CAPE CANAVERAL AIR FORCE STATION, BIOASTRONAUTICS OPERATIONAL SUPPORT UNIT
Cape Canaveral
Brevard County
Florida

HABS No. FL-583-A

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Buildings Survey
National Park Service
U.S. Department of the Interior
100 Alabama Street, SW
Atlanta, GA 30303

HISTORIC AMERICAN BUILDINGS SURVEY

CAPE CANAVERAL AIR FORCE STATION,
BIOASTRONAUTICS OPERATIONAL SUPPORT UNIT
HABS No. FL-583-A

Location: East of Hangar Road/Industry Road intersection
Cape Canaveral Air Force Station (CCAFS)
Cape Canaveral
Brevard County
Florida

The Bioastronautics Operational Support Unit (BOSU), Building No. 49635, is located within the Industrial Area of CCAFS, at latitude: 28.493801, longitude: -80.579505. These coordinates were obtained on September 17, 2012, through Google Earth™. The coordinates datum are North American Datum 1983.

Present Owner/ Occupant: National Aeronautics and Space Administration (NASA)
Kennedy Space Center (KSC), FL 32899-0001

Present Use: Laboratory facility for KSC Environmental Health/Health Physics groups

Significance: The BOSU is considered individually eligible for listing in the National Register of Historic Places under Criterion A, in the area of Space Exploration. Its period of significance is considered to be from 1964, when it was designed, through 1972, when the United States Air Force (USAF) transferred the building to NASA for use as an occupational health clinic. Because the facility has achieved significance within the past fifty years, Criteria Consideration G applies. It primarily derives its significance from the surgical suite, located at the north end of the building, which retains its original layout, surface finishes, and furnishings.

The BOSU demonstrates one of the roles the USAF played in the United States (U.S.) Manned Space Program. The BOSU was constructed by the USAF to house the Launch Site Recovery Command Post for the Launch Site Recovery Team (LSRT), as well as a completely equipped surgical suite. Although no emergencies ever occurred during a manned spaceflight launch, the BOSU housed a vital service to the U.S. Manned Space Program. In addition, it served as the location where the Apollo 1 astronauts were first taken following the fire within their capsule during a simulation at Launch Complex (LC) 34.

Historian: Patricia Slovinac, Architectural Historian
Archaeological Consultants, Inc. (ACI)
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Sarasota, Florida 34240

March 2013

Project Information: The documentation of the Cape Canaveral Air Force Station, Bioastronautics Operational Support Unit, was conducted in 2012 for KSC by ACI, under contract to InoMedic Health Applications (IHA), and in accordance with KSC's Programmatic Agreement Regarding Management of Historic Properties, dated May 18, 2009. The field team consisted of architectural historian, Patricia Slovinac (ACI), and independent photographer, Penny Rogo Bailes. Assistance in the field was provided by Barbara Naylor, KSC Historic Preservation Officer, and Nancy English, KSC Cultural Resource Specialist. The written narrative was prepared by Ms. Slovinac; it was edited by Joan Deming, ACI Project Manager; Elaine Liston, KSC Archivist; Ms. Naylor; Ms. English; and Jane Provancha, Environmental Projects-Manager, IHA. The photographs and negatives were processed by Zebra Color, Inc., an independent photography and processing studio.

The Scope of Services for the project, which was compiled based on the Programmatic Agreement, specified a documentation effort following HABS Level II Standards. Information for the written narrative was primarily gathered through informal interviews with current NASA and contractor personnel, the KSC Archives Department, the KSC Institutional Imaging Facility, the KSC Engineering Documents Center, the Air Force Space and Missile History Center, and various NASA center websites. In addition, the Patrick Air Force Base (AFB) Historian, the U.S. Army Corps of Engineers (ACOE) Jacksonville District Office, and the Society of U.S. Air Force Flight Surgeons were contacted; however, no relevant information was obtained. Selected drawings were provided by KSC's Engineering Documentation Center, which serves as the repository for all facility drawings. For the BOSU, this included the original as-built drawings, as well as drawings depicting major additions and modifications to the facility. It should also be noted that KSC does not periodically produce drawings of their facilities to show current existing conditions.

LIST OF ACRONYMS

ACI	Archaeological Consultants, Inc.
ACOE	Army Corps of Engineers
AFB	Air Force Base
AS	Apollo/Saturn
BOSU	Bioastronautics Operational Support Unit
CCAFS	Cape Canaveral Air Force Station
CSM	Command/Service Module
DoD	Department of Defense
EVA	Extravehicular Activity
ICBM	Intercontinental Ballistic Missile
IHA	InoMedic Health Applications
IRBM	Intermediate Range Ballistic Missile
ISS	International Space Station
KSC	Kennedy Space Center
LC	Launch Complex
LRST	Launch Recovery Support Team
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
SA	Saturn/Apollo
SSP	Space Shuttle Program
STS	Space Transportation System
U.S.	United States
USAF	United States Air Force
USSR	Union of Soviet Socialist Republics

Part I. Historical Information

A. Physical History:

1. **Date of erection:** The BOSU was constructed between March 1964 and February 1965.[1]

2. **Architect/Engineer:** The original building was designed by Steward-Skinner Associates, Miami, Florida, and the ACOE, Jacksonville, Florida.[2] The addition was completed by Architects in Association Rood & Zwick, of Cocoa, Florida.[3]

3. **Original and subsequent owners, occupants, uses:** The BOSU was originally owned by the USAF's Patrick AFB, and used as a hospital/surgical suite and an administrative office for the Gemini Launch Site Recovery Command Post/LRST. In 1972, the building was transferred to NASA KSC for use as an occupational health facility. At the time of documentation, the facility was being used as a health physics and environmental health laboratory.[4]

4. **Builder:** Not available. The consulted sources were unable to provide information on the construction contractor for the BOSU.

