 1988. That same year, the Laboratory discovered the human telomere (Benegas 1995b:36–41; LANL 2002; Machen et al. 2010:73–74; Whitacre 2020:26).

Post–Cold War Era (1991–2005)

The transition from the Cold War era to the post–Cold War era, initiated by the collapse of the Soviet Union at the end of 1991, prompted a period of profound change throughout the Laboratory. Because international treaties restricted and then halted the testing of nuclear weapons, Laboratory scientists had to devise new methods of ensuring the safety and reliability of the nation's nuclear stockpile. The last underground nuclear test conducted by the United States occurred in 1992. In the years following, the

Laboratory developed sophisticated methods of analyzing the viability of weapons as part of the stockpile stewardship program (DOE 2015; LANL 2002; Machen et al. 2010:13, 19; Mitchell 2003:61; Walker 1994).

Although weapons research remained the Laboratory's prime mission, this program brought about new methods of experimentation and broadened the scope of scientific work. The Laboratory continued to make huge advances in computing capacity and capabilities, spurred by the need to solve the increasingly complex codes required for weapons certification. The Laboratory also made major advances in human-health research, culminating in increased bioforensic research aimed at thwarting biological terrorism. Multiple Laboratory experiments flew on satellites to conduct research in the space sciences, and Laboratory scientists began a formal program to provide scientific and technical expertise in support of homeland security issues. Prominent endeavors during this period included the Advanced Simulation and Computing Initiative in 1995, the expansion and renaming of the Los Alamos Meson Physics Facility to LANSCE in 1995, and the first test at the Dual-Axis Radiographic Hydrodynamic Test facility in 1999 (Machen et al. 2010:14; Pillai et al. 2022:93–96).

In response to the nation's need for alternative sources of energy, Laboratory scientists initiated studies aimed at investigating the hydrogen economy and broadening the use of fuel cells. Materials science research resulted in advances in understanding and manipulating the world of the very small—the nanosciences—and in developing energy-saving superconducting devices. By the end of this era, in research that underlined the environmental concerns of the times, Laboratory scientists were collaborating with others to improve evacuation planning and to model the effects of natural phenomena such as hurricanes, storm surges, floods, and wildfires (Machen et al. 2010:14).

As noted by the Laboratory's Director for Operations and Infrastructure Strategy Dr. Rekha Pillai and others (2022:102), "Not all major changes to the Laboratory came in the form of national policy or international politics." From May to July 2000, the Cerro Grande Fire, which began as a controlled burn by the National Park Service (NPS), burned 48,000 acres and became New Mexico's largest wildfire at that time. Within LANL, the fire burned across 8,000 acres, charred or destroyed 39 facilities (including significant Manhattan Project–period facilities), severed power and communication lines, and caused extensive smoke and ash damage to both facilities and the environment. The damage totaled $300 million. The fire resulted in the development and construction of a new Interagency Emergency Operations Center at TA-49 and a new pyramidal structure for operations (Coonley 2001; NA-LA 2001; Pillai et al. 2022:102–106).

The beginning of this era also saw the first underground repository for nuclear waste built in the United States. Completed in 1990, the Waste Isolation Pilot Plant (WIPP) was constructed across 16 square miles of salt beds in southeast New Mexico. WIPP was built to accept up to 175,565 cubic meters of transuranic waste from the United States' national laboratories and weapons facilities for 10,000 years. The first shipment of transuranic waste from the Laboratory arrived at WIPP on March 26, 1999 (Lopez 2014; Pillai et al. 2022:100–101; Weaver 2017). At an associated press event, Secretary of Energy and former New Mexico governor Bill Richardson stated, "This shipment to WIPP represents the beginning of fulfilling the long-overdue promise to all Americans to safely clean up the nation's Cold War legacy of nuclear waste and protect the generations to come" (WIPP 2022).

More Recent Times (2006–2020)

The period after 2005 is represented by significant changes to LANL's organizational landscape, with transformations in both operations and missions. In 2006, DOE-NNSA awarded the Laboratory's management and operating contract to a new consortium, whereas the University of California had exclusively held the contract and run the Laboratory for the previous 60 years. The awardee was construction-focused Los Alamos National Security (LANS), which was a sole-purpose, dedicated, limited-liability corporation that comprised the University of California; Bechtel National, Inc.; Washington Group International; and BWX Technologies, Inc. The LANS contract transitioned LANL from a not-for-profit to a for-profit contract model. DOE-NNSA expected LANS to perform excellent science research and development; develop and construct infrastructure; manage Laboratory projects, programs, and business services; and remediate and manage the environment. LANS held the contract for a decade (Allen 2012:1; Chodos 2006; Pillai et al. 2022:125–126; Richardson 2011:2; Secretary of Energy 2004; U.S. Congress 2003).

Two 2014 events notably affected the Laboratory's operations and mission. The first was the establishment of a DOE Office of Environmental Management (or DOE-EM). Partially spurred by a 2014 LANL-caused incident at WIPP that closed down the facility for 5 years, DOE established this office to assume oversight of all legacy contamination at the Laboratory. This significantly changed the amount of waste overseen by the Laboratory and the way waste was managed. The second was a mission change that was initiated in 1993. DOE-NNSA's 2014 strategic plan mandated the Laboratory to produce at least 30 plutonium pits per year by 2026 and in perpetuity. At the time (and today), the Laboratory's Plutonium Processing Facility was the only physical plant in the United States equipped to do pit production (Duffy 1989; George 2018; Kornreich 2019:22–23; Kramer 2016:22; Lunn and Roark 2020; Pillai et al. 2022:131).

DOE-NNSA did not extend the LANS contract; in a ca. 2015 performance review, LANS scored only satisfactorily in operations and infrastructure and fell short in safety, management systems, and cybersecurity. These assessed shortfalls were due to the 2014 WIPP incident, shipping and construction project issues, a 2012 contamination and a 2015 arc-flash accident at LANSCE, and a 2-year (2013–2015) pause in Plutonium Processing Facility operations (Chadwick 2019; Pillai et al. 2022:125). As presented in Pillai and others (2022:125), former Laboratory Director Robert Kuckuck observed, ". . . the interests of the private sector and the university were not aligned . . ." and noted a detrimental "culture difference" (Kramer 2016:23).

After 10 years, DOE-NNSA competed the Laboratory's management and operating contract for the second time in history. The awardee was Triad National Security, LLC (Triad)—a consortium of the Regents of the University of California, Battelle Memorial Institute, and Texas A&M University (Chadwick 2019; Pillai et al. 2022:126). NA-LA tasked Triad "with changing lab culture around safety, security, conduct of operations, contract assurance" (Chadwick 2019:8). Bringing in a new leadership team from outside of LANL, Triad took responsibility for the Laboratory on November 1, 2018, and implemented significant changes (Chadwick 2019; Pillai et al. 2022:126).

The new Triad leadership team was especially challenged on March 11, 2020, when the World Health Organization declared COVID-19 a pandemic, and the governor of New Mexico declared a state of public health emergency. Almost overnight, the Laboratory transitioned from more than 12,000 staff working on campus to more than 10,000 teleworking. The Laboratory remained in a similar posture for nearly 2 years. The outcomes of the pandemic at LANL were two-fold. First, the Laboratory became the leader in the DOE-NNSA complex in addressing the challenges of the pandemic. The event also provided a chance for the Laboratory to enhance operations and implement internal and external initiatives to employ all of the strengths of the organization. Second, the Laboratory was afforded the opportunity to support the national COVID-19 pandemic response. LANL, along with other research organizations, shared equipment (e.g., high-performance computing) and expertise (e.g., complex system-modeling capabilities) to study the virus's history, nature, genomics, and molecular structure; to predict the pandemic's progression; and to screen potential drug candidates (Beierschmitt 2020:30–34; Governor of New Mexico 2020; Mason 2021:10; Pasqualoni and Siegel 2020; Pillai et al. 2022:140–141; Tyler 2020, 2021). "The success and learning during the COVID-19 pandemic will be translated to improve all areas of the Laboratory, including delivering the pit production mission" (Pillai et al. 2022:142).

CHAPTER 3: HISTORIC CONTEXTS

Historic contexts provide information about historical patterns and trends by defining historical themes, geographical areas, and chronological periods. These three components provide a consistent framework for evaluations (Lee and McClelland 1999:11). The historical theme for the former TA-60 RAAC is Nuclear Testing by the United States, with a sub-theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. The geographical area is the United States, its territories, and its trusteeships; and the chronological period is the Cold War. The central mission of the Laboratory throughout the Cold War was the design and testing of weapons for the nation's nuclear arsenal.

Nuclear Testing by the United States

The United States conducted the first atomic bomb test (Trinity device) in July 1945 at the Alamogordo Bombing Range in south-central New Mexico (Figure 3-1). Subsequently, the United States dropped atomic bombs on Japan that August to help end World War II. The United States conducted intermittent nuclear testing through October 1958 and then entered into a moratorium that was contingent on reciprocity by the Soviet Union and ongoing negotiations. When the Soviet Union abruptly resumed nuclear testing in September 1961, the United States began a year-round testing program. The Soviet Union and the United States ratified the Limited Test Ban Treaty on August 5, 1963, as worldwide concern about radioactive fallout intensified. This treaty effectively banned all testing of nuclear weapons in space, the atmosphere, and the oceans, which redirected all subsequent nuclear testing underground. On July 1, 1968, the United States, the Soviet Union, and 60 additional countries signed the Treaty on the Non-Proliferation of Nuclear Weapons (also known as the Nuclear Nonproliferation Treaty), a binding commitment with a goal of disarmament by the nuclear-weapon states that entered into force on March 5, 1970. The United States and the Soviet Union developed the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty in 1974 and 1976, respectively. These documents effectively restricted all nuclear tests to yields no greater than 150 kilotons.[5] The Soviet Union conducted their last nuclear test on October 24, 1990, and on December 11, they and the United States ratified the Threshold Test Ban Treaty. On October 2, 1992, the United States entered into another unilateral nuclear testing moratorium that has been observed to this day despite the fact that other countries conducted nuclear tests into the late 1990s (Carr 2020c:24, 33; DOE 1994:i–iii; 2015:x; Machen 1988:3; Machen et al. 2010:94).

Notably, all of the early nuclear testing by the United States involved the direct participation of Laboratory staff (Tyler 1954:66–68). Speaking to LASL's involvement with nuclear testing, the Manager of the AEC's Santa Fe Operations Office Carroll L. Tyler (1954:66) explained in 1954,

> The development of atomic weapons of all types involves a composite effort including: primary experimental research, theoretical investigations and calculations, component development experimentation, and full-scale nuclear detonations. It is essentially impossible to apportion credit . . .

[5] A kiloton is the energy of a nuclear explosion equivalent to the explosive power of 1,000 tons of TNT.

Figure 3-1. Detonation of the Trinity device by Project Y on July 15, 1945, at the Alamogordo Bombing Range, in New Mexico (LANL image, accession no. 6503994).

From June 1946 to September 1992, the United States conducted 1,054 nuclear tests.[6] For the first 20 years, these tests were primarily conducted at the Pacific Proving Ground and at the Nevada Proving Ground. The Pacific Proving Ground was established by the AEC in 1947 at Enewetak Atoll in the Marshall Islands, where the United States had established military bases at former World War II Japanese bases. Acting on a proposal by President Truman, the United Nations took Trusteeship of the Marshall Islands (Occupied Enemy Territories) and gave the United States Administering Authority in April 1947, with a charge to protect the health and lands of the inhabitants[7] (Brown 2014; DOE 1994:iii–28; Kunkle et al. 2018a, 2018b; Kunkle and Ristvet 2004:4, 19; Machen et al. 2010:94).

President Truman approved development of a continental proving ground within the Nellis Air Force Base Gunnery and Bombing Range (present-day Nevada Test and Training Range) in December 1950. By February 1951, the United States had established the Nevada Proving Ground there for nuclear testing. This location was renamed NTS in 1955 and the Nevada National Security Site (NNSS) in 2010. From June 1946 to May 1973, a very few other tests were conducted within the Nellis Air Force Base Gunnery and Bombing Range; in the Pacific Ocean near Johnston Atoll, on Christmas Island, and outside of San Diego, California; in the South Atlantic Ocean; near Carlsbad and Farmington, New Mexico; in Fallon and central Nevada; in Hattiesburg, Mississippi; near Parachute and Meeker, Colorado; and on Amchitka Island, Alaska. All tests were tracked as atmospheric (at the surface; from a barge or tower; or via an

6 All dates and times in the nuclear testing record were converted from local times to Greenwich Mean Time, which is how they are reflected in this chapter.

7 This section does not detail the subsequent actions—social, political, financial, and legal—made by the Marshallese, the United Nations, or the United States regarding the trusteeship and subsequent agreements; for this history, the reader should consult other sources, such as Meade and Meade (2018).

airburst, airdrop, balloon, or rocket), underground (from a crater, shaft, or tunnel), or underwater (Atomic Heritage Foundation 2023; DOE 1994:iii–28; 2015; Fehner and Gosling 2006:44–46, 75, 126; Kunkle et al. 2018a, 2018b; Machen et al. 2010:94).

As explained by Laboratory senior historian Dr. Alan B. Carr (2020c:1–2), the United States conducted nuclear testing for many reasons, including to

- verify that weapons would work,
- explore what weapons could do in combat,
- improve and advance weapon designs,
- confirm the reliability of stockpiled weapons,
- test weapon delivery systems,
- ensure that weapons would not detonate accidentally,
- assess potential weapon vulnerabilities,
- study explosion phenomenology, and
- explore potential peaceful uses (such as large-scale excavation and fracking).

Late Manhattan Project Period (1945–1946)

At the end of 1945, the United States had two nuclear weapons in its stockpile. The first nuclear test series, Operation Crossroads, occurred in June–July 1946 at Bikini Atoll in the Pacific Ocean. The Laboratory manufactured the plutonium components of two Fat Man–type devices and directed two tests, which were requested by the Joint Chiefs of Staff and approved by President Truman. Before the tests, the military moved more than 160 inhabitants of Bikini Atoll to Rongerik Atoll. Focused on the effects of an atomic weapon on naval forces both from an airdrop and from underwater, this nuclear test series used 95 scrapped and anchored World War II ships. The operation's task force included more than 40,000 people. To explore the biological effects of nuclear weapons, the test included almost 5,500 test animals placed on the ships. Unexpectedly, the second detonation (Baker device) created a serious radiation problem and deposited more radioactive material than expected on the remains of the anchored fleet (Figure 3-2). During the post-blast survey retrieval of animals and decontamination, personnel exposure levels climbed. The task force canceled a planned third detonation. By the end of 1946, the United States had nine nuclear weapons in its stockpile (Bass 2008; Brown 2014; Carr 2020c:4–6; DOE 1994:1; Fehner and Gosling 2006:30–32; Kunkle et al. 2018a; Machen et al. 2010:12, 69, 94; McGehee and Garcia 1999:15, 71; McGehee et al. 2003:15).

Importantly, it was during this nuclear test series that the term "fallout" was first used. Observations were made of radioactive rain occurring 400 miles away on the day after the detonation of the Yoke device, which had the largest explosive yield yet (Kunkle et al. 2018a). When discussing the hazards of experimental or accidental detonation of nuclear weapons, the Laboratory's Assistant Health Division Leader for Biomedical Research Wright H. Langham and others (1955:3) shared the "hazard results from residual plutonium deposited in the fall-out pattern, which may produce chronic contamination over a long period of time." Fallout became the principal danger of nuclear testing. Carr (2020c:2) summarized the term and its potential prevention and consequences regarding the Trinity test:

> During a nuclear test, particles that come in contact with the fireball are irradiated and a portion of the material is ejected into the atmosphere. Eventually, these contaminated particles fall back to earth, hence the infamous term: fallout. To minimize the dangers of fallout, nuclear tests (including Trinity) were generally performed in very arid regions. Ideally, the irradiated particles would climb high into the atmosphere and be evenly

dispersed across the globe at very low levels, which posed no significant threat to people. Precipitation, however, would drive irradiated particles back to earth quickly in a very concentrated area; this concentration of radioactive material could be very hazardous to anyone below. As such, weather was an important consideration in selecting the bombing range as the location for the test.

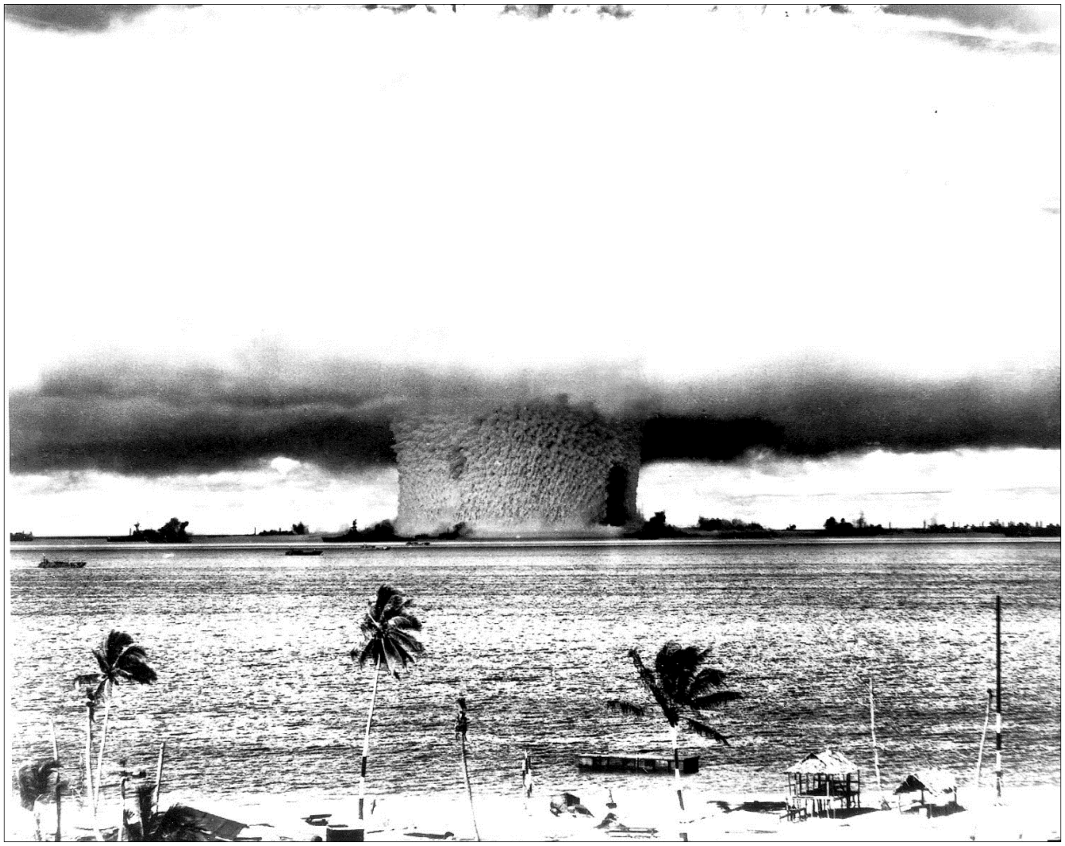

Figure 3-2. Detonation of the Baker device at Bikini Atoll on July 24, 1946, during the Operation Crossroads test series (NNSS image, accession no. NTS-XX71).

Renewed, albeit safeguarded, conversations about establishing a continental nuclear testing site resumed. Although a continental site would resolve existing challenges of Marshallese stewardship, access, logistics, weather forecasting, safety, and security, it could have serious domestic-relations problems. Navy Captain Howard B. Hutchinson of the Armed Forces Special Weapons Project researched the idea of a continental testing site under Project Nutmeg. As noted by DOE senior historian Terrence R. Fehner and chief historian F. G. Gosling (2006:36), “Under suitable conditions, Hutchinson stated, it did ‘not seem probable that harmful concentrations of soluble radio isotopes’ could result from nuclear testing” at a properly engineered site. Hutchison narrowed his preferred locations to the arid southwest and the humid southeast. In the southwest, he liked New Mexico, because the state had already endured an atomic test, the Laboratory was located within its bounds, and atomic bombs were stored at Sandia Base just outside of Albuquerque. In the southeast, he liked the North Carolina Coast between Cape Hatteras and Cape Fear because prevailing winds could take any unexpected radioactive fallout to the Atlantic Ocean (Fehner and Gosling 2006:36–37).

Nuclear weapons are of two basic types: a fission (or atomic) bomb and a thermonuclear (or hydrogen) bomb. Fission bombs, such as those used in World War II, split uranium or plutonium atoms. A thermonuclear bomb—a theory first proposed by Fermi in 1941—is a nuclear explosive device in which more than half of the total explosive yield comes from fusion reactions. Fission bombs have upper limits to their explosive yields and thermonuclear bombs do not. In 1948, the nation increased its nuclear stockpile to 50. On August 29, 1949, the Soviet Union secretly detonated their first fission bomb. By the end of 1949, the United States had 170 nuclear weapons in its stockpile and was debating thermonuclear-bomb development. In January 1950, President Truman accelerated atomic weapons development, including research into a thermonuclear bomb. The administration tasked the Laboratory with a rapid determination of the technical feasibility of a thermonuclear device (Carr 2020b:7; 2020c:6; Fehner and Gosling 2006:34, 38; Kunkle et al. 2018a; Machen et al. 2010:91–92). Historian Judith Machen and others (2010:92) noted that this effort became the Laboratory's first Cold War weapons program.

Project Nutmeg was revived when war broke out on the Korean Peninsula, and national priorities changed. The stakes were high, and on November 30, 1950, President Truman indicated at a press conference that atomic weapons were a viable option for use in the Korean conflict. He subsequently directed the AEC, assisted by the DOD, to identify a suitable continental nuclear testing site. With Project Nutmeg results in hand and a recommendation by the Laboratory's J Division Leader Dr. Alvin Graves, the National Security Council for Atomic Energy chose the Nevada location. Bradbury felt that the Nevada site had a degree of public radiological safety that exceeded the other two options—the Wendover Bombing Range at Dugway Proving Ground in western Utah and the White Sands Proving Ground (formerly part of the Alamogordo Bombing Range) in south-central New Mexico (Atomic Heritage Foundation 2023; Carr 2020c:7; Fehner and Gosling 2006:38–44; Kunkle et al. 2018a).

