

CAPE CANAVERAL AIR FORCE STATION,  
MISSILE ASSEMBLY BUILDING AE  
(Hangar AE)  
Cape Canaveral  
Brevard County  
Florida

HAER NO. FL-8-B

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
Department of Interior  
100 Alabama St., SW  
Atlanta, Georgia 30303

HISTORIC AMERICAN ENGINEERING RECORD  
CAPE CANAVERAL AIR FORCE STATION,  
MISSILE ASSEMBLY BUILDING AE  
(Hangar AE)

HAER NO. FL-8-B

Location: Hangar Road, Cape Canaveral Air Force Station (CCAFS),  
Industrial Area, Brevard County, Florida.

USGS Cape Canaveral, Florida, Quadrangle. Universal Transverse  
Mercator Coordinates: E 540610 N 3151547, Zone 17, NAD 1983.

Date of Construction: 1959

Present Owner: National Aeronautics and Space Administration (NASA)

Present Use: Home to NASA's Launch Services Program (LSP) and  
the Launch Vehicle Data Center (LVDC). The LVDC allows  
engineers to monitor telemetry data during unmanned rocket  
launches.

Significance: Missile Assembly Building AE, commonly called  
Hangar AE, is nationally significant as the telemetry  
station for NASA KSC's unmanned Expendable Launch Vehicle  
(ELV) program. Since 1961, the building has been the  
principal facility for monitoring telemetry communications  
data during ELV launches and until 1995 it processed  
scientifically significant ELV satellite payloads. Still in  
operation, Hangar AE is essential to the continuing mission  
and success of NASA's unmanned rocket launch program at  
KSC. It is eligible for listing on the National Register of  
Historic Places (NRHP) under Criterion A in the area of  
Space Exploration as Kennedy Space Center's (KSC) original  
Mission Control Center for its program of unmanned launch  
missions and under Criterion C as a contributing resource  
in the CCAFS Industrial Area Historic District.

Report Prepared by: New South Associates, Stone Mountain, Georgia

Date: November 13, 2013

PART I. HISTORICAL INFORMATION

List of Acronyms

CCAFS	Cape Canaveral Air Force Station
CIF	Central Instrumentation Facility
ELV	Expendable Launch Vehicle Program
GN <sub>2</sub>	Gaseous Nitrogen
GOES-6	Geostationary Operational Environmental Satellite 6
GSE	Ground Servicing Equipment
JPL	Jet Propulsion Laboratory
KSC	John F. Kennedy Space Center
LSP	Launch Services Program
LVDC	Launch Vehicle Data Center
MCC	Mission Control Center
MDC	Mission Director's Center
NASA	National Aeronautics and Space Administration
NRHP	National Register of Historic Places
OGO	Orbiting Geophysical Observatory
PPF	Payload Processing Facility
SSP	Space Shuttle Program

A. Physical History

1. Date(s) of Construction: 1959 with significant modifications and additions from 1961-1964.<sup>1</sup>

2. Architects/Engineers:

Original 1959 Building - Hardwick & Lee, Architects  
1965 High Bay Test Area Addition - J.E. Greiner Company  
2001 LVDC Renovation - AJT & Associates  
2003 MDC Renovation - Space Gateway Support  
2009 Lobby Renovation - Jones Edmunds

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<sup>1</sup> NASA, "Real Property Record - Missile Assembly Building AE," on file at the NASA KSC Real Property Office.

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3. Builder/Contractor/Supplier: Not known

4. Original Plans and Construction:

Hangar AE originally featured a standardized metal warehouse design with a gable roof, corrugated metal exterior, hangar bay doors, and a rectangular plan. The original hangar building now forms the central portion of the building between the entrance lobby and the rear high bay test area.

5. Alterations and Additions:

Hangar AE has undergone several alterations and additions over the years to keep pace with the evolution of launch vehicle telemetry technology. The hangar's original sliding doors on the east elevation were replaced with a one-story gable-roof addition in 1963. The original building was expanded in 1961 with construction of the high bay test area on its west end. By 1964, the original hangar was largely transformed into its current appearance. It also had two timber antenna towers that are no longer standing.

In 1966, NASA improved the high bay test area to meet Class 10,000 cleanliness standards. This included constructing new interior walls to modify laboratory and office space, adding recessed lighting fixtures, new photography lighting, and completely renovating the existing air conditioning and ventilation system. The Agency also constructed a new air lock enclosure on the

west end of the building's high bay to minimize contamination from the outside.<sup>2</sup>

Since the mid-1960s, several interior areas of Hangar AE were modified to keep pace with the evolving telemetry and computer technology of modern rocket programs. The early one-room, 950-square foot LVDC added in the mid-1970s was replaced in 2001 with a new three-room, 2,511-square foot LVDC. The new LVDC could support telemetry data processing for multiple test operations running at the same time or a single large launch operation.<sup>3</sup> In 2003, NASA built a new Mission Director's Center (MDC), which worked in tandem with the adjacent LVDC. Finally, in 2008 the front lobby of the building was renovated and the second floor contractor work area was remodeled.<sup>4</sup>

## B. Historical Context

Historic resources associated with NASA's manned spaceflight programs like Apollo and the Space Shuttle are well documented at KSC and CCAFS. Less well-represented and equally significant are facilities associated with the ELV launch programs, referred to in one NASA publication as the "backbone of the space program in Florida."<sup>5</sup> Today, these programs are managed under NASA's LSP that operates Hangar AE.

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<sup>2</sup> NASA, "Construction of Facilities - Fiscal Year 1965, Modification to Building 'AE'," memorandum ARCH00012173 63C.1 on file at KSC Archives.

<sup>3</sup> NASA, "NASA Facts: Launch Vehicle Data Center (LVDC)," Kennedy Space Center, FS-2001-05-014-KSC, 2006.

<sup>4</sup> Jones Edmunds, "Hangar AE Lobby Renovation," construction drawings, February 15, 2008.

<sup>5</sup> Linda Herridge, "ELV Launches Remain Kennedy's Backbone," NASA Kennedy Space Center, 2008, available from <http://www.nasa.gov/centers/kennedy/about/history/elvs.html>, accessed May 9, 2013.

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From 1958 to the present, NASA has launched hundreds of scientific, Earth-observing, and interplanetary mission satellites into orbit from launch pads at CCAFS.<sup>6</sup> The various spacecraft launched on these missions helped revolutionize scientists' understanding of space, Earth, and the universe. Since 1961, Hangar AE has been essential to the ELV program as KSC's principal telemetry data processing facility and until 1995 was a satellite payload checkout facility. The building continues to house NASA's modern LVDC for telemetry communications during unmanned launches.

#### The CCAFS Industrial Area and Hangar AE

Hangar AE is one of several NASA buildings located at CCAFS, just east of the Agency's KSC facilities on Merritt Island (Figures 1 and 2). CCAFS was established in 1949 as the Air Force Missile Test Range, later renamed the Eastern Test Range, the nation's first long-range military missile proving ground. The range's Cape Canaveral location had all the characteristics required for missile testing. It was isolated, sparsely populated, and offered an over-water flight range that was relatively free from shipping lanes and inhabited land masses. Also, the islands of the Caribbean and South Atlantic were ideal locations for missile tracking stations.

The first launch pads and support facilities were built at CCAFS in 1950 and the Banana River Naval Station (later called Patrick Air Force Base) located 16 miles to the south was designated as the range headquarters and support base. The official name of the missile range was changed several times over the next few decades and gained the nickname

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<sup>6</sup> National Park Service, History Division, "Cape Canaveral Air Force Station," National Historic Landmark Nomination Form, 1983, 8-0.

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"Missile Row" after its chain of beach side launch pads, each of which was associated with a specific missile.<sup>7</sup>

To support the launch facilities, the Air Force built an Industrial Area next to the Banana River, a safe distance to the west of the launch pads. The early CCAFS Industrial Area facilities were austere and largely followed standardized military designs. This was especially true for the large missile assembly hangars, which shared similar designs that were modified depending on the needs of the individual missile program housed there.

Eventually there were 21 missile assembly buildings completed in the CCAFS Industrial Area, each composed of a central high bay flanked by two-story, concrete block wings on either side. Large sliding doors on either end of the high bay provided access for missile components and completed missiles with full-length bridge cranes to move components back and forth in the buildings. Over the years, the standardized forms of the assembly buildings were adapted to meet the needs of increasingly sophisticated missile families. Missile stages were assembled in the hangars, transported to their associated launch complexes by truck or rail, and then carted up an approach ramp. The final assembly and checkout of the missile was accomplished via a mobile service structure or tower.

The single-story, warehouse design of Hangar AE differed somewhat from the other missile assembly buildings in the area. The original gable-roofed central section of Hangar AE was built in 1959 by the Air Force to house components of the Mace missile system, which by that time had reached the end of its research and development phase (Figure 3). Historic photographs in the KSC Archives show that the letters "AE"

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<sup>7</sup> National Park Service, 1983, 8-2.

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stood for "Auxiliary Equipment," indicating that the hangar was primarily a storage and support building. The hangar originally had a full-length open bay work area with a two-ton capacity bridge crane as shown in Figure 4. On either side of the high bay were concrete block partition walls that divided the high bay from offices and other support areas on the north and south sides of the building.

#### NASA and Hangar AE

The Air Force granted NASA the use of Hangar AE in 1961 to use as a new telemetry station for the Agency's emerging unmanned rocket program. The purpose of telemetry is to relay information to engineers about rocket systems that function properly during a launch and those that do not. Telemetry data are critical to the launch of rockets that cost millions of dollars to manufacture and that reach distances thousands of miles away from the launch site. Data on errant flight events enable engineers to repair problems for the next flight. As one former Hangar AE engineer stated, "Project managers who decided to save money by cutting back on telemetry coverage have often regretted it."<sup>8</sup> NASA's goal was to have complete radio reception during all critical events of a rocket flight, including the powered flight phases, stage separations, and reorientations. At the beginning of the ELV program, NASA and the Air Force maintained a string of telemetry stations along the islands to the southeast of Cape Canaveral, with additional telemetry-equipped ships and airplanes to fill in any gaps in the data.<sup>9</sup>

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<sup>8</sup> Hal Greenlee, "Ground Control," *AMIGA Computing Magazine*, August 1996, 49.

<sup>8</sup> Ibid.

<sup>9</sup> Ibid.

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The birth of what was later called the ELV program occurred in 1958 with the launch of the nation's first spacecraft, the *Explorer 1* satellite. Launched in response to the Soviet Union's launch of *Sputnik 1* on October 4, 1957, *Explorer 1* lifted off from CCAFS under direction of the U.S. Army Ballistic Missile Agency on January 31, 1958. Launched on a Jupiter-C rocket developed under the direction of Wernher von Braun, the satellite carried a cosmic ray detector designed to measure the radiation environment in Earth orbit. Four more *Explorer* missions launched in 1958, primarily on Delta rockets from Launch Complexes 17 and 26 at CCAFS.<sup>10</sup>

Central to the Agency's evolving rocket program were the Delta rockets that carried the first *Explorer* missions. A telemetry station for the early Delta program was first housed in the adjacent Hangar S, which was also served as the CCAFS center of activity for Project Mercury. The Delta branch operated a small telemetry station built on the ground floor of the Hangar S high bay.<sup>11</sup> Built by Douglas Aircraft and managed by NASA's Goddard Space Flight Center, Delta vehicles have carried over 200 of NASA's scientific and communications payloads into orbit and beyond to other planets. Their reliable track record and frequent launch missions gave Delta rockets a reputation as the "workhorses of NASA's expendable launch vehicle family."<sup>12</sup>

NASA's 1961 move into Hangar AE offered more room for a larger telemetry station and office space for project managers and engineers in the adjacent E&O Building. With its ample space, the Goddard team at Hangar AE installed early computer systems to process the huge volume of

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<sup>10</sup> Erik Conway, "Explorer 1 - History," NASA Jet Propulsion Laboratory, available from <http://www.jpl.nasa.gov/explorer/history/>, accessed May 9, 2013.

<sup>11</sup> Greenlee, 1996, 49.

<sup>12</sup> Herridge, 2008.

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telemetry data received via the hangar's two antenna towers on the north and south sides of the building.<sup>13</sup> The towers were removed after the 1965 construction of the Central Instrumentation Facility (CIF) in the KSC Industrial Area. The CIF became KSC's central telemetry data reception hub for all manned and unmanned launch programs. The data were relayed from the CIF to Hangar AE and then processed in the telemetry computer laboratory shown in Figure 5.

In 1961, NASA also moved the management of its new Atlas-Centaur rocket from Marshall Space Flight Center in Huntsville, Alabama, to Hangar AE.<sup>14</sup> The powerful Atlas-Centaur rocket was the launch vehicle for *Surveyor 1* in 1966, the first U.S. spacecraft to make a soft landing on the Moon.<sup>15</sup> The same year it moved the Atlas-Centaur team to Hangar AE, NASA built a 3,600-square foot high-bay spacecraft test area on the west end of the hangar, as shown in historic photographs, Figures 6-8. The 1961 high bay and adjacent support areas were designed to assemble and checkout satellite payloads before launch. In 1966, the high bay test area was upgraded to provide Class 10,000 cleanliness standards for spacecraft checkout.<sup>16</sup>

One of the earliest payloads processed in the new high bay was Goddard Space Flight Center's *Ranger* spacecraft.<sup>17</sup> A significant early ELV program, *Ranger* (1961-1965) was

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<sup>13</sup> Greenlee, 1996, 49.

<sup>14</sup> Ibid.

<sup>15</sup> NASA, "Surveyor 1,"

<http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1966-045A>, accessed October 24, 2013.

<sup>16</sup> Cleanrooms are classified according to the number and size of particles permitted per volume of air, so a Class 10,000 clean room allows 10,000 particles per cubic meter.

<sup>17</sup> NASA, "Master Development Plan for NASA Technical Facilities at AMR [Atlantic Missile Range], Revision II," Launch Facilities Design Group, January 1961, 4, on file at KSC Archives.

launched on a Delta vehicle as the first U.S. attempt to get close-up images of the Moon's surface in preparation for the Apollo program. "We want to know something about the character of the surface on which the landing is to be made," explained NASA Deputy Administrator Hugh L. Dryden, "and obtain just as much information as we can before man actually gets there."<sup>18</sup> The final preparations for *Ranger* launches, including disassembly, inspection, integrated equipment tests, and flight readiness checks, occurred in the Hangar AE high bay. A photo of the spacecraft in Hangar AE is shown in Figure 9.<sup>19</sup> Equipped with six cameras, the *Ranger* spacecraft was designed to descend straight down to the Moon's surface and relay images of its surface back to Earth until the moment of impact. The first six *Ranger* flights ended in failure, but the seventh was a success.<sup>20</sup>

NASA continued to modify and expand Hangar AE between 1961 and 1964, when ownership was officially transferred from the Air Force to NASA.<sup>21</sup> In 1964, the south wing of Hangar AE was modified with a new Mission Control Center (MCC, now called the Mission Director's Center or MDC) that NASA said was "developed for the placement of the Mission Director in a suitable location to conduct complete mission operations."<sup>22</sup> It was here that management personnel communicated with the launch pad and every worldwide site involved in the launch. As shown in the historic photograph in Figure 10, the front

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<sup>18</sup> NASA, "Lunar Impact: A History of Project Ranger," NASA History Division, last updated 2006, available from [http://history.nasa.gov/SP-4210/pages/Ch7.htm#Ch7\\_Top](http://history.nasa.gov/SP-4210/pages/Ch7.htm#Ch7_Top), accessed May 9, 2013.

