WHITE SANDS SPACE HARBOR HAER No. NM-27
(Space Shuttle Landing Facility)
White Sands Missile Range
Approximately 6.8 miles northeast of intersection of Range Road 7 and Range Road 10 and approximately 2.5 miles west of Dońa Ana-Otero County line
White Sands vicinity
Dońa Ana County
New Mexico

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
U.S. Department of the Interior
Intermountain Regional Office
12795 Alameda Parkway
Denver, CO 80225-0287

HISTORIC AMERICAN ENGINEERING RECORD

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(Space Shuttle Landing Facility)

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Location:	White Sands Missile Range Approximately 6.8 miles northeast of intersection of Range Road 7 and Range Road 10 and approximately 2.5 miles west of Doña Ana-Otero County line White Sands vicinity Doña Ana County New Mexico U.S.G.S. 7.5. Minute Las Cruces, New Mexico, quadrangle, Universal Transverse Mercator Coordinates: E 32.93817 N 106.41016 Zone 13S, NAD 1983
Present Owner:	Commander, U.S. Army White Sands Missile Range, New Mexico 88002-5018
Present Use:	Vacant
Significance:	The White Sands Space Harbor (WSSH) has a direct association with the U.S. Space Shuttle Program (SSP), as the site of the landing of Space Transportation System (STS)-3 *Columbia* in March 1982; this is the only STS landing to take place outside Edwards Air Force Base in California and Kennedy Space Center in Florida. The WSSH district is considered to have national significance and is eligible for listing in the National Register of Historic Places (NRHP) under Criterion A for its association with the NASA SSP with a period of significance of 1976-2011. Because it achieved significance within the past fifty years, Criterion Consideration G also applies.

Report
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118 South 11th Street
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Date: September 2013

LIST OF ACRONYMS

ABGR	Alamogordo Bombing and Gunnery Range
ABS	Anti-lock Braking System
ACHP	Advisory Council on Historic Preservation
ACI	Archaeological Consultants, Inc.
AIAA	American Institute of Aeronautics and Astronautics
APE	Area of Potential Effects
ATC	Air Traffic Control
BTT	Basic Training Target
CCC	Civilian Conservation Corps
CIT	California Institute of Technology
CONEX	Container Express
DC-X	Delta Clipper, Experimental
DoD	Department of Defense
GPS	Global Positioning System
HAFB	Holloman Air Force Base
HPO	Historic Preservation Officer
HPWG	Historic Preservation Working Group
HUB	Harbor Utility Building
IGS	Inter Glide Slope
IHA	InoMedic Health Applications, LLC
JSC	Johnson Space Center
KSC	Kennedy Space Center
LC	Launch Complex
MD	McDonnell Douglas
MSBLS	Microwave Scanning Beam Landing System
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NAVAIDS	Navigational Aids
NEPA	National Environmental Policy Act
NHL	National Historic Landmark

NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
NSA	New South Associates
OCC	Operations Control Center
ORD	Army Ordinance Department
PAPI	Precision Approach Path Indicator
RFP	Request for Proposal
SCAPE	Self Contained Atmospheric Protective Ensemble
SHPO	State Historic Preservation Officer
SSP	Space Shuttle Program
SSRT	Single Stage Rocket Technology
STA	Shuttle Training Aircraft
STS	Space Transportation System
TACAN	Tactical Air Navigation
TAL	Transoceanic Abort Landing
UHF	Ultrahigh Frequency
USAAF	United States Army Air Force
USAF	United States Air Force
VITT	Vehicle Integration Test Team
WPA	Works Progress Administration
WSMR	White Sands Missile Range
WSNM	White Sands National Monument
WSPG	White Sands Proving Ground
WSSH	White Sands Space Harbor
WSTF	White Sands Test Facility

PART I. HISTORICAL INFORMATION

A. INTRODUCTION

The National Aeronautics and Space Administration (NASA) operated and managed the WSSH for astronaut training operations and as an alternate landing facility for the U.S. Space Shuttle Program (SSP) from 1976-2011. It has a direct association with the SSP as the site of the landing of Space Transportation System (STS)-3 *Columbia* in March 1982. The WSSH is located on the WSMR northeast of the NASA-operated White Sands Testing Facility (WSTF). The WSSH facility included the runways and support facilities (Area 1); the orbiter deservice area (Area 2); operations control center (Area 3); and original operations control center/deservice area/Delta Clipper site (Area 4). NASA formally ended the SSP on August 31, 2011, and in the summer of 2012 disposed of the WSSH and released use of the property to WSMR.

The WSSH Space Shuttle Landing Facility lies at the north end of the WSSH and contains approximately 4,900 acres. Area 1 is comprised of twenty-eight resources, including three runways, a control tower, a weather tower, a helicopter staging area, navigational aids and support facilities, a HUB maintenance facility, a fire station, portable storage buildings, and a generator building. The runways were constructed between 1976 and 1988. The HUB maintenance facility and support buildings are prefabricated and were located together between 1984 and 1992 to house training and landing needs. The Control Tower was purpose-built in 1979 and Weather Tower No. 4 was assembled in phases from 1982-2005. The WSSH Space Shuttle Landing Facility was vacated in 2011 and all electronic equipment, machinery, and furnishings were removed. In the summer of 2012, the U.S. Army initiated occupation and reuse of the facility and the Control Tower was relocated from WSSH to the WSMR Museum for storage and future exhibition.

Located at the south end of the WSSH, Area 2 contains the Deservice Pad, Heavy Equipment Maintenance Building, Latrine, Environmental Office, Field Engineer Office, Security Guard Shacks, Workshops, and several storage buildings. A natural surface tow way connects the Deservice Pad to Range Road 10 and the Runways in Area 1. A gravel road connects Area 2 to Range Road 10 and the Operations

Control Center at Area 3, which is located at the southwest corner of WSSH. Area 3 contains the Operations Control Center, Dispensary, Communications Building, Weather Trailer, Loading Dock, Helicopter Landing Pad, and mobile trailers. Area 4 is comprised of the ruins of two concrete pads and a loading dock as well as a small survey marker commemorating the STS-3 Columbia landing in March 1982. A natural surface access road connects Area 4 to Range Road 10. The land area and dunes within the Alkali Flat outside the footprint of Areas 2, 3, and 4 is controlled by the U.S. Army and U.S. Air Force.

B. HISTORICAL CONTEXT

1. CHARACTER/ENVIRONMENT

The White Sands Space Harbor (WSSH) is located on the U.S. Army White Sands Missile Range (WSMR) near Las Cruces in Doña Ana County, New Mexico. This military post lies in the Tularosa basin along the upper edge of the Chihuahuan Desert, a vast eco-region straddling the U.S.-Mexico border in the central and northern portions of the Mexican Plateau. The Tularosa basin is an arid high-desert region covering approximately 6,000 square miles between the Rio Grande and Pecos River in south-central New Mexico with elevations ranging from approximately 3,800-4,200′ feet above sea level. This stark desert is composed of the world's largest surface deposit of gypsum, a very soft sulfate mineral made of sulfur and calcium. Gypsum is derived from the Greek word gypsos, which means "chalk" or "plaster." Located between two towering mountain ranges, the gypsum sand dune is commonly known as "White Sands."[1]

The landlocked, bowl-shaped Tularosa basin is 150 miles long and 50-60 miles in width. It is located between the San Andres Range to the west and the Sacramento Mountains to the east. The unique sand dunes originated many millions of years ago when a shallow, glacial lake called Lake Otero covered south-central New Mexico. When the lake eventually evaporated, it left behind gypsum bearing marine deposits nearly 1,600′ thick. The exposed northern region of the lakebed is a 1,600-square mile area called the Alkali Flat. The southern region contains an ephemeral lake, or playa, called Lake Lucero with a very high mineral content. Although summer temperatures can easily exceed 100 degrees, the unique white sand reflects the sun's rays and the grains are so fine they are cool and silky to the touch. Gypsum is commonly

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[1] Andreloi 1998: Section 3.1.2.2; Bennett, Jeffrey, and Douglas Wilder. "Physical Resources Foundation Report: White Sands National Monument. Natural Resources Report NPS/NRPC/NRR-2009/166." National Park Service, Fort Collins, Colorado, 2009: 9.

used to make plaster of Paris, fertilizers, drywall and Portland cement.[2]

The near ceaseless desert winds, clocked at more than fifty miles per hour, push the fine gypsum grains to form crests as high as sixty feet on the upwind side, and under the pressure of gravity, the sand slides down steep slipfaces, giving the sands dynamic movement. Each year, the most active dunes advance to the northeast more than thirty feet, covering almost everything in their path; the more stable dunes move very little. The gypsum dunes are a harsh and dry environment with fierce sandstorms, flash floods, and temperatures ranging from below zero in winter to more than 110 degrees in summer. Only a few plants and animals have adapted to survive.[3]

2. CHARACTER

Isolated, spacious, and built on the Northrup Strip within a federal installation, the location of 100-square mile WSSH at the WSMR offered some definite advantages for the expansive runways needed for the SSP. Area 1 of the Space Shuttle Landing Facility is comprised of three runways, a control tower, a weather tower, a helicopter staging area, navigational aids and support facilities, a HUB maintenance facility, a fire station, portable storage buildings, and a generator building. The immense "X" shaped intersecting runways are its dominating feature. The few support buildings and structures are organized around the runways. The control tower and the HUB buildings are clustered together on the east side of the intersection. The navigation aids and support facilities are located along the runways. The Space Shuttle Landing Facility is surrounded by open desert and ringed by mountain ranges.