Notably, the Laboratory would play a much larger role in continental tests than they did in Pacific Proving Ground tests. Operation Ranger was the first nuclear test series at the newly established Nevada Proving Ground. Conducted in 1951 by the Laboratory, five tests studied a low-yield detonation, measurements of alpha particles, potential design flaws, and manned and unmanned aircraft penetrations of atomic clouds. The manned flights measured gamma ray doses, and the unmanned flights collected atomic cloud samples. Next to performance, radiological safety was of critical concern. Thomas L. Shipman, the Laboratory's Health Division leader at the time, directed the radiological survey work. He expected only the most minimal exposure by Operation Ranger to any offsite population but developed emergency plans for any unexpectedly high exposures. Subsequent radiological surveys indicated no areas of significant activity; however, of little apparent consequence, radioactive snow subsequently fell in the midwestern and northeastern United States due to radioactive materials caught in high-altitude winds. (DOE 1994:1; 2015:2–3; Fehner and Gosling 2006:45–46, 55-–57, 61–65; Kunkle et al. 2018a; Petersen 1995; Shipman 1958:68).

Other 1951 nuclear test series included Operation Greenhouse, Operation Buster, and Operation Jangle. The Laboratory directed the four tests of the Operation Greenhouse test series in the Pacific Proving Ground. The proof-of-principle test using the George device demonstrated that a fission device could detonate a secondary hydrogen device, and the Item device was the first test using boosting. The Nevada Proving Ground hosted Operations Buster and Jangle. Operation Buster included five tests directed by the Laboratory and involved ground-level tests, the first troop participation exercises, and the first airdrop from a jet aircraft (Figure 3-3). Operation Jangle included two tests codirected by the Laboratory and the DOD. This nuclear test series observed the first underground nuclear detonation (Uncle device) by the United States. Underground tests would be of two types: shaft (vertical) and tunnel (horizontal) (Atomic Heritage Foundation 2023; Carr 2020b:6, 18; 2020c:7, 9; DOE 1994:1–2; 2015:2–3; Fehner and Gosling 2006:65–72; Kunkle et al. 2018a; Langham and Storer 1953:76; Machen et al. 2010:12, 92; McDuff 2018:3; Petersen 1995).

Figure 3-3. Detonation of the Charlie device on October 30, 1951, during Operation Buster at the Nevada Proving Ground (LANL image, accession no. CN70-3430).

By the end of 1951, the United States had 438 nuclear weapons in its stockpile and 4 new weapon types. The 1952 Operation Tumbler-Snapper test series occurred at the Nevada Proving Ground. Eight tests were directed by the Laboratory, with three of those codirected by the DOD. Scientists studied shock velocity, shock overpressure, and explosion yields—and notably, atomic clouds—using remotely piloted aircraft with Laboratory-designed wing-tip sampling pods. Unfortunately, one of the detonations caused the first known livestock injuries since the Trinity test, but no hazards occurred to test personnel (Carr 2020c:7; DOE 1994:2; 2015:2–5; Fehner and Gosling 2006:79–80; Kunkle et al. 2018a).

Designed, fabricated, and assembled at the Laboratory, the United States detonated the first thermonuclear bomb (Mike device) on October 31, 1952. It stood 20 feet tall, had a diameter of 7 feet, and weighed 82 tons (Figure 3-4). Using the fission-fusion concept developed by the Laboratory, it was set off on Elugelap Island in the Enewetak Atoll in the Pacific Proving Ground during Operation Ivy. With a 10.4-megaton burst and a 3-mile-wide fireball, the blast disintegrated the island, left a near-mile-wide crater, and deforested nearby islands (Carr 2020c:9; DOE 1994:2; 2015:4–5; Fehner and Gosling 2006:79–80, 84; Kunkle et al. 2018a; Machen et al. 2010:92).

Figure 3-4. The Laboratory's Test Director Marshall Holloway (center) and colleagues standing in front of the Mike device (Operation Ivy) on Elugelap Island in the Enewetak Atoll in the Pacific Proving Ground (LANL image, accession no. P-66:C246009).

President Dwight D. Eisenhower set a new defense policy in July 1953 that had a greater reliance on nuclear weapons. The 1953 Operation Upshot-Knothole test series at the Nevada Proving Ground comprised Upshot weapons-development tests and Knothole military-effects tests. Notably, this nuclear test series included the only airburst delivery by the United States; the Grable test was a collaboration between the Laboratory and Picatinny Arsenal in Wharton, New Jersey (Figure 3-5). Like previous nuclear test series, Operation Upshot-Knothole integrated troop maneuvers, performed manned penetrations of atomic clouds, and conducted biomedical tests on animals. This nuclear test series also hosted the Federal Civil Defense Administration and an array of effects experiments—using trucks, cars, backyard shelters, and wood-frame buildings with basement shelters, furniture, mannequins, and household items (Carr 2020c:9–10; DOE 1994:2–3; 2015:4–5; Fehner and Gosling 2006:88–95; Kunkle et al. 2018a; LASL 1954:4).

Figure 3-5. Detonation of the Grable device fired from a 280-mm gun on May 25, 1953, during Operation Upshot-Knothole at the Nevada Proving Ground (LANL image, accession no. CIC-9:di99-1877).

Following the Soviet Union's announcement in August 1953 that they possessed a thermonuclear bomb, the United States began investigating whether a superweapon could be produced in a short period. Although it was a thermonuclear device, Mike was not a deliverable weapon. The already-planned spring 1954 Operation Castle test series in the Pacific Proving Ground—expanded in the spring of 1953 to include Bikini Atoll—was redirected toward the testing of superweapons and fallout theories (Carr 2020c:10; Fehner and Gosling 2006:113; Kunkle et al. 2018b; Kunkle and Ristvet 2004:4). Thomas D. Kunkle and others (2018b) noted, "Ideas as to how to build thermonuclear bombs were as common at Los Alamos as screen plays in Hollywood. Perhaps more than any other single person, it was Marshall Holloway who translated scientific fantasy into actual, functioning superweapons." The first thermonuclear gravity bomb was ready for service in February 1954, without ever having been tested (Kunkle et al. 2018b).

The Operation Castle test series was planned for both Bikini and Enewetak Atolls, and all tests projected megaton[8] yields. Radioactive fallout beyond the immediate area of the two atolls was deemed unlikely. On February 28, 1954, the United States conducted its largest nuclear test when they detonated the Bravo device—the first of the Operation Castle test series—at Bikini Atoll (Figure 3-6). At 15 megatons, it

[8] A megaton is the energy of a nuclear explosion that is equivalent to the explosive power of 1 million tons of TNT.

yielded more than twice the anticipated 6 megatons. The blast sent large radioactive particles into the stratosphere, and then they plunged back to Earth. The radiation levels were surprisingly high both onsite and downwind, and test personnel immediately experienced hazardous conditions. In a control bunker 20 miles from the detonation site, radioactivity measured 800 roentgens,[9] and ships stationed 30 miles from the site experienced up to 5 roentgens of radioactivity. While the fallout cloud drifted east toward neighboring atolls, evacuations of test personnel ensued (Brown 2014; Carr 2020c:10; DOE 1994:3; 2015:4–5; Fehner and Gosling 2006:114–116; Kunkle et al. 2018b; Machen et al. 2010:94).

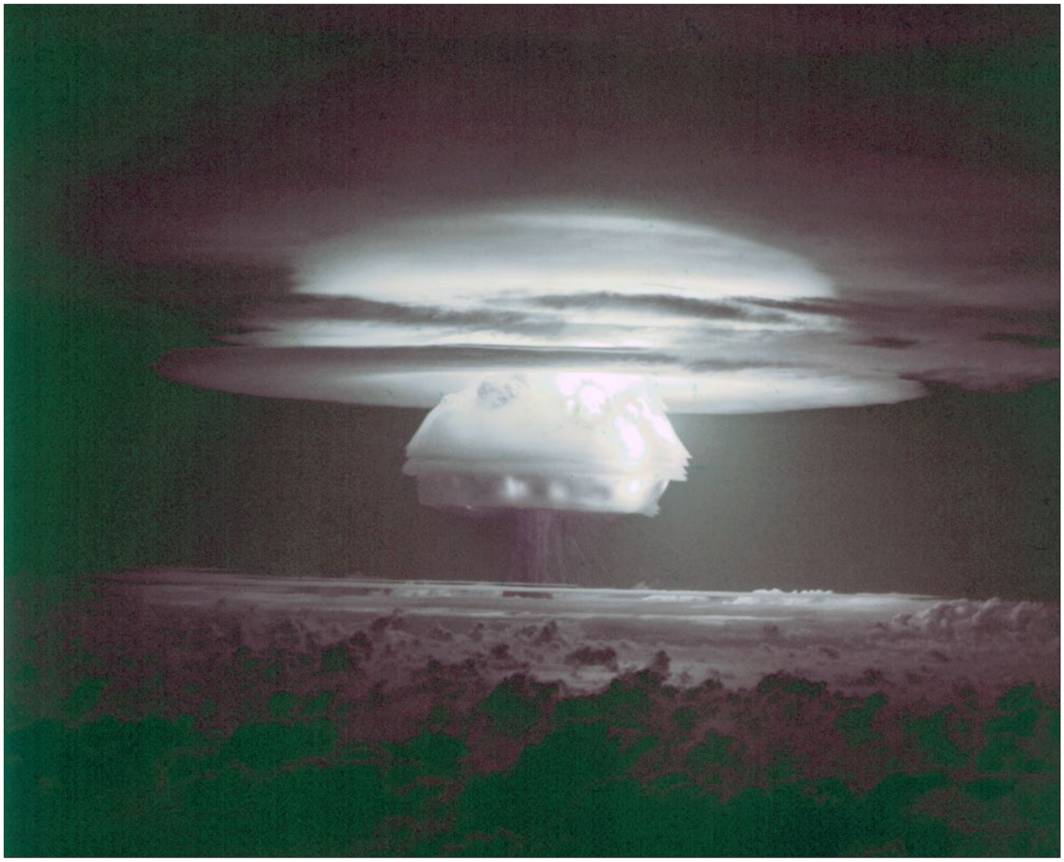

Figure 3-6. Detonation of the Bravo device on February 28, 1954, during Operation Castle on Bikini Atoll in the Pacific Proving Ground (LANL image, accession no. P72).

One day after detonation of the Bravo device, the U.S. Air Force evacuated military personnel stationed at a weather station on Rongerik Atoll—133 miles from ground zero—where air measurements were 40 to 98 roentgens. The day after that, 82 residents were evacuated from Rongelap Atoll, where air measurements were estimated to be 100 to 125 roentgens. Islanders of Rongelap and Ailinginae Atolls experienced symptoms of high radiation exposure. The military also evacuated residents of other nearby islands, including Rongerik and Utirik Atolls. Approximately 665 residents received radiation overexposures from the Operation Castle-Bravo blast, and approximately 236 Marshallese were evacuated during the emergency. Two weeks later, a Japanese fishing boat arrived home with a crew of 23 who were suffering from radiation exposure—air measurement approximations ranged from 130 to 450 roentgens. The *Daigo Fukuryu Maru* was 100 miles east of Bikini Atoll, trawling for tuna, when the

[9] The roentgen is a unit for measuring ionization caused by gamma and X-rays in air and does not relate to the biological effects of radiation on the human body. It is an easily measured unit of exposure and was named for Wilhelm Roentgen, who discovered X-rays.

Bravo device was detonated. The remaining tests were reshaped and subjected to much more stringent weather criteria using an expanded danger zone (Carr 2020b:9; 2020c:11; Fehner and Gosling 2006:114–116; Kunkle and Ristvet 2004:2; Langham and Storer 1953:4–5, 20, 43, 54–55; Shipman 1954:10–12). As noted by Carr (2020b:9), "The danger of fallout gradually eclipsed the Soviet Union as a threat."

Operation Castle made deliverable thermonuclear weapons a reality, completely revolutionized atomic weapons development, and solidified opposition to atomic testing for its long-term implications on international relations and humanity. Extremely disturbed by the dangers posed by thermonuclear weapons, President Eisenhower gave an "Atoms for Peace" speech to the United Nations assembly on December 8, 1953. Subsequently, he pressed his administration to explore curbing the arms race or setting a moratorium on large-scale testing. The U.S. State Department, the AEC, both laboratories—LASL and the University of California Radiation Laboratory at Livermore (renamed Lawrence Radiation Laboratory [LRL] in 1958 and present-day Lawrence Livermore National Laboratory [LLNL])—and the DOD all opposed a nuclear testing moratorium because it was not seen to be in the national interest (Carr 2020b:9; Fehner and Gosling 2006:116–120; Kunkle et al. 2018b; Machen et al. 2010:93). As noted by Fehner and Gosling (2006:123), "Radioactive fallout set the context for nuclear weapons testing over the remainder of the decade. No respecter of national boundaries, fallout had spread worldwide and become a contentious international issue."

Operation Teapot's 14 tests in 1955 included tests by both laboratories and a Laboratory-DOD test. Experiments sought to improve small weapons for tactical applications and to examine a fireball's interaction with nearby structures. Due to advocating by U.S. Test Director Graves, the AEC was as transparent as they could be about Operation Teapot, especially regarding offsite exposures to civilian populations. Operation Wigwam, a Laboratory-DOD test also conducted in 1955, was the first underwater test by the United States (Carr 2020c:11; DOE 1994:3–4; 2015:4–7; Fehner and Gosling 2006:123–126, 139; Kunkle et al. 2018b).

In 1955–1956, the Laboratory conducted Operation Project 56 at NTS. This nuclear test series of four detonations included safety experiments that significantly alerted the nuclear weapons community that the nuclear stockpile was not safe and could be set off accidentally. If that was not enough, a recovery team recorded air measurements ranging from 4.3 to 28 roentgens after the No. 4 device and plutonium contamination that measured 10 miles by 2 miles after the entire series. Subsequently, safety tests became part of the regular testing program. The United States conducted Operation Redwing in 1956 in the Pacific Proving Ground. Goals were to proof-test the stockpile, continue tests on developmental weapons, advance research on new techniques and designs, and further the DOD's weapon effects program. This nuclear test series also included the first airdrop by the United States of a thermonuclear weapon (Carr 2020c:12; DOE 1994:4–5; Fehner and Gosling 2006:143–146; Kunkle et al. 2018b).

Late Cold War Era (1956–1991)

The nuclear test series of 1957 included Operation Project 57 in the Nellis Air Force Range and Operations Plumbbob and Project 58 at NTS. Operation Project 57 was one safety experiment on plutonium dispersal, and Operation Plumbbob comprised 29 tests. Significantly, during Operation Plumbbob, the Laboratory conducted the first true underground test with the Pascal-A device in a shaft, and the University of California Radiation Laboratory at Livermore conducted the first contained underground detonation (Rainier device) with no radioactive release detected. Operation Plumbbob also saw the first test by the United States using a balloon (Lassen device) and a rocket (John device), or air-to-air missile. By the end of 1957, the United States had 5,543 nuclear weapons in its stockpile (Atomic Heritage Foundation 2023; Carr 2020b:18; 2020c:12; DOE 1994:5–6; 2015:8–11; Fehner and Gosling 2006:159–160, 178; Kunkle et al. 2018b).

The Soviet Union launched Sputnik, the first space satellite, on October 4, 1957. Nikita Khrushchev, who became the Soviet Premier in March 1958, announced the discontinuation of all nuclear testing and requested the same of other nuclear countries. The United States conducted five test series between February and October 1958: Operation Project 58 A at NTS, Operation Hardtack in the Pacific Proving Ground, Operation Newsreel on Johnston Atoll, Operation Argus in the South Atlantic Ocean, and Operation Hardtack II at NTS. Notably, one of the Operation Newsreel exoatmospheric tests (Teak device) triggered the first high-altitude electromagnetic pulse. On August 22, 1958, President Eisenhower announced a 1-year nuclear testing moratorium to end all nuclear testing by the United States on October 30. Operation Hardtack II was originally named Operation Millrace; its name was changed after President Eisenhower's moratorium announcement to avoid potential criticism for starting a new test series. Operation Hardtack II would now focus on exploring methods to detect underground detonations. In 1958, the United States added 12 new weapons types to its stockpile (Carr 2020c:12–14; DOE 1994:6–10; Fehner and Gosling 2006:184–187, 190, 193; Kunkle et al. 2018b; Machen et al. 2010:94)

Fehner and Gosling (2006:195) noted,

> The moratorium was not entirely unwelcome in the testing community. After a record seventy-seven nuclear weapons tests in 1958, the testing system, noted one participant, "was tired, tired, tired." Sufficient data existed from the Hardtack I and II and Argus shots to keep weapon scientists busy for at least a year or two.

During the moratorium, the United States worked on indirectly related activities. These projects helped to keep the nuclear testing apparatus (staff and infrastructure) in a state of readiness. Hydronuclear tests, pioneered by the Lawrence Radiation Laboratory (present-day LLNL), were conducted at the Laboratory during the moratorium. Preapproved by President Eisenhower, these tests used very small amounts of fissile material and produced fission yields less than the device's built-in high explosives. In 1959, the United States added nine new weapons types to its stockpile (Carr 2020c:13–15; Fehner and Gosling 2006:195).

Talks failed with the Soviet Union, and President Eisenhower announced that the voluntary nuclear testing moratorium would expire on December 31, 1959. While testing remained on hold, weapons manufacturing did not. Talks continued to flounder, and on August 30, 1961, the Soviet Union announced their resumption of nuclear testing. Moving quickly, they conducted 50 atmospheric tests in 60 days, with a combined yield that totaled more than all previous tests of all nations combined. The nuclear testing community put pressure on President Kennedy for the United States to resume atmospheric nuclear testing. Reluctantly, he agreed, but nuclear testing would have to be conducted without fallout. The 1961 Operation Nougat test series at NTS ran from September to June 1962, and all but one test was conducted entirely underground. This nuclear test series also included the first joint United States-United Kingdom test (Pampas device) on March 1, 1962. Almost all of the tests vented radioactive clouds, and fortunately, almost all were minor releases. The exception was the Des Moines device. Detonated by the Lawrence Radiation Laboratory, it spewed radioactive debris across a canyon at the test site. A radiation safety monitor 10 miles away had to take immediate cover, and within a week, analysts found contaminated milk in Spokane, Washington (Carr 2020c:15–18, 21; DOE 1994:10–12; Fehner and Gosling 2006:197–198; Kunkle et al. 2018b).

Following discussions that began in the mid-1950s about peaceful uses for nuclear power, the Plowshare Program was implemented under the AEC's Division of Military Application in 1957. The Plowshare nuclear test series, which involved both laboratories, began in 1961 and explored the feasibility of using nuclear explosions for excavation, natural gas exploration, and earth moving. The Plowshare nuclear test series would include 27 tests from 1961 to 1973, including 4 tests outside of NTS: Gnome near Carlsbad, New Mexico, in December 1961; Gasbuggy near Farmington, New Mexico, in December 1967; Rulison near Parachute, Colorado, in September 1969; and Rio Blanco near Meeker, Colorado, in May 1973 (Buck 1983:6; Carr 2020c:18; DOE 2015:x, 138; Pillai et al. 2022:44).

Bowing to pressure for renewed atmospheric testing, President Kennedy approved Operation Dominic. The first atmospheric tests conducted by the United States since October 1958, this nuclear test series was conducted from April to October 1962 on Christmas Island, which was owned by the United Kingdom and located southwest of San Diego, California (Figure 3-7). Notably, an LRL device (Frigate Bird) was the first and only fully operational test of a nuclear-tipped missile. October 1962 saw the largest nuclear test by the Soviet Union. The Tsar Bomba device yielded 50 megatons, or a blast three times more powerful than the Castle-Bravo device. This month also saw the beginning of the Cuban Missile Crisis, a time when nuclear war seemed imminent. Even during the crisis, both nations continued to test. From 1959 to 1962, the United States built nearly 24,000 nuclear weapon pits (Carr 2020b:11; 2020c:17–18; DOE 1994:12–17; Fehner and Gosling 2006:198; Kunkle et al. 2018b).

Figure 3-7. Detonation of the Yeso device, a 3-megaton airdrop, at Christmas Island on June 10, 1962, during Operation Dominic (LANL image, accession no. P87).

The fiscal year (FY) 1963 (July 1962–June 1963) nuclear test series encompassed Operation Sunbeam at NTS, Operation Fishbowl in the Pacific Proving Ground, Operation Storax at NTS, and Operation Roller Coaster within the Nellis Air Force Range. The DOD directed both Operation Sunbeam and Operation Fishbowl. Operation Storax saw an LRL shot (Sedan device from the Plowshare Program) that resulted in the largest crater at NTS. Operation Roller Coaster was the first joint United States–United Kingdom nuclear test series and included the last atmospheric test conducted by the United States. It is notable that the United States conducted more nuclear tests during 1962 than in any other year. In the 1961–1962 period, 15 new weapons types were added to the nuclear weapons stockpile that then totaled 25,540 (Carr 2020b:18; 2020c:18–19; DOE 1994:15–19; Fehner and Gosling 2006:198-199; Kunkle et al. 2018b).

President Kennedy gave his “peace speech” in June 1963, and in July, Soviet Premier Khrushchev proposed a ban on nuclear tests in the atmosphere, in outer space, and underwater. Ratification of the Limited Test Ban Treaty in August 1963 by the United States and the Soviet Union sent all United States nuclear testing underground, which left many unanswered questions about nuclear weapons effects beyond the atmosphere. Operation Niblick, the FY 1964 nuclear test series; Operation Whetstone, the FY 1965 nuclear test series; and Operation Flintlock, the FY 1966 nuclear test series, were conducted primarily at NTS. Each of these series also conducted one test outside of NTS: Fallon, Nevada; Hattiesburg, Mississippi; and Amchitka Island, Alaska; respectively. Scientists used these one-off tests as nuclear test detection research experiments (DOE 1994:10–28; Fehner and Gosling 2006:199; Kunkle et al. 2018b).