5. **Original plans and construction:** The original design of the BOSU was completed between 1963 and 1964; the drawings are dated January 1964. The facility was rectangular in plan, and one story in height. It was designed with a surgical suite at the north end and support areas at the south end.[5]

6. **Alterations and additions:** In 1975, the original computer room was subdivided into three rooms; by 1983, modifications were made to the original conference room, which decreased its square footage. In 1992, a 2,250-square foot, four-room addition was constructed at the south end of the facility.[6]

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[1] Patrick Air Force Base, *Chronology of Atlantic Missile Range and Air Force Eastern Test Range* (Florida: Patrick Air Force Base History Office, no date), 66, on file, Air Force Space & Missile Museum, CCAFS.
[2] Steward-Skinner Associates, "As Built Drawings: Bioastronautics-Operational Support Unit," July 1965, on file, KSC Engineering Documentation Center.
[3] Architects in Association Rood & Zwick, "Addition to Cape Dispensary Building No. 49365," July 1989, on file, KSC Engineering Documentation Center.
[4] NASA KSC, "Real property record, Building 49365," on file, KSC Real Property Office.
[5] Steward-Skinner Associates, "As Built Drawings."
[6] NASA KSC, "Building 49365;" Rood & Zwick, "Addition to Cape Dispensary."

B. Historical Context:

Circa 1963, the ACOE commissioned Steward-Skinner Associates, an architecture firm from Miami, Florida, to design the BOSU facility, to be located east of the Industry Road/Hangar Road intersection in the Industrial Area of CCAFS. Early design concepts placed the surgical suite at the north end, and offices, laboratories, and other support areas at the south end.[7] This concept was retained; however, the arrangement of the rooms was altered before the final drawings were produced (see Photo Nos. 46, 48). On February 27, 1964, the construction contract for the facility was let. Construction of the building began in March 1964; it was 93 percent complete by December of that year. The USAF and ACOE accepted the BOSU for beneficial occupancy on February 16, 1965.[8] The final inspection and acceptance of the facility occurred on April 30, 1965.[9]

Once constructed, the north end of the BOSU served as a hospital, with medical services provided by military doctors; an associated heliport was situated to the east.[10] The facility had areas for surgery, X-ray, ear and eye exams, and dental exams, and also hosted a five-week residency for nurses enrolled in the Aerospace Nursing Course of the USAF's Space Nursing Program.[11] At the south end of the facility were offices for the doctors, as well as laboratories. In addition, there was a computer complex where the Pan American weather group was stationed. This group monitored the weather during planned launch windows and sent weather balloons into the upper atmosphere to check weather conditions.[12]

The BOSU also housed the Launch Site Recovery Command Post, which was responsible for the LSRT, a twelve-man crew of specially trained medics supplied by the Department of Defense (DoD). For each manned spacecraft launch, the group was divided into three teams of four. In the case of an emergency during launch operations, the LSRT teams would recover the astronauts from the launch pad, carry them to safety, administer emergency medical assistance, and transport them to the BOSU, where doctors were capable of providing medical treatment to the astronauts within the surgical suite.[13]

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[7] Steward-Skinner Associates, "Bioastronautics-Operational Support Unit," January 1964, on file, KSC Archives Department.
[8] Patrick Air Force Base, *Chronology of Atlantic Missile Range*, 80. Beneficial occupancy means the owner, in this case the USAF, can occupy a building for its intended purpose prior to construction being complete.
[9] Steward-Skinner Associates, "As Built Drawings;" F.P. Stainback, "Transfer of MCF Construction, Bioastronautics Bldg & Comm & Elec Shop," no date, on file, KSC Archives Department, Voucher 67-1035.
[10] Patrick Air Force Base, *Chronology of Atlantic Missile Range*, 66.
[11] Barbara S. Czerwinski, Linda H. Plush, and Barbara K. Bailes, "Nurses' Contributions to the US Space Program," *AORN Journal*, May 2000, 1051-57, http://www.aornjournal.org/article/S0001-2092%2806%2961554-8/abstract.
[12] Norman Fields, personal communication (phone interview) with Patricia Slovinac (ACI), March 13, 2012, notes on file, ACI, Sarasota, Florida.
[13] "Angel of Mercy to the Astronauts," *Ebony*, June 1964, 48-54; NASA, "Gemini Contingency Information Plan, May 11, 1966," in *Exploring the Unknown, Selected Documents in the History of the U.S. Civil Space Program,*

In March 1965, the BOSU physicians performed the three pre-flight physicals for the Gemini III astronauts, Virgil I. "Gus" Grissom and John W. Young.[14] These physicals occurred ten days prior to liftoff, two days prior to liftoff, and on the morning of the flight. They included temperature, blood pressure, and weight checks; blood and urine analyses; skin examinations; and eye, ear, nose, and throat examinations.[15] In June, the pre-flight physicals for the Gemini IV crew were performed in the BOSU. No other flight crews would have their pre-flight exams in the BOSU.[16] However, the LSRT supported all manned Project Gemini flights; similar support was provided for the manned flights of the Apollo Program.