<sup>19</sup> Ibid., [http://history.nasa.gov/SP-4210/pages/Ch9.htm#Ch9\\_Top](http://history.nasa.gov/SP-4210/pages/Ch9.htm#Ch9_Top), accessed May 9, 2013.

<sup>20</sup> NASA, "Ranger (1961-1965)," Goddard Space Flight Center, 2005, available at <http://nssdc.gsfc.nasa.gov/planetary/lunar/ranger.html>, accessed May 8, 2013.

<sup>21</sup> Cape Canaveral Air Force Station (CCAFS), "Transfer and Acceptance of Military Real Property - Assembly Test Building 'A-E', Facility No. 60680," 1964, on file at KSC Real Property Office.

<sup>22</sup> NASA, "Mission Control Center AE," Goddard Space Flight Center Launch Operations, April 17, 1964, 1-1, memorandum on file at KSC Archives.

of the MCC contained large illuminated displays for viewing plotting boards and closed-circuit televisions, which showed the real-time flight vehicle telemetry information that follows.

- vehicle flight progress
- Doppler plot (vehicle velocity)
- present position or impact prediction
- tracking station readiness
- range readiness
- guidance readiness
- range count
- time left to end of window
- Eastern Standard Time
- Greenwich Mean Time

According to an early facility manual, "the status of the entire operation may be interpreted from these displays."<sup>23</sup> The MCC was originally located in what is now Room 1025, a communications equipment room, and was nearly identical in function to the current Mission Director's Center (MDC) in Room 1012.

By the mid-1960s, Hangar AE was fully equipped to process satellite payloads and process telemetry data for scores of ELV launches through the rest of the decade and beyond. Photograph archives at KSC include several images of Hughes Aircraft Company engineers checking out the *Syncom 1* satellite in Hangar AE during January of 1963. Launched on a Delta vehicle from Launch Complex 17 in February of that year, *Syncom* was the first geosynchronous communications satellite, which meant that to an observer on Earth the

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<sup>23</sup> Ibid.

satellite appeared to stay in the same position in the sky (Figures 11 and 12).

Programs launched from CCAFS and associated with Hangar AE from this era included the astronomy, lunar, and planetary missions of the *Mariner* (1962), *Pioneer* (1965-1978), *Surveyor* (1966), and *Lunar Orbiter* (1966-1967) missions.<sup>24</sup> Later programs included the 1975-1976 *Viking* missions to Mars and the 1977 *Voyager* missions to the outer planets of the solar system, which launched on Titan III-Centaur launch vehicles. A series of Orbiting Geophysical Observatories (OGOs) were launched from CCAFS in the 1960s and 1970s on Atlas-Agena and Thor-Agena vehicles. The Titan-Centaur vehicle was NASA's most powerful unmanned rocket in the 1970s, chosen to launch missions to study Mars, Jupiter, Saturn, and the Sun.<sup>25</sup> Figure 13 shows the Geostationary Operational Environmental Satellite 6 (*GOES-6*) undergoing checkout in the Hangar AE high bay in 1983. The *GOES-6* satellite provided meteorological data from a fixed position above Earth.<sup>26</sup> Occasionally, Space Shuttle payloads were also processed in the Hangar AE high bay test area.<sup>27</sup>

Today, Hangar AE continues to house telemetry operations for what NASA now calls its LSP. Since the 1990s, NASA has made it policy to purchase ELV launch services from commercial providers like United Launch Alliance and Lockheed Martin. In this relationship, the commercial providers furnish and

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<sup>24</sup> NASA, "Major NASA Launches," John F. Kennedy Space Center, June 1999, 1, available from [http://www.nasa.gov/centers/kennedy/pdf/167422main\\_majorlaunch.pdf](http://www.nasa.gov/centers/kennedy/pdf/167422main_majorlaunch.pdf), accessed May 8, 2013.

<sup>25</sup> Ibid.

<sup>26</sup> NASA, "GOES-6", available from <http://goes.gsfc.nasa.gov/text/history/goes/goes6.html>, accessed November 4, 2013.

<sup>27</sup> NASA, "Facilities Handbook for Building AE," LSP-UG-411.01, January 2006, 5.

operate the payload and launch vehicle while NASA provides the launch pad and telemetry facilities. The LSP was established to better manage these relationships and provide the necessary expertise to ensure mission success.<sup>28</sup>

## Conclusion

The facilities provided by Hangar AE since 1961 enabled the development of NASA's robust and ever-evolving unmanned launch program. From the first success of *Explorer 1* in 1958 to the latest scientific missions to Mars, Hangar AE has played a central role in hundreds of ELV launches at CCAFS that revolutionized scientific understanding of Earth, space, and the solar system. By necessity, the building has been continually modified and updated to keep pace with the evolution of rocket technology and telemetry data processing. Nonetheless, it possesses a continuity of mission and function that underscores its historic significance as the home of NASA's Cape Canaveral ELV program.

## PART II. STRUCTURAL/DESIGN INFORMATION

### A. General Statement

#### 1. Character:

Hangar AE is located on Hangar Road approximately 1 mile south of CCAFS Industry Road (NASA Causeway East). It is centrally located about 3 miles from several launch pads, including Titan Pad 40, Atlas Complex 36, and Delta Complex 17. The building was first completed as a metal warehouse type building in 1959 and acquired by NASA from

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<sup>28</sup> NASA, "NASA Facts: NASA's Launch Services Program," [http://www.nasa.gov/sites/default/files/files/LSP\\_factsheet\\_Nov2011.pdf](http://www.nasa.gov/sites/default/files/files/LSP_factsheet_Nov2011.pdf), accessed October 24, 2013.

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the Air Force through a NASA/Department of Defense agreement in 1961. After NASA acquired it, Hangar AE underwent numerous modifications to expand its payload checkout and test capabilities, including a high bay clean room complex. The original corrugated metal gable-roof portion of the building is still evident, with various later additions on each of its elevations. The hangar's design contributes to the larger military industrial character of the surrounding CCAFS Industrial Area.

In addition to its high bay clean room complex, the building contains a telemetry ground station; an extensive communications center for data, voice, and video; three Launch Vehicle Data Centers (LVDCs), the Mission Director's Center (MDC), and offices for payload and contractor personnel. The building's extensive cabling systems and electronic equipment have been constantly upgraded and improved. The clean room was regularly used until 1995 for prelaunch preparations and checkout of payloads launching on ELVs or, occasionally, on the Space Shuttle. The last spacecraft to be processed in the clean room was *Swift* in 2004.

## 2. Condition of Fabric:

Hangar AE continues to function as NASA's primary ELV telemetry laboratory at CCAFS. It is regularly maintained and in good condition.

## B. Description

Hangar AE is a one-story building with rigid steel frame, a corrugated aluminum gable roof, corrugated aluminum exterior walls, and a concrete foundation. The building has a rectangular footprint that measures 320'-0" x 120'-0" and it

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has a high bay clean room on the west end. There are projecting concrete block and corrugated aluminum additions that contain entrances and utilities on the north and south elevations. There is a square gable-roof addition next to the entrance on the southeast (front) elevation.

The building is functionally divided into five major areas: the south wing (1000 Area), the central bay (1100 Area), the north wing (1200 Area), the high bay clean room complex (1400 Area), and the second floor (2000 Area). The main entrance leads into a newly renovated lobby on the east end of the building. Two main corridors run along the north and south sides of the building providing access to the five functional areas.

#### The South Wing

The south wing of the building contains the Mission Director's Center (Room 1012); the MDC observation area (Room 1002); a communications facility for audio, video, and data routing (Room 1020); a network interface area (Room 1025); the telemetry ground station with display devices (Room 1040); and the data processing equipment area (Room 1056). The south wing contains no spacecraft customer workspace. The entire area was designed to provide Mission Directors and their project staff with a central facility from which tests, mission simulations, and launch operations could be conducted. The ground station receives, monitors, and records telemetry data signals from pre-launch checkout through ascent phase and into spacecraft separation and orbital insertion. Video and audio data are transmitted for coordination and visual display. During the pre-launch phase, these data are evaluated to determine the flight

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readiness of the launch vehicle. In the post-launch phase, the data are evaluated for a detailed performance review.<sup>29</sup>

#### The Central Bay

The central bay is primarily a data display area assigned to the three LVDCs in Rooms 1120, 1130, and 1140. There is also a spacecraft ground servicing equipment (GSE) staging area (Room 1150). Each LVDC is approximately 780 square-feet in area and has carpeted raised floors, drywall partitions, and acoustical ceiling tiles with drop fluorescent lighting. They have theatrical-style seating with high ceilings and dimmable indirect lighting. Each room has seating for 24 personnel at self-sufficient computer consoles. Each room has six display screens, including two seven-foot projectors and four plasma screens.<sup>30</sup>

#### The North Wing

The north wing of the building primarily contains NASA personnel office space, contractor space, and a conference room in Room 1210. This area is permanently assigned to NASA and launch operations support contractor personnel. The wing features standard construction with tile covered concrete floors, drywall partition walls, and acoustical tile ceilings with drop fluorescent lighting.<sup>31</sup>

#### The High Bay Clean Room Complex

The high bay clean room complex on the west end of the building provides Class 10,000 cleanliness standards and

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<sup>29</sup> NASA, "Facilities Handbook for Building AE," LSP-UG-411.01, January 2006, 11.

<sup>30</sup> Ibid.

<sup>31</sup> Ibid., 7.

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supporting anterooms. All rooms comply with clean room standards. The high bay test area has a laminar-flow ventilation system that moves air from east to west. The entire east wall is composed of an air filter grid from floor to ceiling. The west wall, except for the entry door, is a similar air filter grid used for return air. The test area has a concrete floor painted with epoxy and concrete block walls on the north and south sides. The room is well-lit with fluorescent fixtures and is equipped with two wall-mounted cameras viewed on an internal building video system. There are two overhead cranes in the room, including one 5-ton bridge crane with a 34' hook height and a 2-ton monorail crane with a 39' hook height. Other services in the room include standard wall power, compressed air, and a gaseous nitrogen (GN<sub>2</sub>) purge panel.<sup>32</sup>

There is an airlock on the west end of the high bay used to transfer payloads and service equipment into the clean room. Closed with pneumatically sealed hangar doors, the area had a laminar flow ventilation system that was used to eliminate as much contamination as possible during the transfer process.

There are several supporting anterooms to the high bay. Room 1420 is the precision cleaning area where small parts were cleaned and then taken into the test area via an air shower through doors 1420A and 1420C. Room 1430 is a test and storage area open to the high bay test area. It was used for storage and staging of larger parts such as solar panels that could be passed into the main room when needed. Another test and storage area is in Room 1470, which was normally locked and not open to the high bay test area. It was used for battery storage and charging or miscellaneous equipment. There is a high bay observation room in 1251, a very popular place for management and guests when a payload was present.

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<sup>32</sup> Ibid., 15-16.

It was used to observe and control payload testing and is not subject to contamination control.<sup>33</sup>

#### The Second Floor

The second floor contains another observation area for the LVDCs below and additional spacecraft customer office cubicles. It is accessed via a set of stairs near the east entry door and there are additional stairs at the west end of the north corridor.

#### C. Operation

Hangar AE was mostly considered a customer-operated facility in terms of satellite payload processing in the high bay test area. That is, the commercial customer of NASA's Hangar AE facilities was responsible for its own day-to-day operations in regard to spacecraft arrival, set-up, inspection, and checkout. The exception to this policy is the overhead crane operations and high bay door opening and closing, which were handled by launch operations support contractor personnel.<sup>34</sup>

The typical processing flow for spacecraft checkout in the high bay test area began when the payload's associated GSE arrived at Hangar AE. The GSE was moved into the building, set-up, and readied for operations before the spacecraft arrived. After spacecraft arrival and inspection, it was prepared to move into the high bay, also known as the Payload Processing Facility (PPF). The move was usually made through the airlock into the high bay test area where the payload was configured for launch with the installation of solar panels, antennas, or other items. Hangar AE was not equipped to perform hazardous fueling operations involving cryogenic or

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<sup>33</sup> Ibid., 18.

<sup>34</sup> Ibid., 3.

hypergolic fuels, although it could accommodate initial pressure system checks, propellant system leak tests, and payload functional testing with ground checkout equipment. Following the completion of all required tasks, the payload was readied for the move to the launch pad and mated to the launch vehicle. Normally the exit process was the reverse of the entry procedure.<sup>35</sup>

#### D. Site Information

Hangar AE is located on Hangar Road between Hangar S and Hangar AM. The building is surrounded on all four sides by paved parking areas and grassy berms that separate it from adjacent buildings. The surrounding landscape of the CCAFS Industrial Area contains a concentration of missile assembly buildings (hangars), administrative buildings, warehouse/storage buildings, and other facilities that support NASA and Air Force missions at CCAFS. These facilities were grouped together away from the seaside launch complexes for safety reasons. The area is arranged in a grid shape with most of the hangars arrayed along the east and west sides of Hangar Road and Phillips Parkway.

### PART III. SOURCES OF INFORMATION

#### A. Primary Sources

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## 2. Historic Views

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Aerial View of Hangar AE, 1961. Photograph image LOD-61-2195. Kennedy Space Center Archives.

Interior View of Hangar AE, 1961. Photograph image LOD-61-7260. Kennedy Space Center Archives.

The Hangar AE Telemetry Laboratory, 1967. Photograph image 116-KSC-67-2231. Kennedy Space Center Archives.

View of Hangar AE High Bay Under Construction, 1961. Photograph image LOD-61-2146. Kennedy Space Center Archives.

Hangar AE with High Bay Under Construction, 1961.  
Photograph image LOD-61-2974. Kennedy Space Center  
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Hangar AE High Bay Under Construction, 1961.  
Photograph image LOD-61-4343. Kennedy Space Center  
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View of Telemetry Displays and Work Stations in the  
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Photograph image 116-KSC-383-001. Kennedy Space  
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#### C. Likely Sources Not Yet Investigated

Research was conducted at KSC and CCAFS using primary and secondary sources. Sources that were not investigated that may contain secondary information include NASA Headquarters and at the offices of the various architects and contractors that constructed Hangar AE.

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

#### PART IV: PROJECT INFORMATION

NASA KSC determined that Hangar AE is eligible to the NRHP under Criterion A in the area of Space Exploration and has completed HAER documentation of the building, in keeping with the Agency's documentation of other NRHP-listed or eligible properties. New South Associates, Inc., under

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contract with InoMedic Health Applications (IHA), a subcontractor to NASA KSC, conducted the HAER documentation and historical research for this project in March of 2013. David Diener served as the project photographer, David L. Price served as Project Historian, and Mary Beth Reed served as the Principal Investigator.

In order to complete the project, New South Associates' personnel were allowed full access to the facility, under the supervision of Barbara Naylor, KSC Historic Preservation Officer, and Nancy English, KSC Environmental Specialist. Photographs were taken of the building's interior rooms, exterior, and context. David Price conducted a limited number of oral interviews with facility managers and personnel and otherwise compiled the historical documentation required for the project. Elaine Liston, KSC Archivist, provided a wealth of information from her office in the KSC Archives Office.