Operation Latchkey, the FY 1967 nuclear test series; Operation Crosstie, the FY 1968 nuclear test series; Operation Bowline, the FY 1969 nuclear test series; and Operation Mandrel, the FY 1970 nuclear test series, finished out the decade and consisted of shots associated with the Plowshare Program, safety experiments, weapons-related tests, weapons-effects tests, and nuclear test detection research experiments (Figure 3-8). The test of the Boxcar device under Operation Crosstie was the largest nuclear test, underground or otherwise, at NTS. In 1970, the United States tested 60 devices, and the Soviet Union tested 21 devices. This same year, the United States’ stockpile contracted to 26,008 weapons. Operation Emery, the FY 1971 nuclear test series, included the Baneberry device. A set of unique circumstances caused a radioactive release from this detonation that resulted in the development of a panel to review containment plans for all subsequent tests (Carr 2020b:14; 2020c:32; DOE 2015:52–71).

The early 1970s saw a focus on anti-ballistic missile defenses by both the United States and the Soviet Union, and the Nuclear Nonproliferation Treaty entered into force. The United States continued conducting nuclear test series at NTS—Operation Grommet, FY 1972; Operation Toggle, FY 1973; and Operation Arbor, FY 1974. The United States and the Soviet Union continued to forge a path toward improved relations with the development of arms control treaties. The Threshold Test Ban Treaty, completed in the summer of 1974, limited underground tests to a design yield of 150 kilotons (DOE 2015:x, 76–85). Carr (2020c:33) noted, “. . . but there was a significant problem: The technology did not exist to enforce the treaty. The United States and USSR [Soviet Union] observed the treaty in the years that followed, but it would not enter into force until the final years of the Cold War.” In the late 1970s, the United States performed the following nuclear test series: Operation Bedrock, FY 1975; Operation Anvil FY 1976; Operation Fulcrum, FY 1977; Operation Cresset, FY 1978; and Operation Quicksilver, FY 1979. In 1978, the Soviet Union surpassed the United States in the number of weapons it maintained. It was also the last year during which the United States would perform more than 20 nuclear tests (Carr 2020c:33; DOE 2015:84–93).

Figure 3-8. The ground collapses and creates a subsidence crater just minutes after the Pliers device was detonated on August 27, 1969, during Operation Mandrel at NTS (LANL image, accession no. P92:PUB69193042).

The 1980s witnessed dramatic improvements in the United States–Soviet Union relations and 176 nuclear tests conducted by the United States: Operation Tinderbox, FY 1980; Operation Guardian, FY 1981; Operation Praetorian, FY 1982; Operation Phalanx, FY 1983; Operation Fusileer, FY 1984; Operation Grenadier, FY 1985; Operation Charioteer, FY 1986; Operation Touchstone, FY 1988; Operation Musketeer, FY 1987; and Operation Cornerstone, FY 1989. By 1986, the Soviet Union had approximately 45,000 weapons (Carr 2020c:33; DOE 2015:94–111). This same year, after the Chernobyl disaster in the Soviet Union, Iceland hosted President Ronald Reagan and General Secretary Mikhail Gorbachev, who discussed "a plan for abolishing nuclear weapons" (Carr 2020c:33). The Joint Verification Experiment followed in 1988. Soviet scientists observed a nuclear test at NTS (Kearsarge test from Operation Touchstone; Figure 3-9), and scientists from the United States observed the Shagan test at the Semipalatinsk Test Site in the Soviet Union. Neither nuclear test exceeded the 150-kiloton limit outlined in the Threshold Test Ban Treaty. In 1988, the Soviet Union tested 27 nuclear devices and the United States tested 12. The United States conducted the Operation Aqueduct test series in FY 1990 and the Operation Sculpin test series in FY 1991 and began the Operation Julin test series in FY 1992 (Carr 2020c:33; DOE 2015:x, 106–113).

Figure 3-9. Scientists from the United States and the Soviet Union discuss the Joint Verification Experiment around the Kearsarge test at NTS (LANL image, accession no. P167:NF9353C).

During the late 1980s, the United States continued to apply "unceasing political, economic, and military pressure to the floundering socialist dictatorship" (Carr 2020c:34). After the fall of the Berlin Wall in November 1989, the Soviet Union would conduct one additional nuclear test (with eight devices) in October 1990. This same year, the United States and the Soviet Union signed the 1990 Protocols to the Threshold Test Ban Treaty and the Peaceful Nuclear Explosion Treaty. The Soviet Union would formally dissolve in December 1991, but not before they and the United States ratified the Threshold Test Ban Treaty (Carr 2020c:33; DOE 2015:x, 110–113). Carr (2020c:34) notes, "With the Cold War over, weapons systems currently in development in the United States were quickly canceled, but testing continued in 1992." On September 23, the Divider test of the Operation Julin nuclear test series became the last full-scale nuclear test conducted by the United States. On October 2, 1992, President George H. W. Bush entered the United States into another unilateral nuclear testing moratorium. Presidents Bill Clinton and George W. Bush subsequently extended the moratorium in July 1993 and March 1994, respectively. Despite the fact that other countries conducted nuclear tests into the late 1990s, this moratorium has been observed by the United States to this day. The United States conducted 1,054 nuclear tests between 1945 and 1992, which produced approximately 190 megatons of energy (Carr 2020b:16; 2020c:34; DOE 1994:i–iii; 2015:112–113; Machen et al. 2010:94).

Although additional tests associated with Operation Julin were scheduled, nuclear testing by the United States ended abruptly in September 1992 after the Divider test. Four of the numerous planned nuclear tests following Divider were Icecap and Mexia by LANL and Gabbs and Greenwater by LLNL. The Icecap device was within 2 weeks of testing, and the diagnostic rack remains suspended in the 152-foot-tall tower over a hole one-third of a mile deep at Icecap Ground Zero at NNSS (Figure 3-10) (Carr 2020c:34; Gowin 2019; Scammel 2005:53, 58) (Ron Cosimi, personal communication 2024).

Figure 3-10. The Icecap Ground Zero site at the NNSS showing service tower, cables, cranes, trailers, and other equipment (NNSS image, accession no. NF2192).

As explained by Carr (2020c:20–21), underground nuclear tests

> were the tests that produced the modern stockpile. Their technical stories largely remain secret, but many of the innovations that were pioneered during the period of underground nuclear testing are not. For instance, the laboratories greatly miniaturized warheads, and hardened them to increase survivability when under attack. Los Alamos pioneered the development of insensitive high explosives, and was the first laboratory to successfully test and field such compounds in nuclear weapons. Underground testing directly led to advances in design that made weapons lighter, more accurate, more versatile, more robust, and much safer.

The “DOE has been directed to maintain an underground test readiness program in case it is in the ‘supreme national interest’ to resume nuclear testing” (DOE 2015:x), and the NNSS remains the “preferred location for National nuclear Security Administration defense programs, industry research, and development efforts” (Atomic Heritage Foundation 2023). The current Stockpile Stewardship and Management Program relies on ongoing subcritical testing at NNSS (Brunish 2019:36). As noted by Laboratory scientists Ghazar R. Papazian and others (2003:75), “The NTS continues to be a testbed for experiments that return unique and crucial data in support of the enduring stockpile and fundamental weapons physics. The location and geology of the site, coupled with a traditional ‘can-do’ attitude, serve the laboratories and the nation well.”

Underground Nuclear Testing

The present-day NNSS was established in December 1950 within the Nellis Air Force Base Gunnery and Bombing Range. The site was renamed the Nevada Proving Ground in February 1951, NTS in 1955, and the NNSS in 2010. Established for continental nuclear testing, the NNSS is located 65 miles north of Las Vegas in southern Nevada and measures 1,350 square miles. The site has a small town called Mercury and several mining camps, including the Area 12 camp. Named regions of the NNSS included Frenchman Flat, Yucca Flat, Rainier Mesa, and Pahute Mesa, with the latter two supporting the horizontal-tunnel tests. Although nuclear testing ceased at the site in 1992, the NNSS continued to be used for national security needs (Atomic Heritage Foundation 2023; Machen 1988:21; McGehee et al. 2007:7; Merlin 2016). For a photographic look at the artifacts, landscapes, and heritage of the United States continental nuclear testing at the NNSS, see Coolidge (1996), Scammell (2005), Merlin (2016), and Gowin (2019).

The United States performed 839 underground nuclear tests at NTS: 763 shaft (or borehole) tests, 24 of which were joint United States–United Kingdom tests; 67 tunnel tests; and 9 crater tests (Figure 3-11). LANL and LLNL individually and sometimes in collaboration with SNL and/or the DOD sponsored shaft and tunnel tests at NTS. Typically, weapons effects testing was performed for the DOD (and later for the Defense Nuclear Agency), while weapons designs (performance) testing was conducted for DOE. Shaft testing objectives included weapons development, weapons design, safety, stockpile reliability, and physics phenomenology, whereas tunnel testing objectives included weapons effects, such as radiation, blast and shock, and consequences to underground structures. LANL and LLNL individually and sometimes in collaboration with the DOD sponsored crater tests. Four were weapons-effects tests, and the other five were in support of the Plowshare Program (DOE 2015; Machen 1988:4; McDuff 2018:4; McGehee et al. 2007:5).

Figure 3-11. An oblique aerial photograph of NTS in 1977 (LANL image, accession no. IM-4:JN77-552).

Testing Logistics

The process to prepare for an underground nuclear test in a shaft began with a proposal by Laboratory staff, permission from DOE, and an approval by the president of the United States. Once approved, work began at both the Laboratory and NTS (Machen 1988:6–7).

Design and Fabrication of Test Components at the Laboratory

Staff from LANL design and engineering divisions determined the nuclear device to be used for an upcoming test and what information needed to be gained from the test. Scientists began conducting theoretical and experimental tests, making and refining calculations, and investigating hydrodynamic effects through nonnuclear tests. Using results of this work, scientists designed diagnostic experiments that would be mounted on the downhole structure above the nuclear device (Machen 1988:7; Mortensen et al. 2003:44; Papazian 2023). This downhole structure was called a *diagnostic rack* at LANL and a *canister* at LLNL (Raffi Papazian, NNSS Nuclear Testing Archive, personal communication 2023). The downhole structure held the nuclear explosive, diagnostic instruments, and downhole components of the timing and firing hardware. Unsurprisingly, Laboratory racks grew longer and heavier over time as more diagnostics and line-of-sight pipes were added (Brunish 2019:29–30; Machen 1988:7).

Laboratory-designed diagnostic racks were built in sections at a shop at the north end of TA-03 by the Laboratory's operations contractor.[10] Racks were subjected to pull tests using hydraulic rams to verify load strength and welds and then were "tuned" (or aligned) using a device target stand (Figure 3-12) (Ron Cosimi, personal communication 2024). These activities occurred at a nearby tower in TA-03 and later at the TA-60 RAAC (Figure 3-13 through Figure 3-16). Timing and firing engineers would select the desired systems to provide timing signals to the diagnostic equipment and to arm and fire the nuclear device. The nuclear devices used in underground tests were normally designed at LANL, and many parts were fabricated onsite, although other DOE contractors contributed components (Machen 1988:11; Nelson 1975). The nuclear device was attached to a device-mounting stand connected to the bottom of the diagnostic rack and protected by the device canister. The entire assembly would be suspended using wire-rope harnesses and turnbuckles connected to a load equalizer (Barry Bailey, personal communication 2023; Ron Cosimi, personal communication 2024).

Wire-rope harnesses used to lower the downhole structure, which was suspended from the load equalizer, were also assembled at LANL. The wire ropes were made in standard 80-foot lengths fitted with an open socket on one end and a closed socket on the other end. Ironworkers fit the sockets to the wire ropes either by "pouring" (filling with hot liquid zinc) or "swaging" (pressing a socket onto a wire rope using a 5,000-ton hydraulic press; Figure 3-17). Wire-rope harnesses were tested with hydraulic rams (Figure 3-18). The wire-rope harnesses were then coiled, crated, and shipped to NTS (Johnson 1968).

[10] Laboratory operations contractors included Zia Company (1946–1986), Pan Am World Services (1986–1989), and Johnson Controls World Services (1989–1997; Pillai 2022:59).

Figure 3-12. Laboratory staff check lines of sight on a diagnostic rack in 1969 (LANL image, accession no. PUB 69108-020).

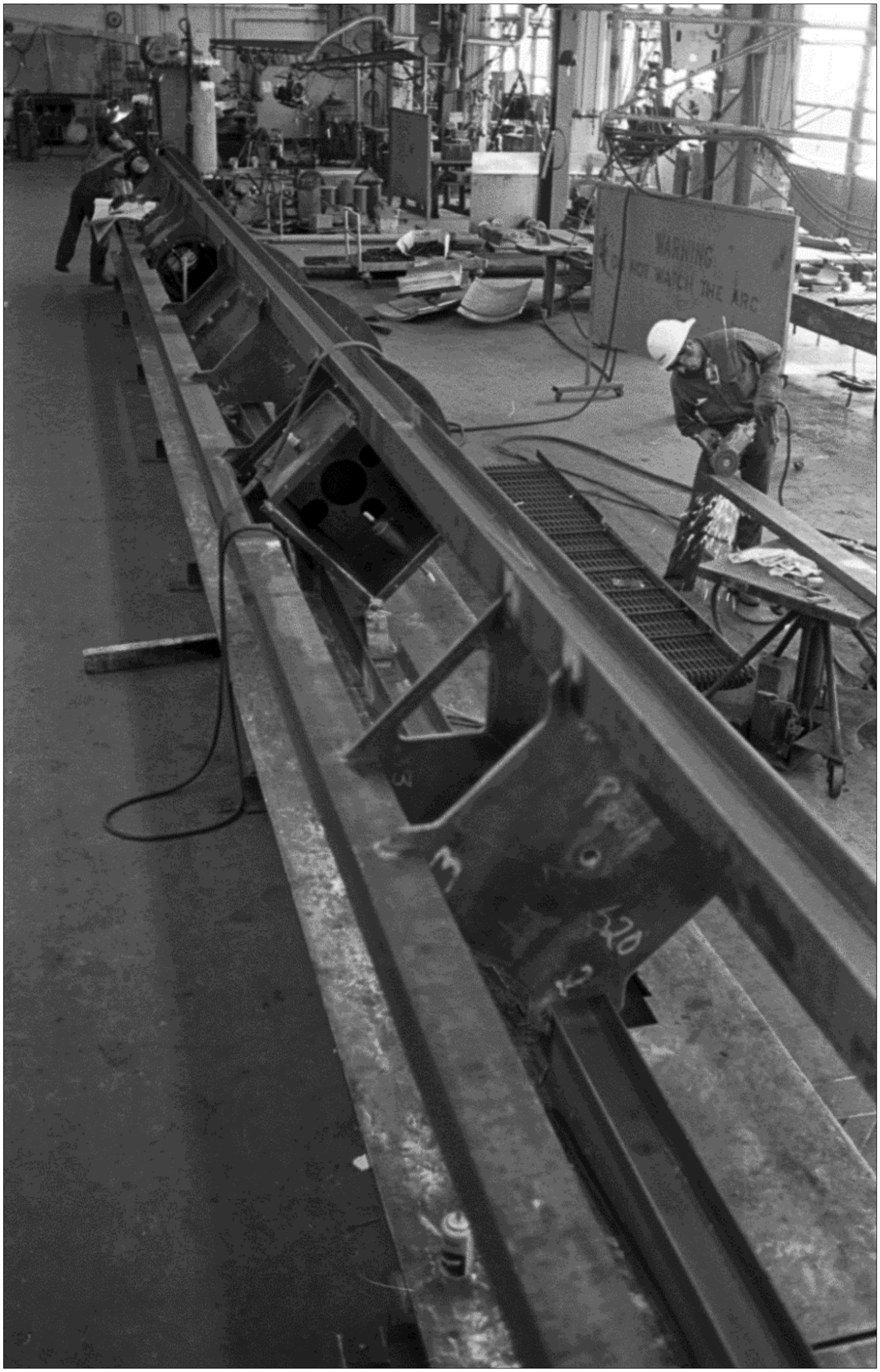

Figure 3-13. Steelworkers fabricate a diagnostic rack in the TA-03 Zia Company shop in 1975 (LANL image, accession no. PUB 75233-061).

Figure 3-14. Laboratory staff “tune” a diagnostic rack in the TA-03 rack tower in 1975 (LANL image, accession no. PUB 75233-089).

Figure 3-15. Diagnostic rack in transport from the north TA-03 facilities in 1986, likely to the TA-60 RAAC (LANL accession no. A-2012-028 B14F4).

Figure 3-16. *La cuna* in use in the north bay of TA-60-0017, 1990 (LANL image, accession no. IM-9:RN90-198-038).

Figure 3-17. Laboratory employees prepare to pour hot liquid zinc into the sleeve of a socket in 1968 (LANL image, accession no. 21-00002079-PUB 68193).

Figure 3-18. A wire-rope and socket assembly following strength testing in 1968. The holding power of the sockets was generally greater than the strength of the wire-ropes (LANL image, accession no. 21-00002059-PUB 68193).

Rack Transport to NTS

Following fabrication and tuning, racks were disassembled and shipped to NTS, where the assembly and tuning was repeated by LANL staff over the downhole itself (Nelson 1975:9). Former J-6 NTS scientist Barry Bailey (personal communication 2023) recalls, "It was important that the rack was continuously supported over its entire length during transport: if the four I-beams on the rack were bent, it could result in problems with aligning experiments within the structure of the rack, and this could result in the loss of critical data during the execution of the 'test.'"

Test Preparation at NTS

Meanwhile at NTS, crews designed and drilled an emplacement hole. Shaft tests required emplacement holes that typically measured 1.8 to 3.0 m (6 to 10 ft) in diameter and 183 to 670 m (600 to 2,200 ft) deep. Drilling the holes at NTS was a 24-hour operation that took 3 to 12 weeks per hole, depending on the hole's location, depth, and diameter. Construction crews assembled a modular service tower over the emplacement hole and set up diagnostic recording trailers and other test support structures, such as the timing station and the Red Shack, which both transmitted the arming and firing signals downhole. Test support structures had to be located several hundred feet from the emplacement hole so as not to fall into the subsidence crater created when the underground cavity created by the explosion collapsed. Next, crews laid electrical cables and up to 10,000 feet of gas-blocked coaxial cables that would run from the downhole structure to the test support structures (Figure 3-19) (Machen 1988:5–13; McDuff 2018:5–7).

Once the downhole structure arrived at NTS, it was suspended from the service tower above the emplacement hole where it would be protected against weather while the diagnostic equipment was installed and the assembly was "tuned" again (Figure 3-20) (Machen 1988:12; McDuff 2018:7; Mortensen et al. 2003:38). When the downhole structure was ready, the nuclear device was transported from its assembly area elsewhere at NTS via armed guard to test ground zero (Machen 1988:14). "Once the device was inserted, the [LANL] rack was lowered into the [device] canister, and the two bolted together" (Barry Bailey, personal communication 2023). Scientists installed the diagnostic instruments, the timing and firing systems, and the nuclear device and attached them all to the cabling. The complete assembly included the rack, diagnostic instruments, timing and firing systems, and the nuclear device, which were attached to the cabling and lowered to the bottom of the emplacement hole by either wire-rope harnesses and a load equalizer (LANL) or emplacement pipes (LLNL) (Brunish 2019:26; McDuff 2018:12–14).

Before the test, the modular service tower was disassembled and removed for reuse elsewhere. The downhole structure was then covered with stemming materials to prevent the escape of radioactive debris and gases. Stemming materials consisted of layers of magnetite, sand, concrete, and epoxy specific to each test (Brunish 2019:27; McDuff 2018:7; Mortensen et al. 2003:38,45).

Test Firing at NTS

A "shot panel" met the day before the scheduled test to review procedures for safety and security. On detonation day (D-Day), a readiness briefing was held, and the DOE test controller gave the LANL test director permission to fire. Signals for the arming process, activation of recording equipment, and firing were sent from the Control Point to the Red Shack by an automatic sequencer via microwave or optical fiber signals. The coaxial cables transmitted information from detectors on the rack to the recording trailers and then back to the Control Point. Staff at the Control Point (Figure 3-21) could have seen puffs of dust or felt the ground shake at the moment of detonation, and a subsidence crater could have formed. After the test, Laboratory scientists compared predictions with actual test results and analyzed samples of radioactive debris collected from the emplacement hole (Machen 1988:7, 15–18).