In January 1967, the BOSU supported its only emergency related to the U.S. Manned Space Program: the AS-204 Command Module fire at LC 34 that erupted during a simulation on January 27th. Just after midnight on January 28, the bodies of the three astronauts in the vehicle, Virgil I. "Gus" Grissom, Edward H. White II, and Roger B. Chaffee, were brought to the BOSU.[17] Here, military doctors conducted a preliminary post-mortem examination of each, including physical, microscopic, radiographic, and toxicological examinations. In addition, twenty-seven members of the Pad Safety Crew, who had suffered smoke inhalation, contusions, and abrasions, were examined at the BOSU; two were kept overnight for observation.[18]

On December 19, 1972, the same day as the landing of Apollo 17, ownership of the BOSU was officially transferred to NASA KSC and the facility became known as the Dispensary. At this time, the facility was being used by Pan American, NASA's contractor for medical and environmental health services per contract NAS10-7448. The building housed eighteen occupational medical and environmental health personnel, and seven employees of the U.S. Public Health Services, as well as an environmental monitoring group. The facility, capable of supporting medical exams and X-ray imaging, was anticipated to accommodate 1,110 patients each month.[19] The medical services were contained within the east side of the north area of the BOSU; the health physics operations were within the west side of the north area. The middle

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Volume VII: Projects Mercury, Gemini, and Apollo, edited by John M. Logsdon, 363-70 (Washington, DC: US Printing Office, 2008), http://history.nasa.gov/SP-4407vol7Chap1-Docs.pdf.

[14] Royce G. Olson, "Mission Support by the Department of Defense," *Gemini Summary Conference, February 1 and 2, 1967 [SP-138]* (Washington, DC: NASA, Office of Scientific and Technical Information, 1967).

[15] Dolores O'Hara, interview by Rebecca Wright, JSC Oral Historic Project. April 23, 2002, http://www.jsc.nasa.gov/history/oral_histories/OHaraDB/oharadb.htm; Dolores O'Hara, personal communication (email) with Patricia Slovinac, ACI, April 8, 2012, on file, ACI, Sarasota, Florida.

[16] Beginning with the Gemini V flight, all pre-flight physicals were conducted in the Operations and Checkout Building in the KSC Industrial Area. "Astronauts Checked in New Med Lab," *Spaceport News*, September 16, 1965, 3.

[17] On April 24, 1957, NASA officially designated the AS-204 test 'Apollo 1'.

[18] Apollo 204 Review Board, "Appendix D," *Report of Apollo 204 Review Board to the Administrator, National Aeronautics and Space Administration* (Washington, DC: NASA Headquarters, 1967), http://history.nasa.gov/Apollo204/appendices/app_d_11.pdf; NASA KSC, "AS 204 Release #3," news release, January 27, 1967, Sweetsir Collection, Box 37A.1, Folder 14, Kennedy Space Center Archives Department, Florida.

[19] Raymond L. Clark, "Memo to NASA Headquarters," October 5, 1972, Facility No. 49635, on file, Real Property Office, Kennedy Space Center; NASA KSC, "Building 49365."

area of the building held office spaces for the environmental health group, which supported manned and unmanned launches by NASA, as well as military missions operated by CCAFS.[20]

At the south end, a quarantine lab was established circa 1974 by the environmental monitoring group,[21] which verified the cleanliness of both unmanned and manned spacecraft set to launch. The process included testing air and surface samples of the interior of the vehicle taken by laboratory technicians.[22] In particular, a Planetary Protection Laboratory was established for NASA Jet Propulsion Laboratory's Viking missions to Mars. This lab validated the sterilization cycle of the Viking spacecraft, to ensure the number of microorganisms on the spacecraft met Planetary Protection requirements to prevent contamination of Mars by organisms from Earth.[23] Similar activities were conducted through the lunar missions of Apollo, and throughout the Space Shuttle Program (SSP); the lab created microbial profiles of the High Bay in the Operations & Checkout Building and Vehicle Assembly Building in preparation of payloads that were to be carried aboard the Shuttle.[24]

In 1975, the original computer room was subdivided into three rooms; by 1983, modifications were made to the original conference room, which decreased its square footage.[25] In 1980, the environmental health unit moved from the BOSU to KSC; the medical clinic and environmental monitoring group remained. As the SSP gained momentum, the environmental monitoring group conducted environmental surveys and wildlife surveys throughout KSC.[26] These surveys included geographic information systems mapping, weather analysis, attempts to predict the direction of the launch cloud and how its concentration of acid would affect plants and wildlife, and the set-up of drinking water tanks on the Shuttle. The laboratory also tested the drinking water throughout CCAFS and KSC, assisted with crop growing experiments, integrated life sciences experiments on the Shuttle, and provided ground control for those experiments. Also included in the south area was a clinical microbiology lab, which would analyze samples from the astronauts, and provide occupational health wellness checks.[27]