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[2] Andreoli 1998: Section 3.1.4; Welsh, Michael. "Dunes and Dreams: A History of White Sands National Monument. Administrative History: White Sands National Monument." National Park Service, Division of History, Intermountain Cultural Resources Center, Santa Fe, New Mexico, Professional Paper No. 55, 1995: Chapter 1; Bennett and Wilder 2009: 9.
[3] Andreoli, 1998: Section 3.1.2.2; Andreoli, 1998: Section 3.2.3; Welsh, 1995: Chapter 1; Bennett & Wilder, 2009: 7-18.

3. EARLY SETTLEMENT

For a period of nearly 10,000 years, American Indians occupied the Tularosa Basin, until a major drought around A.D. 1350 forced outmigration. For the next 250 years, the basin was occupied only by small groups of hunters and gatherers on a limited basis. By the time of Spanish colonization in the mid-seventeenth century, nomadic groups of Athabascan tribes were established in the nearby mountains. By the eighteenth century, the Mescalero Apache were the only Indian tribe living in the Tularosa Basin. European colonization in the basin was delayed by Apache resistance until the mid-nineteenth century.[4]

In the late eighteenth and early nineteenth centuries, settlers made occasional salt expeditions from El Paso to the Alkali Flats. The area was part of Mexico until 1848, when it was turned over to the U.S. as part of the Treaty of Guadalupe Hidalgo. In 1849, the U.S. Army initiated exploration of the region and in 1855 established Fort Stanton, a military outpost on the Chisholm Trail in the Sacramento Mountains, and Camp Comfort in 1858 at White Sands. The military also constructed a service wagon road through the San Augustin Pass that separates the San Andres Mountains from the Organ Mountains.[5]

4. RANCHING THE TULAROSA BASIN

Under U.S. military protection, in the early 1860s, Hispanic families from the Rio Grande Valley moved to the area and established permanent agricultural communities, the first being Tularosa. These ranchers applied gypsum to the exterior of their adobe homes giving them a distinctive white appearance from a distance. After the Mescalero Apache Reservation was established in 1873 in the Sacramento Mountains and the Desert Land Act passed in 1877, this region of the New Mexico territory was colonized by European settlers from the eastern United States and western Texas.

[4] Eidenbach, 2010: n.p.
[5] Welsh, 1995: Chapters 1-2.

Ranchers replowed long abandoned agricultural lands and established free-range livestock ranches with sheep, Angora goats, horses, and cattle. Homesteads were built near permanent water sources flanking the "old salt lake." Miners searched the mountains for gold, silver, copper, lead, zinc, and other minerals. Boston investors established a copper mining town called Estey City, which operated from 1901-1910, before it was abandoned. Among the legendary inhabitants of White Sands was Pat Garrett who killed Billy the Kid in 1881 and was later shot to death in 1908 near the San Augustin Pass.[6]

Once Congress granted New Mexico statehood in 1912, new public land laws were soon implemented that resulted in the end of the open range ranches and a shift to a cash-based economy centered on mining, timber harvesting, stock raising, agriculture, and construction of railroads. A period of severe drought in the 1890s and overgrazing led to soil erosion and desertification of the once rich native grasslands, which caused the open range cattle ranches to go bankrupt. In addition, the hopes of a new gypsum-based construction industry never materialized. In the 1930s, the Great Depression and droughts brought the frontier era to an end with the federal government setting aside large tracts of land in the central and western sections of the White Sands basin.[7]

5. CONSERVATION

Local residents first envisioned conservation of the White Sands in 1898 when a group of businessmen from nearby El Paso, Texas, proposed the Mescalero National Park as a game hunting preserve. Around that same time, geologists intensified their studies of the White Sands, realizing its significance as a unique natural occurrence. Railroads reached the area in 1901 with stations in Alamogordo in Otero County to the east and Las Cruces in Doña Ana County to the west. In addition, newly established public universities, such as the University of New Mexico in Santa Fe

[6] Welsh, 1995: Chapters 1-2; Eidenbach, 2010: n.p.
[7] Welsh, 1995: Chapter 2; NPS, 2005: 19.

and New Mexico State University in nearby Las Cruces, initiated academic studies of the dunes.[8]

Federal designation of U.S. Highway 80 in the late 1920s from Savannah, Georgia, to San Diego, California, across southern New Mexico boosted the regional economy with automobile tourism. Roadside businesses, such as service stations and motels, opened along the 2,726-mile route called the "Dixie Overland Highway," which had originated in the South in 1914 with the motto: "The Shortest and Only Year Round Ocean-to-Ocean Highway." U.S. 80 also carried sections of the transcontinental Lee Highway and Jefferson Davis National Highway, both connecting Washington, D.C., with San Diego, as well as the Bankhead Highway, connecting El Paso with San Diego.[9]

As one of the principal transcontinental highways, towns along U.S. 80 in New Mexico included Roswell, Alamogordo, Las Cruces, Deming, Lordsburg, and Mescalero within the Mescalero Apache Reservation. Until the mid-twentieth century, travelers along U.S. 80 were diverted around White Sands to El Paso, Texas, although an unimproved road, State Route 3, opened through the sand dunes in the late 1920s. Nevertheless, U.S. 80 provided much improved access to the remote White Sands region.[10]

6. WHITE SANDS NATIONAL MONUMENT

Feasibility studies were initiated in the 1920s for commercial mining of the vast White Sands gypsum field. Passionate local opposition led to the resurrection of the idea of an all-year national park and ultimately to the creation of the White Sands National Monument in January 1933 by President Herbert Hoover. Straddling Doña Ana and Otero counties, the 115-square mile national park was dedicated on April 29, 1934. From 1936-1940, the National Park Service (NPS) constructed several support facilities designed by NPS architects, and constructed by the Works Progress Administration (WPA). These facilities included

[8] Welsh, 1995: Chapter 2.
[9] Weingroff, 2011: n.p.
[10] Weingroff, 2011: n.p

staff residences, restrooms, access roads, and a Spanish pueblo-style Visitor Center; most were listed in the NRHP in 1988.[11]

The state highway department improved State Route 3 in the late 1930s and relocated U.S. 70/U.S. 80 through the San Augustin Pass between Alamogordo and Las Cruces, bypassing El Paso, and providing direct access to the new national monument (in 1991, New Mexico dropped the U.S. 80 designation). Soon, White Sands became the most popular national park in the southwestern U.S., averaging around 450,000 visitors annually.[12]

7. UNITED STATES ARMY WHITE SANDS MISSILE RANGE

During World War II, the U.S. Army established a rocket testing and bombing range at White Sands, due in part to the result of rocket research at Roswell, New Mexico, located approximately 130 miles to the east. The nearly 3,200-square mile installation at White Sands is the largest in the U.S., covering a swath of the desert in five counties in south-central New Mexico. The enormous installation is contiguous with the north side of Fort Bliss, established in 1849 at El Paso, Texas, and includes the White Sands National Monument. Much of the secluded land was already under local, state, and federal government jurisdiction, primarily as part of military firing, target, and bombing ranges. The New Mexico Highway Department declared U.S. 70, which crosses the WSMR, a military road subject to periodic closures.[13]

The initial military facility was the Alamogordo Army Air Field, established by the U.S. Army Air Force (USAAF) in April 1941 six miles west of Alamogordo at the western base of the Sacramento Mountains. By the end of 1941, the federal government cancelled public land grazing leases at White Sands so the land could be used by the USAAF as the Alamogordo Bombing and Gunnery

[11] NPS, 2007: n.p.; Welsh, 1995: Chapter 3; Bennett & Wilder, 2009: 3.
[12] Weingroff 2011: n.p; NPS 2005: 19; Welsh 1995: Chapter 3).
[13] Quinn, Michael E. "White Sands Missile Range: V-2 Rocket Facilities." Historic American Engineering Record. National Park Service, 1984: 9; Buchanan, David G., John P. Johnson and William A. Brenner. "White Sands Missile Range: Dona Anna, Sierra, Socorro, & Lincoln Counties, New Mexico." Historic American Engineering Record. National Park Service, Washington, DC, 1984: 66.