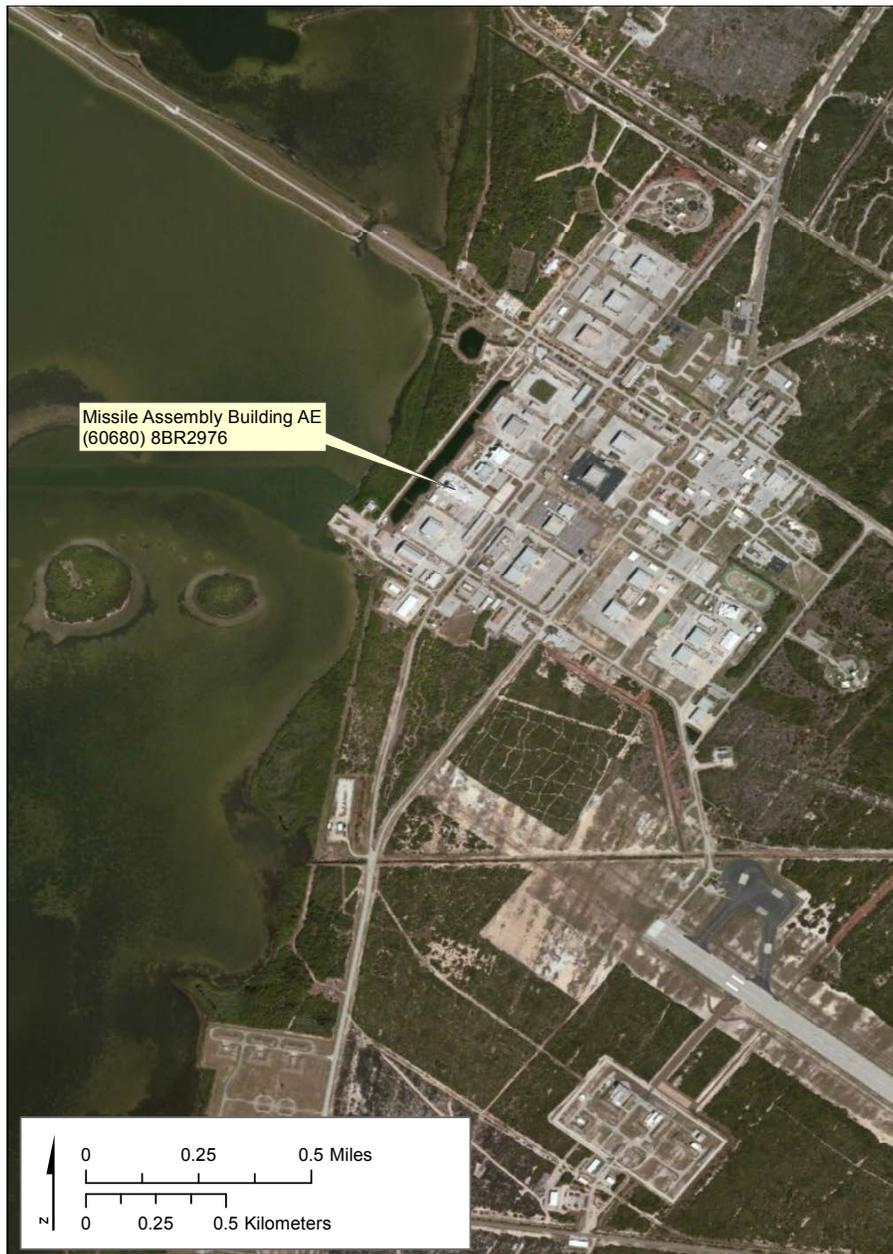
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APPENDIX:  
HISTORIC VIEWS



Source: USGS 7.5 Minute Topographic Quadrangle Map, Orsino, FL (1976)

Figure 1. USGS quadrangle map showing the location of the Missile Assembly Building AE (Hangar AE), 1976.



Source: ESRI Resource Data, Imagery Layer

Figure 2. Aerial photograph showing the location of the Missile Assembly Building AE (Hangar AE) in the Cape Canaveral Air Force Station Industrial Area, 2013.

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Figure 3. Aerial view of Hangar AE, 1961. (Courtesy of Kennedy Space Center Archives, Image LOD-61-2195).



Figure 4. Interior view of Hangar AE, 1961. (Courtesy of Kennedy Space Center Archives, Image LOD-61-7260).



Figure 5. The Hangar AE Telemetry Laboratory, 1967. (Courtesy of Kennedy Space Center Archives, Image 116-KSC-67-2231).



Figure 6. View of Hangar AE high bay under construction, 1961.  
(Courtesy of Kennedy Space Center Archives, Image LOD-61-2146).

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Figure 7. Hangar AE with high bay under construction, 1961.  
(Courtesy of Kennedy Space Center Archives, Image LOD-61-2974).

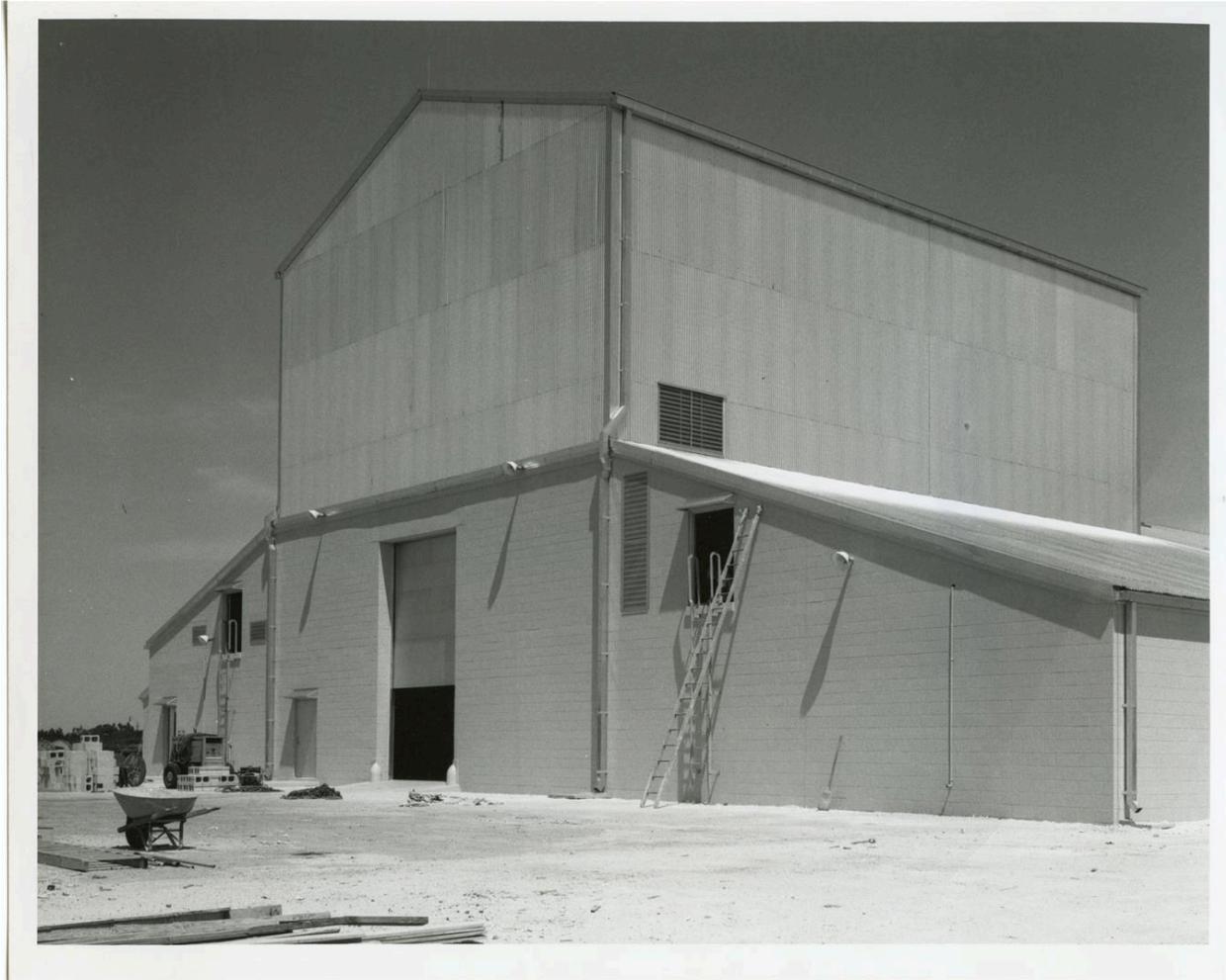


Figure 8. Hangar AE high bay under construction, 1961. (Courtesy of Kennedy Space Center Archives, Image LOD-61-4343).

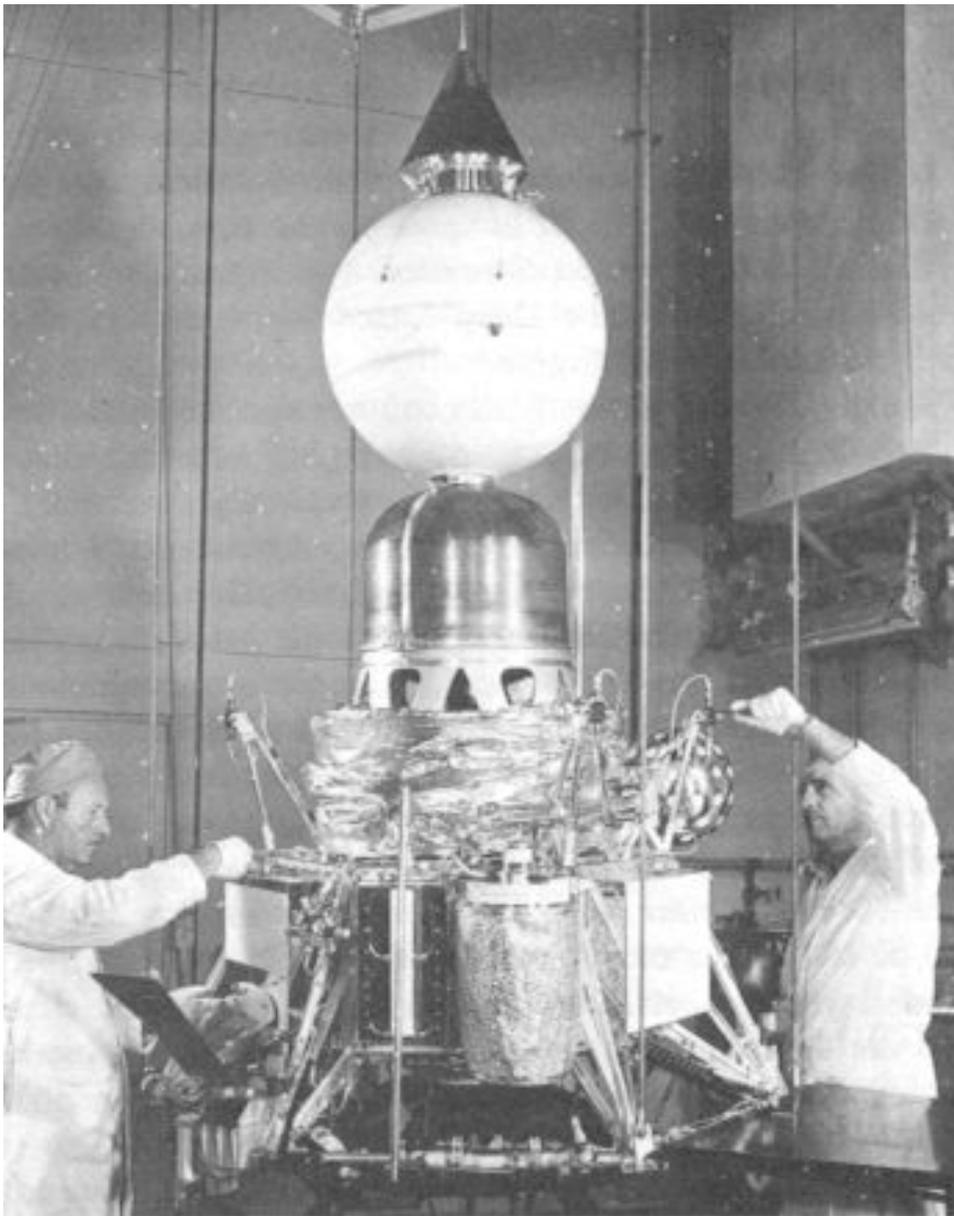


Figure 9. Technicians make final adjustments to the Ranger 3 Spacecraft at Hangar AE. (Source: "Lunar Impact: A History of Project Ranger," NASA History Division, 2006.)



Figure 10. View of telemetry displays and work stations in the Hangar AE Mission Control Center, circa 1964. (Courtesy of Kennedy Space Center Archives, Image 116-KSC-383-001).

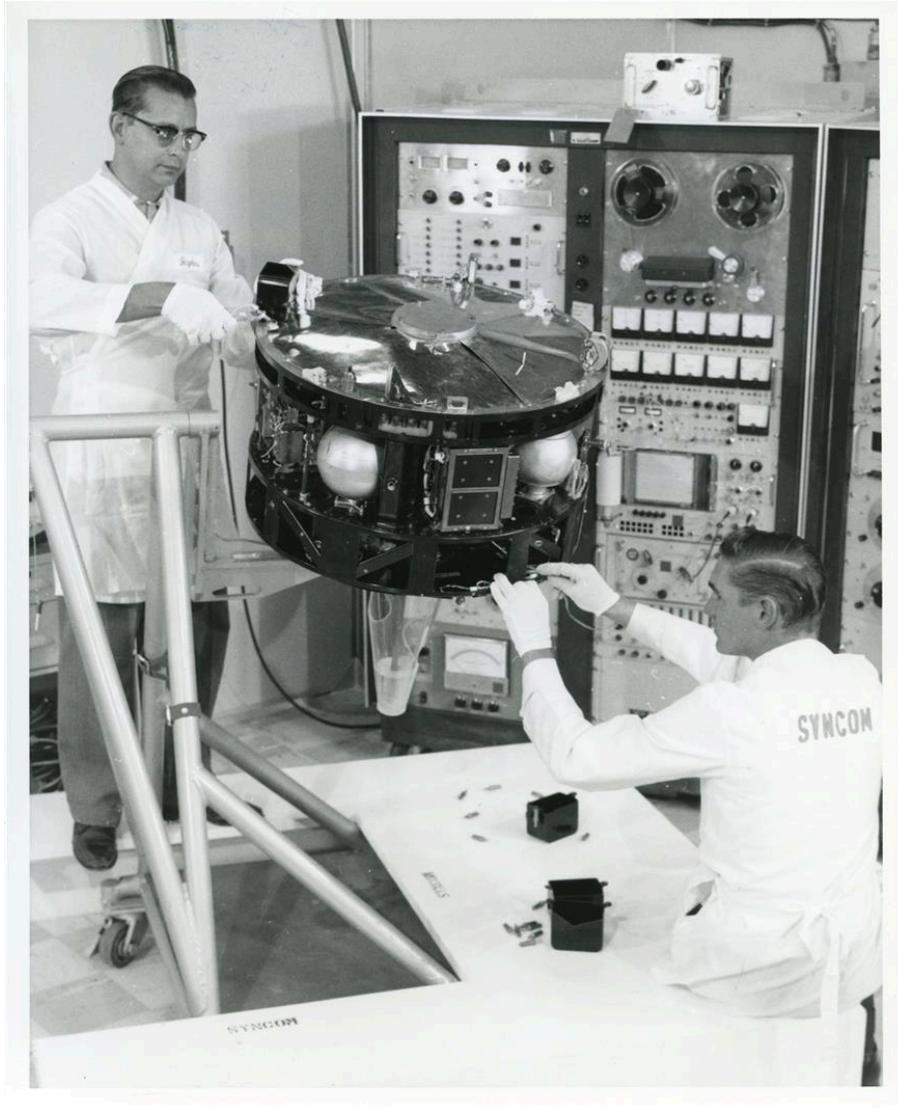


Figure 11. *Syncom 1*, the first geosynchronous communications satellite, undergoes final checkout by Hughes Aircraft Co. engineers in the Hangar AE high bay. (Courtesy of Kennedy Space Center Archives, Image 63-Syncom-18).