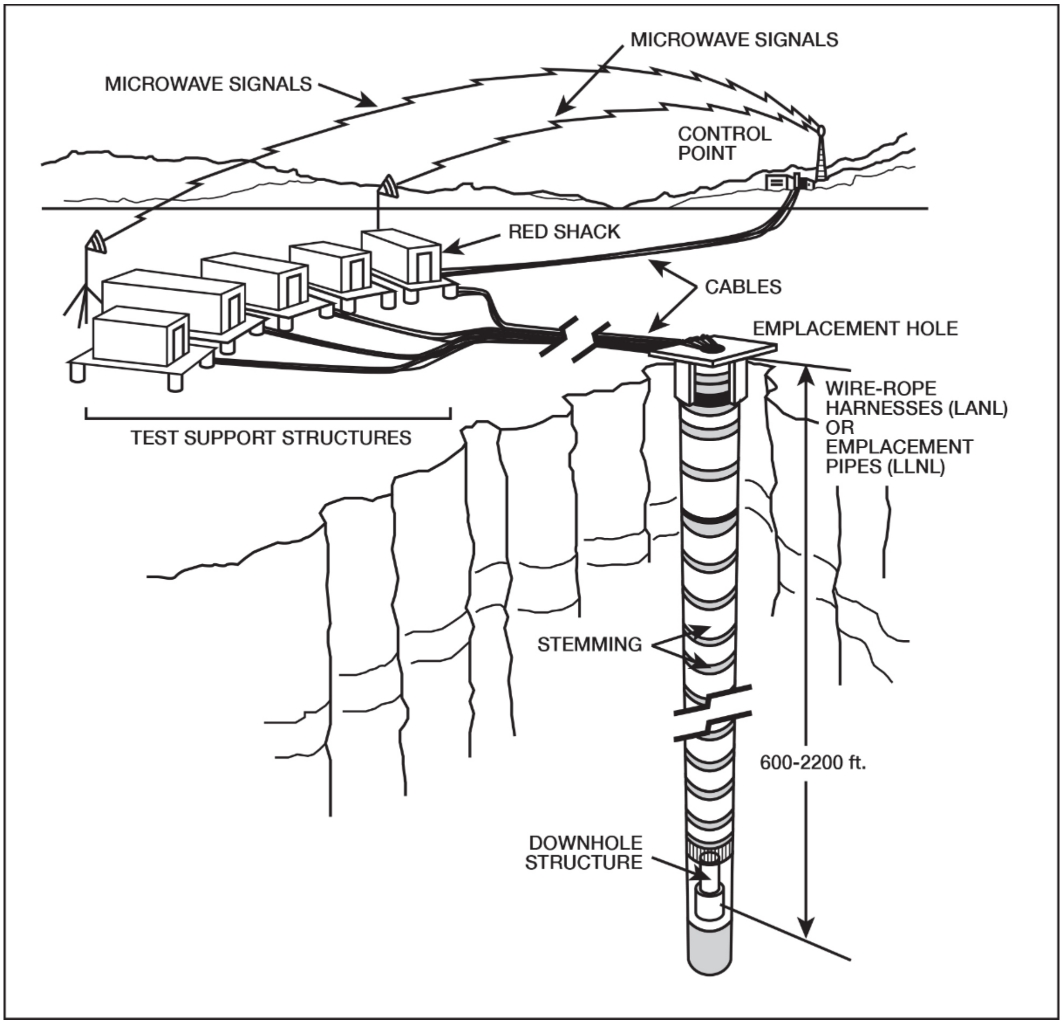

Figure 3-19. Diagram showing the layout of an underground shaft test at NTS (after Machen 1988:7 and Brunish 2019:16).

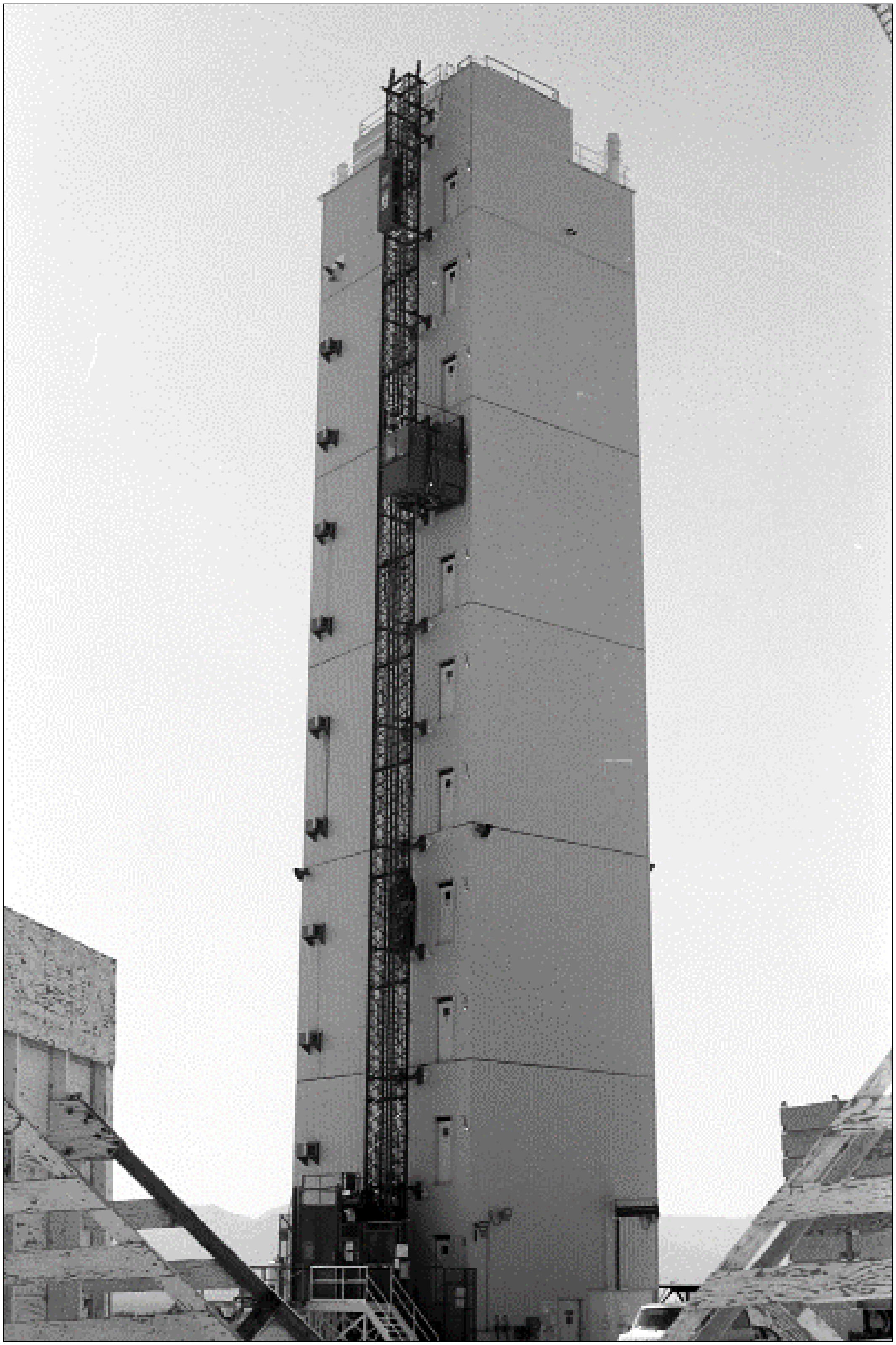

Figure 3-20. A modular service tower at NTS in 1991 (LANL image, accession no. PAO 91295-011).

Figure 3-21. Staff inside a control point at NTS, ca. 1990s. (LANL image, accession no. P180).

Altogether, field preparation time once a LANL rack arrived at NTS could take more than 3 months (J Division, presentation 1990). The collaborative effort of the Laboratory's comprehensive Nuclear Test Program was described by scientist Walter Machen (1988:7):

> In effect a highly specialized physics laboratory, the completed rack, when emplaced downhole and ready of detonation, represents the efforts of hundreds of people—among them physicists, construction workers, engineers, technicians, drillers, geologists, and safety experts—who coordinate their efforts to conduct a successful test.

LLNL North Las Vegas Facility

LLNL developed and built their downhole structures for underground testing at the North Las Vegas Facility—also known as the Losee Road complex or the Atlas Facility—near the DOE's Nevada Site Office in North Las Vegas. In 2007, the facility was being used as both a machine shop and an experiment building (McGehee et al. 2007:12). Both LLNL and the A-1 Machine Shop at the North Las Vegas Facility retain components of the Gabbs canister. Note that the Gabbs canister components at the A-1 Machine Shop are scheduled to be moved temporarily to the NNSS while the facility undergoes a mission expansion project (Raffi Papazian, NNSS Nuclear Testing Archive, personal communication 2023). Notably, LLNL's North Las Vegas Facility is the only complex in the United States that could be considered architecturally or functionally similar to the former TA-60 RAAC at LANL. Both facilities are currently inactive for their constructed purpose (McGehee et al. 2007:12).

LANL TA-60 Development

TA-60 is located on a mesa (unofficially called Sigma Mesa) on land formerly within TA-03. The area was used for agricultural purposes before the Manhattan Project, then remained undeveloped until the 1960s. One of the first buildings in the vicinity of the future RAAC was the TA-03-0219 High Frequency Radio Facility (present-day TA-60-0045), an earthen-covered structure built to house communications equipment and supplies and shelter staff in the event of a nuclear attack or other emergency (Jeremy Brunette, personal communication 2024). The facility also had several related antennae and support structures (LANL 2023; Sobojinski et al. 1993:2.4).

In 1985–1986, the RAAC was constructed to support underground testing activities at NTS (Figure 3-22). It included TA-03-0489 (present-day TA-60-0017), a pre-engineered metal building that housed office, pull-test, and shop areas and TA-03-1485 (present-day TA-60-0019) that contained two rack towers and underground shafts designed to hang test racks being prepared for underground testing (Figure 3-23) (McGehee et al. 2005:44).

Figure 3-22. Laboratory staff with General Withers at the dedication ceremony for the newly completed RAAC at TA-60 in August 1986 (LANL image, accession no. PAO 89386-026).

Figure 3-23. Rack hanging in TA-60-0019 rack tower shaft during the dedication ceremony in August 1986 (LANL image, accession no. PAO 86386-005).

In 1989, the Laboratory redefined its TAs, including the southeastern portions of TA-03. The buildings and structures within them were renamed from TA-03 to TA-60. At that time, aside from the RAAC, TA-60 contained "Laboratory support and maintenance operations and contractor service facilities" (Sobojinski et al. 1993:2.3). The High Frequency Radio Facility, two transportable office buildings and several portable storage structures located near the RAAC were accessed by a single gravel road with a gate west of TA-60-19. Proposed master plans and memos dating from 1986 to 1992 show that five additional buildings (plus support structures) were proposed for the complex, though none were built. Over the years, impermanent structures have come and gone, but no additional major facilities have been added (Sobojinski et al. 1993:2.3–2.7).

The RAAC was built to support underground nuclear testing conducted at NTS (Figure 3-24), then continued to support subcritical tests carried out at NTS after nuclear testing ceased following the 1992 testing moratorium. The RAAC was subsequently vacated but later "reactivated as recently as 2005 for the 'Unicorn' underground subcritical test conducted at NTS in August 2006" (LANL 2007:1). The Unicorn test "was conducted using a typical underground test setup, including LANL wire-rope harnesses (used to lower the rack into its hole), a LANL rack, a deep hole, and a mobile tower structure" (LANL 2007:8). In 2007, the RAAC buildings TA-60-0017 and TA-60-0019 were decommissioned but designated for long-term preservation and placed on the Laboratory's "Candidates for Preservation" list. The buildings remained empty until 2019, when the south portion of TA-60-0017 was reoccupied as a permitted treatment, storage, and disposal facility.

Figure 3-24. Rack hanging in TA-60-0019 rack tower in 1991 (LANL image, accession no. CN91-3085).

Multiple items related to the operations at the former RAAC remain onsite. Photographs show that the items have moved within the site (Figure 3-25), but they are currently located within the legacy storage yard northeast of TA-60-0019.

Figure 3-25. Aerial photograph of the RAAC, 1991 (LANL image, accession no. IM-9; RN91 241-358).

CHAPTER 4: MULTIPLE-PROPERTY METHOD OF EVALUATION AND ELIGIBILITY CRITERIA

Structures in the TA-60 RAAC legacy storage yard were evaluated using a multiple-property documentation approach. This systematic approach serves as a useful evaluation tool to determine the historical significance of a group of thematically related properties.

Historic Context

A key element of the multiple-property documentation approach is context. Historic contexts provide information about historical patterns and trends by defining historical themes, geographical areas, and chronological periods. These three components provide a consistent framework for evaluations (Lee and McClelland 1999:11). The TA-60 RAAC legacy storage yard properties are technologically and historically related, and the historic context provided in Chapter 3 establishes the relevant historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. The defined geographical area is the former TA-60 RAAC, which was in use during the late Cold War era and just beyond (1985–1992). The properties under study were evaluated for National Register eligibility within their historic context, with decisions being related to final eligibility recommendations based on their property type and retention of integrity.

Property Types

The multiple-property documentation approach requires the identification of property types that are associated with the relevant historic contexts. This identification facilitates the evaluation of individual properties within the broader complex of all evaluated properties. Properties are compared with other historical resources that have similar histories and similar physical characteristics (DOE 1997). Properties are first assessed against the list of properties exempt from review, and properties that are not exempt are then subdivided into the LANL property types.

Properties Exempt from Review

Some property types are exempt from evaluation. The CRMP and the PA provide a list of those that require no formal documentation unless they exhibit significant architectural or engineering features or are associated with a National Register–eligible site or district. Exempted properties include the following:

- Structures with minimal or no visible surface manifestations (i.e., pits; underground storage tanks; underground vaults; buried material disposal areas; septic tanks; underground pipelines; sewer lines; and steam, stormwater, acid, or electrical manholes)
- Aboveground fuel tanks and water tanks
- Wells and boreholes
- Roadblock barriers
- Transformer and pressure-relief valve stations
- Mobile trailers, modular buildings, and enclosures that serve as temporary administrative support office space or storage facilities

Additionally, properties less than 50 years old may also be exempt from review until a later date. In general, properties must be at least 50 years old and meet at least one of four criteria to be eligible for inclusion in the National Register. Sometimes a property less than 50 years old is evaluated, as in the case of the former TA-60 RAAC legacy storage yard.

LANL Property Types

As reflected in the PA and the CRMP, four general property types are associated with the Laboratory's historical themes:

- Laboratory-Processing Facilities: These facilities have forms and shapes that are most often directly related to the essential activities they perform, the mission they support, or the equipment they house. Examples include research, testing, processing, and production facilities.
- Administration Facilities: These facilities are closely associated with the operation of laboratory-processing facilities. Administration facilities are typically located away from experimental areas; this practice allows administrative personnel and material to remain separate from operational hazards and maximizes their distance from experiments. Examples include administrative and staff offices, cafeterias, health and safety offices, light laboratory spaces, break areas, and change rooms.
- Security Facilities: These facilities are associated with the general operation of a property or TA and support the main overarching theme of research, development, and testing related to the Laboratory's nuclear weapons and high-explosives programs. Examples include guard stations, security lights, guard towers, special nuclear material vaults, and physical exclusion structures such as fencing and barriers.
- Support Facilities: These facilities were constructed to support research and development activities. Examples include warehouses, water tanks, utilities, waste-treatment facilities, machine shops, power plants, vehicles, and electrical substations.

Eligibility Criteria

Under the NHPA, historic properties are defined as prehistoric and historic sites, buildings, structures, districts, and objects included in, or eligible for inclusion in, the National Register, as well as artifacts, records, and remains related to such properties (54 U.S. Code 300308). Archaeological sites are evaluated for listing in the National Register following the NPS guidelines, *How to Apply the National Register Criteria for Evaluation* (Shrimpton 2002) and 36 CFR 60.4:

> The quality of significance in American history, architecture, archeology, 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) that are associated with events that have made a significant contribution to the broad patterns of our history (**Criterion a**); or
> (b) that are associated with the lives of significant persons in our past (**Criterion b**); 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 (**Criterion c**); or
> (d) that have yielded, or may be likely to yield, information important in prehistory or history (**Criterion d**).

Additional criteria, called criteria considerations, allow for the inclusion of cultural resources that are not usually considered for listing in the National Register. Under 36 CFR 60.4, resources considered under the criteria considerations must also be eligible under one or more of the four previously listed criteria and possess integrity.

(a) A religious property deriving primary significance from architectural or artistic distinction or historical importance (**Criteria Consideration a**); or
(b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event (**Criteria Consideration b**); or
(c) a birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life (**Criteria Consideration c**); or
(d) a cemetery that derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events (**Criteria Consideration d**); or
(e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived (**Criteria Consideration e**); or
(f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance (**Criteria Consideration f**); or
(g) a property achieving significance within the past 50 years if it is of exceptional importance (**Criteria Consideration g**).

Integrity

Beyond the application of the above significance criteria and criteria considerations, a cultural resource must also retain sufficient integrity to be eligible for listing in the National Register. To possess integrity, properties must be able to convey their importance from the period of significance by retaining several, and usually most, of the seven aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. Historic properties either retain integrity or they do not (Shrimpton 2002:44). The NPS guidance (Shrimpton 2002:44–45) provides the following:

- **Location** is the place where the historic property was constructed or the place where the historic event occurred.
- **Design** is the combination of elements that create the form, plan, space, structure, and style of a property.
- **Setting** is the physical environment of a historic property.
- **Materials** are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- **Workmanship** is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- **Feeling** is a property’s expression of the aesthetic or historic sense of a particular period of time.
- **Association** is the direct link between an important historic event or person and a historic property.

Notably, the order of these aspects reflects their importance, and they range from physical qualities to perceptions. Thus, a property that retains only integrity of feeling and association (perceptions) would not be eligible for listing in the National Register. Additionally, the importance of which aspects of integrity a property should retain is dependent on the criteria for which it is significant. As such, significance must be established to assess integrity. A property eligible under Criterion (a) or (b) should retain the essential physical features it possessed during the significant association. A property eligible under Criterion (c) must retain most of the essential physical features (distinctive characteristics or artistic values) it possessed during its period of significance. Less importance to physical features is given to a property eligible under Criterion (d). Ultimately, properties eligible under Criteria (a), (b), and (c) should be able to convey their significance through the visual qualities that made them important (Shrimpton 2002:44–47).

CHAPTER 5: DESCRIPTIONS AND ELIGIBILITY DETERMINATIONS OF EVALUATED PROPERTIES

For this investigation, seven structures in the TA-60 RAAC legacy storage yard were documented and assessed for eligibility for listing in the National Register (Table 5-1; Figure 5-1).

Table 5-1. Evaluated Structures in the TA-60 RAAC Legacy Storage Yard

Item Name	Date(s) of Manufacture or Fabrication	Manufacturer/Engineer	National Register Eligibility
La Cuna	ca. 1987	LANL operations support contractor (Pan American World Services)	Eligible under Criteria a and c and Criteria Consideration g
Second Steering Dolly	1988	General Trailer Co.	Not Eligible
Rack Transporter (Jeep, Rack Trailer, and Steering Dolly)	1989	Neil F. Lampson Inc.; General Trailer Co.	Eligible under Criteria a and c and Criteria Consideration g
Mexia Diagnostic Rack	ca .1991–1992	LANL operations support contractor (Johnson Controls World Services)	Eligible under Criteria a and c and Criteria Consideration g
Mexia Device Canister	ca. 1991–1992	LANL operations support contractor (Johnson Controls World Services)	Eligible under Criteria a and c and Criteria Consideration g
Mexia Device Mounting Stand	ca. 1991–1992	LANL operations support contractor (Johnson Controls World Services)	Eligible under Criteria a and c and Criteria Consideration g
Mexia Device Target Stand	ca. 1991–1992	LANL operations support contractor (Johnson Controls World Services)	Eligible under Criteria a and c and Criteria Consideration g

Figure 5-1. Map of evaluated structures at the TA-60 RAAC legacy storage yard.

La Cuna

Technical Area: 60
Structure Number: n/a
Original Function: *La cuna*
Current Function: Inactive
Year Fabricated: ca. 1986–1987
NPS Property Type: Structure
LANL Property Type: Support Facility

Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: Yes (Criteria a and c and Criteria Consideration g)

Figure 5-2. *La cuna* north of TA-60-0017, circa 2007 (LANL image no. DCP_5326).

Figure 5-3. *La cuna*, September 2019 (LANL image no. DSCN0606).

Figure 5-4. Rack schedule located on the end of *la cuna*, September 2023 (LANL image no. DSCN2379).

Figure 5-5. *La cuna*, September 2023 (LANL image no. DSCN2380).

Item Description

La cuna comprises three sections made of orange-painted steel (Figure 5-2 through Figure 5-5). The first section measures 61 feet long by 8 feet 5 inches wide by 7 feet high. The second and third sections both measure 10 feet long by 8 feet 4 inches wide by 6 feet 4 inches high. All sections comprise two equilateral trusses that flank a flat bottom made of diamond-plate steel on steel cross supports. The two side trusses are connected to the flat bottom with welded diagonal bracing. Holes for bolted connections between the sections are located at the top and bottom of the truss ends. One of the sections has a wooden ladder attached underneath the bottom plate. The longest section has three tags affixed to one end that read “ICECAP”, “MEXIA”, AND “RACK SCHEDULE” (see Figure 5-4).

Historical Background

La cuna was fabricated onsite at LANL circa 1987 by Pan Am World Services, the operations support contractor for the Laboratory from 1986 to 1989 (Pillai et al. 2022:59) (Ron Cosimi, personal communication 2024). As the name implies, *la cuna (Spanish for “the cradle”)* was used to support or “cradle” diagnostic racks atop a flatbed trailer in transport (see Figure 3-16). It could also be used to support and protect diagnostic racks to avoid flexing or damaging them during repositioning from a horizontal orientation to hanging vertical in the towers at LANL and NTS. This support was especially important for tests like Mexia, where maintaining line-of-sight from the detectors to the device was paramount. The three sections could be linked together to accommodate diagnostic racks of different lengths. Former J-7 senior test director Ron Cosimi estimated that the rack was in use from 1987 to 1992. The tags on affixed to the end of this *la cuna* indicate that it was scheduled to be used in the upcoming Icecap and Mexia underground nuclear tests. Photographs show that this *la cuna* has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced the three sections as artifact numbers 60-0017-09, 60-0017-11, and 60-0017-12 (Brunette et al. 2019).

Eligibility Determination

This *la cuna* was evaluated under the historic context provided in Chapter 3 of this report. This structure was manufactured during the late Cold War circa 1986 to 1990 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

This *la cuna* is representative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. A *la cuna* was essential for supporting diagnostic racks during transfer within LANL, and this is the only known example left in the United States; therefore, this *la cuna* is eligible for listing in the National Register under Criterion (a).

This *la cuna* does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

La cunas had a unique design to safely move diagnostic racks around LANL. Fabricated by the Laboratory, this *la cuna* does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c).

This *la cuna* has not yielded and is not likely to yield information important in history because *la cuna* itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

La cuna possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Second Steering Dolly

Technical Area: 60
Structure Number: n/a
Original Function: Steering dolly
Current Function: Inactive
Year Manufactured: 1988
NPS Property Type: Structure

LANL Property Type: Support Facility
Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: No

Figure 5-6. Steering dolly, September 2023 (LANL image no. DSCN2382).

Figure 5-7. Steering dolly, February 2024 (LANL image no. IMG_0420).