Range (ABGR), renamed the White Sands Proving Grounds (WSPG) in 1945. The WSPG was a 1,243,000-acre land area incorporating the ABGR, the nearby ORDCIT (a joint venture between the U.S. Army Ordnance Department and California Institute of Technology at Fort Bliss), and additional portions of the Fort Bliss Artillery Range. Following the air attack on Pearl Harbor in December 1941, construction of the 5,900-acre air base began in February 1942 with full status achieved by June 1942.[14]

In 1944, the War Department chose White Sands as a missile research and nuclear bomb test site, due to its geography, isolation, and proximity to the Los Alamos Laboratory outside Santa Fe, New Mexico, approximately 200 miles to the north. On July 16, 1945, the first atomic bomb was detonated at the Trinity Test Site, an 18 by 24-mile area located on the Jornada del Muerto, Spanish for "journey of the dead man," in the northern end of the WSPG in Socorro County. Trinity was a test of a 16-kiloton nuclear fission, plutonium device developed as part of the Manhattan Project in coordination with research laboratories and facilities at Los Alamos, New Mexico; Oak Ridge, Tennessee; and Hanford, Washington, along with assistance from scientists at the University of Chicago and University of California at Berkeley.[15]

The Trinity test led to the creation of the "Fat Man" bomb detonated over Nagasaki, Japan, on August 9, 1945, ending the war five days later and ushering in the Atomic Age. The 36,480-acre

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[14] United States Air Force. "Holloman Air Force Base History." Holloman Air Force Base, New Mexico, Public Affairs Office. Website http://www.holloman.af.mil/library/factsheets/factsheet.asp?id=4361, accessed November 17, 2011; Buchanan, 1984: 18; Eidenbach, Peter L. "A Brief History of the White Sands Proving Ground, 1941-1965." Las Cruces, New Mexico: Human Systems Research, Inc., 1997: 1; Deming, Joan, and Patricia Slovinac. "Survey and Evaluation of NASA-owned Historic Facilities and Properties in the Context of the U.S. Space Shuttle Program: White Sands Test Facility, Las Cruces, New Mexico." Archaeological Consultants, Inc., Sarasota, Florida, 2007: Section 4.2. Unpublished report prepared for NASA Johnson Space Center, Houston, Texas.

[15] Greenwood, Richard. "Trinity Site." National Register of Historic Places Nomination, National Park Service, Washington, DC, 1975; Andreoli, 1998: Section 3.6.

Trinity Test Site was designated a National Historic Landmark in 1965, when a stone monument was erected to commemorate the site, which includes the base camp, Ground Zero (detonation site), control bunkers, the Schmidt-McDoñald Ranch House, where the bomb was assembled, and "Jumbo," a huge steel vessel designed to enclose the plutonium in the event of an unsuccessful test.[16]

The U.S. Army Corp of Engineers initiated construction of the Main Post Headquarters in early 1945. This post was located in the southwest corner of WSMR along the eastern base of the Organ Mountains in Doña Ana County and contained the W.W. Cox San Augustin Ranch as well as abandoned mines. The main post was designed with four quadrants containing the administrative and troop area, technical area, industrial and warehouse area, and the quarters and parade ground area. Temporary CCC buildings and an aircraft hangar were relocated from the Sandia Base in Albuquerque. A large Quonset hut was constructed for the V-2 program, as well as many temporary buildings, nearly all of which have since been replaced.[17]

The assembly and testing of captured German V-2 rockets was initiated in June 1945 from an army blockhouse at Launch Complex 33 (LC-33); a 75-foot tall gantry crane on a launch pad with rolling tracks was added in 1946. The testing of liquid-filled V-2 rockets capable of reaching outer space launched the American rocket program and led to U.S. exploration of space. Testing at LC-33 continued until 1952 when the U.S. Army transferred the rocket program to Redstone Arsenal in Huntsville, Alabama. The White Sands LC-33 Blockhouse and Gantry was designated a National Historic Landmark in 1985.[18]

The U.S. Navy constructed its own rocket firing facilities in 1946 at Launch Complex 35 with a launch pad and two steel launch towers. Other launch and testing sites were constructed at

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[16] Greenwood, 1975: n.p.; Buchanan, 1984: 49; Andreoli, R.J. "White Sands Missile Range, Range-Wide Environmental Impact Statement." WSMR, New Mexico, 1998: Section 3.6. Unpublished report on file at WSMR.
[17] Buchanan, 1984: 66.
[18] Quinn, 1986: n.p.; Buchanan, 1984: 68; Butowsky, Harry A. "White Sands Blockhouse and Gantry Crane." National Register of Historic Places Nomination, National Park Service, 1984; Andreoli, 1998: Section 3.6.

various locations from the late 1940s through the 1950s. From 1946-1961, the main post was expanded with semi-permanent buildings, including multi-story barracks and Quonset huts, as well as permanent facilities such as the headquarters, administration building, laboratory, missile assembly buildings, commissary, fire station, elementary school, cafeteria, chapel, recreational facilities, clinic, museum, mess hall, and family housing. In addition, several, small support outposts were built across the base.[19]

After World War II ended, the nearly 60,000-acre Alamogordo Army Airfield was deactivated. In 1947, it became home to the 49th Wing of the U.S. Air Force Air Command and in 1948 was renamed Holloman Air Force Base (HAFB) in honor of Col. George V. Holloman, a pioneer in guided missile research. In the 1950s and 1960s, the base became a renowned site for testing and development of pilotless aircraft and guided missiles. The base is home to the world's longest and fastest high-speed test track, nearly 10 miles long, which hosted a world land speed record for a railed vehicle with a recent run of 6,543 miles per hour, or Mach 8.5. Currently, the mission of the HAFB is research and development of advanced self-protection systems for combat aircraft, aerial reconnaissance improvements, and new weapons delivery systems. Nearly 2,100 people live on the HAFB, which supports about 21,000 active-duty, Guard Reserve, retirees, Department of Defense civilians, and their family members.[20]

On April 29, 1958, the WSPG was officially renamed White Sands Missile Range (WSMR), which is pronounced "Whiz-Mer" by local residents. President John F. Kennedy visited WSMR to witness rocket launches in June 1963. The WSMR Historic District, containing approximately 50 buildings, was determined eligible for listing in the NRHP in the 1990s for its Cold War significance (1946-1991). The American Institute of Aeronautics and Astronautics (AIAA), the professional society for the field

[19] Buchanan, 1984: 68-89.
[20] USAF, 2008: n.p.

of aerospace engineering, designated WSMR a Historic Aerospace Site in 2004.[21]

8. NORTHRUP STRIP

Northrop Aircraft, Inc. (Northrop) selected White Sands in 1948 for construction of a natural surface gypsum airfield. Founded in 1939 by John Knudson "Jack" Northrop (1895-1981) in the Los Angeles suburb of Hawthorne, Northrop designed and manufactured specialized military aircraft, including tailless, fixed-wing jet fighters - predecessor of the B-2 Stealth Bomber - intercontinental ballistic missiles, and target drones. Northrop used the White Sands airfield, located on the Alkali Flat approximately 6.5 miles east of the base of the San Andres Mountains, as a target drone firing range during anti-aircraft gunnery training exercises by military personnel from the U.S. Army and U.S. Air Force. The airfield flanked the north side of the White Sands National Monument and west side of the HAFB.[22]

A former chief engineer at Lockheed, Jack Northrop was well known and respected in the field of aviation, receiving numerous honors and awards, including a Presidential Certificate of Merit in 1974. When he retired in 1952, the WSMR acquired control of the Northrop airfield, which became known as the "Northrup Strip" due to a longstanding typographical error. Jack Northrop's association with Northrup Strip appears to have been short-lived, from 1948-1952, and the exact nature of his involvement is undocumented. In 1952, Northrop purchased the Radioplane Company, which Reginald Denny established in 1939 for manufacturing target drones for the U.S. Army and U.S. Navy. By the late 1940s, the Radioplane drones were small, all-metal, piston-powered drones that became known as Basic Training Targets or BTTs. By the late 1950s, the BTTs evolved into experimental,

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[21] Buchanan, 1984: 18.