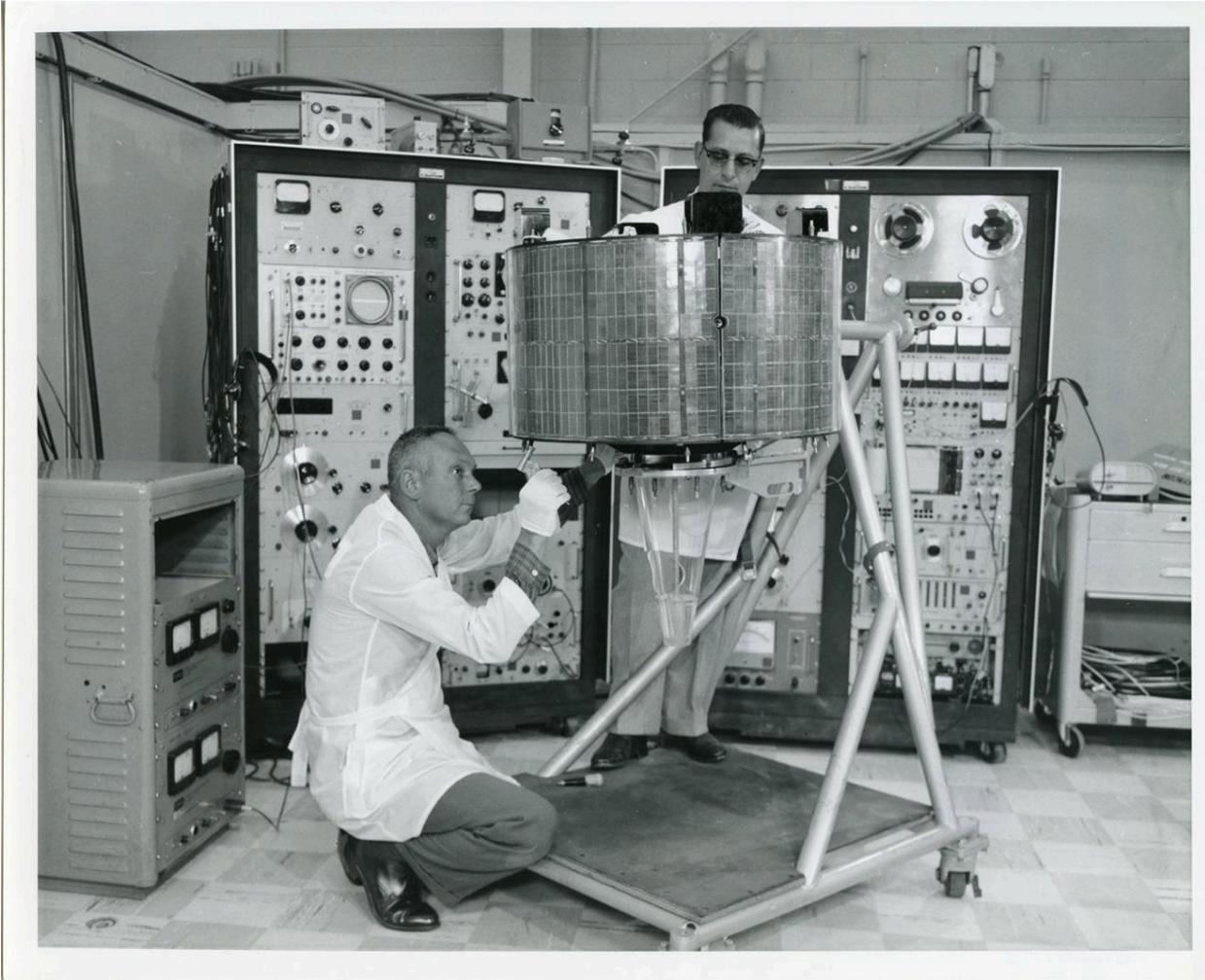


Figure 12. Hughes Aircraft Co. engineers conduct final checkout of *Syncom 1* satellite in Hangar AE high bay prior to mating to Delta launch vehicle. (Courtesy of Kennedy Space Center Archives, Image 63-Syncom-20).

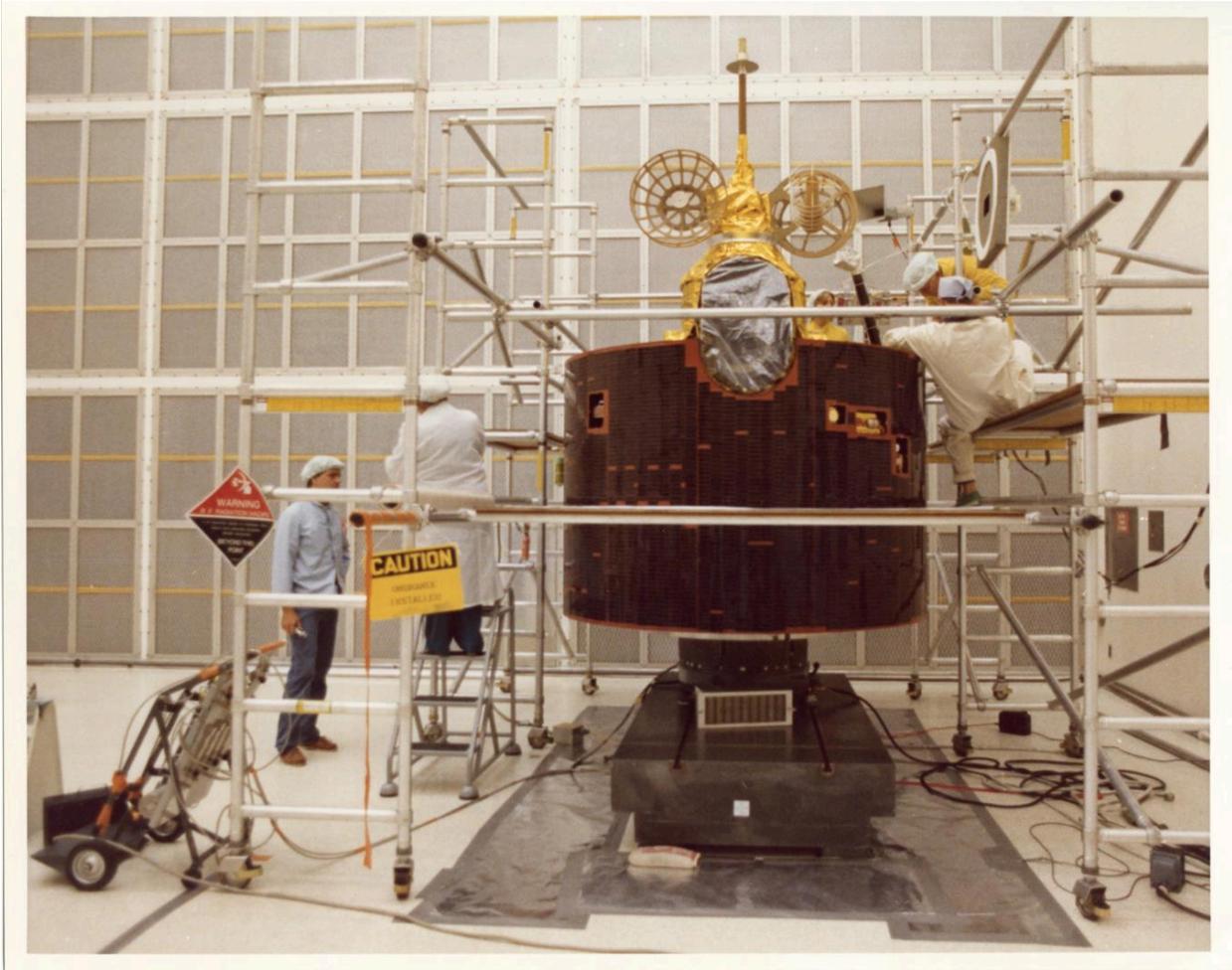


Figure 13. Engineers check out the *GOES-6* satellite in Hangar AE high bay, 1983. (Courtesy of Kennedy Space Center Archives, Image 102-KSC-383C-1019-5).

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APPENDIX:

TABLE OF UNMANNED LAUNCH OPERATIONS  
ASSOCIATED WITH HANGAR AE

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
THOR ABLE TIROS-1	ETR (Eastern Test Range)	1-Apr-60	Earth Orbit
DELTA-1 ECHO-1	ETR	13-May-60	Failed to Orbit
DELTA-2 ECHO-1A	ETR	12-Aug-60	Earth Orbit
DELTA-3 TIROS-2	ETR	23-Nov-60	Earth Orbit
DELTA-4 EXPLORER-10	ETR	25-Mar-61	Earth Orbit
DELTA-5 TIROS-3	ETR	12-Jul-61	Earth Orbit
DELTA-6 EXPLORER-12	ETR	16-Aug-61	Earth Orbit
AVT-1 BIG SHOT-1	ETR	15-Jan-62	Ballistic Trajectory
DELTA-7 TIROS-4	ETR	8-Feb-62	Earth Orbit
DELTA-8 OSO-1	ETR	7-Mar-62	Earth Orbit
DELTA-10 TIROS-5	ETR	19-Jun-62	Earth Orbit
DELTA-11 TELSTAR-1	ETR	10-Jul-62	Earth Orbit
AVT-2 BIG SHOT-2	ETR	18-Jul-62	Ballistic Trajectory
DELTA-12 TIROS-6	ETR	18-Sep-62	Earth Orbit
DELTA-13 EXPLORER-14	ETR	2-Oct-62	Earth Orbit
DELTA-14 EXPLORER-15	ETR	27-Oct-62	Earth Orbit
DELTA-15 RELAY-1	ETR	13-Dec-62	Earth Orbit
DELTA-16 SYNCOM-1	ETR	14-Feb-63	Geosynchronous Earth Orbit
DELTA-17 EXPLORER-17	ETR	3-Apr-63	Earth Orbit
DELTA-18 TELSTAR-2	ETR	7-May-63	Earth Orbit
DELTA-19 TIROS-7	ETR	19-Jun-63	Earth Orbit
DELTA-20 SYNCOM-2	ETR	26-Jul-63	Geosynchronous Earth Orbit
DELTA-21 EXPLORER-18	ETR	27-Nov-63	Earth Orbit
ATLAS/CENTAUR-2 (PAYLOAD DEMO)	ETR	27-Nov-63	Earth Orbit
DELTA-22 TIROS-8	ETR	21-Dec-63	Earth Orbit
DELTA-23 RELAY-2	ETR	21-Jan-64	Earth Orbit
THOR/AGENA-2 ECHO-2	ETR	25-Jan-64	Earth Orbit
ATLAS/AGENA-8 RANGER-6	ETR	30-Jan-64	Lunar Impact
DELTA-24 EXPLORER-20 BE-A	ETR	19-Mar-64	Geosynchronous Earth Orbit
ATLAS-263D FIRE-1	ETR	14-Apr-64	Ballistic Trajectory
ATLAS/CENTAUR-3 (PAYLOAD DEMO)	ETR	30-Jun-64	Failed to Orbit
ATLAS/AGENA-9 RANGER-7	ETR	28-Jul-64	Lunar Impact

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA-25 SYNCOM-3	ETR	19-Aug-64	Geosynchronous Earth Orbit
THOR/AGENA-3 NIMBUS-1	WTR (Western Test Range)	28-Aug-64	Earth Orbit
ATLAS/AGENA-10 OGO-1	ETR	4-Sep-64	Earth Orbit
DELTA-26 EXPLORER-21	ETR	4-Oct-64	Earth Orbit
ATLAS/AGENA-11 MARINER-3	ETR	5-Nov-64	Solar Orbit
ATLAS/AGENA-12 MARINER-4	ETR	28-Nov-64	Mars Transfer Orbit
ATLAS/CENTAUR-4 SURVEYOR-M1	ETR	11-Dec-64	Earth Orbit
DELTA-27 EXPLORER-26	ETR	21-Dec-64	Earth Orbit
DELTA-28 TIROS-9	ETR	21-Jan-65	Earth Orbit
DELTA-29 OSO-2	ETR	3-Feb-65	Earth Orbit
ATLAS/AGENA-13 RANGER-8	ETR	17-Feb-65	Lunar Impact
ATLAS/CENTAUR-5 SURVEYOR-D1	ETR	3-Mar-65	Failed to Liftoff
ATLAS/AGENA-14 RANGER-9	ETR	21-Mar-65	Lunar Impact
DELTA-30 INTELSTAT-1 EARLY BIRD	ETR	6-Apr-65	Geosynchronous Earth Orbit
ATLAS-264D FIRE-2	ETR	22-May-65	Ballistic Trajectory
DELTA-31 EXPLORER-28	ETR	29-May-65	Earth Orbit
DELTA-32 TIROS-10	ETR	2-Jul-65	Earth Orbit
ATLAS/CENTAUR-6 SURVEYOR-D2	ETR	11-Aug-65	Simulated Lunar Orbit
DELTA-33 OSO-C	ETR	25-Aug-65	Failed to Orbit
THOR/AGENA-4 OGO-2	WTR	14-Oct-65	Earth Orbit
DELTA-34 EXPLORER-29	ETR	6-Nov-65	Earth Orbit
THOR/AGENA-5 ALOUETTE-2 EXPLORER-31	WTR	28-Nov-65	Earth Orbit
DELTA-35 PIONEER-6	ETR	16-Dec-65	Solar Orbit
DELTA-36 ESSA-1	ETR	3-Feb-66	Earth Orbit
DELTA-37 ESSA-2	ETR	28-Feb-66	Earth Orbit
ATLAS/CENTAUR-8 SURV. MASS. MOD	ETR	8-Apr-66	Earth Orbit
ATLAS/AGENA-15 OAO-1	ETR	8-Apr-66	Earth Orbit
THOR/AGENA-15 OAO-1	ETR	8-Apr-66	Earth Orbit
THOR/AGENA-6 NIMBUS-2	WTR	15-May-66	Earth Orbit
DELTA-38 EXPLORER-32	ETR	25-May-66	Earth Orbit
ATLAS/CENTAUR-10 SURVEYOR-1	ETR	30-May-66	Lunar Landing

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Table 1. Unmanned Launch Operations Associated with Hangar AE