Item Description

The second steering dolly is made of orange-painted steel and measures 36 feet long by 8 feet 6 inches wide by 3 feet 2 inches high (Figure 5-6 and Figure 5-7). It has four axles (two in the front and two in the rear) that are spanned by two main steel members with several welded cross members. The front wheels are exposed, whereas the rear wheels are covered by wheel wells with General Trailer Company–branded mud flaps. Hydraulic tubing and mechanical workings are located on the underside near the front wheels. The rear of the trailer has red brake/running lights.

Historical Background

The second steering dolly was manufactured on April 24, 1988, by the General Trailer Company, Springfield, Illinois. The General Trailer Company (present-day General Trailer Parts, LLC) was established in 1953. In the 1970s, the company acquired patents for innovative systems that included a vehicle with a self-steering trailer, a weighing apparatus for a fifth-wheel assembly, and load-monitoring vehicle suspension (Better Business Bureau 2024; Justia Patents 2024).

The steering dolly appears to have been designed for use in conjunction with a rack transporter. Due to its earlier manufacture date, it could have been superseded by the steering dolly currently attached to the rack transporter, or it could have been designed for use in specific cases. J-7 senior test director Ron Cosimi (personal communication 2024) shared that multiple diagnostic racks were often on site at the same time and required more than one rack transporter to move them around. Photographs show that the second steering dolly has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-13 (Brunette et al. 2019).

Eligibility Determination

The second steering dolly was evaluated under the historic context provided in Chapter 3 of this report. The structure was manufactured during the late Cold War in 1988. The second steering dolly retains integrity of location, design, setting, materials, workmanship, and feeling.

The second steering dolly is associated with the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Steering dollies, as part of the rack transporter, were essential for transferring diagnostic racks from LANL to NTS for underground nuclear testing; however, the second steering dolly has no known associated history and might not have been used. Therefore, the second steering dolly is not eligible for listing in the National Register under Criterion (a).

The second steering dolly does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

Although it was specifically manufactured for the Laboratory, the second steering dolly does not have the distinctive characteristics of a type and method of construction; therefore, the second steering dolly is not eligible for listing in the National Register under Criterion (c).

The second steering dolly has not yielded and is not likely to yield information important in history, because the second steering dolly itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

Because the second steering dolly is not eligible under Criteria a, b, c, or d, Criteria Consideration g does not apply to this evaluation.

Rack Transporter (Jeep, Rack Trailer, and Steering Dolly)

Technical Area: 60
Structure Number: n/a
Original Function: Rack transporter
Current Function: Inactive
Year Manufactured: 1989
NPS Property Type: Structure
LANL Property Type: Support Facility

Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: Yes (Criteria a and c and Criteria Consideration g)

Figure 5-8. Rack transporter holding the Mexia diagnostic rack, March 2024 (LANL image no. DSCN2639).

Figure 5-9. Rack transporter holding the Mexia diagnostic rack, September 2023 (LANL image no. DSCN2364).

Figure 5-10. Jeep, March 2024 (LANL image no. DSCN2635).

Figure 5-11. Steering dolly, March 2024 (LANL image no. DSCN2636).

Item Description

The rack transporter comprises three items—jeep, rack trailer, and steering dolly—and measures 78 feet 4 inches long, 11 feet wide, and 7 feet 5 inches high. The jeep is a wheeled component in the front, and the steering dolly is a wheeled component in the rear (Figure 5-8 through Figure 5-11). The rack trailer spans atop them both and is made primarily of welded steel with some wood-board lining. The rack trailer includes a hydraulics system operated by levers, an electrical system, indicator lights, and a winch with steel cable. The jeep and steering dolly are made of welded steel and have an electrical system, indicator lights, and rubber tires and mud flaps. All three units are painted orange. The rack transporter sits in the TA-60 RAAC legacy storage yard holding the Mexia diagnostic rack.

Historical Background

The rack trailer was manufactured on October 30, 1989, by Neil F. Lampson, Inc., Kennewick, Washington. An affixed label shows that the component is a Rack Trailer, model number ERT-100, serial number TR-417-001. As manufactured, it weighed 47,655 pounds. The jeep was manufactured in September 1989 by the General Trailer Company, Springfield, Oregon. The steering dolly is model number STRDOLLY and was built with a 50-ton capacity. It appears to have been purchased by Neil F. Lampson, Inc., the same month it was built for use as part of the rack transporter. Used to move racks from TA-03 to TA-60, the rack transporter was in use through 1992.

Neil F. Lampson, Inc. (present-day Lampson International) began as a small crane and drayage company in 1946. The company developed their first crawler transporter in 1975 and their first crawler crane in 1978. The latter was developed for use at a nuclear construction site, and Lampson cranes were used at the NNSS (Lampson International 2020a, 2020b). The General Trailer Company (present-day General Trailer Parts, LLC) was established in 1953. In the 1970s, the company acquired patents for innovative systems that included a vehicle with a self-steering trailer, a weighing apparatus for a fifth-wheel assembly, and load-monitoring vehicle suspension (Better Business Bureau 2024; Justia Patents 2024). In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-07 (Brunette et al. 2019).

Eligibility Determination

This rack transporter was evaluated under the historic context provided in Chapter 3 of this report. This structure was manufactured during the late Cold War in 1989 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

This rack transporter typifies the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. A rack transporter was essential for transferring diagnostic racks within the Laboratory between TA-03 (place of fabrication) and TA-60 (location for tuning and testing), and this is the only known example left in the United States. Therefore, this rack transporter is eligible for listing in the National Register under Criterion (a).

This rack transporter does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

Specifically manufactured for the Laboratory, this rack transporter does have the distinctive characteristics of a type and method of construction. Rack transporters had a unique design to safely move diagnostic racks from LANL to NTS; therefore, this rack transporter is eligible for listing in the National Register under Criterion (c).

This rack transporter has not yielded and is not likely to yield information important in history, because the rack transporter itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

The rack transporter possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Mexia Diagnostic Rack

Technical Area: 60
Structure Number: n/a
Original Function: Diagnostic rack
Current Function: Inactive
Year Fabricated: ca. 1991–1992
NPS Property Type: Structure
LANL Property Type: Laboratory-processing facility

Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: Yes (Criteria a and c and Criteria Consideration g)

Figure 5-12. Mexia diagnostic rack south of TA-60-0017, circa 2007 (LANL image no. DCP_5321).

Figure 5-13. Mexia diagnostic rack on the rack transporter, March 2024 (LANL image no. DSCN2637).

Figure 5-14. Mexia diagnostic rack on the rack transporter, September 2019 (LANL image no. DSCN0607).

Figure 5-15. Detail view of knight-chess-piece-shaped void, September 2023 (LANL image no. DSCN2371).

Item Description

The Mexia diagnostic rack measures 55 feet long, 6 feet 7 inches high, and 7 feet wide (as it rests on the rack transporter). It is made of steel coated with a silver/aluminized paint (Figure 5-12 through Figure 5-15). Steel members located at four corners stretch the length of the rack and support “station plates” of various shapes and intervals. The plates have numerous voids cut out, some of which allow pipes to extend along the interior of the rack. One void approximately midway along the rack has an identifiable shape as a knight chess piece in profile. Plywood blocking and two steel eyes are located at the top of the rack where it was designed to hang from wire ropes. The rack features a series of stenciled, two-letter/two-number codes spray-painted in black along the interior piping. A stamped code (T2, R1688, 9A, SPAR 3) is located near the top of the rack. Three artifacts associated with the Mexia diagnostic rack were identified and are listed in Table 5-2.

Table 5-2. Artifacts Associated with the Mexia Diagnostic Rack

Item Name	Artifact No.	Dates of Use	Manufacturer/Engineer
Large Turnbuckle (1 of 2)	60-0017-05	1960s–1992	Unknown
Large Turnbuckle (2 of 2)	60-0017-06	1960s–1992	Unknown
Box of Wire Ropes	60-0017-14	1960s–1992	Upson Walton; WRTB; ESCO; LANL

Historical Background

The Mexia diagnostic rack was fabricated circa 1991–1992 by Johnson Controls World Services, which was the operations support contractor for the Laboratory from 1989 to 1997 (Pillai et al. 2022:59) (Ron Cosimi, personal communication 2024). The fabrication process is described in Chapter 3. A rack connector plate and clamp plates are located near the top of the rack. Rack connector plates served as an interface between cables routed inside the rack and those laid on the ground surface at the test site. Clamp plates helped with the alignment of cables to the connector plate. A steel ring—slightly wider than the rest of the rack—is located above the connector and clamp plates. Cables passed through and were protected by this ring on their way down the rack. Partially enclosed steel boxes can be seen in various locations on the rack. These boxes were designed to hold detectors and would have been filled with lead shot and then fully enclosed to protect the equipment inside. In reference to the aforementioned knight-chess-piece-shaped void, former J-6 NTS scientist Barry Bailey (personal communication 2023) recalls, “. . . vacant space on station plates were [*sic*] often cut out for several reasons. First, if the plate didn’t need to support anything, it was often ‘cut out’. This also reduced the weight of the rack. Second, it allowed magnetite sand dropped from the surface after the rack’s lowering to the required depth in the hole, to better flow around diagnostic experiments. This helped to ‘block’ any spurious radiation that might interfere with the experiments mounted within the rack.” The chess-piece design was the result of creative ironworkers who liked to practice cutting novel shapes.

Although the exact fabrication date for the diagnostic rack is unknown, it was designed to be used in the Mexia underground nuclear test, which was scheduled to follow the Divider test in the Operation Julin test series. Nuclear testing by the United States ended abruptly in the fall of 1992, when President George H. W. Bush entered the United States into a unilateral nuclear testing moratorium. Therefore, the Mexia diagnostic rack’s fabrication can be estimated as circa 1991–1992. The Mexia diagnostic rack was nearly ready for shipping, and an emplacement hole had already been prepared at NTS. The preceding diagnostic rack, Icecap, was approximately 2 weeks from testing when the moratorium took effect. Underground nuclear test names were chosen from military branch manuals of allowable names. The name “Mexia” was chosen by former J-7 senior test director Ron Cosimi (personal communication 2024) among a series of names based on towns in Texas.

The Mexia diagnostic rack is one of two remaining. Because the moratorium ended nuclear testing so abruptly, two LANL diagnostic racks had already been fabricated and were awaiting testing. The Mexia rack remains at LANL in the TA-60 RAAC legacy storage yard. The other diagnostic rack, fabricated for the Icecap test, remains hanging at Icecap ground zero at NNSS. Components of a canister (LLNL’s name for diagnostic racks) for the Gabbs test also remain at the North Las Vegas facility. Because diagnostic racks were destroyed during nuclear testing, only those awaiting scheduled tests at the time of the 1992 moratorium remain. Aerial photographs show that the Mexia rack has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-08 (Brunette et al. 2019).

The following summary provides a limited background on the artifacts associated with the Mexia diagnostic rack. Wire ropes were used to hang diagnostic racks in test emplacement holes at NTS. Their manufacture process is described in Chapter 3. The sockets on the ends of the wire ropes in the TA-60 RAAC legacy storage yard were manufactured by ESCO and met Wire Rope Technical Board (WRTB) standards. ESCO, a subsidiary of WEIR, designs, manufactures, and services equipment used in mining and infrastructure (The Weir Group PLC 2024). The WRTB is an association that comprises wire-rope manufacturers in the United States. They establish standards, promote technical information, and conduct and underwrite research (WRTB 2024). Upson Walton, founded in 1871, is part of Muncy Industries, who focus on the heavy-lift and wire-rope rigging industries (Muncy Industries 2017).

The large turnbuckles were used in conjunction with load equalizers (as described in Chapter 3) to hang diagnostic racks. The turnbuckles have no manufacturer marks.

Eligibility Determination

The Mexia diagnostic rack was evaluated under the historic context provided in Chapter 3 of this report. This structure was designed and fabricated during the late Cold War circa 1991–1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

The Mexia diagnostic rack exemplifies the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. A diagnostic rack was the core component of an underground nuclear test, and due to the destructive nature of testing, the Mexia diagnostic rack is one of only two remaining examples from the United States testing program. Therefore, this structure is eligible for listing in the National Register under Criterion (a).

The Mexia diagnostic rack does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

Fabricated by the Laboratory’s operations contractors, each diagnostic rack was designed uniquely to support specific experiments. The Mexia diagnostic rack does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c).

The Mexia diagnostic rack has not yielded and is not likely to yield information important in history, because the rack itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

The Mexia diagnostic rack possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Mexia Device Canister

Technical Area:	60
Structure Number:	n/a
Original Function:	Mexia device canister
Current Function:	Inactive
Year Fabricated:	ca. 1991–1992
NPS Property Type:	Structure
LANL Property Type:	Laboratory-processing facility

Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: Yes (Criteria a and c and Criteria Consideration g)

Figure 5-16. Mexia device canister south of TA-60-0017, circa 2007 (LANL image no. DCP_5322).

Figure 5-17. Mexia device canister, September 2023 (LANL image no. DSCN0605).

Figure 5-18. Mexia device canister, March 2024 (LANL image no. DSCN2625).

Figure 5-19. Mexia device canister, September 2023 (LANL image no. DSCN2392).

Item Description

The Mexia device canister is a steel cylinder that measures 8 feet 2 inches in diameter by 14 feet 3 inches long. An inset, protruding steel cap is installed on one end, and an aluminum cap with two handles is bolted onto the other end (Figure 5-16 through Figure 5-19).

Historical Background

The Mexia device canister was fabricated circa 1991–1992 for use in the Mexia underground nuclear test. Former J-6 NTS scientist Barry Bailey (personal communication 2023) recalls, “Each [LANL] equipment rack had a canister at its lower end to protect the device and related hardware. For the majority of the time the equipment rack was being prepared in the Assembly [service] tower, the canister sat at ground level [test ground zero] over the emplacement hole.” When the downhole structure was ready, the nuclear device was transported from its assembly area elsewhere at NTS via armed guard to test ground zero (Machen 1988:14). “Once the device was inserted, the [LANL] rack was lowered into the canister, and the two bolted together” (Barry Bailey, personal communication 2023). Although the Mexia device canister was not opened and, therefore, the inside not inspected during the course of this survey, device canisters were lined with boron carbide-loaded polyethylene bricks.

The Mexia underground nuclear test was scheduled to follow the Divider test in the Operation Julin test series. Nuclear testing by the United States ended abruptly in the fall of 1992, when President George H. W. Bush entered the United States into a unilateral nuclear testing moratorium. Therefore, the Mexia device canister’s fabrication can be estimated as circa 1991–1992.

The Mexia device canister is one of two remaining. Because the moratorium ended nuclear testing so abruptly, two LANL diagnostic racks and related equipment (such as device canisters) had already been fabricated and were awaiting testing. The Mexia device canister remains at LANL in the TA-60 RAAC legacy storage yard. The Icecap device canister exists at NNSS, where the Icecap rack remains hanging at Icecap ground zero. Because device canisters were destroyed along with their diagnostic racks during nuclear testing, only those awaiting scheduled tests at the time of the 1992 moratorium remain. Photographs show that the Mexia device canister has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-10 (Brunette et al. 2019).

Eligibility Determination

The Mexia device canister was evaluated under the historic context provided in Chapter 3 of this report. This structure was fabricated during the late Cold War circa 1991–1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

The Mexia device canister is demonstrative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Fabricated to protect the nuclear device and related hardware, the Mexia device canister was an essential component for the underground nuclear test. Due to the destructive nature of testing, the Mexia device canister is one of only two remaining examples from the United States testing program. Therefore, this structure is eligible for listing in the National Register under Criterion (a).

The Mexia device canister does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

Device canisters were uniquely designed to protect the nuclear device and related hardware of a specific diagnostic rack. Fabricated by the Laboratory, the Mexia device canister does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c).

The Mexia device canister has not yielded and is not likely to yield information important in history, because the Mexia device canister itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

The Mexia device canister possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Mexia Device Mounting Stand

Technical Area: 60
Structure Number: n/a
Original Function: Mexia device mounting stand
Current Function: Inactive
Year Fabricated: ca. 1991–1992
NPS Property Type: Structure

LANL Property Type: Laboratory-processing facility
Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: Yes (Criteria a and c and Criteria Consideration g)

Figure 5-20. Mexia device mounting stand, September 2023 (LANL image no. DSCN2389).

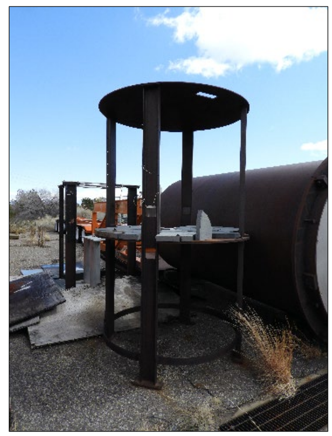

Figure 5-21. Mexia device mounting stand, March 2024 (LANL image no. DSCN2644).

Item Description

The Mexia device mounting stand is a frame made of steel and aluminum that measures 5 feet 11 inches in diameter and 9 feet 2 inches high (Figure 5-20 and Figure 5-21). It is currently sitting upside down. The circular aluminum base plate (currently at the top) supports four vertical steel rails that extend up and support a circular device support plate in the middle of the stand and a steel hoop located just below (currently above) fastening plates. Both the base plate and the device support plate have cutouts or voids. The device support plate has a layer of boron-carbide-loaded polyethylene bricks and an aluminum bracket for a neutron generator attached to its underside (currently the top).

Historical Background

The Mexia device mounting stand was fabricated circa 1991–1992 by Johnson Controls World Services, which was the operations support contractor for the Laboratory from 1989 to 1997 (Pillai et al. 2022:59) (Ron Cosimi, personal communication 2024). The Mexia device mounting stand—also called a device rack or a weapon rack—would have held the nuclear device, been attached to the bottom of the diagnostic rack, and been protected by the Mexia device canister. The boron-carbide-loaded polyethylene bricks were fabricated by the operations support contractor and were neutron absorbers. The neutron generator would fire neutrons into the nuclear device in the last 5 seconds of the countdown (Ron Cosimi, personal communication 2024).

Eligibility Determination

The Mexia device mounting stand was evaluated under the historic context provided in Chapter 3 of this report. This structure was fabricated during the late Cold War circa 1991–1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

The Mexia device mounting stand is illustrative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Fabricated to hold the nuclear device and related hardware, the Mexia device mounting stand was an essential component for the underground nuclear test. Due to the destructive nature of testing, the Mexia device mounting stand is one of only two remaining examples from the United States testing program; therefore, this structure is eligible for listing in the National Register under Criterion (a).

The Mexia device mounting stand does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

Device mounting stands were uniquely designed to hold the nuclear device and related hardware associated with a specific diagnostic rack. Fabricated by the Laboratory, the Mexia device mounting stand does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c).

The Mexia device mounting stand has not yielded and is not likely to yield information important in history, because the Mexia device mounting stand itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

The Mexia device mounting stand possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Mexia Device Target Stand

Technical Area:	60
Structure Number:	n/a
Original Function:	Mexia device target stand
Current Function:	Inactive
Year Fabricated:	ca. 1991–1992
NPS Property Type:	Structure

LANL Property Type: Laboratory-processing facility
Associated Theme(s): Weapons Research, Development, Testing, and Stockpile Support: NTS Testing
Integrity: Yes
Eligible: Yes (Criteria a and c and Criteria Consideration g)

Figure 5-22. Mexia device target stand, March 2024 (LANL image no. DSCN2645).

Figure 5-23. Mexia device target stand, March 2024 (LANL image no. DSCN22631).

Item Description

The Mexia device target stand is a rectilinear frame that measures 6 feet 6 inches across and 6 feet 6 inches high and is made of steel and aluminum (Figure 5-22 and Figure 5-23). A round steel base plate supports four vertical steel columns and an aluminum top plate. The aluminum base plate is lined with boron-carbide-loaded polyethylene bricks. Extending from the center of the base plate are two cylindrical aluminum pedestals topped by an engraved rectangular aluminum plate. This component measures 3 feet high. The aluminum plate at the top has cutouts or voids. The word "Mexia" and other letters and numbers are hand-painted on the bricks.

Historical Background

The Mexia device target stand was fabricated circa 1991–1992 by Johnson Controls World Services, which was the operations support contractor for the Laboratory from 1989 to 1997 (Pillai et al. 2022:59) (Ron Cosimi, personal communication 2024). The Mexia device target stand was used to align the lines of site associated with the numerous detectors on the diagnostic rack. Alignments would be within 0.005-inch accurate, and the device target stand would be used to build the device mounting stand. The boron-carbide-loaded polyethylene bricks were fabricated by the operations support contractor and were neutron absorbers (Ron Cosimi, personal communication 2024).

Eligibility Determination

The Mexia device target stand was evaluated under the historic context provided in Chapter 3 of this report. This structure was fabricated during the late Cold War circa 1991–1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

The Mexia device target stand is evocative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Fabricated to align the lines of site of the numerous detectors on the Mexia diagnostic rack, the Mexia device target stand was an essential component for the underground nuclear test. Because device target stands were discarded after each test, the Mexia device target stand is likely one of only two remaining examples from the United States testing program; therefore, this structure is eligible for listing in the National Register under Criterion (a).

The Mexia device target stand does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b).

Device target stands were uniquely designed to align the lines of sight of a specific diagnostic rack. Fabricated by the Laboratory, the Mexia device target stand does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c).

The Mexia device target stand has not yielded and is not likely to yield information important in history, because the Mexia device target stand itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d).

The Mexia device target stand possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

CHAPTER 6: SUMMARY AND RECOMMENDATIONS

LANL proposes to develop 3.56 acres of TA-60 next to the former RAAC as a consolidated waste facility. In compliance with Section 106 of the NHPA, 36 CFR 800, the CRMP, and the PA, LANL undertook an evaluation of the items in the TA-60 legacy storage yard. Seven structures in the storage yard were assessed for eligibility for listing in the National Register. NA-LA makes the following National Register eligibility determinations: *la cuna*; the rack transporter (jeep, rack trailer, and steering dolly); the Mexia diagnostic rack; the Mexia device canister; the Mexia device mounting stand; and the Mexia target stand are eligible for listing in the National Register, and the second steering dolly is not eligible for listing in the National Register.