[22] Freeman, Paul. "Abandoned & Little-Known Airfields: Northrup Strip/White Sands Space Harbor, White Sands, New Mexico." Website http://www.airfields-freeman.com/NM/Airfields_NM_Alamagordo.html, accessed September 23, 2011; Offutt, Frank. "WSSH Background." Unpublished response to questionnaire submitted by Victoria Bradley, 1994: n.p., on file at WSTF; Andreoli, 1998: Section 3.7.1.5; Deming and Slovinac, 2007: Section 4.4.

jet-powered anti-radar missiles and turbojet-powered drones that could reach supersonic speeds of Mach 2. A Northrop marketing image from 1955 was most likely set at White Sands.[23]

Unmanned drones in the form of scale miniature fighter planes and helicopters took off at nearby HAFB and were fired upon over the Alkali Flat. Surviving and damaged drones landed or parachuted at Northrup Strip before being returned to HAFB for repairs and additional testing. The unmanned drones were controlled remotely by Northrop and military personnel from the WSMR Post Headquarters, HAFB, or via a mobile truck. At that time, there was no Control Tower at the airfield. During its use as a drone firing range in the 1950s and 1960s, the Northrup Strip airfield featured a drone maintenance building near Range Road 10 (Area 4) and a drone staging/tie-down area along the center of the 3,200′ long, north-south runway, which was simply a graded gypsum surface with few if any navigational aids or markings. None of the Northrup Strip facilities from this period survive.[24]

9. NASA AT WHITE SANDS

President Dwight D. Eisenhower (1890-1969) created the National Aeronautics and Space Administration (NASA) on October 1, 1958, in response to the Soviet launching of *Sputnik* on October 4, 1957. The first artificial earth satellite, *Sputnik* remained in orbit for three months before burning up on reentry on January 4, 1958. The surprise success of *Sputnik* spurred the Space Race between the United States and the Soviet Union during the Cold War (1947-1991). NASA’s first series of missions were to send man into space, followed by manned orbits around the Earth, mastery of rendezvous and docking procedures, and finally,

[23] Freeman, 2008: n.p.; Guttman, John. “John Northrop’s XP-79B Jet Fighter.” Aviation History. Website http://www.historynet.com/jack-northrops-xp-79b-jet-fighter-jan-96-aviation-history-feature.htm, accessed November 19, 2011; Bergensen, Paul. “Jack (John Knudson) Northrop.” Website copyright 2003 http://www.bergen.org/AAST/Projects/Engineering_Graphics/_EG2000/flyingwing/history/jack.htm, accessed November 19, 2011; Deming and Slovanic, 2007: Section 4-4; Goebel, Greg. “Unmanned Aerial Vehicles,” 2010: Section 1.0-1.3. Website http://vectorsite.net/twuav.html, accessed November 29, 2011; Offutt, 1994: n.p.

[24] Offutt, Frank interview with Robbie D. Jones, WSSH, September 2011; Mitchell, Robert E. interview with Robbie D. Jones, WSSH, September 2011.

landing man on the Moon. These goals defined the three main programs of the late 1950s and 1960s: Mercury, Gemini, and Apollo. This effort culminated in the first moon landing on July 20, 1969. Moon landings continued until 1972 when the Apollo program ceased. By that time, it was clear that the next major program would be based on a reusable space shuttle, designed to serve orbiting space stations and related missions.

Initially, NASA had agencies located at Hampton, Virginia; Cleveland, Ohio; Washington, DC; Los Angeles and San Jose, California; and Huntsville, Alabama. In 1960, NASA astronauts began training on the WSMR, with the first manned flight into space taking place in May 1961.

NASA established the Lyndon B. Johnson Space Center White Sands Test Facility (WSTF) in July 1962 as the Apollo Spacecraft Propulsion Development Facility to perform testing of vital flight systems for the Apollo mission to land men on the Moon. Located at the U.S. Army WSMR on the west side of the San Andres Mountain Range, the first engine tests at the 87-square mile WSTF took place in September 1964. Two years later, NASA completed the Little Joe II test program for Apollo.[25]

NASA entered into an agreement with the U.S. Army in 1976 for establishing an orbiter landing strip on a separate 100-square mile outparcel at the Northrup Strip, located approximately 55 miles northeast on the east side of the San Andres Mountains. In February 1969, President Richard Nixon (1913-1994) established the Space Task Group, which conducted a study to recommend a future course for the U.S. Space Program. In May 1970, NASA initiated a series of drop tests at the Northrup Strip using a one-tenth scale model of the experimental Space Shuttle, a reusable space flight vehicle providing routine access to space which the U.S. Department of Defense (DoD) had been exploring since the mid-1950s. A helicopter hovering at an altitude of

[25] NASA WSTF. "White Sands Space Harbor: 25th Anniversary Celebration, August 11, 2001": n.p. Unpublished brochure, on file at NASA WSTF; Deming and Slovinac, 2007: Section 4.3.

8,000′ dropped the model, which then glided to the ground, controlled remotely from a mobile NASA van.[26]

The NASA Space Shuttle Program (SSP) was formally launched by President Richard Nixon on January 5, 1972. With the mission of developing a reusable space shuttle system, the program was officially known as the Space Transportation System (STS). In the spring of 1976, NASA selected Northrup Strip as a Space Shuttle operations and astronaut training facility. That May, the airfield was upgraded, lengthened to 15,000′, widened to 100′ with additional 50′ shoulders, and renamed "Runway 17/35." Initial test flights began in May 1976 with shuttle pilots from Houston flying into El Paso then to White Sands for two missions per day and nineteen approaches on each mission. NASA leased a privately owned commercial hangar at El Paso for storing Shuttle Test Aircraft (STA), which were Gulfstream II aircraft that had been highly modified to simulate the flight characteristics and instrumentation of the Space Shuttle from about 35,000′ to touchdown. Over the course of the NASA SSP, pilots and commanders completed roughly 70 to 80 percent of their training at WSSH, flying 500 to 1,000 approaches, respectively. Training sessions occurred some 200-250 days out of the year in the 1980s and 1990s, tapering to 160-180 days in recent years as the program came to a close in 2011.[27]

Due to a limited budget, NASA staff acquired surplus military equipment and a handful of temporary, prefabricated and portable buildings, including a Fire Station at the center of the runways. A mobile Air Traffic Control Tower used at the Apollo Lunar Landing Test operation at NASA's Ellington Field in Houston was relocated to Northrup Strip via a flatbed trailer. Ultrahigh

[26] Buchanan, 1984: 24; U.S. Army. "WSMR: Fact Sheet," 4. Undated, unpublished brochure, on file at WSMR; Andreoli, 1998: Section 3.7.1.5. Unpublished report on file, WSMR; Deming and Slovinac, 2007: Section 3.1.
[27] Offutt, 1994: n.p.; Paczynski, Alex S. "NASA Johnson Space Center Facilities Oral History Project: Alex S. Paczynski, interviewed by Jennifer Ross-Nazzal." Las Cruces, New Mexico, August 10, 2009; Mitchell, 2011; Offutt, 2011; Deming and Slovinac, 2007: Section 4.4.

Frequency (UHF) radios and other communication equipment were borrowed from the U.S. Army.[28]

In October 1978, NASA designated Northrup Strip as a back-up shuttle-landing site and the primary abort-once-around landing site, requiring substantial improvements. Northrup Strip was chosen because it remains dry throughout most of the year and was under the flight path of the first Earth orbit following launch. In 1979, NASA added a second 15,000′ long runway, named "Runway 23/05," which ran east-west and intersected Runway 17/35 near its center – forming an "X" shaped footprint. NASA engineers modified the mobile Control Tower into a stationary structure by attaching the cab to a former Apollo Propulsion Test Stand from the WSTF. The stationary Control Tower was located southeast of the runways' intersection. NASA also constructed an Operations Control Center (OCC) and "Deservice" area along Range Road 10 at the site of the preexisting target drone maintenance building (no longer extant). Connected to the runways via a natural surface graded towway, the Deservice area featured a concrete pad supporting a stationary 75-ton derrick crane for mating and demating the shuttle to a modified Boeing 747 jet for transportation to Kennedy Space Center (KSC) in Florida. The crane (no longer extant) was transported from the NASA Marshall Space Flight Center at Huntsville, Alabama, where it had served as the mate-demate device from 1976-1979 for the Orbiter *Enterprise* when it arrived and departed for testing.[29]

Runway 17/35 replicated the runway at KSC and Runway 23/05 replicated the runway at Edwards Air Force Base (EAFB) in California so that shuttle pilots could practice landings at one location simultaneously. The runways were made of graded gypsum that had been compacted with water from a manmade waterhole at the southern end of Runway 17/35. NASA continued its practice of acquiring surplus military prefabricated portable buildings and equipment. A Microwave Scanning Beam Landing System was brought in from EAFB. The lone purpose-built facility was the Control Tower, which NASA engineers created by attaching the cab unit of

[28] Paczynski, 2009: 13; Mitchell, 2011; Offutt, 2011; Deming and Slovinac, 2007: Section 4.4; Dennis G. Perrin. Telephone interview with Robbie D. Jones, June 13, 2013.
[29] Paczynski, 2009: 4, 11; NASA, 2001: n.p.

a Mobile Air Traffic Control Tower to a repurposed Apollo Propulsion Test Stand relocated from the WSTF on the opposite side of the San Andres Mountain Range.[30]

The first flight (STS-1) of Space Shuttle *Columbia* into the Earth's orbit occurred in April 1981; the second flight (STS-2) occurred in November 1981. After three decades of operations and 135 flights into orbit, NASA formally ended the SSP on August 31, 2011. Over this span, NASA used a total of five space shuttles: *Columbia*, *Challenger*, *Discovery*, *Atlantis*, and *Endeavour* (the prototype, *Enterprise*, never went into space).