Mission	Launch Range	Date	Orbit/Status
ATLAS/AGENA-16 OGO-3	ETR	6-Jun-66	Earth Orbit
THOR/AGENA-7 PAGEOS-1	ETR	23-Jun-66	Earth Orbit
DELTA-39 EXPLORER-33	ETR	1-Jul-66	Earth Orbit
ATLAS/AGENA-17 LUNAR ORBITER-1	ETR	10-Aug-66	Lunar Orbit
DELTA-40 PIONEER-7	ETR	17-Aug-66	Solar Orbit
ATLAS/CENTAUR-7 SURVEYOR-2	ETR	20-Sep-66	Lunar Trajectory
DELTA-41 ESSA-3	WTR	2-Oct-66	Earth Orbit
ATLAS/CENTAUR-9 SURVEYOR-SD4	ETR	26-Oct-66	Simulated Lunar Trajectory
DELTA-42 INTELSAT II F1	ETR	26-Oct-66	Unstable Earth Orbit
ATLAS/AGENA-18 LUNAR ORBITER-2	ETR	6-Nov-66	Lunar Orbit
ATLAS/AGENA-19 ATS-1	ETR	6-Dec-66	Geosynchronous Earth Orbit
DELTA-44 INTELSAT II-PAC	ETR	11-Jan-67	Geosynchronous Earth Orbit
DELTA-45 ESSA-4	WTR	26-Jan-67	Earth Orbit
ATLAS/AGENA-20 LUNAR ORBITER-3	ETR	4-Feb-67	Lunar Orbit
DELTA-46 OSO-3	ETR	8-Mar-67	Earth Orbit
DELTA-47 INTELSAT II-ATL	ETR	22-Mar-67	Earth Orbit
ATLAS/AGENA-21 ATS-2	ETR	5-Apr-67	Earth Orbit
ATLAS/CENTAUR-12 SURVEYOR-3	ETR	17-Apr-67	Lunar Landing
DELTA-48 ESSA-5	WTR	20-Apr-67	Earth Orbit
ATLAS/AGENA-22 LUNAR ORBITER	ETR	4-May-67	Lunar Orbit
DELTA-49 EXPLORER-34	WTR	24-May-67	Earth Orbit
ATLAS/AGENA-23 MARINER-5	ETR	14-Jun-67	Venus Transfer Orbit
ATLAS/CENTAUR-11 SURVEYOR-4	ETR	14-Jul-67	Lunar Trajectory
THOR/AGENA-8 OGO-4	WTR	18-Jul-67	Earth Orbit
DELTA-50 EXPLORER-35	ETR	19-Jul-67	Lunar Orbit
ATLAS/AGENA-24 LUNAR ORBITER-5	ETR	1-Aug-67	Lunar Orbit
DELTA-51 BIOSATELLITE-2	ETR	7-Sep-67	Earth Orbit
ATLAS/CENTAUR-13 SURVEYOR-5	ETR	8-Sep-67	Lunar Landing
DELTA-52 INTELSAT II-PAC	ETR	28-Sep-67	Geosynchronous Earth Orbit
DELTA-53 OSO-4	ETR	18-Oct-67	Earth Orbit
ATLAS AGENA-25 ATS-3	ETR	5-Nov-67	Geosynchronous Earth Orbit
ATLAS/CENTAUR-14 SURVEYOR-6	ETR	7-Nov-67	Lunar Landing
DELTA-54 ESSA-6	WTR	10-Nov-67	Earth Orbit
DELTA-55 PIONEER-8 AND TTS-1	ETR	13-Dec-67	Solar Orbit & (TTS) Earth

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Table 1. Unmanned Launch Operations Associated with Hangar AE

Mission	Launch Range	Date	Orbit/Status
			Orbit
ATLAS/CENTAUR-15 SURVEYOR -7	ETR	7-Jan-68	Lunar Landing
DELTA-56 GEOS-2	WTR	11-Jan-68	Earth Orbit
ATLAS/AGENA-26 OGO-5	ETR	4-Mar-68	Earth Orbit
THOR/AGENA-5 NIMBUS-B	WTR	18-May-68	Failed to Orbit
DELTA-57 EXPLORER-38	WTR	4-Jul-68	Earth Orbit
ATLAS/CENTAUR-17 ATS-4	ETR	10-Aug-68	Remained in Transfer Orbit
DELTA-58 ESSA-7	WTR	16-Aug-68	Earth Orbit
DELTA-59 INTELSAT III-A	ETR	18-Sep-68	Failed to Orbit
DELTA-60 PIONEER-9 AND TETR-2	ETR	8-Nov-68	Solar Orbit
DELTA-61 HEOS-1	ETR	5-Dec-68	Earth Orbit
ATLAS/CENTAUR-16 OAO-2	ETR	7-Dec-68	Earth Orbit
DELTA-62 ESSA-8	WTR	15-Dec-68	Earth Orbit
DELTA-63 INTELSAT III-2	ETR	18-Dec-68	Geosynchronous Earth Orbit
DELTA-64 OSO-5	ETR	22-Jan-69	Earth Orbit
DELTA-65 ISIS-I	WTR	30-Jan-69	Earth Orbit
DELTA-66 INTELSAT III-3	ETR	5-Feb-69	Geosynchronous Earth Orbit
ATLAS/CENTAUR-20 MARINER-6	ETR	25-Feb-69	Mars Transfer Orbit
DELTA-67 ESSA-9	ETR	26-Feb-69	Earth Orbit
ATLAS/CENTAUR-19 MARINER-7	ETR	27-Mar-69	Mars Transfer Orbit
THOR/AGENA-10 NIMBUS-3 AND EGRS-13	WTR	13-Apr-69	Earth Orbit
DELTA-68 INTELSAT III-4	ETR	21-May-69	Geosynchronous Earth Orbit
THOR/AGENA-11 OGO-6	WTR	5-Jun-69	Earth Orbit
DELTA-69 EXPLORER-41	WTR	21-Jun-69	Earth Orbit
DELTA-70 BIOSATELLITE-3	ETR	28-Jun-69	Earth Orbit
DELTA-71 INTELSAT III-E	ETR	25-Jul-69	Incorrect Orbit
DELTA-72 OSO-6	ETR	9-Aug-69	Earth Orbit
ATLAS/CENTAUR-18 ATS-5	ETR	12-Aug-69	Geosynchronous Earth Orbit
DELTA-73 PIONEER-E and TETR-C	ETR	27-Aug-69	Failed to Orbit
DELTA-74 SKYNET-I	ETR	22-Nov-69	Geosynchronous Earth Orbit
DELTA-75 INTELSAT III-6	ETR	14-Jan-70	Geosynchronous Earth Orbit
DELTA-76 ITOS-1 and OSCAR-5	WTR	23-Jan-70	Earth Orbit
THOR/AGENA-12 SERT-II	WTR	3-Feb-70	Earth Orbit

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Table 1. Unmanned Launch Operations Associated with Hangar AE

<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA-77 NATOSAT-1	ETR	20-Mar-70	Geosynchronous Earth Orbit
THOR/AGENA-13 NIMBUS and TOPO-1	WTR	8-Apr-70	Earth Orbit
DELTA-78 INTELSAT III-7	ETR	22-Apr-70	Geosynchronous Earth Orbit
DELTA-79 INTELSAT III-8	ETR	23-Jul-70	Earth Orbit
DELTA-80 SKYNET-2	ETR	19-Aug-70	Earth Orbit
ATLAS/CENTAUR-21 OAO-B	ETR	30-Nov-70	Failed to Orbit
DELTA-81 NOAA-1	WTR	11-Dec-70	Earth Orbit
ATLAS/CENTAUR-25 INTELSAT IV F2	ETR	26-Jan-71	Geosynchronous Earth Orbit
DELTA-82 NATOSAT-II	ETR	2-Feb-71	Geosynchronous Earth Orbit
DELTA-83 EXPLORER-43	ETR	13-Mar-71	Earth Orbit
DELTA-84 ISIS-2	WTR	1-Apr-71	Earth Orbit
ATLAS/CENTAUR-24 MARINER-8	ETR	9-May-71	Failed to Orbit
ATLAS/CENTAR-23 MARINER-9	ETR	30-May-71	Mars Transfer Orbit
DELTA-85 OSO-7, TETR-4	ETR	29-Sep-71	Earth Orbit
DELTA-86 ITOS-B	WTR	21-Oct-71	Failed to Orbit
ATLAS/CENTAUR-26 INTELSAT IV F3	ETR	19-Dec-71	Geosynchronous Earth Orbit
ATLAS/CENTAUR-28 INTELSAT IV F4	ETR	23-Jan-72	Geosynchronous Earth Orbit
DELTA-87 HEOS-2	WTR	31-Jan-72	Earth Orbit
ATLAS/CENTAUR-27 PIONEER-10	ETR	2-Mar-72	Jupiter Trajectory
DELTA-88 TD-1	WTR	12-Mar-72	Earth Orbit
ATLAS/CENTAUR-29 INTELSAT IV F5	ETR	13-Jun-72	Geosynchronous Earth Orbit
DELTA-89 ERTS-1	WTR	23-Jul-72	Earth Orbit
ATLAS/CENTAUR-22 OAO-3	ETR	21-Aug-72	Earth Orbit
DELTA-90 EXPLORER-47	ETR	23-Sep-72	Earth Orbit
DELTA-91 NOAA-2 and OSCAR-6	WTR	15-Oct-72	Earth Orbit
DELTA-92 ANIK-1	ETR	10-Nov-72	Geosynchronous Earth Orbit
DELTA-93 NIMBUS-5	WTR	11-Dec-72	Earth Orbit
ATLAS/CENTAUR-30 PIONEER-11	ETR	5-Apr-73	Earth Orbit
DELTA-94 ANIK-II	ETR	20-Apr-73	Geosynchronous Earth Orbit
DELTA-95 EXPLORER-49	ETR	10-Jul-73	Lunar Orbit
DELTA-96 ITOS-E	WTR	16-Jul-73	Failed to Orbit
ATLAS/CENTAUR-31 INTELSAT IV F7	ETR	23-Aug-73	Geosynchronous Earth Orbit
DELTA-97 EXPLORER-50	ETR	26-Oct-73	Earth Orbit
ATLAS/CENTAUR-34 MARINER-10	ETR	3-Nov-73	Venus Transfer Orbit

CAPE CANAVERAL AIR FORCE STATION,  
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 (Hangar AE)  
 HAER NO. FL-8-B

Table 1. Unmanned Launch Operations Associated with Hangar AE

<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA-98 NOAA-3	WTR	6-Nov-73	Earth Orbit
DELTA-99 EXPLORER-51	WTR	16-Dec-73	Earth Orbit
DELTA-100 SKYNET-IIA	ETR	18-Jan-74	Incorrect Orbit
TITAN III/CENTAUR-1 VIKING-DS (PROOF FLIGHT)	ETR	11-Feb-74	Failed to Orbit
DELTA-101 WESTAR-I	ETR	13-Apr-74	Geosynchronous Earth Orbit
DELTA-102 SMS-I	ETR	16-May-74	Geosynchronous Earth Orbit
DELTA-103 WESTAR-II	ETR	10-Oct-74	Geosynchronous Earth Orbit
DELTA-104 NOAA-4, OSCAR-7, INTASAT	WTR	15-Nov-74	Earth Orbit
ATLAS/CENTRAUR-32 INTELSAT IV F8	ETR	21-Nov-74	Geosynchronous Earth Orbit
DELTA-105 SKYNET-II	ETR	23-Nov-74	Geosynchronous Earth Orbit
TITAN III/CENTAUR-2 HELIOS-I	ETR	10-Dec-74	Solar Orbit
DELTA-106 SYMPHONIE-1	ETR	19-Dec-74	Geosynchronous Earth Orbit
DELTA-107 LANDSAT-2	WTR	22-Jan-75	Earth Orbit
DELTA-108 SMS-2	ETR	6-Feb-75	Geosynchronous Earth Orbit
ATLAS/CENTRAUR-33 INTELSAT IV F6	ETR	20-Feb-75	Failed To Orbit
DELTA-109 GEOS-3	WTR	9-Apr-75	Earth Orbit
DELTA-110 ANIK III	ETR	7-May-75	Geosynchronous Earth Orbit
ATLAS/CENTRAUR-35 INTELSAT IV F1	ETR	22-May-75	Geosynchronous Earth Orbit
DELTA-111 NIMBUS-6	WTR	12-Jun-75	Earth Orbit
DELTA-112 OSO-8	ETR	21-Jun-75	Earth Orbit
DELTA-113 COS-B	WTR	9-Aug-75	Earth Orbit
TITAN III/CENTAUR-4 VIKING-1	ETR	20-Aug-75	Mars Transfer Orbit
DELTA-114 SYMPHONIE-2	ETR	27-Aug-75	Geosynchronous Earth Orbit
TITAN III/CENTAUR-3 VIKING-2	ETR	9-Sep-75	Mars Transfer Orbit
ATLAS/CENTRAUR-36 INTELSAT IV F1	ETR	26-Sep-75	Geosynchronous Earth Orbit
DELTA-115 EXPLORER-54	WTR	6-Oct-75	Earth Orbit
DELTA-116 GEOS-1	ETR	16-Oct-75	Geosynchronous Earth Orbit
DELTA-117 EXPLORER-55	ETR	20-Nov-75	Earth Orbit
DELTA-118 RCA-SATCOM I	ETR	12-Dec-75	Geosynchronous Earth Orbit
TITAN III/CENTAUR-5 HELIOS-II	ETR	15-Jan-76	Solar Orbit

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Mission	Launch Range	Date	Orbit/Status
DELTA-119 CTS (HERMES)	ETR	16-Jan-76	Geosynchronous Earth Orbit
ATLAS/CENTRAUR-37 INTELSAT IV F2	ETR	29-Jan-76	Geosynchronous Earth Orbit
DELTA-120 MARISAT-1	ETR	19-Feb-76	Geosynchronous Earth Orbit
DELTA-121 RCA-SATCOM II	ETR	26-Mar-76	Geosynchronous Earth Orbit
DELTA-122 NATO III-A	ETR	22-Apr-76	Geosynchronous Earth Orbit
DELTA-123 LAGEOS	WTR	4-May-76	Earth Orbit
ATLAS/CENTRAUR-38 COMSTAR-D1	ETR	13-May-76	Geosynchronous Earth Orbit
DELTA-124 MARISAT-2	ETR	10-Jun-76	Geosynchronous Earth Orbit
DELTA-125 PALAPA-1	ETR	8-Jul-76	Geosynchronous Earth Orbit
ATLAS/CENTRAUR-40 COMSTAR-D2	ETR	22-Jul-76	Geosynchronous Earth Orbit
DELTA-126 NOAA-5	WTR	29-Jul-76	Earth Orbit
DELTA-127 MARISAT-3	ETR	14-Oct-76	Geosynchronous Earth Orbit
DELTA-128 NATO III-B	ETR	28-Jan-77	Geosynchronous Earth Orbit
DELTA-129 PALAPA-2	ETR	10-Mar-77	Geosynchronous Earth Orbit
DELTA-130 ESA GEOS-1	ETR	20-Apr-77	Incorrect Earth Orbit
ATLAS/CENTRAUR-39 INTELSAT IVA F4	ETR	26-May-77	Geosynchronous Earth Orbit
DELTA-131 GOES-B	ETR	16-Jun-77	Geosynchronous Earth Orbit
DELTA-132 GMS	ETR	14-Jul-77	Geosynchronous Earth Orbit
ATLAS/CENTRAUR-45 HEAO-1	ETR	12-Aug-77	Earth Orbit
TITAN III/CENTAUR-7 VOYAGER-2	ETR	20-Aug-77	Jupiter/Saturn Trajectory
DELTA-133 SIRIO	ETR	25-Aug-77	Geosynchronous Earth Orbit
TITAN III/CENTAUR-6 VOYAGER-1	ETR	5-Sep-77	Jupiter/Saturn Trajectory
DELTA-134 OTS	ETR	13-Sep-77	Failed to Orbit
ATLAS/CENTAUR-43 INTELSAT IVAF5	ETR	29-Sep-77	Failed to Orbit
DELTA-135 ISEE A/B	ETR	20-Oct-77	Earth Orbit
DELTA-136 METEOSAT	ETR	22-Nov-77	Geosynchronous Earth Orbit
DELTA-137 JAPAN CS (SAKURA-1)	ETR	15-Dec-77	Geosynchronous Earth Orbit
ATLAS/CENTAUR-46 INTELSAT IVA F3	ETR	7-Jan-78	Geosynchronous Earth Orbit
DELTA-138 IUE	ETR	26-Jan-78	Geosynchronous Earth Orbit
ATLAS/CENTAUR-44 FLTSATCOM-1	ETR	9-Feb-78	Geosynchronous Earth Orbit
DELTA-139 LANDSAT-3	WTR	5-Mar-78	Earth Orbit
ATLAS/CENTAUR-48 INTELSAT IVA F6	ETR	31-Mar-78	Geosynchronous Earth Orbit