In 1992, a 2,250-square foot, four-room addition was constructed at the southeast end of the facility.[28] One of the rooms was a mechanical equipment room; the other three formed a suite of laboratories. Within this suite, one room served as a generic work area, one was an organic

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[20] Bob Martin, personal communication (email) with Patricia Slovinac (ACI), July 9, 2012, on file, ACI, Sarasota, Florida.
[21] NASA KSC, "Modifications for Planetary Quarantine Lab," September 1974, on file, KSC Engineering Documentation Center.
[22] Fields, phone interview.
[23] Sheryl Bergstrom, personal communication (email) with Bob Martin, July 8, 2012, on file, ACI, Sarasota, Florida.
[24] Fields, phone interview; Bergstrom, email.
[25] NASA KSC, "Building 49365."
[26] Martin, email.
[27] Randy Sumner, personal communication (phone interview) with Patricia Slovinac (ACI), February 24, 2012, notes on file, ACI, Sarasota, Florida.
[28] NASA KSC, "Building 49365."

chemistry lab, and the third was an inorganic chemistry lab.[29] Since the 1992 addition, no other alterations have been made to the BOSU that have changed its layout. However, some of the rooms received new paint and carpeting, in place of the original floor tiles.

In 2003, the medical clinic was removed from the BOSU, and the health physics group moved back to the building, taking the entire north area; at this time, the facility was renamed the Environmental Health/Health Physics Facility.[30] At the time of documentation, the north area was being used for analyzing radioactive materials, and the south end contained microbiology and chemistry labs, as well as rooms for processing Self Contained Atmospheric Protective Ensemble (SCAPE) equipment.[31]

Cape Canaveral Air Force Station

With the increasing concern over the Union of Soviet Socialist Republic's (USSR) missile and nuclear development after World War II, the DoD created the Committee on Long Range Proving Grounds in October 1948. One of their first duties was to select a suitable missile test site. Four locations were examined, including an area near Washington State, with tracking stations in the Aleutian Islands of Alaska; the Naval Air Missile Test Center at Point Mugu, California; the Naval Air Station at El Centro, California; and Cape Canaveral, Florida, which was near the existing Banana River Naval Air Station (now Patrick AFB).[32] Cape Canaveral was eventually selected for several critical reasons. First, the Government already owned land at the Cape, and the undeveloped nature of the remaining land made it less expensive to acquire. In addition, its isolated location enhanced security for research and development. Furthermore, the launch area was accessible via water, easing the logistics of transporting heavy rockets and building supplies. Operationally, missiles could be launched over the Atlantic Ocean and tracked from islands, such as Bermuda. Also, Florida's temperate climate allowed year round operation of a missile site.[33]

In May 1949, President Harry S. Truman signed the legislation to officially establish the Joint Long Range Proving Ground at Cape Canaveral with Patrick AFB as the support base. Although

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[29] Sumner, phone interview.
[30] Martin, email; NASA KSC, "Building 49365."
[31] Rodney Nickell, personal communication (informal interview) with Patricia Slovinac (ACI), February 15, 2012, notes on file, ACI, Sarasota, Florida; Carlton Hall, personal communication (informal interview) with Patricia Slovinac (ACI), February 15, 2012, notes on file, ACI, Sarasota, Florida.
[32] Harry A. Butowsky, *National Historic Landmark Federal Agency Nomination, Cape Canaveral Air Force Station* (Washington, DC: National Park Service, 1983), 8-2. For ease of discussion, the name Patrick AFB will be used throughout the context.
[33] David Barton and Richard S. Levy, *An Architectural and Engineering Survey and Evaluation of Facilities at Cape Canaveral Air Force Station, Brevard County, Florida* (Resource Analysts, Inc., March 16, 1984), 3-4; Charles D. Benson and William B. Faherty, *Gateway to the Moon: Building the Kennedy Space Center Launch Complex* (Gainesville, FL: University Press of Florida, 2001), 1; Butowsky, *Cape Canaveral Air Force Station*, 8-2; Cliff Lethbridge, "The History of Cape Canaveral," *Spaceline.org*, 2000.

the entire facility was initially under the cooperative use of the Army, Navy, and USAF, the USAF, by a directive of the DoD, ultimately assumed responsibility for the Range. Subsequently, on May 16, 1950, the Cape Canaveral Missile Range was redesignated as the Long Range Proving Ground, the first of many subsequent name changes.[34]

Construction at the southern tip of Cape Canaveral commenced in July 1950, under the direction of the Jacksonville District of the ACOE. These activities included the construction of Port Canaveral and LCs 1, 2, 3, and 4. Although not fully completed, the Army conducted the first successful launch, a Bumper rocket from LC 3, on July 24, 1950. Construction of LC 3 was completed by 1951. By 1952, LC 4 was finished, followed closely by LC 1 and LC 2 in 1953.[35]

During the late 1940s and early 1950s, USAF activities at CCAFS focused on winged cruise missile research and development as a deterrent force in the weapons race between the U.S. and the USSR. The earliest launch pads (LCs 1, 2, 3, 4, 9, 10, 21, and 22), located at the southern tip of the CCAFS, were used for firing experimental winged missiles including the Lark, Matador, Navaho, Snark, Bomarc, Bull Goose, and Mace. Support buildings, including a communications building, a water plant, a fire fighting unit, electrical substations, a skid strip for the landing and reuse of the missiles, and Hangars C and O, were constructed near these original launch pads.[36]