Determination of Effects

The consolidated waste facility project, as currently proposed, has no potential to affect any of the resources under study (see Figure 1-4); however, the proposed consolidated waste facility project will affect National Register–eligible TA-60-0017 and could have the potential to affect TA-60-0019 and TA-60-0045. NA-LA will submit a separate consultation package with a determination of effect to the aforementioned facilities. With this upcoming consultation in mind, NA-LA took the opportunity during this eligibility assessment to conduct extensive archival research and to prepare a comprehensive historic context that meets the standard mitigation practice in accordance with the PA for the built-environment at LANL.

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Appendix A: Project Location Map

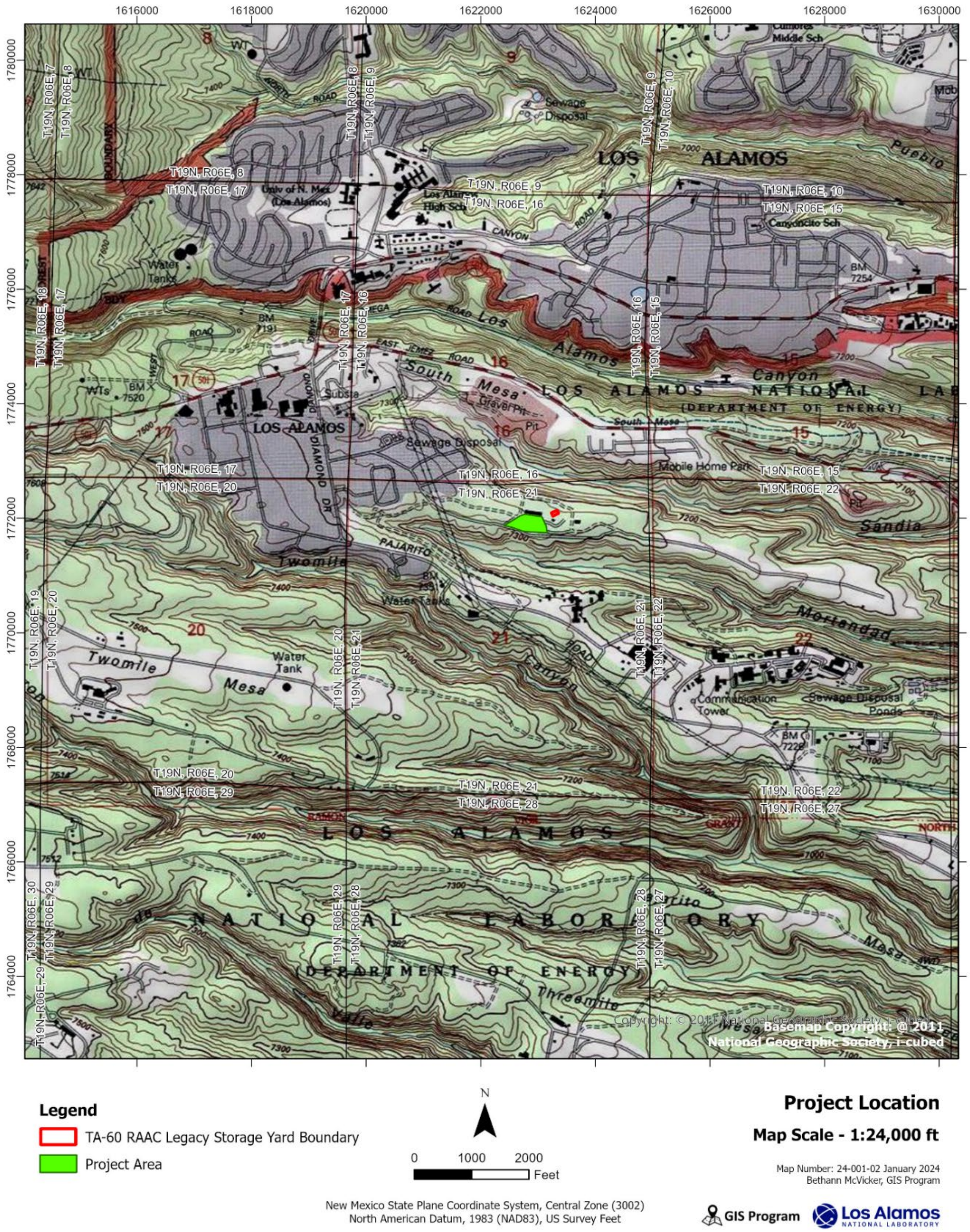


Figure A-1. Project location map.

Appendix B: LANL Structure Forms

LANL TA- Structure: TA-60-9999

Camera: Piglet; Pedro; Napoleon

Frame #s: DCP_5326; DSCN0606, DSCN0608; DSCN2372 - DSCN2380, DSCN2384 - DSCN2385, DSCN2624

Surveyor(s): C. Gregory, C. Townsend

Date: 4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name: La Cuna (The Cradle, rack

UTMs easting: 381940 northing: 3970356 zone: 13

Legal Description: Map: Frijoles, New Mexico

tnsp: 19N range: 6E sec: 21

Current Use/ Function: Inactive

Original Use/ Function: La Cuna

Date (estimated): ca. 1987

Date (actual):

Property Type: Support

Description (construction material, exterior features, windows, doors)

La cuna comprises three sections made of orange-painted steel. The first section measures 61 feet long by 8 feet 5 inches wide by 7 feet high. The second and third sections both measure 10 feet long by 8 feet 4 inches wide by 6 feet 4 inches high. All sections comprise two equilateral trusses that flank a flat bottom made of diamond-plate steel on steel cross supports. The two side trusses are connected to the flat bottom with welded diagonal bracing. Holes for bolted connections between the sections are located at the top and bottom of the truss ends. One of the sections has a wooden ladder attached underneath the bottom plate. The longest section has three tags affixed to one end that read, “ICECAP”, “MEXIA”, AND “RACK SCHEDULE”.

Historical Background

La cuna was fabricated onsite at LANL circa 1987 by Pan Am World Services, the operations support contractor for the Laboratory from 1986 to 1989. As the name implies, la cuna (Spanish for “the cradle”) was used to support, or “cradle” diagnostic racks atop a flatbed trailer in transport. It could also be used to support and protect diagnostic racks to avoid flexing or damaging them during repositioning from a horizontal orientation to hanging vertical in the towers at LANL and NTS. This support was especially important for tests like Mexia, where maintaining line-of-sight from the detectors to the device was paramount. The three sections could be linked together to accommodate diagnostic racks of different lengths. Former J-7 senior test director Ron Cosimi estimated that the rack was in use from 1987 to 1992. The tags on affixed to the end of this la cuna indicate that it was scheduled to be used in the upcoming Icecap and Mexia underground nuclear tests. Photographs show that this la cuna has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced the three sections as artifact numbers 60-0017-09, 60-0017-11, and 60-0017-12.

Foundation: Other

Alterations: not applicable

Condition: Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, Second Steering Dolly, Rack Transporter (Jeep, Rack Trailer, and Steering Dolly), Mexia Diagnostic Rack, Mexia Device Canister, Mexia Device Mounting Stand, and Mexia Device Target Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐ Nuclear Weapon Design and Testing ☑ Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science	☐	Energy and Environment: Research and Design Projects	☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑ Super Computing ☐ Space Sciences ☐

Reactor Technology ☐ Biomedical/Health Physics ☐ Strategic and Supporting Research ☐

Environment/Waste Management ☐ Administration and Social History ☐ Architectural History ☐

Significant Yes ☑ No ☐

NRHP Eligibillity Criteria A ☑ B ☐ C ☑ D ☐ Criterion Consideration G ☑

Significance Details

This la cuna is representative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. A la cuna was essential for supporting diagnostic racks during transfer within LANL, and this is the only known example left in the United States; therefore, this la cuna is eligible for listing in the National Register under Criterion (a). This la cuna does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). La cunas had a unique design to safely move diagnostic racks around LANL. Fabricated by the Laboratory, this la cuna does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c). This la cuna has not yielded, and is not likely to yield, information important in history, because la cuna itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). La cuna possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Integrity Excellent

Integrity Details

This structure was manufactured during the late Cold War circa 1986 to 1990 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

NRHP Eligible Eligible ☑ Not Eligible ☐

Recommendations/ Additional Comments

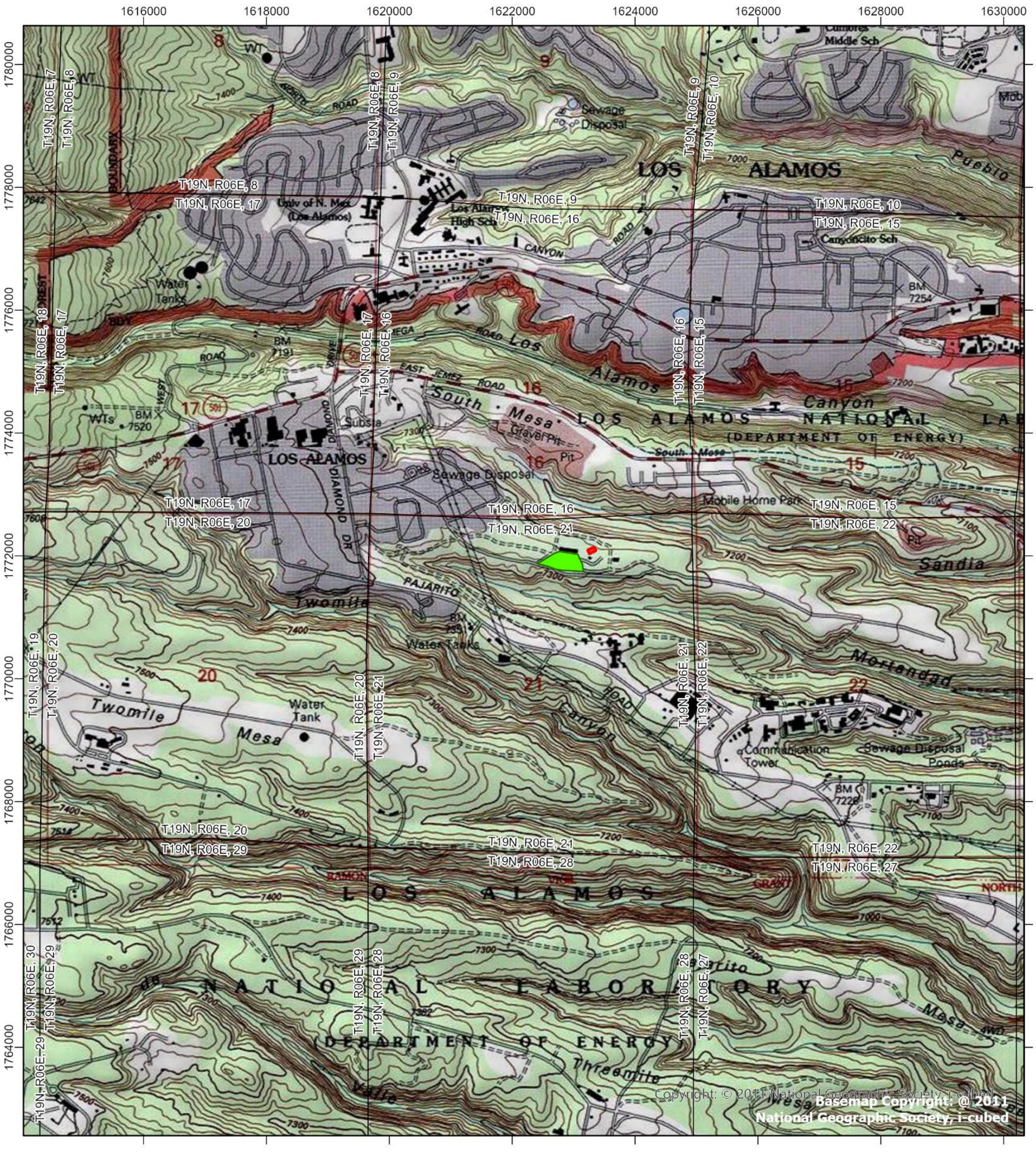
In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

Total sq ft 680 **Architect/ Builder** LANL operations support contractor (Pan American World Services)

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

N

0 1000 2000 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Legend

TA-60 RAAC Legacy Storage Yard Boundary

Project Area

N

0 100 200 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location Map

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

La Cuna Photographs

La cuna, September 2019 (LANL image no. DSCN0606).

La cuna north of TA-60-0017, circa 2007 (LANL image no. DCP_5326).

La Cuna Photographs

La cuna, September 2023 (LANL image no. DSCN2380).

Rack schedule located on end of *la cuna*, September 2023 (LANL image no. DSCN2379).

La Cuna Photographs

Two sections of *la cuna*, September 2023 (LANL image, DSCN2384).

Two sections of *la cuna*, September 2019 (LANL image, DSCN0608).

LANL TA- Structure: TA-60-9999

Camera: Pedro; Napoleon; Cameron iPhone

Frame #s: DSCN0609; DSCN2381 - DSCN2383; IMG_0418 - IMG_0422

Surveyor(s): C. Gregory, C. Townsend

Date: 4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name: Second Steering Dolly

UTMs easting: 381946 | northing: 3970359 | zone: 13

Legal Description: Map: Frijoles, New Mexico | tnsp: 19N | range: 6E | sec: 21

Current Use/ Function: Inactive | Original Use/ Function: Second Steering Dolly

Date (estimated): | Date (actual): 1988 | Property Type: Support

Description (construction material, exterior features, windows, doors)

The second steering dolly is made of orange-painted steel and measures 36 feet long by 8 feet 6 inches wide by 3 feet 2 inches high (Figure 5-6 to Figure 5-7). It has four axles (two in the front and two in the rear) that are spanned by two main steel members with several welded cross members. The front wheels are exposed, whereas the rear wheels are covered by wheel wells with General Trailer Company–branded mud flaps. Hydraulic tubing and mechanical workings are located on the underside near the front wheels. The rear of the trailer has red brake/running lights.

Historical Background

The second steering dolly was manufactured on April 24, 1988, by the General Trailer Company, Springfield, Illinois. The General Trailer Company (present-day General Trailer Parts, LLC) was established in 1953. In the 1970s, the company acquired patents for innovative systems that included a vehicle with a self-steering trailer, a weighing apparatus for a fifth-wheel assembly, and load-monitoring vehicle suspension.

The steering dolly appears to have been designed for use in conjunction with a rack transporter. Due to its earlier manufacture date, it could have been superseded by the steering dolly currently attached to the rack transporter, or it could have been designed for use in specific cases. J-7 senior test director Ron Cosimi shared that multiple diagnostic racks were often on site at the same time and required more than one rack transporter to move them around. Photographs show that the second steering dolly has been relocated within RAAC, but always remained within the complex. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-13.

Foundation: Other

Alterations: not applicable

Condition: Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, La Cuna, Rack Transporter (Jeep, Rack Trailer, and Steering Dolly), Mexia Diagnostic Rack, Mexia Device Canister, Mexia Device Mounting Stand, and Mexia Device Target Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐ Nuclear Weapon Design and Testing ☑ Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science ☐ Energy and Environment: Research and Design Projects ☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑ Super Computing ☐ Space Sciences ☐

Reactor Technology ☐ Biomedical/Health Physics ☐ Strategic and Supporting Research ☐

Environment/Waste Management ☐ Administration and Social History ☐ Architectural History ☐

Significant Yes ☐ No ☑

NRHP Eligibillity Criteria A ☐ B ☐ C ☐ D ☐ Criterion Consideration G ☐

Significance Details

The second steering dolly is associated with the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Steering dollies, as part of the rack transporter, were essential for transferring diagnostic racks from LANL to NTS for underground nuclear testing; however, the second steering dolly has no known associated history and might not have been used. Therefore, the second steering dolly is not eligible for listing in the National Register under Criterion (a). The second steering dolly does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). Although it was specifically manufactured for the Laboratory, the second steering dolly does not have the distinctive characteristics of a type and method of construction, therefore, the second steering dolly is not eligible for listing in the National Register under Criterion (c). The second steering dolly has not yielded and is not likely to yield information important in history,because the second steering dolly itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). Because the second steering dolly is not eligible under Criteria a, b, c, or d, Criteria Consideration g does not apply to this evaluation.

Integrity Excellent

Integrity Details

The structure was manufactured during the late Cold War in 1988. The second steering dolly retains integrity of location, design, setting, materials, workmanship, and feeling.

NRHP Eligible Eligible ☐ Not Eligible ☑

Recommendations/ Additional Comments

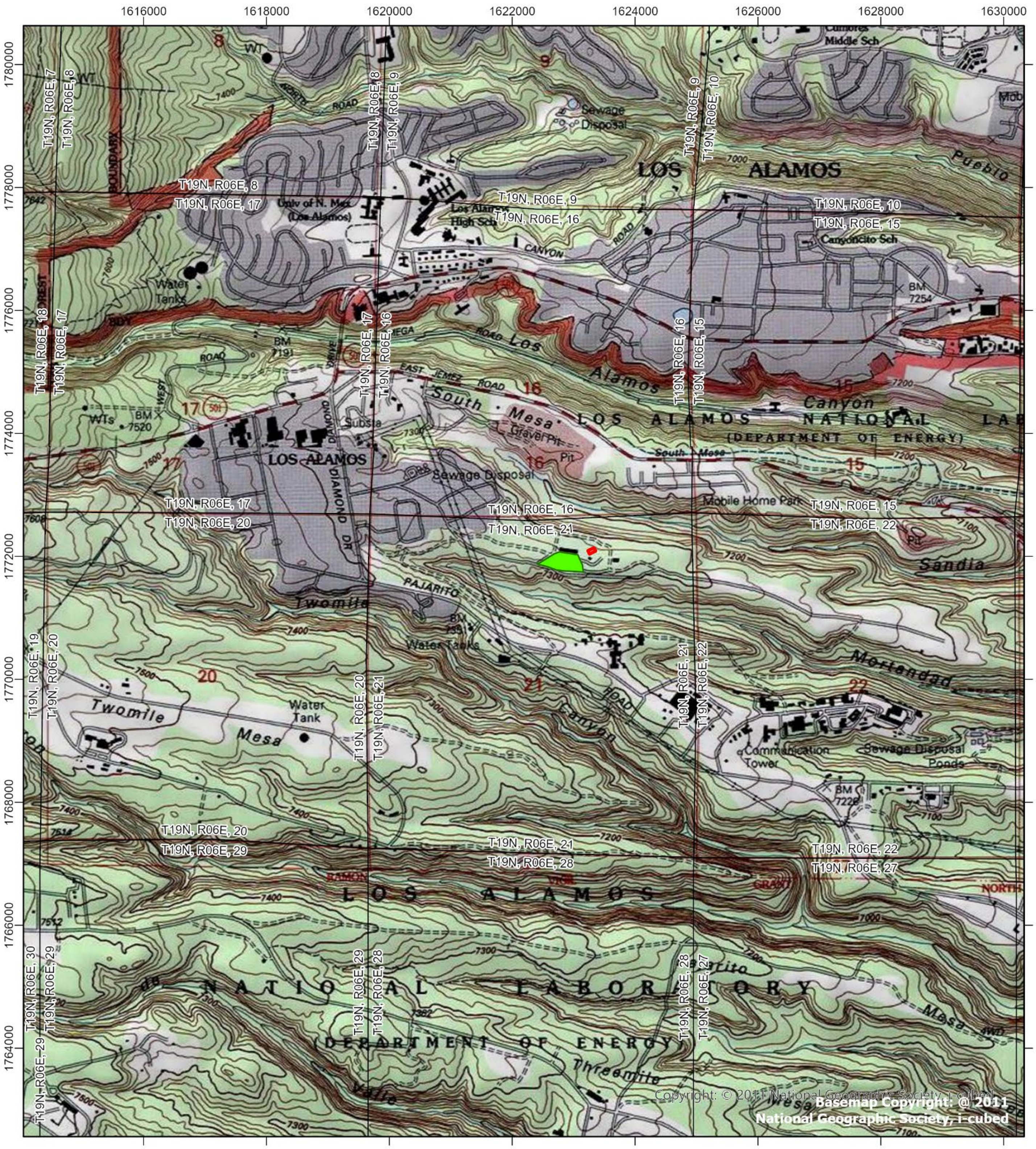
In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

Total sq ft 306 **Architect/ Builder** General Trailer Co.

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

TA-60 RAAC Legacy Storage Yard Boundary

Project Area

N

0 1000 2000 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Legend

TA-60 RAAC Legacy Storage Yard Boundary

Project Area

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location Map

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

GIS Program

Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Second Steering Dolly Photographs

Second steering dolly, September 2023 (LANL image no. DSCN2382).

Second steering dolly, February 2024 (LANL image no. IMG_0420).

Second Steering Dolly Photographs

Second steering dolly, September 2019 (LANL image no. DSCN0609).

Close-up of second steering dolly front wheels, February 2024 (LANL image no. IMG_0422).

LANL TA- Structure: TA-60-9999

Camera: Pedro; Napoleon

Frame #s: DSCN0607; DSCN2358 - DSCN2367, DSCN2369 - DSCN2370, DSCN2632 - DSCN2640

Surveyor(s): C. Gregory, C. Townsend

Date: 4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name: Rack Transporter (Jeep, Rack Trailer, and Steering Dolly)

UTMs easting: 381947 northing: 3970372 zone: 13

Legal Description: Map: Frijoles, New Mexico tnsp: 19N range: 6E sec: 21

Current Use/ Function: Inactive

Original Use/ Function: Rack Transporter

Date (estimated):

Date (actual): 1989

Property Type: Support

Description (construction material, exterior features, windows, doors)

The rack transporter comprises three items—jeep, rack trailer, and steering dolly—and measures 78 feet 4 inches long, 11 feet wide, and 7 feet 5 inches high. The jeep is a wheeled component in the front, and the steering dolly is a wheeled component in the rear. The rack trailer spans atop them both and is made primarily of welded steel with some wood-board lining. The rack trailer includes a hydraulics system operated by levers, an electrical system, indicator lights, and a winch with steel cable. The jeep and steering dolly are made of welded steel and have an electrical system, indicator lights, and rubber tires and mud flaps. All three units are painted orange. The rack transporter sits in the TA-60 RAAC legacy storage yard holding the Mexia diagnostic rack.