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Table 1. Unmanned Launch Operations Associated with Hangar AE

Mission	Launch Range	Date	Orbit/Status
DELTA-140 BSE	ETR	7-Apr-78	Geosynchronous Earth Orbit
DELTA-141 OTS-2	ETR	11-May-78	Geosynchronous Earth Orbit
ATLAS/CENTAUR-50 PIONEER VENUS-1	ETR	20-May-78	Venus Trajectory
DELTA-142 GOES-C	ETR	16-Jun-78	Geosynchronous Earth Orbit
ATLAS/CENTAR-41 COMSTAR-D3	ETR	29-Jun-78	Geosynchronous Earth Orbit
DELTA-143 ESA GEOS-2	ETR	14-Jul-78	Geosynchronous Earth Orbit
ATLAS/CENTAUR-51 PIONEER VENUS PROBE	ETR	8-Aug-78	Venus Trajectory
DELTA-144 ISEE-C	ETR	12-Aug-78	Solar Orbit
DELTA-145 NIMBUS-7	WTR	24-Oct-78	Earth Orbit
ATLAS/CENTAUR-52 HEAO-2	ETR	13-Nov-78	Earth Orbit
DELTA-146 NATO III-C	ETR	19-Nov-78	Geosynchronous Earth Orbit
DELTA-147 ANIK B	ETR	16-Dec-78	Geosynchronous Earth Orbit
DELTA-148 SCATHA (P78-2)	ETR	30-Jan-79	Earth Orbit
ATLAS/CENTAUR-47 FLTSATCOM-2	ETR	4-May-79	Geosynchronous Earth Orbit
DELTA-149 WESTAR-III	ETR	10-Aug-79	Geosynchronous Earth Orbit
ATLAS/CENTAUR-53 HEAO-3	ETR	20-Sep-79	Earth Orbit
DELTA-150 RCA-SATCOM III	ETR	7-Dec-79	Earth Orbit
ATLAS/CENTAUR-49 FLTSATCOM-3	ETR	17-Jan-80	Geosynchronous Earth Orbit
DELTA-151 SMM	ETR	14-Feb-80	Earth Orbit
DELTA-152 GOES-D	ETR	9-Sep-80	Geosynchronous Earth Orbit
ATLAS/CENTAUR-57 FLTSATCOM-4	ETR	30-Oct-80	Geosynchronous Earth Orbit
DELTA-153 SBS-1	ETR	15-Nov-80	Geosynchronous Earth Orbit
ATLAS/CENTAUR-54 INTELSAT V F2	ETR	6-Dec-80	Geosynchronous Earth Orbit
ATLAS/CENTAUR-42 COMSTAR-D4	ETR	21-Feb-81	Geosynchronous Earth Orbit
DELTA-154 GOES-E	ETR	22-May-81	Geosynchronous Earth Orbit
ATLAS/CENTAUR-56 INTELSAT V F1	ETR	26-May-81	Geosynchronous Earth Orbit
DELTA-155 DE-A/B	WTR	3-Aug-81	Earth Orbit
ATLAS/CENTAUR-59 FLTSATCOM-5	ETR	6-Aug-81	Geosynchronous Earth Orbit
DELTA-156 SBS-2	ETR	24-Sep-81	Geosynchronous Earth Orbit
DELTA-157 SME and MICROSAT SSTL	WTR	6-Oct-81	Earth Orbit
DELTA-158 RCA-SATCOM D	ETR	20-Nov-81	Geosynchronous Earth Orbit
ATLAS/CENTAUR-55 INTELSAT V F3	ETR	15-Dec-81	Geosynchronous Earth Orbit
DELTA-159 RCA-SATCOM E	ETR	16-Jan-82	Geosynchronous Earth Orbit

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Mission	Launch Range	Date	Orbit/Status
DELTA-160 WESTAR-IV	ETR	26-Feb-82	Geosynchronous Earth Orbit
ATLAS/CENTAUR-58 INTELSAT V F4	ETR	5-Mar-82	Geosynchronous Earth Orbit
DELTA-161 INSAT-1A	ETR	10-Apr-82	Geosynchronous Earth Orbit
DELTA-162 WESTAR-V	ETR	9-Jun-82	Geosynchronous Earth Orbit
DELTA-163 LANDSAT D	WTR	16-Jul-82	Earth Orbit
DELTA-164 ANIK D1	ETR	28-Aug-82	Geosynchronous Earth Orbit
ATLAS/CENTAUR-60 INTELSAT V F5	ETR	28-Oct-82	Geosynchronous Earth Orbit
DELTA-165 RCA-SATCOM F	ETR	28-Oct-82	Geosynchronous Earth Orbit
DELTA-166 IRAS	WTR	26-Jan-83	Geosynchronous Earth Orbit
DELTA-167 RCA-SATCOM 1R	ETR	11-Apr-83	Geosynchronous Earth Orbit
DELTA-168 GOES-F	ETR	28-Apr-83	Geosynchronous Earth Orbit
ATLAS/CENTAUR-61 INTELSAT V F6	ETR	19-May-83	Geosynchronous Earth Orbit
DELTA-169 ESA EXOSAT	WTR	26-May-83	Earth Orbit
DELTA-170 GALAXY-A	ETR	28-Jun-83	Geosynchronous Earth Orbit
DELTA-171 TELSTAR-3A	ETR	28-Jul-83	Geosynchronous Earth Orbit
DELTA-172 RCA-G	ETR	8-Sep-83	Geosynchronous Earth Orbit
DELTA-173 GALAXY-B	ETR	22-Sep-83	Geosynchronous Earth Orbit
DELTA-174 LANDSAT-D	WTR	1-Mar-84	Earth Orbit
ATLAS/CENTAUR-62 INTELSAT V F9	ETR	9-Jun-84	Incorrect Earth Orbit
DELTA-175 AMPTE	ETR	16-Aug-84	Earth Orbit
DELTA-176 GALAXY-C	ETR	21-Sep-84	Geosynchronous Earth Orbit
DELTA-177 NATO III-D	ETR	13-Nov-84	Geosynchronous Earth Orbit
ATLAS/CENTAUR-63 INTELSAT VA F10	ETR	23-Mar-85	Geosynchronous Earth Orbit
ATLAS/CENTAUR-64 INTELSAT VA F11	ETR	30-Jun-85	Geosynchronous Earth Orbit
ATLAS/CENTAUR-65 INTELSAT VA F12	ETR	28-Sep-85	Geosynchronous Earth Orbit
DELTA-178 GOES-G	ETR	3-May-86	Failed to Orbit
DELTA-180 SDIO	ETR	3-May-86	Earth Orbit
ATLAS/CENTAUR-66 FLTSATCOM F7	ETR	5-Dec-86	Geosynchronous Earth Orbit
DELTA-179 GOES-H	ETR	26-Feb-87	Geosynchronous Earth Orbit
DELTA-182 PALAPA-B2P	ETR	20-Mar-87	Geosynchronous Earth Orbit
ATLAS/CENTAUR-67 FLTSATCOM F6	ETR	27-Mar-87	Failed to Orbit
DELTA-181 SDIO	ETR	8-Feb-88	Earth Orbit

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Table 1. Unmanned Launch Operations Associated with Hangar AE

Mission	Launch Range	Date	Orbit/Status
ATLAS/CENTAUR-68 FLTSATCOM F8	ETR	25-Sep-89	Geosynchronous Earth Orbit
DELTA-189 COBE	WTR	18-Nov-89	Earth Orbit
DELTA-195 ROSAT	ETR	1-Jun-90	Earth Orbit
ATLAS/CENTAUR-69 CRRES	ETR	25-Jun-90	Earth Orbit
SCOUT-216 REX	WTR	29-Jun-91	Earth Orbit
DELTA-210 EUVE	ETR	7-Jun-92	Earth Orbit
SCOUT-215 SAMPEX	WTR	3-Jul-92	Earth Orbit
DELTA-212 GEOTAIL	ETR	24-Jul-92	Earth Orbit
TITAN III/CENTAUR-4 MARS OBSERVER	ETR	25-Sep-92	Mars Transfer Orbit
SCOUT-210 MSTI-1	WTR	21-Nov-92	Earth Orbit
SCOUT-217 RADCAL	WTR	25-Jun-93	Earth Orbit
ATLAS/CENTAUR-73 GOES-1	ETR	14-Apr-94	Geosynchronous Earth Orbit
SCOUT-218 MSTI-2	WTR	9-May-94	Earth Orbit
DELTA-227 WIND	ETR	1-Nov-94	Lunar Orbit
ATLAS/CENTAUR-77 GOES-J	ETR	23-May-95	Geosynchronous Earth Orbit
DELTA-229 RADARSAT	WTR	4-Nov-95	Earth Orbit
ATLAS/CENTAUR-121 SOHO	ETR	2-Dec-95	Solar Transfer Orbit
DELTA-230 XTE	ETR	30-Dec-95	Earth Orbit
DELTA-232 NEAR	ETR	17-Feb-96	Heliocentric Orbit
DELTA-233 POLAR	WTR	24-Feb-96	Earth Orbit
PEGASUS-XL TOMS	WTR	2-Jul-96	Earth Orbit
PEGASUS-XL FAST	WTR	21-Aug-96	Earth Orbit
PEGASUS-XL SAC-B HETE	WFF (Wallops Flight Facility)	4-Nov-96	Failed to Separate S/C
DELTA-239 MARS GLOBAL SURVEYOR	ETR	7-Nov-96	Mars Transfer Orbit
DELTA-240 MARS PATHFINDER	ETR	4-Dec-96	Mars Transfer Orbit
ATLAS/CENTAUR-79 GOES-K	ETR	25-Apr-97	Geosynchronous Earth Orbit
DELTA II/MS1a	WTR	1-May-97	Not Available
DELTA II/THOR	ETR	20-May-97	Not Available
DELTA II/MS2	WTR	9-Jul-97	Not Available
ATLAS/AC133	ETR	28-Jul-97	Not Available
PEGASUS/SEASTAR	WTR	1-Aug-97	Earth Orbit

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Table 1. Unmanned Launch Operations Associated with Hangar AE

<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA II/MS3	WTR	20-Aug-97	Not Available
DELTA-247 ACE	ETR	25-Aug-97	Solar Orbit
DELTA II/ACE	ETR	25-Aug-97	Not Available
ATLAS/AC146 GE3	ETR	4-Sep-97	Not Available
DELTA II/MS4	WTR	26-Sep-97	Not Available
ATLAS/ECHOSTAR	ETR	5-Oct-97	Not Available
TITAN IVB/CENTAUR-21 CASSINI/HUYGENS	ETR	15-Oct-97	Saturn Transfer Orbit
TITAN/CASSINI	ETR	15-Oct-97	Not Available
ATLAS/DSCSIII	ETR	24-Oct-97	Not Available
DELTA II/GPS II-28	ETR	5-Nov-97	Not Available
DELTA II/MS5	WTR	8-Nov-97	Not Available
ATLAS/AC149 GALAXY	ETR	8-Dec-97	Not Available
DELTA II/MS6	WTR	19-Dec-97	Not Available
ATHENA/LUNAR PROSPECTOR	ETR	6-Jan-98	Lunar Orbit
DELTA II/SKYNET	ETR	9-Jan-98	Not Available
ATLAS/AC-109 NRO	ETR	29-Jan-98	Not Available
DELTA II/GLOBAL STAR 1	ETR	14-Feb-98	Not Available
DELTA II/MS7	WTR	18-Feb-98	Not Available
PEGASUS-XL SNOE	WTR	25-Feb-98	Earth Orbit
PEGASUS/SNOE	WTR	26-Feb-98	Not Available
ATLAS/AC-151/INTELSAT 806	ETR	27-Feb-98	Not Available
ATLAS/AC-132/UHF-F8	ETR	16-Mar-98	Not Available
DELTA II/MS8	WTR	29-Mar-98	Not Available
PEGASUS-XL TRACE	WTR	1-Apr-98	Earth Orbit
PEGASUS/TRACE	WTR	1-Apr-98	Not Available
STS-90/NEUROLAB	ETR	17-Apr-98	Not Available
DELTA II/GLOBAL STAR 2	ETR	24-Apr-98	Not Available
TITAN II/NOAA-K	WTR	13-May-98	Earth Orbit
DELTA II/MS9	WTR	17-May-98	Not Available
DELTA III/GALAXY 10	ETR	26-Aug-98	Not Available
DELTA II/MS-10	WTR	9-Sep-98	Not Available
PEGASUS/ORBCOM 3	WFF	24-Sep-98	Not Available
ATLAS/AC-134 HOTBIRD	ETR	9-Oct-98	Not Available

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Table 1. Unmanned Launch Operations Associated with Hangar AE

<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
ATLAS/AC-130 UHF F/O F9	ETR	20-Oct-98	Not Available
PEGASUS-XL SCD-2/WING GLOVE	ETR	22-Oct-98	Earth Sub-Orbit
PEGASUS/SCD-2/WING GLOVE	ETR	22-Oct-98	Not Available
DELTA II/DEEP SPACE 1	ETR	24-Oct-98	Deep Space Trajectory
PEGASUS/SWAS	ETR	6-Dec-98	Not Available
DELTA II/MARS ORBITER	ETR	11-Dec-98	Mission Failure
DELTA II/MARS LANDER	ETR	3-Jan-99	Mission Failure
ATHENA/ROCSAT	ETR	26-Jan-99	Not Available
DELTA II/STARDUST	ETR	7-Feb-99	Comet Sample Mission
ATLAS-AC 152/JCSAT-6	ETR	15-Feb-99	Geosynchronous Earth Orbit
DELTA II/ARGOS P-91	ETR	23-Feb-99	Not Available
ATLAS/Eutelsat-W3	ETR	12-Apr-99	Not Available
DELTA II/LandSat-7	WTR	15-Apr-99	Earth Orbit
DELTA III/ORION	ETR	4-May-99	Not Available
PEGASUS/Terriers	WTR	18-May-99	Mission Failure
DELTA II/Globalstar 3	ETR	10-Jun-99	Not Available
DELTA II/FUSE	ETR	24-Jun-99	Earth Orbit
DELTA II/Globalstar 4	ETR	10-Jul-99	Not Available
DELTA II/Globalstar 5	ETR	25-Jul-99	Not Available
DELTA II/Globalstar 6	ETR	17-Aug-99	Not Available
ATLAS/AC 155/ECHOSTAR 5	ETR	23-Sep-99	Not Available
DELTA/GRS2R3	ETR	7-Oct-99	Not Available
ATLAS/AC 136/UHF/F10	ETR	22-Nov-99	Not Available
PEGASUS/Orbcom IV	WTR	4-Dec-99	Not Available
ATLAS/AC 141/EOS	WTR	18-Dec-99	Earth Orbit
ATLAS/AC 138/DSCS/MLV 8	ETR	20-Jan-00	Not Available
ATLAS/AC 158/Hispasat IC	ETR	3-Feb-00	Not Available
DELTA II/Globalstar 7	ETR	8-Feb-00	Not Available
DELTA II/IMAGE	WTR	25-Mar-00	Earth Orbit
ATLAS/AC 137/GOES-L	ETR	3-May-00	Geosynchronous Earth Orbit
DELTA II/GPSIIR-4	ETR	10-May-00	Not Available
ATLAS3A/Eutelsat-W4	ETR	24-May-00	Not Available
ATLAS/ AC 139/TDRS-H	ETR	29-Jun-00	Earth Orbit
ATLAS/ AC 161/ECHOSTAR 6	ETR	14-Jul-00	Not Available