In 1952, the USSR detonated their first thermonuclear device. Additionally, intelligence reports indicated that they were also developing long-range missiles. Not to be outdone, the U.S. began to advance their ballistic missile development, and by 1955, USAF officials convinced President Eisenhower to assign the intercontinental ballistic missile (ICBM) development program the highest national priority. Subsequently, the DoD approved two intermediate range ballistic missile (IRBM) programs: the USAF's Thor Program and the Army/Navy's Jupiter Program. Both were developed simultaneously and were assigned an equal national priority.[37]

The drive to develop more accurate and powerful weapons led to the construction of numerous additional launch complexes along the CCAFS. Many of the earliest launch complexes were adapted to new uses, such as support structures, for these facilities. Since the Government maintained programs for both ICBMs and IRBMs, launch complexes for both types of missiles were constructed at CCAFS. Over time, the southern area of the CCAFS was developed for launching IRBMs (Redstone, Pershing, Polaris/Poseidon, and Thor) and included LCs 5, 6, 17, 18, 25, 26, 29, and 30; LCs 9 and 10 in this area were used for the Navaho winged

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[34] Lethbridge, "Cape Canaveral." For ease of reference, it will be referred to as CCAFS (Cape Canaveral Air Force Station) throughout the text.
[35] Butowsky, *Cape Canaveral Air Force Station*, 7-3 and 7-4; Lethbridge, "Cape Canaveral."
[36] Barton and Levy, *Cape Canaveral Air Force Station*, 6, 25; E.R. Bramlitt, *History of Canaveral District 1950-1971* (South Atlantic Division, U.S. Army Corps of Engineers, 1971); Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, DC: USAF, Office of Air Force History, 1990), 239.
[37] Neufeld, *Development of Ballistic Missiles*, 143-48, 242.

intercontinental missile. The northern area of the CCAFS was developed for launching ICBMs and space launch vehicles (Atlas, Titan, Saturn) and included LCs 11, 12, 13, 14, 15, 16, 19, 20, 34, 36, and 37.[38]

In 1955, President Dwight D. Eisenhower announced that the U.S. would launch an unmanned satellite as part of the nation's participation in the International Geophysical Year, which was planned for July 1957 through December 1958. Initially, the U.S. Navy's Project Vanguard was chosen to complete this task. Although the Vanguard made use of the reliable Viking rocket, the first test flight did not occur until December 8, 1956, with the second test flight launching on May 5, 1957; both lifted off from CCAFS. After the successful Soviet launches of Sputnik I (October 4, 1957) and Sputnik II (November 3, 1957), and the failure of the third Vanguard test flight, President Eisenhower and the DoD approved the Army's Explorer Project, which was under its Development Operations Division led by Dr. Wernher von Braun.[39] The U.S. successfully entered the space race with the launch of the Army's scientific satellite Explorer I from CCAFS on January 31, 1958, using a four stage Jupiter C missile named Juno I.[40]

Realizing the military's involvement in the space program would jeopardize the goal of using space for peaceful purposes, the President's Science Advisory Committee urged that a centralized agency be created to oversee the scientific exploration of space. Thus, NASA was established as a civilian agency with the mission of carrying out scientific aeronautical and space exploration, both manned and unmanned.[41] Forming the core of this new agency was the National Advisory Committee for Aeronautics (NACA), which had been a leader in flight research since 1915. NACA also had long working relationships with the different U.S. military branches, and the ability to take that research and apply it to civilian applications. Above all, the group had the advantage of a "peaceful, research-oriented image."[42]

Soon after the creation of NASA in 1958, Navy personnel and facilities associated with Project Vanguard, and over 400 scientists from the Naval Research Laboratory, were reassigned to NASA, as was the Army-affiliated Jet Propulsion Laboratory of the California Institute of Technology. Initially working with NASA as part of a cooperative agreement, President

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[38] Barton and Levy, *Cape Canaveral Air Force Station,* 4, 9; Denise P. Messick, Cynthia G. Rhodes, and Charles E. Cantley, *45th Space Wing Cultural Resource Management Plan*, Technical Report No. 386 (Stone Mountain, GA: New South Associates, 1996), 95; James N. Gibson, *Nuclear Weapons of the United States: An Illustrated History* (Atglen, PA: Schiffer Publishing, Ltd., 2000).
[39] Benson and Faherty, *Gateway to the Moon*, 1-2.
[40] Roger D. Launius, *NASA: A History of the U.S. Civil Space Program* (Malabar, FL: Krieger Publishing Company, 2001), 21-8.
[41] R. Cargill Hall, "Civil-Military Relations in America's Early Space Program." In *The U.S. Air Force in Space: 1945 to the 21st Century, Proceedings of the Air Force Historical Foundation Symposium, Andrews AFB, Maryland, September 21-22, 1995*, ed. R. Cargill Hall and Jacob Neufeld (Washington, DC: USAF, USAF History and Museums Program, 1998), 30; Barton and Levy, *Cape Canaveral Air Force Station*, 20.
[42] Roger E. Bilstein, *Testing Aircraft, Exploring Space: An Illustrated History of NACA and NASA* (Baltimore, MD: The Johns Hopkins University Press, 2003), 50-58.