The SSP achieved a number of significant goals. In addition to supporting diverse space facilities such as Spacelab, the Hubble Space Telescope, the *Mir* Space Station, and the International Space Station, the shuttles contributed to many other space programs. Among these were various satellite systems (from COMSAT to the Advanced Communications Technology Satellite, or ACTS), and the unmanned probes that were sent to Jupiter (*Galileo*), Venus (*Magellan*), and the Sun (*Ulysses*). Additionally, the shuttle has deployed a number of Department of Defense (DoD) payloads that remain classified.[31]

On March 30, 1982, at the conclusion of an 8-day flight, the *Columbia* landed at Northrup Strip due to flooding at EAFB in California and harsh weather at KSC in Florida. The landing was delayed by a day, due to a dust storm on the Alkali Flat. This was the shuttle's third orbital flight test mission, known as "STS-3." The two-man crew for STS-3 consisted of Jack R. Lousma (b.1936), commander, and Col. Charles Gordon Fullerton (1936-2013), pilot. Two trains packed with NASA convoy equipment were shipped from EAFB to White Sands and portable buildings such as hangars, barracks, and latrines, were borrowed from the nearby HAFB. Approximately 2,000 civil servants from KSC and EAFB, who

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[30] Pacznski, 2009: 3, 8, 11; NASA, 2001: n.p.; Mitchell, 2011; Deming and Slovinac, 2007: Section 4.4; Dennis G. Perrin. Telephone interview with Robbie D. Jones, June 13, 2013.
[31] Deming, Joan, and Patricia Slovinac. "NASA-Wide Survey and Evaluation of Historic Facilities in the Context of the U.S. Space Shuttle Program: Roll-Up Report." Archaeological Consultants, Inc., Sarasota, Florida, 2008: 2.22-24. Unpublished report on file at the NASA Kennedy Space Center, Florida.

were trained to service the orbiter, were deployed to the Northrup Strip. *Columbia* was stationed at Northrup Strip for several days for flight preparations before being mated to a specially modified Boeing 747 and flown back to KSC on April 6, 1982. The process was delayed due to sandstorms that penetrated the orbiter.[32]

Major General Alan A. Nord (1928-1993), WSMR Ranger Commander from 1980-1982, placed a small, engraved concrete monument in the sand at the location where the STS-3 astronauts met their families and named it the "*Columbia* site." On May 11, 1982, President Ronald Reagan (1911-2004) formally designated the Northrup Strip as the "White Sands Space Harbor," as a result of a petition to Congress by New Mexico Senator and former Apollo astronaut Harrison "Jack" Schmitt (b.1935). The Act stated, "[t]hat the landing strip known as Northrup Strip, located at White Sands Missile Range in the State of New Mexico, shall hereafter be known as 'White Sands Space Harbor'."[33]

Once NASA began using the Shuttle Landing Facility at KSC in Florida in 1984, the WSSH became a back-up to the primary alternate landing site at EAFB in California. This resulted in a diminished role at WSSH within the NASA SSP in regards to orbiter landings. WSSH continued as the primary astronaut training facility for the SSP.

The NASA SSP underwent a thirty-two month hiatus following the loss of the Space Shuttle *Challenger* and the crew of seven astronauts on January 28, 1986. As a consequence, between 1986 and 1989, NASA implemented major changes at all NASA facilities and designated WSSH an official contingency landing site. Management of the NASA SSP was relocated from Johnson Space Center in Texas to NASA Headquarters at KSC in Florida. The NASA SSP at Vandenberg Launch and Landing Site in California was shut down. Changes at WSSH included upgrading and lengthening Runways 23/05 and 17/35 to 35,000′ in length, by adding 10,000′ long approaches on each end and 300′ sidelines. All gypsum runway

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[32] NASA, 2001: n.p.; Paczynski, 2009: 6-8; Deming and Slovinac, 2007: Section 4.4.
[33] Deming and Slovinac, 2007: Section 4.4; U.S. Congress, S.2373 (97th), 1982.

surfaces were also laser leveled and constantly maintained by WSSH personnel. Both of the 35,000′ long by 900′ wide runways had the capability of handling the weight of the Space Shuttle.[34]

In addition, both the OCC and Deservice Area (Area 4) were relocated approximately three miles west along Range Road 10 where new facilities were constructed on a rise overlooking the runways (Areas 2-3) and off the gypsum lakebed where blowing sand would be less of a hazard to the orbiters. Only the original OCC Building, now the Communications Building, was relocated from the original OCC and Deservice area. During this period, new prefabricated and portable facilities were erected at the Control Tower (Area 1), which became the HUB Maintenance Facility and included a maintenance building, office, navigational aids storage, fire station, and tool storage. Several of these buildings were relocated from WSMR; a prefabricated trailer that had been used for NASA's Apollo program was relocated from JSC at Houston.[35]

In 1989, a third runway was constructed at WSSH to allow pilots to practice Transoceanic Abort Landings (TAL). Called Runway 20/02, this runway is 19,800′ long and 200′ wide and replicates runways at the Istres Air Base in France, Zaragoza Air Base in Spain, and Morón Air Base in Spain. From 1988-2002, other TAL sites included the Banjul International Airport in the Republic of Gambia, West Africa, and the Ben Guerir Air Base in Morocco. Each TAL was covered by separate international agreements. Additional support structures such as convoy staging and helicopter landing areas were created alongside the runways.[36]

After NASA resumed the Space Shuttle flights in 1988, the WSSH was used primarily for shuttle flight training by astronauts and the third alternate landing site for Shuttle missions. NASA implemented a temporary two-year hiatus after the loss of Space Shuttle *Columbia* and the crew of seven astronauts during reentry

[34] Mitchell, 2009: 3-4; Deming and Slovinac, 2007: Section 3.5.
[35] Mitchell, 2009: 3-4; Offutt, 2011; Mitchell, 2011.
[36] NASA HPWG. "Space Shuttle Transoceanic Abort Landing (TAL) Sites." Information booklet, 2006: 2-4, published online at http://www.nasa.gov/centers/kennedy/pdf/167472main_TALsites_06.pdf, accessed November 19, 2011.

over Texas on January 16, 2003. In 2004, President George H.W. Bush announced that the NASA SSP would be retired by 2010, although NASA extended the SSP until 2011 due to delays with cargo delivery to the International Space Station. The Space Shuttle *Atlantis* (STS-135) landed safely at KSC in Florida on July 21, 2011, the final landing of almost 30 years of NASA space shuttle flights. President Barack H. Obama formally ended the NASA SSP on August 31, 2011, and gave NASA a new directive of deep space exploration, ultimately sending Americans to Mars.

Other government agencies or private corporations that have used the WSSH runways for training or experiments include the Department of Defense, U.S. Army, U.S. Air Force, Special Operations, General Motors (ABS brake testing), and Lockheed Missile and Space Company. The runways also have been used for emergency landings for both commercial and military aircraft, as well as high-speed automobile testing. Typically, WSSH hosted twenty-five regular personnel, including one NASA employee and twenty-four private contractors. Due to winds, the runways were continuously graded and compacted, a process that took six months for all three runways. Otherwise, the runways would not be usable. With every shuttle launch, a KSC crew of 114 personnel, known as the Rapid Activation Force, was placed on stand-by status in case they were needed as WSSH.[37]

10. DELTA CLIPPER

Between 1993-1997, NASA and McDonnell Douglas (MD) – a private defense contractor based in St. Louis, Missouri – used the abandoned WSSH Deservice Area for experimental test launches and landings of the "Delta Clipper, Experimental (DC-X)," a 1/3 scale prototype for an unmanned, reusable, orbiter spacecraft that was inexpensive, low maintenance, and mobile/transportable for quick turn-around. In order to complete the tests, NASA and MD modified the "Single Stage Rocket Technology" (SSRT) site by constructing a new concrete vertical landing pad adjacent to the original 1979 orbiter deservice pad, which was repurposed for use as a vertical launch pad. The DC-X could be prepared and