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA II/GSPIIR5	ETR	16-Jul-00	Not Available
DELTA III/DM-F3	ETR	23-Aug-00	Not Available
PEGASUS/HETE II	ETR	8-Oct-00	Earth Orbit
ATLAS/ AC 140/DSCS/MLV 9	ETR	19-Oct-00	Not Available
DELTA II/GPSIIR6	ETR	10-Nov-00	Not Available
DELTA II/EO1-SAC-C	ETR	21-Nov-00	Earth Orbit
ATLAS IIA/MLV11 / AC 157	ETR	5-Dec-00	Not Available
DELTA II/GPSIIR7	ETR	30-Jan-01	Not Available
TITAN IV/B-41	ETR	2-Feb-01	Not Available
DELTA II/MARS Odyssey	ETR	7-Apr-01	Mars Orbit
DELTA II/GEOLITE	ETR	18-May-01	Not Available
ATLAS IIAS/ICO-F2	ETR	19-Jun-01	Not Available
DELTA II/MAP	ETR	30-Jun-01	Earth Orbit
ATLAS II/GOES-M	ETR	23-Jul-01	Geosynchronous Earth Orbit
DELTA II/Genesis	ETR	8-Aug-01	Earth Orbit
ATLASIIA/2MLV-10/ac162	WTR	8-Sep-01	Not Available
TAURUS/QuiktOMS	WTR	21-Sep-01	Earth Orbit
ATHENA/Kodiak Star	ETR	29-Sep-01	Earth Orbit
ATLASIIAS/MLV-12 ac/162	ETR	10-Oct-01	Not Available
DELTA II/QuickBird-2	WTR	18-Oct-01	Not Available
DELTA II/JASON/TIMED	WTR	7-Dec-01	Earth Orbit
PEGASUS/HESSI	ETR	5-Feb-02	Earth Orbit
DELTA II/IS-1	ETR	11-Feb-02	Not Available
ATLASIIIB/ECHOSTAR VII	ETR	21-Feb-02	Not Available
ATLAS IIA/TDRS-I	ETR	8-Mar-02	Not Available
DELTA II/AQUA-EOS	ETR	4-May-02	Earth Orbit
TITAN II/NOAA-M	WTR	24-Jun-02	Earth Orbit
DELTA II/CONTOUR	ETR	3-Jul-02	Comet Flyby Mission
ATLAS V/HOTBIRD-6	ETR	21-Aug-02	Not Available
ATLAS IIAS/Hispasat ID	ETR	18-Sep-02	Not Available
DELTA IV/Eutelsat	ETR	20-Nov-02	Not Available
ATLASIIA/TDRS-J	ETR	4-Dec-02	Not Available
DELTA II/ICESAT/CHIPSAT	WTR	12-Jan-03	Earth Orbit
PEGASUS/SORCE	ETR	25-Jan-03	Earth Orbit

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA II/GPSIIR8	ETR	29-Jan-03	Not Available
DELTA IV/DSCS-1	ETR	10-Mar-03	Not Available
DELTA II/GPSIIR9	ETR	31-Mar-03	Not Available
TITAN IV/B-35	ETR	7-Apr-03	Not Available
ATLASIIIB/ASIASAT 4	ETR	11-Apr-03	Not Available
PEGASUS/GALEX	ETR	28-Apr-03	Earth Orbit
ATLAS V/HellasSAT	ETR	13-May-03	Not Available
DELTA II/MER-A	ETR	10-Jun-03	Mars Exploration Rover
PEGASUS/ORBVVIEW-3	WTR	26-Jun-03	Not Available
DELTA II/MER-B	ETR	7-Jul-03	Mars Exploration Rover
ATLAS V/RAINBOW	ETR	17-Jul-03	Not Available
PEGASUS/SCISat	WTR	12-Aug-03	Not Available
DELTA II/SIRTF	ETR	25-Aug-03	Earth Orbit
DELTA IV/DSCS B-6	ETR	29-Aug-03	Not Available
TITAN IV/B-36 (Centaur)	ETR	9-Sep-03	Not Available
ATLAS IIAS/MLV-14 (NROL-18)	WTR	2-Dec-03	Not Available
ATLAS IIIB/UHF/F11	ETR	17-Dec-03	Not Available
DELTA II/GPS IIR-10	ETR	21-Dec-03	Not Available
ATLAS IIAS/AMC-10	ETR	5-Feb-04	Not Available
TITAN IV/B-39 DSP022	ETR	14-Feb-04	Not Available
ATLAS IIIA/MBSat	ETR	13-Mar-04	Not Available
DELTA II/GPS IIR-11	ETR	20-Mar-04	Not Available
ATLAS IIAS/SUPERBIRD-6	ETR	15-Apr-04	Not Available
DELTA II/GP-B	WTR	20-Apr-04	Earth Orbit
Atlas IIAS/AMC-11	ETR	19-May-04	Not Available
TAURUS/ROCSAT	WTR	20-May-04	Not Available
DELTA II/GPS IIR-12	ETR	23-Jun-04	Not Available
DELTA II/AURA	WTR	15-Jul-04	Earth Orbit
DELTA II/Messenger	ETR	3-Aug-04	Mercury Orbit
ATLAS IIAS/NROL-22	ETR	31-Aug-04	Not Available
DELTA II/GPS IIR-13	ETR	6-Nov-04	Not Available
DELTA II/SWIFT	ETR	20-Nov-04	Earth Orbit
ATLAS V/AMC-16	ETR	17-Dec-04	Not Available
DELTA IV H/Heavy Demo	ETR	21-Dec-04	Not Available

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA II/Deep Impact	ETR	12-Jan-05	Comet Impact
ATLAS IIIB/NROL-23 MLV-15	ETR	3-Feb-05	Not Available
ATLAS V/INMARSAT	ETR	11-Mar-05	Not Available
PEGASUS/DART	WTR	15-Apr-05	Mission Failed
TITAN IVB/B-30	ETR	29-Apr-05	Not Available
DELTA II/NOAA-N	WTR	20-May-05	Earth Orbit
ATLAS V/MRO	ETR	12-Aug-05	Mars Orbit
DELTA II/GPS IIR-14	ETR	25-Sep-05	Not Available
ATLAS V/PLUTO/New Horizon	ETR	19-Jan-06	Jupiter Trajectory
PEGASUS/ST-5	ETR	22-Mar-06	Earth Orbit
MINOTAUR/OSP-1 COSMIC	WTR	15-Apr-06	Not Available
ATLAS V/ASTRA 1 KR	ETR	20-Apr-06	Not Available
DELTA II/CALIPSO/CLOUDSAT	WTR	28-Apr-06	Earth Orbit
DELTA IV/GOES-N	ETR	24-May-06	Geosynchronous Earth Orbit
DELTA II/MITEX	ETR	21-Jun-06	Not Available
DELTA IV/NROL-22	WTR	27-Jun-06	Not Available
DELTA II/GPS IIR-15	ETR	25-Sep-06	Not Available
DELTA II/STEREO	ETR	25-Oct-06	Solar Orbit
DELTA IV/DMSP-17	WTR	4-Nov-06	Not Available
DELTA-43/BIOSATELLITE-1	ETR	14-Dec-06	Earth Orbit
DELTA II/NROL-21	WTR	14-Dec-06	Not Available
DELTA II/THEMIS	ETR	17-Feb-07	Earth Orbit
ATLAS V/STP-1	ETR	8-Mar-07	Not Available
PEGASUS/AIM	WTR	25-Apr-07	Earth Orbit
DELTA II/COSMOS-1	WTR	6-Jun-07	Not Available
ATLAS V/NROL-30	ETR	15-Jun-07	Not Available
DELTA II/PHOENIX	ETR	4-Aug-07	Mars Lander
DELTA II/WORLDDVIEW	WTR	18-Sep-07	Not Available
DELTA II/DAWN	ETR	27-Sep-07	Asteroid Orbit
ATLAS V/WGS -2	ETR	10-Oct-07	Not Available
DELTA II/GPS IIR-17	ETR	17-Oct-07	Not Available
DELTA IV/DSP-23	ETR	10-Nov-07	Not Available
DELTA II/COSMOS-2	WTR	8-Dec-07	Not Available
ATLAS V/NROL-24	ETR	10-Dec-07	Not Available

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Table 1. Unmanned Launch Operations Associated with Hangar AE

<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
DELTA II/GPS IIR-18	ETR	20-Dec-07	Not Available
ATLAS V/NROL-28	WTR	13-Mar-08	Not Available
DELTA II/GPS IIR-19	ETR	15-Mar-08	Not Available
ATLAS V/ICO G1	ETR	14-Apr-08	Not Available
DELTA II/GLAST	ETR	11-Jun-08	Earth Orbit
DELTA II/OSTM	WTR	19-Jun-08	Earth Orbit
DELTA II/GeoEye-1	WTR	6-Sep-08	Not Available
PEGASUS/IBEX	WTR	19-Oct-08	Interstellar Trajectory
DELTA 336/COSMO-3	WTR	24-Oct-08	Not Available
DELTA IV/NROL-26	ETR	17-Jan-09	Not Available
DELTA 7320/NOAA-N	WTR	6-Feb-09	Earth Orbit
TAURUS/OCO	WTR	24-Feb-09	Earth Orbit
DELTA II/KEPLER	ETR	6-Mar-09	Earth Orbit
DELTA II/GPS IIR-20	ETR	24-Mar-09	Not Available
Atlas V/WGS-SV2	ETR	3-Apr-09	Not Available
DELTA II/STSS ATRR	WTR	5-May-09	Earth Orbit
Atlas V/LRO/ICROSS	ETR	18-Jun-09	Lunar Orbit
DELTA IV/GOES-O	ETR	27-Jun-09	Geosynchronous Earth Orbit
TBD/CARAVAN-2	WTR	22-Jul-09	Not Available
DELTA II/GPS IIR-21	ETR	17-Aug-09	Not Available
ATLAS V/PAN	ETR	8-Sep-09	Not Available
DELTA II/STSS-DEMO	ETR	25-Sep-09	Earth Orbit
DELTA 344/WorldView-2	WTR	8-Oct-09	Not Available
ATLAS V/DMSP-18	WTR	18-Oct-09	Not Available
ATLAS V/ARES-1	ETR	28-Oct-09	Not Available
ATLAS V/INTELSAT-14	ETR	23-Nov-09	Not Available
DELTA IV/WGS-3	ETR	5-Dec-09	Not Available
DELTA II/WISE	WTR	14-Dec-09	Earth Orbit
ATLAS V/SDO	ETR	11-Feb-10	Earth Orbit
DELTA IV/GOES-P	ETR	4-Mar-10	Geosynchronous Earth Orbit
ATLAS V/X-37B - OTV	ETR	22-Apr-10	Not Available
MINOTAUR/HEX-2A	WTR	22-Apr-10	Not Available
DELTA IV/GPS IIF-01	ETR	27-May-10	Not Available
FALCON 9/Dragon Demo FLT 1	ETR	4-Jun-10	Not Available

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
ATLAS V/AEHF-1	ETR	14-Aug-10	Not Available
ATLAS V/NROL-41	WTR	20-Sep-10	Not Available
DELTA II/COSMO-4	WTR	5-Nov-10	Not Available
DELTA IV/NROL-32	ETR	21-Nov-10	Not Available
FALCON 9/COTS - Demo 1	ETR	8-Dec-10	Earth Orbit
DELTA IV/NROL-49	WTR	20-Jan-11	Not Available
TAURUS/GLORY	WTR	4-Mar-11	Earth Orbit
ATLAS V/OTV-2	ETR	5-Mar-11	Not Available
DELTA IV/NROL-27	ETR	11-Mar-11	Not Available
ATLAS V/NROL-34	WTR	14-Apr-11	Not Available
ATLAS V/SBIRS-GEO-1	ETR	7-May-11	Not Available
DELTA II/SAC-D	WTR	10-Jun-11	Not Available
DELTA IV/GPS IIF-02	ETR	16-Jul-11	Not Available
ATLAS V/JUNO	ETR	5-Aug-11	Jupiter Trajectory
DELTA II/GRAIL	ETR	10-Sep-11	Lunar Orbit
DELTA II/NPP	WTR	28-Oct-11	Earth Orbit
ATLAS V/MSL	ETR	26-Nov-11	Mars Trajectory
DELTA IV/WGS-4	ETR	19-Jan-12	Not Available
ATLAS V/MUOS-1	ETR	24-Feb-12	Not Available
DELTA IV/NROL-25	ETR	3-Apr-12	Not Available
ATLAS V/AEHF-2	ETR	4-May-12	Not Available
FALCON 9/COTS - 2	ETR	22-May-12	Not Available
PEGASUS/NuStar	WTR	13-Jun-12	Earth Orbit
ATLAS V/NROL-38	ETR	20-Jun-12	Not Available
DELTA IV/NROL-15	ETR	29-Jun-12	Not Available
ATLAS V/RBSP	ETR	30-Aug-12	Earth Orbit
ATLAS V/NROL-36	WTR	13-Sep-12	Earth Orbit
DELTA IV/GPS IIF-3	ETR	4-Oct-12	Not Available
FALCON 9/CRS SpaceX-1	ETR	7-Oct-12	Not Available
ATLAS V/OTV-3	ETR	11-Dec-12	Not Available
ATLAS V/TDRS-K	ETR	30-Jan-13	Geosynchronous Earth Orbit
ATLAS V/LDCM	WTR	11-Feb-13	Earth Orbit
FALCON 9/CRS SpaceX-2	ETR	1-Mar-13	Not Available
ATLAS V/SBIRS-GEO-2	ETR	19-Mar-13	Not Available

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<b>Mission</b>	<b>Launch Range</b>	<b>Date</b>	<b>Orbit/Status</b>
ANTARES/Test Flight	WFF	21-Apr-13	Not Available
ATLAS V/GPS IIF-4	ETR	15-May-13	Not Available
DELTA IV/WGS-5	ETR	24-May-13	Not Available
PEGASUS XL/IRIS	WTR	27-Jun-13	Earth Orbit
ATLAS V/MUOS-2	ETR	19-Jul-13	Not Available
DELTA IV/WGS-06	ETR	7-Aug-13	Not Available
DELTA IV/NROL-65	WTR	28-Aug-13	Not Available
ANTARES/Cygnus	WFF	18-Sep-13	Not Available
ATLAS V/AEHF-3	ETR	18-Sep-13	Not Available
FALCON 9/Cassiope	WTR	29-Sep-13	Not Available
DELTA II/THOR III	ETR	N/D	Not Available
PEGASUS/STEP-4	WTR	N/D	Not Available
PEGASUS/FORTE	Not Available	N/D	Not Available
INTELSAT 80	Not Available	N/D	Not Available
PEGASUS/ORBCOM	Not Available	N/D	Not Available