Eisenhower officially transferred a large portion of the Army's Development Operations Division, including the team led by von Braun, to NASA in March 1960. At the same time, Eisenhower named the Huntsville NASA installation the George C. Marshall Space Flight Center, and designated the Missile Firing Laboratory at CCAFS as its Launch Operations Directorate.

Project Mercury

Project Mercury was NASA's first manned spaceflight program, and was active from December 1958 through May 1963. The goals of the project were to "(1) Place a manned spacecraft in orbital flight around the Earth. (2) Investigate man's performance capabilities and his ability to function in the environment of space. (3) Recover the man and the spacecraft safely."[43] Over the course of the program, NASA successfully designed a vehicle that could survive the conditions of space, as well as atmospheric reentry; hired and trained the first U.S. astronauts; developed a worldwide tracking network; created mission control procedures that became the protocol for all future programs; and launched twenty-six missions (manned and unmanned).

All twenty-six missions launched as part of Project Mercury occurred between August 1959 and May 1963. Each of these flights fell into one of three mission categories: research and development, qualification, or manned. Of the twenty-six missions, seven were considered research and development, thirteen were classified as qualification, and six were manned flights. Seventeen of the missions, including all of the manned flights, launched from CCAFS; the remaining nine lifted-off from Wallops Island, Virginia. During this time, seven missions launched from LC 5, including the first U.S. suborbital ballistic flight of Alan Shepard (May 5, 1961) with a Redstone rocket, and ten launched from LC 14, including the first U.S. orbital flight of John Glenn (February 20, 1962) with an Atlas rocket. The CCAFS also provided facilities for the tracking network, such as the original Mercury Control Center and Hangar S for simulators and astronaut quarters. Despite the pace of Project Mercury, the U.S. was unable to beat the Russians, who had successfully launched cosmonaut Yuri Gagarin on April 12, 1961.

Project Gemini

Project Gemini unofficially got its start in May 1959, when NASA Headquarters' Research Steering Committee for Manned Space Flight, commonly known as the Goett Committee after its leader Harry Goett, met for the first time to examine follow-up programs for Project Mercury.[44]

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[43] Walter C. Williams, et al., "Project Review," in *Mercury Project Summary Including the Results of the Fourth Manned Orbital Flight, May 15 and 16, 1963 [SP-45]* (Washington, DC: NASA, Office of Scientific and Technical Information, 1963), 2.

[44] James M. Grimwood and Barton C. Hacker, *Project Gemini: A Chronology* (Washington, DC: NASA, Office of Scientific and Technical Information, 1969), http://history.nasa.gov/SP-4002/contents.htm; Courtney G. Brooks, James M. Grimwood, and Loyd S. Swenson, Jr., *Chariots for Apollo: The NASA History of Manned Lunar Spacecraft to 1969* (Mineola, NY: Dover Publications, Inc., 2009).

Initial ideas included a two-man capsule, extended duration flights (up to two weeks), a manned lunar expedition, and a manned orbiting laboratory. Although lunar exploration became the major focus, the Goett Committee noted that there should be an intermediate step between Project Mercury and a lunar mission.[45]

In January 1961, the focus of Apollo shifted from a lunar reconnaissance to a manned lunar landing. Over the next several months, NASA conducted studies on the concepts of Earth orbit rendezvous, lunar orbit rendezvous, and direct ascent to determine the best approach for reaching the Moon's surface. In the meantime, the leaders of the Space Task Group saw both rendezvous and extended time in orbit as possible focal points for a follow-on program to Project Mercury.[46]

These initial ideas culminated in a "Preliminary Project Development Plan for an Advanced Manned Space Program Utilizing the Mark II Two Man Spacecraft," issued on August 14, 1961. This plan outlined six objectives, which were to be achieved in ten flights between March 1963 and September 1964. The six goals included long-duration flights, a study of the Van Allen radiation belts, controlled landing, rendezvous and docking, astronaut training, and extensive use of vehicles and equipment already on hand.[47] On October 27, 1961, a revised plan was issued, which retained all the original goals except for the Van Allen Study and the focus on using existing hardware; the program also was extended to twelve flights. Further revisions and negotiations with the DoD delayed the project, and finally, on December 8, 1961, NASA approved the final "Project Development Plan for an Advanced Manned Space Program Utilizing the Mark II Two Man Spacecraft." On January 3, 1962, the new program was officially redesignated Project Gemini.[48]

As the intermediate step between Project Mercury and the Apollo Program, the primary objective of Project Gemini was to prepare for a lunar landing. Its established goals were to keep a two-man crew in space for up to fourteen days; rendezvous and dock with orbiting vehicles and maneuver the combination; and to perfect methods of entering the atmosphere and landing.[49] In addition, NASA desired to gain additional information on the effects of weightlessness on humans; and the Flight Operations Division planned on honing new skills in mission planning and control.