[37] NASA, 2001: n.p.; Mitchell, 2011; Offutt, 2011; Deming and Slovinac, 2007: Sections 3.5.3 and 4.4.

launched by a crew of fifteen people and would be flown almost like a typical commercial airliner from spaceports around the U.S.[38]

Twelve DC-X test launches were held at the SSRT site between August 1993 and July 1996 with Apollo astronaut Charles "Pete" Conrad, Jr. (1930-1999) as the ground-based pilot. On July 31, 1996, the DC-X was destroyed by fire on its twelfth flight upon landing when one of the landing legs failed to deploy. At that point, NASA discontinued the DC-X program and all mobile support equipment and portable structures, including a launch test stand and hangar, were removed. Only concrete foundations were left in place.[39]

11. OTHER CHANGES

In the early 1990s, the central operations of WSSH, which included many of the portable support buildings at the HUB, were relocated to the new Orbiter Deservice Area. Since then, NASA acquired additional, prefabricated support buildings by NASA procurements from the Federal Emergency Management Agency (FEMA), HAFB, and other federal property reutilization processes. The agency has also borrowed mobile storage buildings for use at WSSH from the WSMR through an informal loan agreement.[40]

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[38] Hanson, Chris "Xenon." "Delta Clipper DC-X Test Launch, Whites Sands Missile Range." Website http://xenon.arcticus.com/delta-clipper-dc-x-test-launch-white-sands-missile-range-september-1993, accessed November 19, 2011; McDonnell Douglas. "Delta Clipper Test Program Off to Flying Start." Press Release issued June 20, 1994; Lerner, Preston. "Black Day at White Sands." *Air & Space Smithsonian Magazine*, August 2010.
[39] Mitchell, 2011; Offutt, 2011; Lerner, 2010: n.p.
[40] Offutt, 2011; Mitchell, 2011.

PART III. SOURCES OF INFORMATION

A. ENGINEERING PLANS AND DRAWINGS

NASA engineers prepared four sheets of Control Tower drawings, including a site plan, base foundation plan, plan view, elevations, and construction details in the spring of 1979. There are no original engineering plans or drawings for the HUB Maintenance Facility, Runways, or the majority of the Navigational Aids and Support Facilities. Plans were created around 1988 for construction of new asphalt navigational markings for the Runways. NASA staff created an as-built, not-to-scale site plan of the HUB Maintenance Facility, which was used as a base map for this report.

B. EARLY VIEWS AND HISTORICAL DATA

Historic photographs and maps of the WSSH are very limited. A 2010 aerial view of the WSSH can be found on page 38. All views are captioned and dated as available. The other historical data comes from a variety of sources cited in the Bibliography below.

The historic photographs and most of the historical data used in this documentation came from sources within WSTF and WSSH. Other more current imagery was obtained from the online WSTF Media Archive. Many of the original photographs have been donated to the WSMR Museum for digitization and curation. A body of recent aerial photographs were located and photocopied for inclusion in the HAER document to supplement the current ground photography.

C. INTERVIEWS

The following NASA and WSMR employees were interviewed for this documentation.

Robert E. Mitchell, WSTF Manager, September 2011.

Frank Offutt, WSSH Manager, September 2011.

Timothy Davis, WSTF Historic Preservation Officer, September 2011 and March 2012.

Bill Godby, WSMR Historic Preservation Officer, September 2011.

Doyle Piland, WSMR Museum Archivist, September 2011.

Dennis G. Perrin, NASA Johnson Space Center, Houston, Texas, and WSTF Facility Manager (1975-1989), June 2013.

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E. LIKELY SOURCES NOT YET INVESTIGATED

Research was conducted at WSSH and WSTF using primary and secondary sources. Sources that were not investigated that may contain secondary information are archived at the Lyndon B. Johnson Space Center in Houston, Texas.

Additional oral history interviews with other engineers and technicians could also prove useful.

PART IV. PROJECT INFORMATION

In 2011-2012, New South Associates (NSA), under contract with InoMedic Health Applications, LLC (IHA) of Kennedy Space Center, Florida, and in coordination with NASA and the U.S. Army, conducted background research and a historic architecture survey of resources at the NASA WSSH. The survey included the documentation and evaluation for NRHP eligibility for seventy-two resources located in four distinct areas. Based on this research, NSA determined that no properties remained at WSSH from the period prior to NASA acquisition in 1963 except for the footprint of the packed gypsum Runway 17/35.[41]

NSA recommended that the three NASA WSSH Runways and the Control Tower in Area 1 were individually eligible for listing in the NRHP and eligible as contributing resources to the "WSSH Shuttle Landing Facility District" under Criterion A and Criterion Consideration G for their association with the NASA SSP. None of the other sixty-eight inventoried properties were recommended individually eligible for listing in the NRHP due to lack of historical association with the NASA SSP or other historic contexts, lack of unique design or construction features, or insufficient integrity; however, nineteen of these properties, all of which lie within Area 1, were recommended as contributing resources to "WSSH Shuttle Landing Facility District," even though they were not recommended individually eligible for the NRHP. The historic district contained a total of twenty-eight resources: twenty-three are contributing and five are non-contributing.

After formally ending the SSP on August 31, 2011, NASA disposed of the WSSH and released use of the property to the U.S. Army WSMR. The property transfer was a federal undertaking on federally-owned property and subject to compliance with Section 106 of the NRHP Act of 1966, as amended. The undertaking resulted in an Adverse Effect to the NRHP-eligible WSSH Shuttle

[41] Reed, Mary Beth, and Robbie D. Jones. "Historic Architecture Survey and National Register of Historic Places Evaluation of the NASA White Sands Space Harbor on the U.S. Army White Sands Missile Range, Doña Ana County, New Mexico." New South Associates, Stone Mountain, Georgia, 2012. Unpublished report on file at NASA WSTF, Las Cruces, New Mexico.

Landing Facility District. To mitigate the adverse effects, NASA completed HAER Level II documentation of the historic district and relocated the Control Tower to the WSMR Museum for conservation, exhibition, and public interpretation.

The mitigation plan was defined in a Memorandum of Agreement (MOA), executed between NASA, the U.S. Army, and the NM-SHPO in August 2012. The properties within the historic district were documented with large format photography in March 2012.