Historical Background

The rack trailer was manufactured on October 30, 1989, by Neil F. Lampson, Inc., Kennewick, Washington. An affixed label shows that the component is a Rack Trailer, model number ERT-100, serial number TR-417-001. As manufactured, it weighed 47,655 pounds. The jeep was manufactured in September 1989 by the General Trailer Company, Springfield, Oregon. The steering dolly is model number STRDOLLY and was built with a 50-ton capacity. It appears to have been purchased by Neil F. Lampson, Inc., the same month it was built for use as part of the rack transporter. Used to move racks from TA-03 to TA-60, the rack transporter was in use through 1992.

Neil F. Lampson, Inc. (present-day Lampson International) began as a small crane and drayage company in 1946. The company developed their first crawler transporter in 1975 and their first crawler crane in 1978. The latter was developed for use at a nuclear construction site, and Lampson cranes were used at the NNSS. The General Trailer Company (present-day General Trailer Parts, LLC) was established in 1953. In the 1970s, the company acquired patents for innovative systems that included a vehicle with a self-steering trailer, a weighing apparatus for a fifth-wheel assembly, and load-monitoring vehicle suspension. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-07.

Foundation: Other

Alterations: not applicable

Condition: Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, La Cuna, Second Steering Dolly, Mexia Diagnostic Rack, Mexia Device Canister, Mexia Device Mounting Stand, and Mexia Device Target Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐

Nuclear Weapon Design and Testing ☑

Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science ☐

Energy and Environment: Research and Design Projects ☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑

Super Computing ☐

Space Sciences ☐

Reactor Technology ☐

Biomedical/Health Physics ☐

Strategic and Supporting Research ☐

Environment/Waste Management ☐

Administration and Social History ☐

Architectural History ☐

Significant Yes ☑ No ☐

NRHP Eligibillity Criteria A ☑ B ☐ C ☑ D ☐ Criterion Consideration G ☑

Significance Details

This rack transporter typifies the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. A rack transporter was essential for transferring diagnostic racks within the Laboratory between TA-03 (place of fabrication) and TA-60 (location for tuning and testing), and this is the only known example left in the United States. Therefore, this rack transporter is eligible for listing in the National Register under Criterion (a). This rack transporter does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). Specifically manufactured for the Laboratory, this rack transporter does have the distinctive characteristics of a type and method of construction. Rack transporters had a unique design to safely move diagnostic racks from LANL to NTS; therefore, this rack transporter is eligible for listing in the National Register under Criterion (c). This rack transporter has not yielded and is not likely to yield information important in history, because the rack transporter itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). The rack transporter possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Integrity Excellent

Integrity Details

This structure was manufactured during the late Cold War in 1989 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

NRHP Eligible Eligible ☑ Not Eligible ☐

Recommendations/ Additional Comments

In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

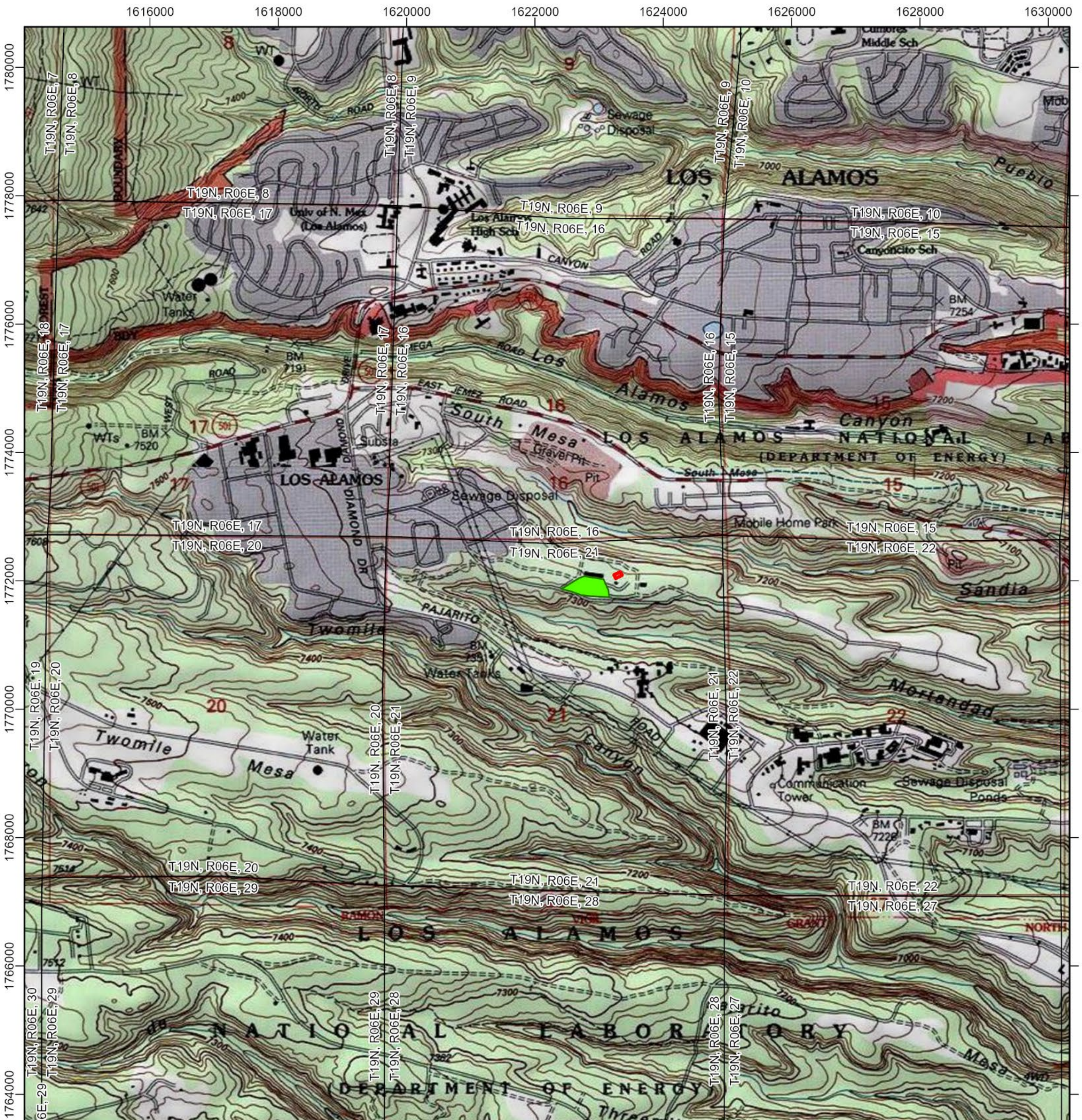
Total sq ft 862

Architect/ Builder Neil F. Lampson Inc.; General Trailer Co.

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

TA-60 RAAC Legacy Storage Yard Boundary

Project Area

N

0 1000 2000 Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Legend

TA-60 RAAC Legacy Storage Yard Boundary

Project Area

N

0 100 200 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location Map

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

GIS Program

Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Rack Transporter Photographs

Rack transporter holding the Mexia diagnostic rack, March 2024 (LANL image no. DSCN2639).

Rack transporter holding the Mexia diagnostic rack, March 2024 (LANL image no. DSCN2637).

Rack Transporter Photographs

Jeep component of the rack transporter, March 2024 (LANL image no. DSCN2635).

Steering dolly component of the rack transporter, March 2024 (LANL image no. DSCN2636).

Rack Transporter Photographs

Rack transporter holding the Mexia diagnostic rack, March 2024 (LANL image, DSCN2638).

Rack transporter holding the Mexia diagnostic rack, September 2023 (LANL image, DSCN2362).

LANL TA- Structure	TA-60-9999
Camera	Piglet; Pedro; Napoleon
Frame #s	DCP_5320 - DCP_5321; DSCN0607; DSCN2364, DSCN2368-DSCN2369, DSCN2371, DSCN23632 - DSCN2633, DSCN2637 - DSCN2640
Surveyor(s)	C. Gregory, C. Townsend
Date	4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name	Mexia Diagnostic Rack	UTMs easting	381935
northing	3970366	zone	13
Legal Description: Map	Frijoles, New Mexico	tnsp	19N
range	6E	sec	21
Current Use/ Function	Inactive	Original Use/ Function	Mexia Diagnostic Rack
Date (estimated)	ca .1991–1992	Date (actual)	
Property Type	Laboratory/Processing		

Description (construction material, exterior features, windows, doors)

The Mexia diagnostic rack measures 55 feet long, 6 feet 7 inches high, and 7 feet wide (as it rests on the rack transporter). It is made of steel coated with a silver/aluminized paint. Steel members located at four corners stretch the length of the rack and support "station plates" of various shapes and intervals. The plates have numerous voids cut out, some of which allow pipes to extend along the interior of the rack. One void approximately midway along the rack has an identifiable shape as a knight chess piece in profile. Plywood blocking and two steel eyes are located at the top of the rack where it was designed to hang from wire ropes. The rack features a series of stenciled two-letter/two-number codes spray-painted in black along the interior piping. A stamped code (T2, R1688, 9A, SPAR 3) is located near the top of the rack. Three artifacts associated with the Mexia diagnostic rack: large turnbuckle (1 of 2; unknown manufacturer), large turnbuckle (2 of 2; unknown manufacturer), and box of wire ropes (manufacture by Upson Walton, WRTB, ESCO, LANL).

Historical Background
The Mexia diagnostic rack was fabricated circa 1991–1992 by Johnson Controls World Services, which was the operations support contractor for the Laboratory from 1989 to1997. A rack connector plate and clamp plates are located near the top of the rack. Rack connector plates served as an interface between cables routed inside the rack and those laid on the ground surface at the test site. Clamp plates helped with the alignment of cables to the connector plate. A steel ring, slightly wider than the rest of the rack, is located above the connector and clamp plates. Cables passed through and were protected by this ring on their way down the rack. Partially enclosed steel boxes can be seen in various locations on the rack. These boxes were designed to hold detectors and would have been filled with lead shot and then fully enclosed to protect the equipment inside. In reference to the aforementioned knight-chess-piece-shaped void, former J-6 NTS scientist Barry Bailey recalls, ". . . vacant space on station plates were [sic] often cut out for several reasons. First, if the plate didn't need to support anything, it was often 'cut out'. This also reduced the weight of the rack. Second, it allowed magnetite sand dropped from the surface after the rack's lowering to the required depth in the hole, to better flow around diagnostic experiments. This helped to 'block' any spurious radiation that might interfere with the experiments mounted within the rack." The chess-piece design was the result of creative ironworkers who liked to practice cutting novel shapes.

Although the exact fabrication dates for the diagnostic rack is unknown, it was designed to be used in the Mexia underground nuclear test, which was scheduled to follow the Divider test in the Operation Julin test series. Nuclear testing by the United States ended abruptly in the fall of 1992, when President George H. W. Bush entered the United States into a unilateral nuclear testing moratorium. Therefore, the Mexia diagnostic rack's fabrication can be estimated as circa 1991–1992. The Mexia diagnostic rack was nearly ready for shipping, and an emplacement hole had already been prepared at NTS. The preceding diagnostic rack, Icecap, was approximately 2 weeks from testing when the moratorium took effect. Underground nuclear test names were chosen from military branch manuals of allowable names. The name "Mexia" was chosen by former J-7 senior test director Ron Cosimi among a series of names based on towns in Texas.

The Mexia diagnostic rack is one of two remaining. Because the moratorium ended nuclear testing so abruptly, two LANL diagnostic racks had already been fabricated and were awaiting testing. The Mexia rack remains at LANL in the TA-60 RAAC legacy storage yard. The other diagnostic rack, fabricated for the Icecap test, remains hanging at Icecap ground zero at NNSS. Components of a canister (LLNL's name for diagnostic racks) for the Gabbs test also remain at the North Las Vegas facility. Because diagnostic racks were destroyed during nuclear testing, only those awaiting scheduled tests at the time of the 1992 moratorium remain. Aerial photographs show that the Mexia rack has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-08.

The following summary provides a limited background on the artifacts associated with the Mexia diagnostic rack. Wire ropes were used to hang diagnostic racks in test emplacement holes at NTS. The sockets on the ends of the wire ropes in the TA-60 RAAC legacy storage yard were manufactured by ESCO and met Wire Rope Technical Board (WRTB) standards. ESCO, a subsidiary of WEIR, designs, manufactures, and services equipment used in mining and infrastructure. The WRTB is an association that comprises wire-rope manufacturers in the United States. They establish standards, promote technical information, and conduct and underwrite research. Upson Walton, founded in 1871, is part of Muncy Industries, who focus on the heavy-lift and wire-rope rigging industries.

The large turnbuckles were used in conjunction with load equalizers to hang diagnostic racks. The turnbuckles have no manufacturer marks.

Foundation Other

Alterations not applicable

Condition Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, La Cuna, Second Steering Dolly, Rack Transporter (Jeep, Rack Trailer, and Steering Dolly), Mexia Device Canister, Mexia Device Mounting Stand, and Mexia Device Target Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐ Nuclear Weapon Design and Testing ☑ Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science ☐ Energy and Environment: Research and Design Projects ☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑ Super Computing ☐ Space Sciences ☐

Reactor Technology ☐ Biomedical/Health Physics ☐ Strategic and Supporting Research ☐

Environment/Waste Management ☐ Administration and Social History ☐ Architectural History ☐

Significant Yes ☑ No ☐

NRHP Eligibillity Criteria A ☑ B ☐ C ☑ D ☐ Criterion Consideration G ☑

Significance Details: The Mexia diagnostic rack exemplifies the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. A diagnostic rack was the core component of an underground nuclear test, and due to the destructive nature of testing, the Mexia diagnostic rack is one of only two remaining examples from the United States testing program. Therefore, this structure is eligible for listing in the National Register under Criterion (a). The Mexia diagnostic rack does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). Fabricated by the Laboratory’s operations contractors, each diagnostic rack was designed uniquely to support specific experiments. The Mexia diagnostic rack does have the distinctive characteristics of a type and method of construction, therefore, it is eligible for listing in the National Register under Criterion (c). The Mexia diagnostic rack has not yielded and is not likely to yield information important in history, because the rack itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). The Mexia diagnostic rack possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Integrity Excellent

Integrity Details: This structure was designed and fabricated during the late Cold War circa 1991–1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

NRHP Eligible Eligible ☑ Not Eligible ☐

Recommendations/ Additional Comments

In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

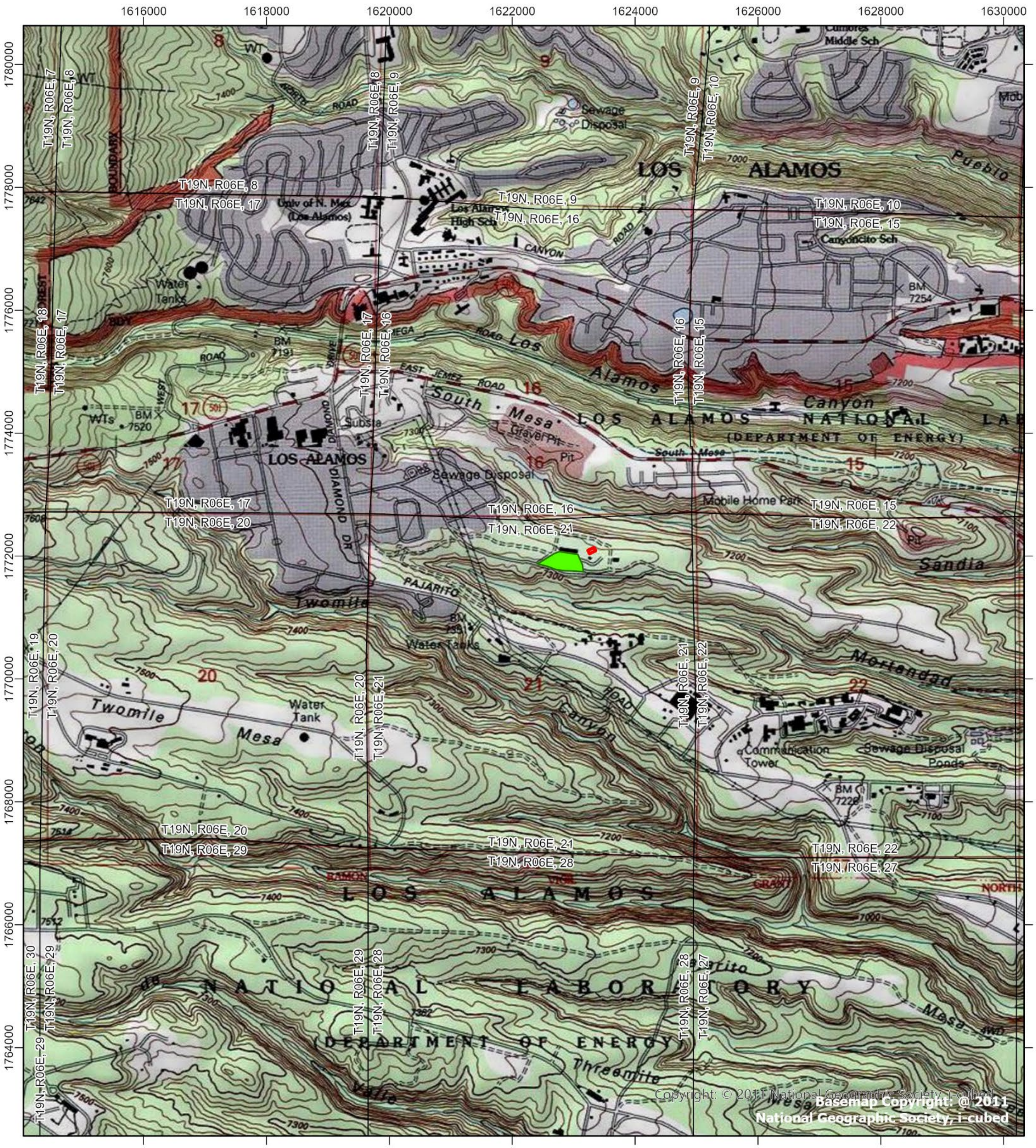
Total sq ft 385

Architect/ Builder LANL operations support contractor (Johnson Controls World Services)

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

0 1000 2000 Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

GIS Program Los Alamos National Laboratory

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Legend

TA-60 RAAC Legacy Storage Yard Boundary

Project Area

N

0 100 200 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location Map

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

GIS Program

Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Mexia Diagnostic Rack Photographs

Mexia diagnostic rack south of TA-60-0017, circa 2007 (LANL image no. DCP_5321).

Mexia diagnostic rack south of TA-60-0017, circa 2007 (LANL image no. DCP_5320).

Mexia Diagnostic Rack Photographs

Mexia diagnostic rack on the rack transporter, March 2024 (LANL image no. DSCN2637).

Mexia diagnostic rack on the rack transporter, September 2019 (LANL image no. DSCN0607).

Mexia Diagnostic Rack Photographs

Detail view of knight chess piece-shaped void, September 2023 (LANL image no. DSCN2371).

Mexia diagnostic rack on the rack transporter, September 2023 (LANL image, DSCN2364).

LANL TA- Structure: TA-60-9999

Camera: Piglet; Pedro; Napoleon

Frame #s: DCP_5322; DSCN0605; DSCN2391 - DSCN2392, DSCN2625- DSCN2626

Surveyor(s): C. Gregory, C. Townsend

Date: 4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name: Mexia Device Canister

UTMs easting: 381937 northing: 3970355 zone: 13

Legal Description: Map: Frijoles, New Mexico tnsp: 19N range: 6E sec: 21

Current Use/ Function: Inactive

Original Use/ Function: Mexia Device Canister

Date (estimated): ca. 1991–1992 Date (actual):

Property Type: Laboratory/Processing

Description (construction material, exterior features, windows, doors)

The Mexia device canister is a steel cylinder that measures 8 feet 2 inches in diameter by 14 feet 3 inches long. An inset, protruding steel cap is installed on one end, and an aluminum cap with two handles is bolted onto the other end.

Historical Background
The Mexia device canister was fabricated circa 1991–1992 for use in the Mexia underground nuclear test. Former J-6 NTS scientist Barry Bailey recalls, "Each [LANL] equipment rack had a canister at its lower end to protect the device and related hardware. For the majority of the time the equipment rack was being prepared in the Assembly [service] tower, the canister sat at ground level [test ground zero] over the emplacement hole." When the downhole structure was ready, the nuclear device was transported from its assembly area elsewhere at NTS via armed guard to test ground zero. "Once the device was inserted, the [LANL] rack was lowered into the canister, and the two bolted together". Although the Mexia device canister was not opened and, therefore, the inside not inspected during the course of this survey, device canisters were lined with boron carbide-loaded polyethylene bricks.

The Mexia underground nuclear test was scheduled to follow the Divider test in the Operation Julin test series. Nuclear testing by the United States ended abruptly in the fall of 1992, when President George H. W. Bush entered the United States into a unilateral nuclear testing moratorium. Therefore, the Mexia device canister's fabrication can be estimated as circa 1991–1992.

The Mexia device canister is one of two remaining. Because the moratorium ended nuclear testing so abruptly, two LANL diagnostic racks and related equipment (such as device canisters) had already been fabricated and were awaiting testing. The Mexia device canister remains at LANL in the TA-60 RAAC legacy storage yard. The Icecap device canister exists at NNSS, where the Icecap rack remains hanging at Icecap ground zero. Because device canisters were destroyed along with their diagnostic racks during nuclear testing, only those awaiting scheduled tests at the time of the 1992 moratorium remain. Photographs show that the Mexia device canister has been relocated within RAAC but always remained within the complex. In 2019, NA-LA documented this structure and referenced it as artifact number 60-0017-10.