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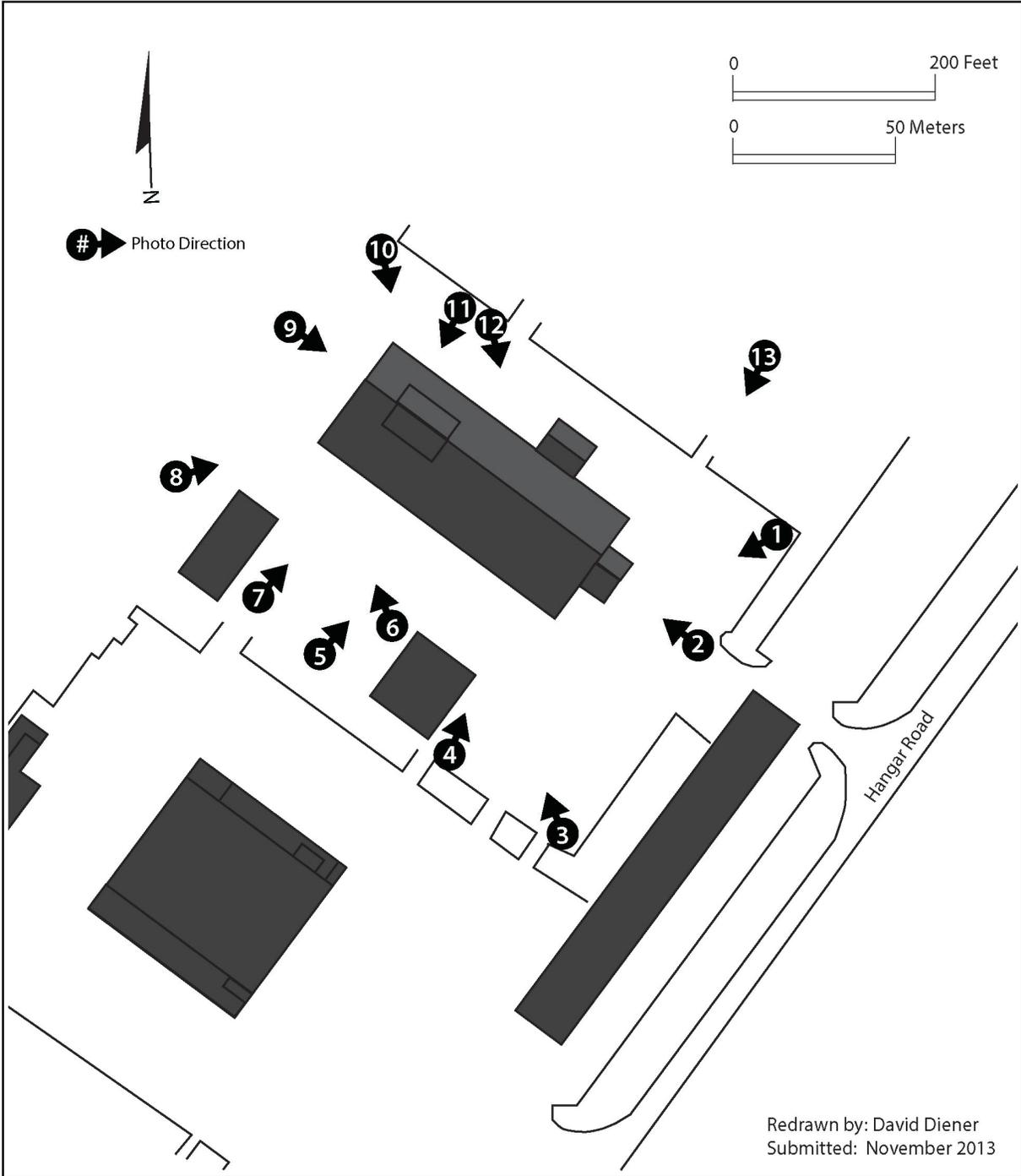
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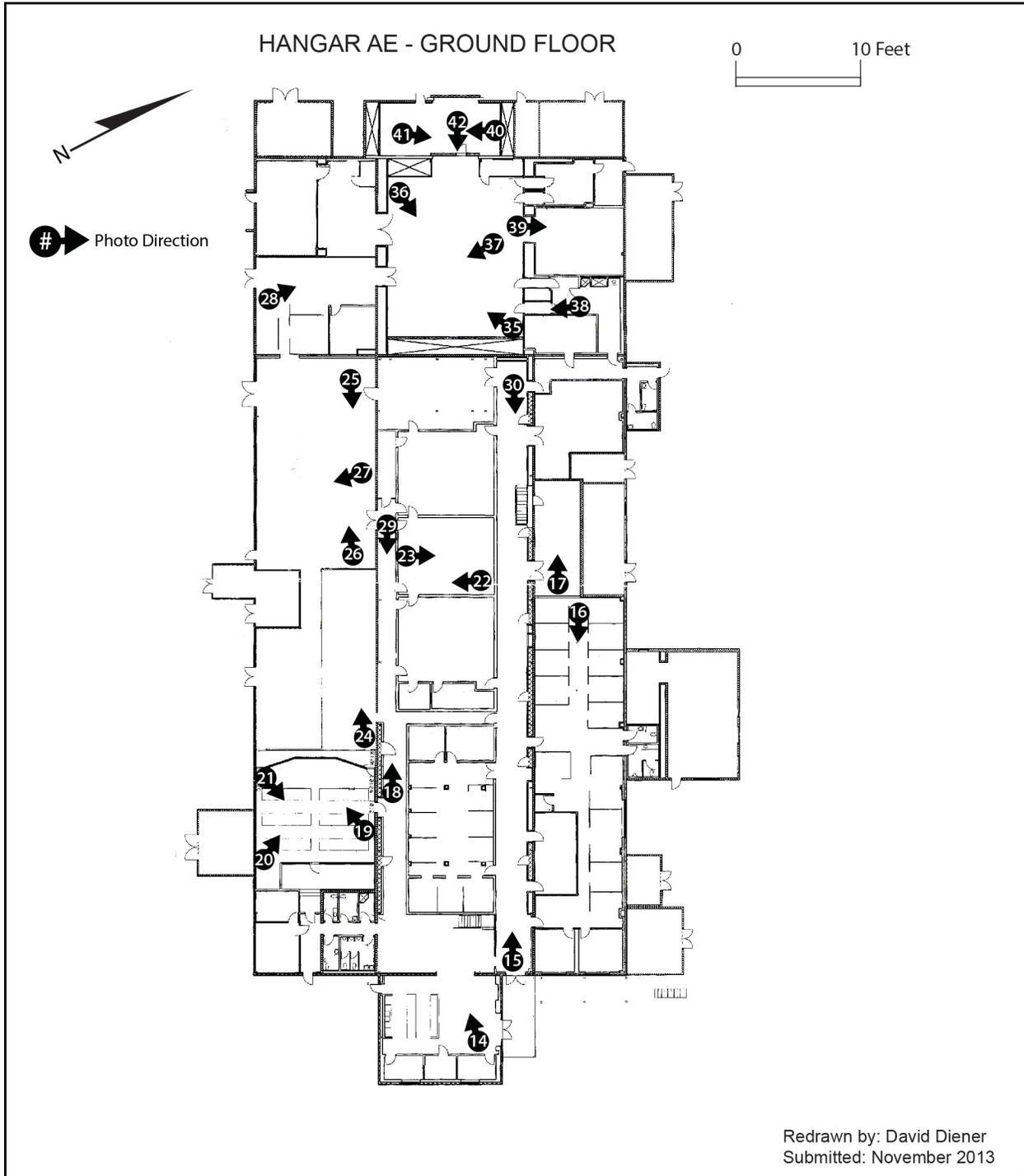
APPENDIX:

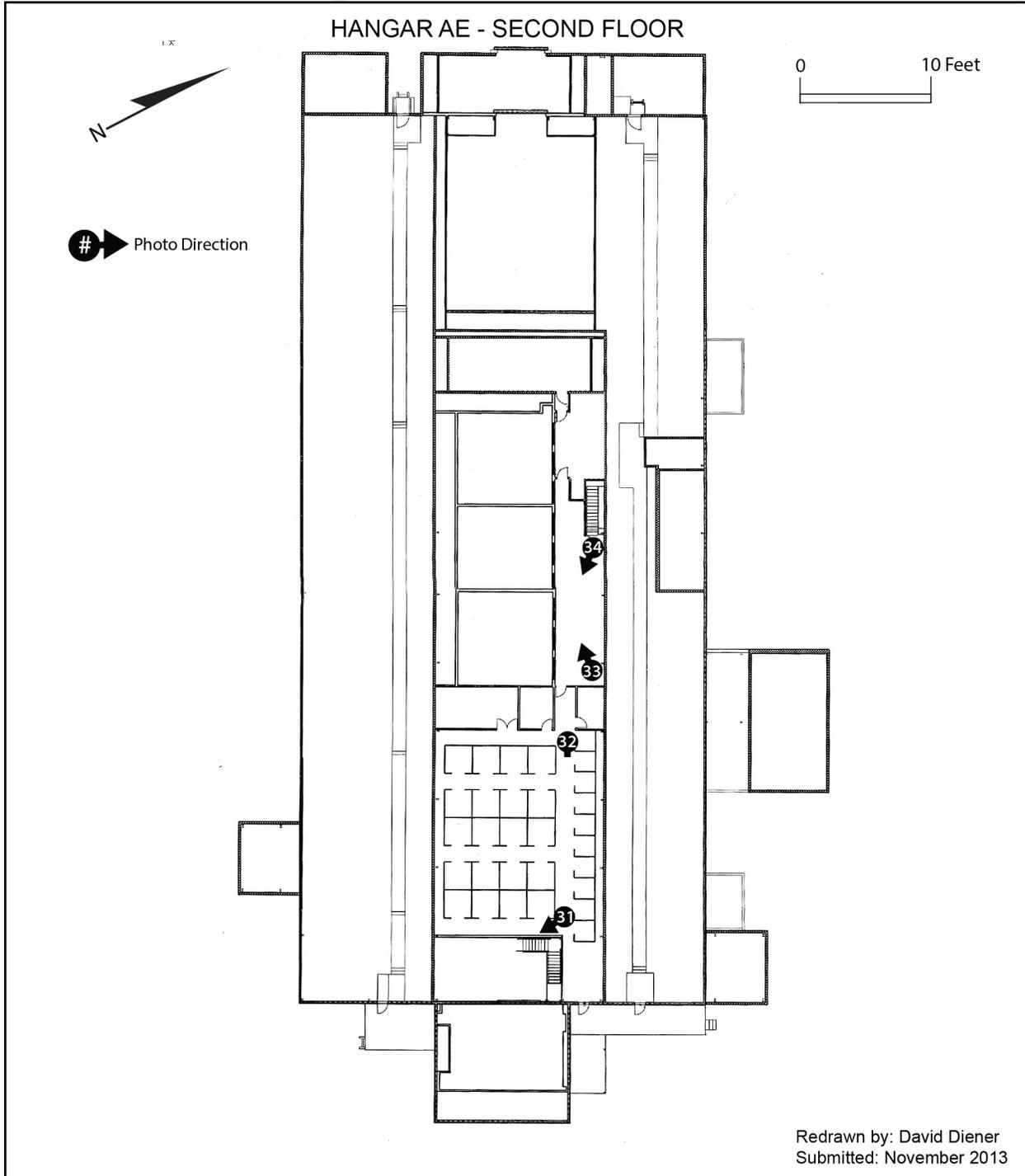
PHOTO LOCATION MAPS

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David Diener, Photographer

March, 2013

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S AND HANGAR AF IN BACKGROUND, VIEW SOUTHWEST.

FL-8-B-2            EXTERIOR VIEW OF EAST ELEVATION, VIEW NORTHWEST.

FL-8-B-3            EXTERIOR OBLIQUE, VIEW NORTHWEST.

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4), VIEW NORTHEAST.

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- FL-8-B-44      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; SEPTEMBER 23, 1959 BY HARDWICK & LEE ARCHITECTS FOR U.S. ARMY CORPS OF ENGINEERS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MISSILE ASSEMBLY BUILDING 'A-E', FOUNDATION PLAN & DETAILS."
- FL-8-B-45      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; SEPTEMBER 12, 1960 BY HARDWICK & LEE ARCHITECTS FOR U.S. ARMY CORPS OF ENGINEERS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MISSILE ASSEMBLY BUILDING 'A-E', FLOOR PLAN & SCHEDULES."
- FL-8-B-46      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; SEPTEMBER 12, 1960 BY HARDWICK & LEE ARCHITECTS FOR U.S. ARMY CORPS OF ENGINEERS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MISSILE ASSEMBLY BUILDING 'A-E', ELEVATIONS & DETAILS."
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- FL-8-B-50      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; APRIL 1959 BY HARDWICK & LEE ARCHITECTS FOR U.S. ARMY CORPS OF ENGINEERS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MISSILE ASSEMBLY BUILDING 'A-E', PLUMBING DETAILS."
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- FL-8-B-52      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; JUNE 26, 1964 BY NASA; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "ASSEMBLY BUILDING 'AE', FIRST FLOOR PLAN ARCHITECTURAL."

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- FL-8-B-54      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; JUNE 26, 1964 BY NASA; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "ASSEMBLY BUILDING 'AE', DETAIL SECTIONS ARCHITECTURAL."
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- FL-8-B-57      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; MARCH 15, 1999 BY AJT & ASSOCIATES; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MODERNIZE LAUNCH VEHICLE DATA CENTER, CCAS HANGAR 'AE', FIRST FLOOR PLAN."

- FL-8-B-58      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; MARCH 15, 1999 BY AJT & ASSOCIATES; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MODERNIZE LAUNCH VEHICLE DATA CENTER, CCAS HANGAR 'AE', MEZZANINE FLOOR PLAN."
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- FL-8-B-60      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; MARCH 15, 1999 BY AJT & ASSOCIATES; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MODERNIZE LAUNCH VEHICLE DATA CENTER, CCAS HANGAR 'AE', BUILDING SECTIONS."
- FL-8-B-61      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; NOVEMBER 14, 2003 BY SPACE GATEWAY SUPPORT; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "MISSION DIRECTORS' CENTER REMODEL, CODE INFORMATION PLAN."
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- FL-8-B-63      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; FEBRUARY 15, 2008 BY JONES EDMUNDS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "HANGAR AE LOBBY RENOVATIONS PHASE I, COVER SHEET."
- FL-8-B-64      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; FEBRUARY 15, 2008 BY JONES EDMUNDS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "HANGAR AE LOBBY RENOVATIONS PHASE I, DRAWING INDEX, ABBREVIATIONS, AND GENERAL NOTES."
- FL-8-B-65      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; FEBRUARY 15, 2008 BY JONES EDMUNDS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "HANGAR AE LOBBY RENOVATIONS PHASE I, SECOND FLOOR PLAN - DEMOLITION AND NEW."
- FL-8-B-66      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; FEBRUARY 15, 2008 BY JONES EDMUNDS; DRAWINGS IN POSSESSION OF KENNEDY SPACE CENTER), "HANGAR AE LOBBY RENOVATIONS PHASE I, EXTERIOR ELEVATIONS."