APPENDIX – LOCATION MAPS

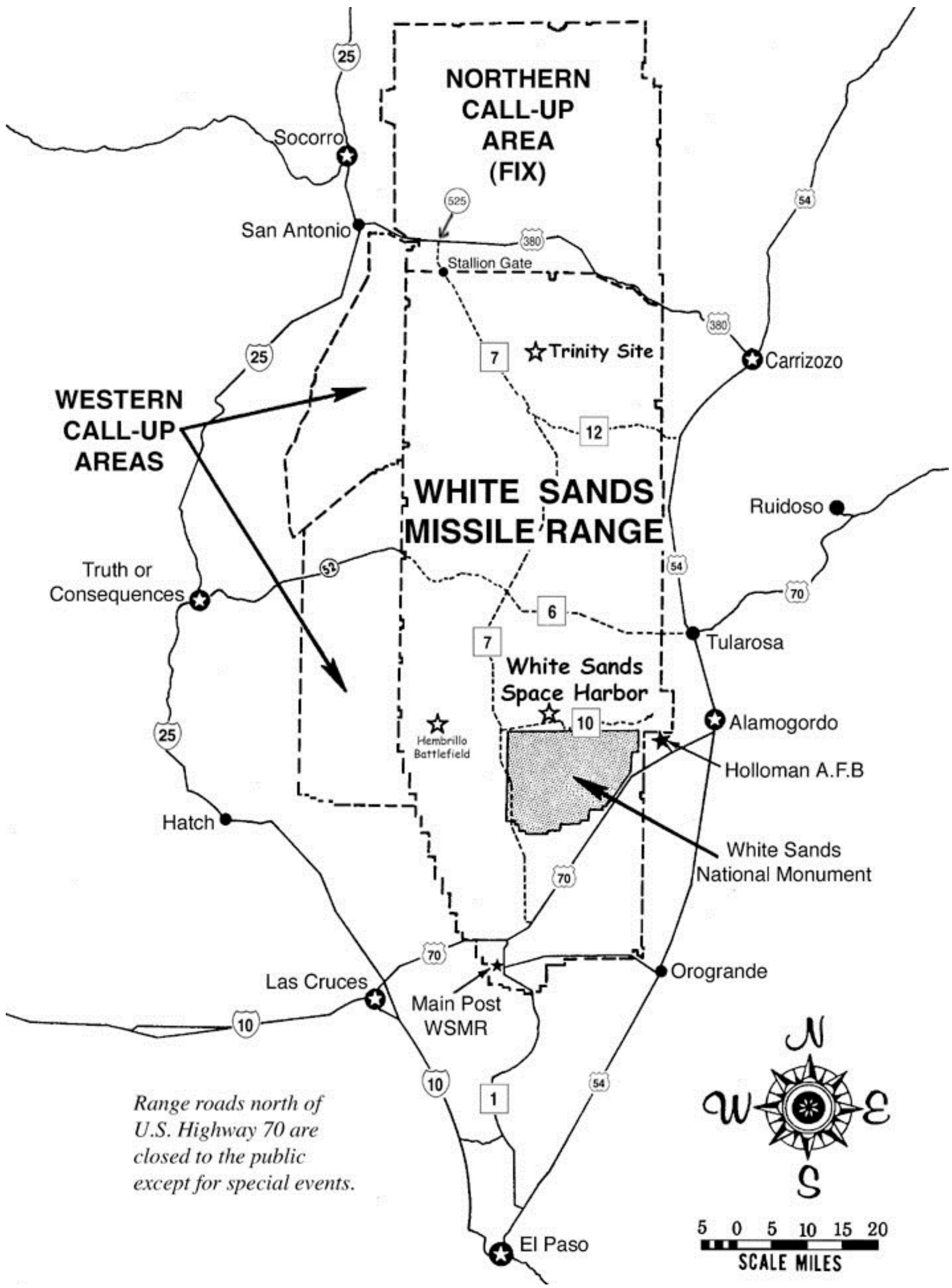

Figure 1. Map of White Sands Military Reservation showing White Sands Space Harbor (Source: U.S. Army).

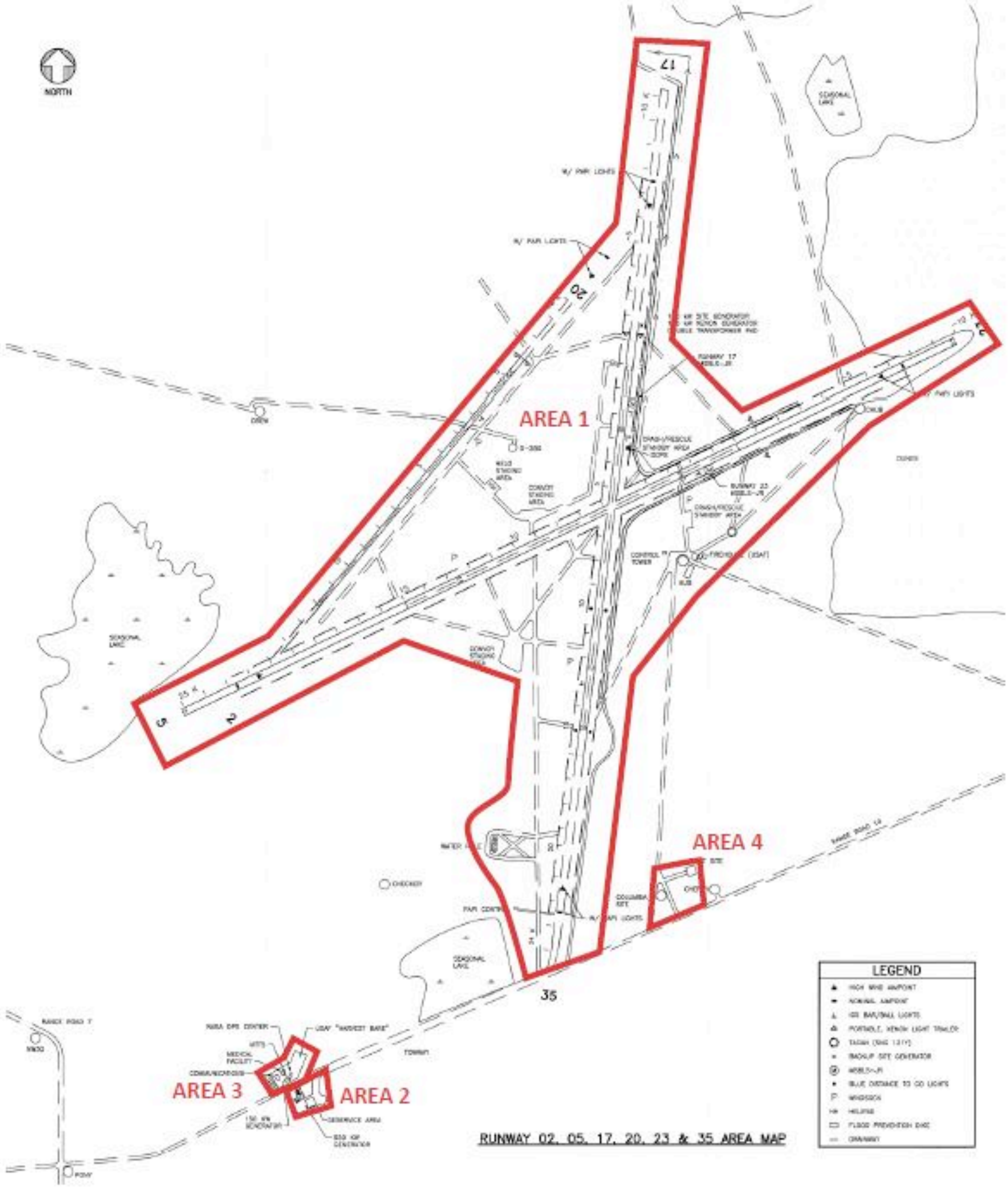

Figure 2. Map shows the location of Areas 1, 2, 3, and 4, which comprise the White Sands Space Harbor. Area 1 delineates the approximately 4,900-acre NRHP boundary of the WSSH Shuttle Landing Facility District (Courtesy of NASA WSTF).

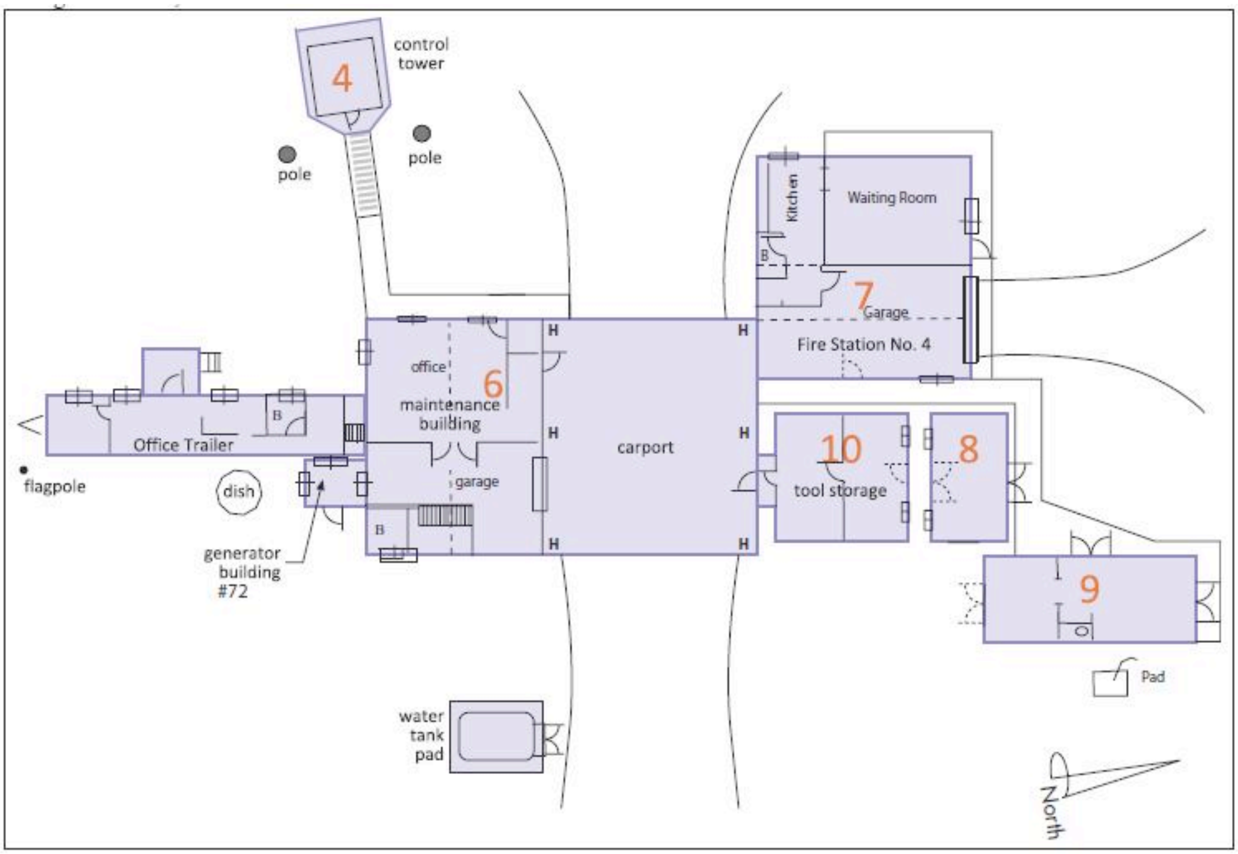

Figure 3. Plan map of the HUB complex in Area 1, including the Control Tower (4), HUB Maintenance Building (6), Fire Station No. 4 (7), NAVAIDS Storage Building (8), NAVAIDS Control Building (9), and HUB Tool Storage (10) (Drawn from not-to-scale site plan courtesy NASA WSTF).