Foundation: Other

Alterations: not applicable

Condition: Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, La Cuna, Second Steering Dolly, Rack Transporter (Jeep, Rack Trailer, and Steering Dolly), Mexia Diagnostic Rack, Mexia Device Mounting Stand, and Mexia Device Target Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐ | Nuclear Weapon Design and Testing ☑ | Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science ☐ | Energy and Environment: Research and Design Projects ☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑ | Super Computing ☐ | Space Sciences ☐

Reactor Technology ☐ | Biomedical/Health Physics ☐ | Strategic and Supporting Research ☐

Environment/Waste Management ☐ | Administration and Social History ☐ | Architectural History ☐

Significant Yes ☑ No ☐

NRHP Eligibillity Criteria A ☑ B ☐ C ☑ D ☐ Criterion Consideration G ☑

Significance Details

The Mexia device canister is demonstrative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Fabricated to protect the nuclear device and related hardware, the Mexia device canister was an essential component for the underground nuclear test. Due to the destructive nature of testing, the Mexia device canister is one of only two remaining examples from the United States testing program. Therefore, this structure is eligible for listing in the National Register under Criterion (a). The Mexia device canister does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). Device canisters were uniquely designed to protect the nuclear device and related hardware of a specific diagnostic rack. Fabricated by the Laboratory, the Mexia device canister does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c). The Mexia device canister has not yielded and is not likely to yield information important in history, because the Mexia device canister itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). The Mexia device canister possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Integrity Excellent

Integrity Details

This structure was fabricated during the late Cold War circa 1991 to 1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

NRHP Eligible Eligible ☑ Not Eligible ☐

Recommendations/ Additional Comments

In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

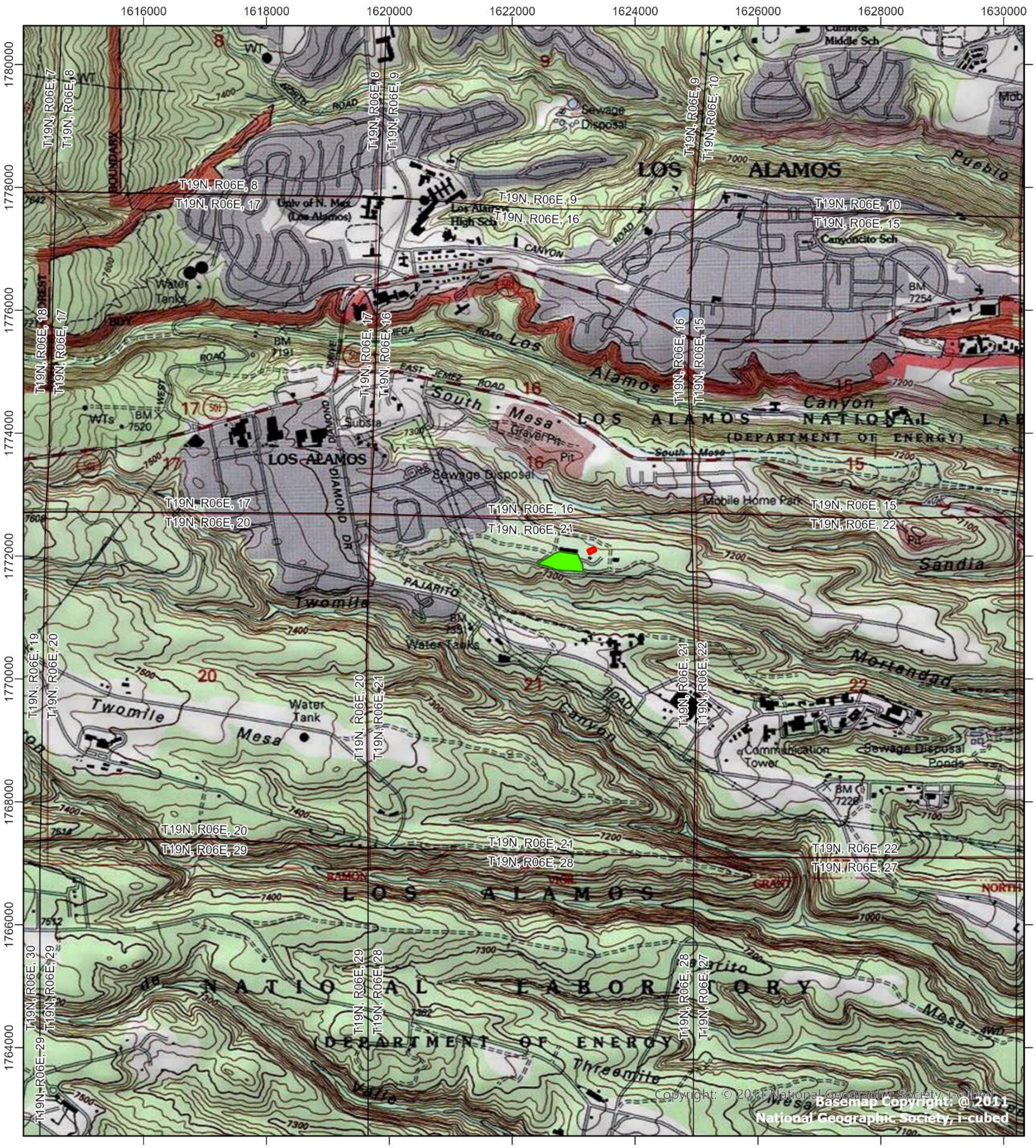
Total sq ft 116

Architect/ Builder LANL operations support contractor (Johnson Controls World Services)

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

N

0 1000 2000 Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Project Location Map

Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

N

0 100 200 Feet

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

GIS Program

Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Mexia Device Canister Photographs

Mexia device canister south of TA 60-0017, circa 2007 (LANL image no. DCP_5322).

Mexia device canister, September 2023 (LANL image no. DSCN0605).

Mexia Device Canister Photographs

Mexia device canister, March 2024 (LANL image no. DSCN2625).

Mexia device canister, September 2023 (LANL image no. DSCN2392).

LANL TA- Structure	TA-60-9999
Camera	Piglet; Napoleon
Frame #s	DCP5322; DSCN2388 - DSCN2389, DSCN2392, DSCN2628, DSCN2630, DSCN2641-DSCN2642,
Surveyor(s)	C. Gregory, C. Townsend
Date	4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name: Mexia Device Mounting Stand

UTMs easting: 381935 | northing: 3970356 | zone: 13

Legal Description: Map: Frijoles, New Mexico | tnsp: 19N | range: 6E | sec: 21

Current Use/ Function: Inactive

Original Use/ Function: Mexia Device Mounting Stand

Date (estimated): ca. 1991–1992

Date (actual):

Property Type: Laboratory/Processing

Description (construction material, exterior features, windows, doors)

The Mexia device mounting stand is a frame made of steel and aluminum that measures 5 feet 11 inches in diameter and 9 feet 2 inches high. It is currently sitting upside down. The circular aluminum base plate (currently at the top) supports four vertical steel rails that extend up and support a circular device support plate in the middle of the stand and a steel hoop located just below (currently above) fastening plates. Both the base plate and the device support plate have cutouts or voids. The device support plate has a layer of boron-carbide-loaded polyethylene bricks and an aluminum bracket for a neutron generator attached to its underside (currently the top).

Historical Background

The Mexia device mounting stand was fabricated circa 1991–1992 by Johnson Controls World Services, which was the operations support contractor for the Laboratory from 1989 to 1997. The Mexia device mounting stand—also called a device rack or a weapon rack—would have held the nuclear device, been attached to the bottom of the diagnostic rack, and been protected by the Mexia device canister. The boron-carbide–loaded polyethylene bricks were fabricated by the operations support contractor and were neutron absorbers. The neutron generator would fire neutrons into the nuclear device in the last 5 seconds of the countdown.

Foundation: Other

Alterations: not applicable

Condition: Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, La Cuna, Second Steering Dolly, Rack Transporter (Jeep, Rack Trailer, and Steering Dolly), Mexia Diagnostic Rack, Mexia Device Canister, and Mexia Device Target Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐

Nuclear Weapon Design and Testing ☑

Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science ☐

Energy and Environment: Research and Design Projects ☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑ Super Computing ☐ Space Sciences ☐

Reactor Technology ☐ Biomedical/Health Physics ☐ Strategic and Supporting Research ☐

Environment/Waste Management ☐ Administration and Social History ☐ Architectural History ☐

Significant Yes ☑ No ☐

NRHP Eligibillity Criteria A ☑ B ☐ C ☑ D ☐ Criterion Consideration G ☑

Significance Details

The Mexia device mounting stand is illustrative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Fabricated to hold the nuclear device and related hardware, the Mexia device mounting stand was an essential component for the underground nuclear test. Due to the destructive nature of testing, the Mexia device mounting stand is one of only two remaining examples from the United States testing program; therefore, this structure is eligible for listing in the National Register under Criterion (a). The Mexia device mounting stand does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). Device mounting stands were uniquely designed to hold the nuclear device and related hardware associated with a specific diagnostic rack. Fabricated by the Laboratory, the Mexia device mounting stand does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c). The Mexia device mounting stand has not yielded and is not likely to yield information important in history, because the Mexia device mounting stand itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). The Mexia device mounting stand possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Integrity Excellent

Integrity Details

This structure was fabricated during the late Cold War circa 1991 to 1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

NRHP Eligible Eligible ☑ Not Eligible ☐

Recommendations/ Additional Comments

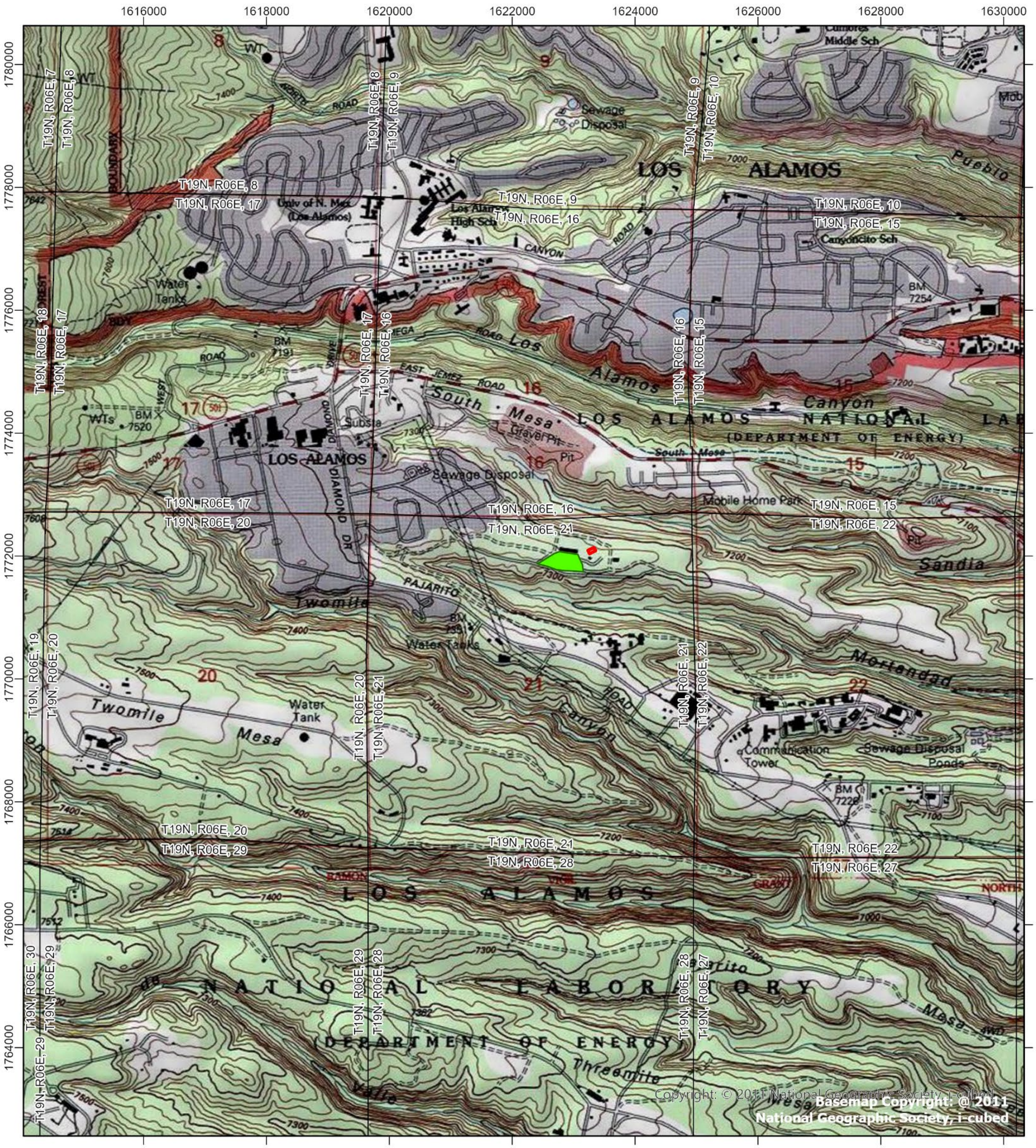
In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

Total sq ft 54 **Architect/ Builder** LANL operations support contractor (Johnson Controls World Services)

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

N

0 1000 2000 Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

N

0 100 200 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location Map

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Mexia Device Mounting Stand Photographs

Mexia device mounting stand, September 2023 (LANL image no. DSCN2389).

Mexia device mounting stand, March 2024(LANL image no. DSCN2644).

LANL TA- Structure	TA-60-9999
Camera	Napoleon
Frame #s	DSCN2386 - DSCN2388, DSCN2390, DSCN2629, DSCN2643, DSCN2645
Surveyor(s)	C. Gregory, C. Townsend
Date	4/26/2024

Los Alamos National Laboratory
Historic Structure Survey Form

Structure Name: Mexia Device Target Stand

UTMs easting: 381937 northing: 3970357 zone: 13

Legal Description: Map: Frijoles, New Mexico tnsp: 19N range: 6E sec: 21

Current Use/ Function: Inactive

Original Use/ Function: Mexia Device Target Stand

Date (estimated): ca. 1991–1992 Date (actual):

Property Type: Laboratory/Processing

Description (construction material, exterior features, windows, doors)

The Mexia device target stand is a rectilinear frame that measures 6 feet 6 inches across and 6 feet 6 inches high and is made of steel and aluminum. A round steel base plate supports four vertical steel columns and an aluminum top plate. The aluminum base plate is lined with boron-carbide-loaded polyethylene bricks. Extending from the center of the base plate are two cylindrical aluminum pedestals topped by an engraved rectangular aluminum plate. This component measures 3 feet high. The aluminum plate at the top has cutouts or voids. The word “Mexia” and other letters and numbers are hand-painted on the bricks.

Historical Background
The Mexia device target stand was fabricated circa 1991–1992 by Johnson Controls World Services, which was the operations support contractor for the Laboratory from 1989 to1997. The Mexia device target stand was used to align the lines of site associated with the numerous detectors on the diagnostic rack. Alignments would be within 0.005-inch accurate, and the device target stand would be used to build the device mounting stand. The boron-carbide–loaded polyethylene bricks were fabricated by the operations support contractor and were neutron absorbers.

Foundation: Other

Alterations: not applicable

Condition: Excellent ☐ Good ☑ Fair ☐ Deteriorating ☐ Contaminated ☐ Burned ☐

Additional Conidition Notes: The structure is in an open-air setting and has been minimally affected by the elements.

Associated Buildings or Structures ☑

If yes, list building/structure names and #s: TA-60-0017, TA-60-0019, La Cuna, Second Steering Dolly, Rack Transporter (Jeep, Rack Trailer, and Steering Dolly), Mexia Diagnostic Rack, Mexia Device Canister, and Mexia Device Mounting Stand

DOE Themes

Nuclear Weapon Components and Assembly ☐ Nuclear Weapon Design and Testing ☑ Nuclear Propulsion ☐

Peaceful Uses: Plowshare, Nuclear Medicine, Nuclear Energy, Nuclear Science ☐ Energy and Environment: Research and Design Projects ☐

LANL Themes

Weapons Research and Design, Testing, and Stockpile Support ☑ Super Computing ☐ Space Sciences ☐

Reactor Technology ☐ Biomedical/Health Physics ☐ Strategic and Supporting Research ☐

Environment/Waste Management ☐ Administration and Social History ☐ Architectural History ☐

Significant Yes ☑ No ☐

NRHP Eligibillity Criteria A ☑ B ☐ C ☑ D ☐ Criterion Consideration G ☑

Significance Details

The Mexia device target stand is evocative of the historical theme of Weapons Research, Development, Testing, and Stockpile Support: NTS Testing. Fabricated to align the lines of site of the numerous detectors on the Mexia diagnostic rack, the Mexia device target stand was an essential component for the underground nuclear test. Because device target stands were discarded after each test, the Mexia device target stand is likely one of only two remaining examples from the United States testing program; therefore, this structure is eligible for listing in the National Register under Criterion (a). The Mexia device target stand does not have associations with significant persons; therefore, it is not eligible for listing in the National Register under Criterion (b). Device target stands were uniquely designed to align the lines of sight of a specific diagnostic rack. Fabricated by the Laboratory, the Mexia device target stand does have the distinctive characteristics of a type and method of construction; therefore, it is eligible for listing in the National Register under Criterion (c). The Mexia device target stand has not yielded and is not likely to yield information important in history, because the Mexia device target stand itself is not an important source of data; therefore, it is not eligible for listing in the National Register under Criterion (d). The Mexia device target stand possesses exceptional importance and therefore is eligible for listing in the National Register under Criteria Consideration g.

Integrity Excellent

Integrity Details

This structure was fabricated during the late Cold War circa 1991 to 1992 and retains integrity of location, design, setting, materials, workmanship, feeling, and association

NRHP Eligible Eligible ☑ Not Eligible ☐

Recommendations/ Additional Comments

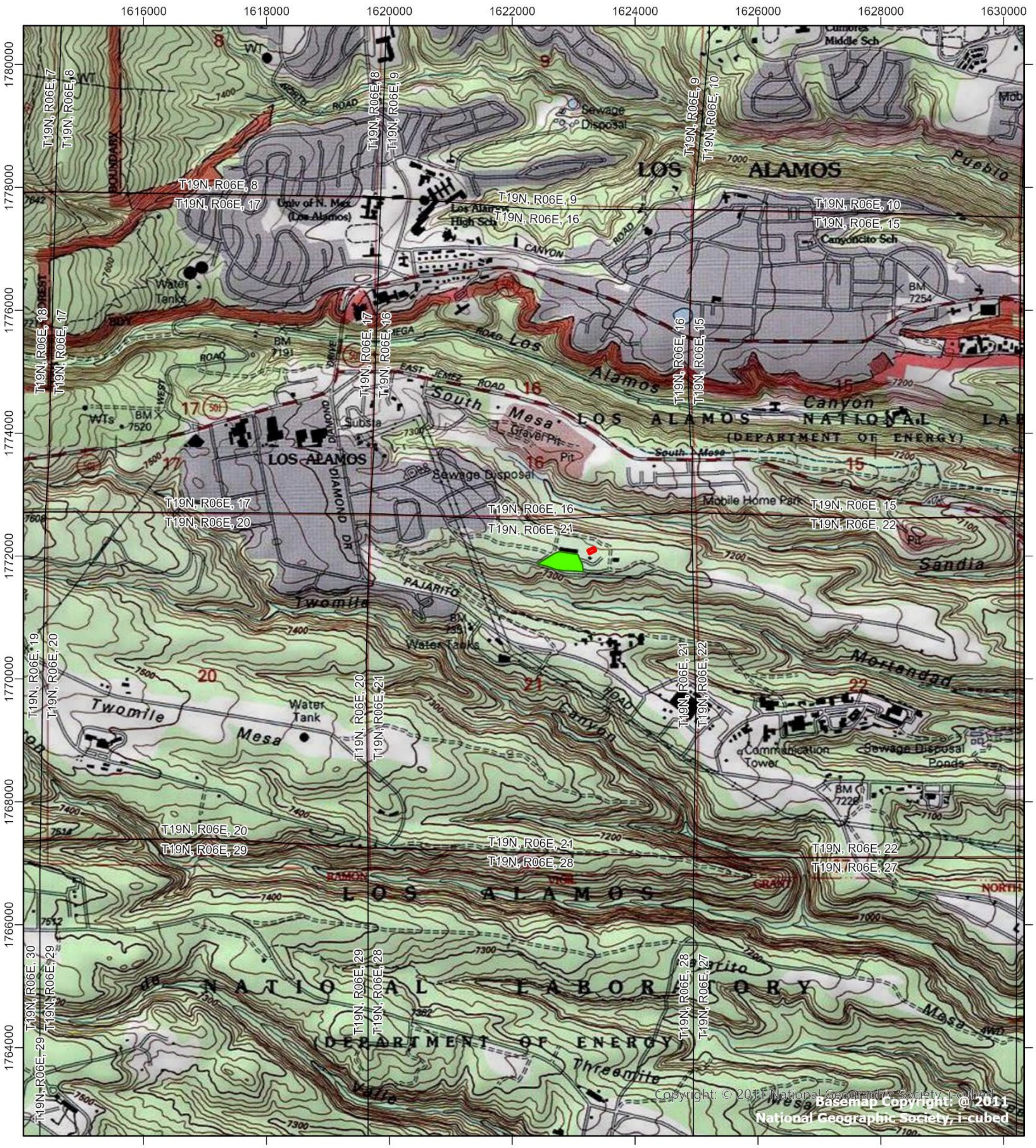
In the future, the TA-60 RAAC legacy storage yard should be covered and/or fenced to protect the structures and artifacts.

Total sq ft 42 **Architect/ Builder** LANL operations support contractor (Johnson Controls World Services)

List of Drawings (Cntrl + Enter for para break)

none

TA-60 RAAC Legacy Storage Yard Project Location and Site Map



Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

N

0 1000 2000 Feet

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location

Map Scale - 1:24,000 ft

Map Number: 24-001-02 January 2024
Bethann McVicker, GIS Program

GIS Program Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Legend

- TA-60 RAAC Legacy Storage Yard Boundary
- Project Area

New Mexico State Plane Coordinate System, Central Zone (3002)
North American Datum, 1983 (NAD83), US Survey Feet

Project Location Map

Map Number: 24-001-03 January 2024
Bethann McVicker, GIS Program

GIS Program
Los Alamos NATIONAL LABORATORY

TA-60 RAAC Legacy Storage Yard Project Location and Site Map

Mexia Device Mounting Stand Photographs

Mexia device target stand, March 2024 (LANL image no. DSCN2645).

Mexia device target stand, March 2024 (LANL image no. DSCN22631).

Mexia Device Mounting Stand Photographs

Mexia device mounting stand, September 2023 (LANL image no. 2390).