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[45] Barton C. Hacker and James M. Grimwood, *On the Shoulders of Titans: A History of Project Gemini* (Washington, DC: NASA, Office of Scientific and Technical Information, 1977).
[46] Hacker and Grimwood, *On the Shoulders of Titans.* The Space Task Group was the initial office created by NASA to operate its manned spaceflight program; it was stationed at the Langley Aeronautical Laboratory (now Langley Research Center) in Hampton, Virginia. As the space program grew, the Space Task Group became an autonomous NASA center, named the Manned Spacecraft Center, and was moved to Houston, Texas. Following the death of President Lyndon B. Johnson, it received its current name: the Lyndon B. Johnson Space Center (JSC).
[47] Hacker and Grimwood, *On the Shoulders of Titans.*
[48] Grimwood and Hacker, *Project Gemini.*
[49] NASA KSC, "Gemini Goals," 2000, http://www-pao.ksc.nasa.gov/kscpao/history/gemini/gemini-goals.htm.

Altogether, Project Gemini flew twelve missions, all of which launched from LC 19 at CCAFS. The first two missions were unmanned development flights. The focus of Gemini I, launched April 8, 1964, was to prove that the Titan II could successfully launch the Gemini spacecraft and put it in orbit.[50] Gemini II, which occurred on January 19, 1965, had as its major objectives demonstrating the adequacy of the spacecraft reentry module's heat protection, the structural integrity of the spacecraft from liftoff through reentry, and the satisfactory performance of spacecraft systems.[51]

The first manned mission, Gemini III, occurred on March 23, 1965, with astronauts Virgil I. “Gus” Grissom as command pilot and John W. Young as pilot. This three-orbit mission focused on testing the maneuverability of the spacecraft, as Grissom and Young changed the shape of their orbit, shifted from their orbital plane, and dropped to a lower altitude by firing the vehicle’s thrusters.[52] The launch of Gemini IV on June 3, 1965, marked the beginning of the first four-day flight of the U.S. Manned Space Program. Initially, the astronauts, James A. McDivitt and Edward H. White II, were to fly in formation with the second stage of the Titan II booster after separation. The attempt was unsuccessful, as the astronauts proved that the intended method, aiming the thrusters towards the target, would not work. However, during the mission, White successfully completed the first extravehicular activity (EVA), or spacewalk, by an American.

Gemini V, launched August 21, 1965, was an eight-day mission conducted by L. Gordon Cooper, Jr. and Charles “Pete” Conrad, Jr. Scheduled to perform a practice rendezvous with a “pod,” electrical problems forced a cancellation of the experiment. Instead, Cooper and Conrad maneuvered the vehicle to a predetermined position, in effect completing a “phantom rendezvous.”[53] The goal of Gemini VI, scheduled to launch in October 1965, was to be the first rendezvous and docking mission of the program. The mission plan called for the launch of an unmanned Agena target vehicle by an Atlas rocket, followed by the launch of the manned Gemini vehicle. The astronauts, Walter M. Schirra, Jr. and Thomas P. Stafford, Jr., would catch up to the Agena target from a lower orbit, and then manipulate their vehicle for rendezvous. On October 25, 1965, the Agena/Atlas combination was launched from LC 14 at CCAFS; however, shortly afterwards, mission control lost all telemetry signals from Agena and cancelled the launch of Gemini VI. Although the mission was considered a failure, three days later with the approval of the White House, NASA announced that the mission would be redesignated Gemini VI-A and would rendezvous with another manned vehicle, Gemini VII.[54]

On December 4, 1965, Gemini VII launched with astronauts Frank Borman and James A. Lovell, Jr. for a fourteen-day mission, meant to solve problems of long-duration spaceflight. For eleven days, Borman and Lovell performed various in-flight experiments, including the evaluation of a

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[50] Hacker and Grimwood, *On the Shoulders of Titans.*
[51] Grimwood and Hacker, *Project Gemini.*
[52] Grimwood and Hacker, *Project Gemini.*
[53] Grimwood and Hacker, *Project Gemini.*
[54] Grimwood and Hacker, *Project Gemini;* Hacker and Grimwood, *On the Shoulders of Titans.*

new, lightweight spacesuit. On December 15, Gemini VI-A launched from CCAFS and proceeded to track down the orbiting Gemini VII vehicle. Rendezvous was completed that afternoon, when Schirra piloted his capsule to within 1' of the other, and the two flew in formation around each other for five hours. Gemini VI-A landed on December 16, followed two days later by Gemini VII.[55]

Gemini VIII, with astronauts Neil A. Armstrong and David R. Scott, launched on March 16, 1966; less than six hours after launch, it became the first vehicle to rendezvous and dock to a prelaunched Agena target vehicle. Unfortunately, one of Gemini's thrusters became stuck causing the docked vehicles to roll continuously. Armstrong undocked his vehicle from the Agena, but could only fix the thruster by using the reentry control thrusters; thus, Gemini VIII was forced to make an emergency return to Earth just ten hours after launch. Gemini IX, which launched with Thomas P. Stafford, Jr. and Eugene A. Cernan on June 3, 1965, was supposed to have docked with a modified Agena, but the failed release of its protective shroud caused a cancellation of the objective.[56]