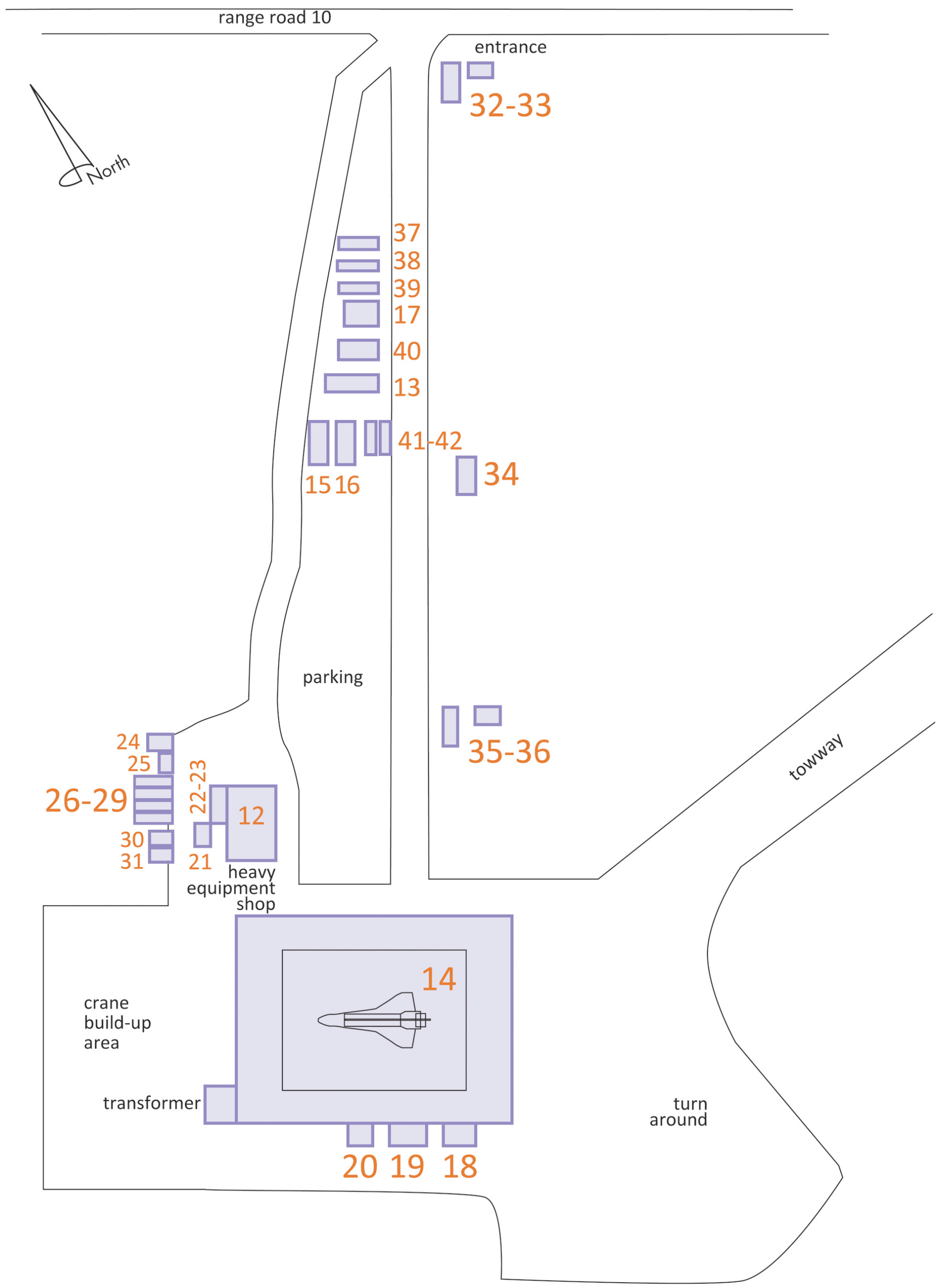

Figure 4. Plan of Area 2, Orbital Deservice Area. Environmental Office (13), Deservice Pad (14), Storage (15-17, 20, 22-30, 33, 36-39, 41, 42), Payload Shop (18), Workshop (19), Steam Pad (21), Polaris Shed (31), Security Guard Shack (32, 35), Field Engineer Office (34), Latrine (40).

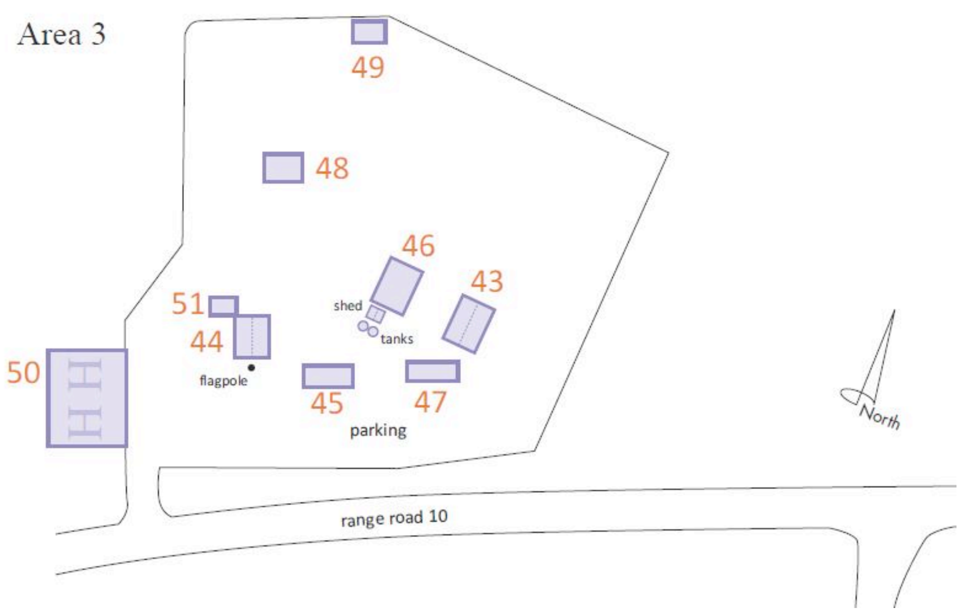

Figure 5A. Plan of Area 3, Operations Control Center (43), Communications Building (44), SCAPE Building (45), Dispensary (46), VITT Trailer (47), Loading Dock (48), Weather Trailer (49), Helicopter Landing Pad (50), SCAPE (51).

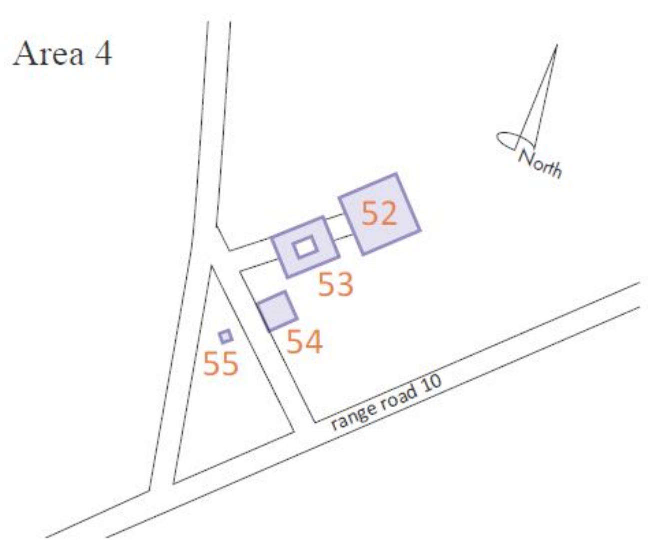

Figure 5B. Plan of Area 4, Original Operations Control Center/Deservice Area/Delta Clipper Site. STS-3 Deservice Pad/Delta Clipper Launchpad (52), Delta Clipper Landing Pad (53), Loading Dock (54), *Columbia* Site Survey Marker (55).

Figure 6. Aerial image of Whites Sands Space Harbor, 2010.