Gemini X launched on July 18, 1966, carrying astronauts John W. Young and Michael Collins. During their four-day mission, Young and Collins rendezvoused and docked with their Agena target in low orbit and then maneuvered their spacecraft to a higher orbit to rendezvous with the Agena target from Gemini VIII. Gemini XI, with Charles "Pete" Conrad, Jr. and Richard F. Gordon, Jr., launched on September 12, 1966. The astronauts rendezvoused and docked with their target vehicle eighty-five minutes after launch. Gemini XII, the last mission of the program, launched on November 11, 1966, with astronauts James A. Lovell, Jr. and Edwin E. "Buzz" Aldrin, Jr. The four-day mission incorporated a rendezvous and docking task with an Agena and three EVAs.[57]

The Apollo Program

The Apollo Program had unofficially begun on February 5, 1959, when NASA established the Working Group on Lunar Exploration to formulate a lunar exploration program. Subsequently, a Research Steering Committee was created, which included personnel from the various NASA centers. At its first meeting in May 1959, the committee prioritized various aspects of a space program, which included a manned lunar landing and return to Earth. The concept was further discussed at the committee's second meeting (June 1959) and at its third meeting (December 1959). By the following January (1960), enough progress had been made to bring about the suggestion of a formal name, "Apollo," for the new program, with the goal of landing astronauts on the Moon and returning them safely to Earth. T. Keith Glennan, NASA Administrator, approved the name on July 25, 1960, and it was subsequently announced at the first NASA-

[55] Grimwood and Hacker, *Project Gemini.*
[56] Grimwood and Hacker, *Project Gemini.*
[57] Grimwood and Hacker, *Project Gemini.*

Industry Program Plans Conference three days later. On September 1, 1960, the STG officially created the "Apollo Project Office."[58]

Altogether, the Apollo Program flew thirty-two missions, including the initial research/development and qualification flights, the lunar flights, the Skylab application, and the Apollo-Soyuz Test Project. Three different launch complexes were used: LC 34 (seven launches) and LC 37 (eight launches) at CCAFS, and LC 39 (seventeen launches; twelve from Pad A and five from Pad B) at KSC. Of the total thirty-two flights, fifteen were manned, and of the seven attempted lunar landing missions, six were successful. No major launch vehicle failures of either the Saturn IB or Saturn V occurred; however, there were two major Command/Service Module (CSM) failures, one on the ground (Apollo 1) and one on the way to the Moon (Apollo 13).[59]

The first four test flights of the Apollo Program (Saturn/Apollo [SA]-1 through SA-4) were launched from LC 34 and flew suborbital trajectories utilizing the Saturn I Block I vehicle. These flights verified the aerodynamics and structure of the launch vehicle, performed scientific experiments known as Project High Water I and Project High Water II, and tested an "engine-out" contingency, in which the fuel was rerouted from the failed engine to the seven remaining engines.[60]

The next phase of testing utilized the Block II configuration of the Saturn I vehicle. All six of these flights were launched from LC 37, since LC 34 was being modified for the assembly, checkout, and launch of the larger, more powerful Saturn IB vehicle. The first flight, SA-5, launched on January 24, 1964, was the first orbital flight of the Apollo Program, as well as the first to test a fully-fueled second stage. The next two flights, SA-6 (May 28, 1964) and SA-7 (September 18, 1964), carried boilerplate CSMs to test telemetry and various systems, as well as the Launch Escape System. Due to the success of these two flights, the next three were used to carry satellites into space.[61]

The first test flight using the Saturn IB vehicle, designated Apollo/Saturn 201 (AS-201), launched from LC 34 on February 26, 1966, carrying the first true spacecraft on a suborbital

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[58] Ivan D. Ertel and Mary Louise Morse, *The Apollo Spacecraft: A Chronology, Volume 1* (Washington, DC: NASA, Scientific and Technical Information Office, 1969), http://www.hq.nasa.gov/office/pao/History/SP-4009/contents.htm#Volume%20I.

[59] NASA, *Facts: John F. Kennedy Space Center,* 1994, 82.

[60] These experiments created artificial clouds to provide data on atmospheric physics. Although the vehicle tests were successful, the experiments produced questionable results. Robert Godwin, *Project Apollo: The Test Program* (Burlington, Ontario: Apogee Books, 2006), 4; Ertel and Morse, *A Chronology, Volume 1*; Mary Louise Morse and Jean Kernahan Bays, *The Apollo Spacecraft: A Chronology, Volume 2* (Washington, DC: NASA, Scientific and Technical Information Office, 1973), http://www.hq.nasa.gov/office/pao/History/SP-4009/contents.htm#Volume%20II.

[61] SA-9, carrying Pegasus 1, was launched on February 16, 1965; SA-8 launched on May 25, 1965, with Pegasus 2; and SA-10 launched on July 30, 1965, with Pegasus 3. Godwin, *The Test Program*, 5-6, 16-24; Morse and Bays, *A Chronology, Volume 2*; Brooks and Ertel, *A Chronology, Volume 3*.

flight to test its heat shield. Two more unmanned flights followed to test the instrumentation unit and the behavior of the fuel in the vehicle's second stage. AS-202 also subjected the Command Module to the full force of re-entry for the first time. The fourth scheduled flight, set to launch from LC 34 in February 1967, was to be the first manned mission of the Apollo Program. During a countdown simulation on January 27, 1967, the Command Module caught fire on the launch pad, killing astronauts Virgil I. "Gus" Grissom, Edward H. White II, and Roger B. Chaffee. The event was later commemorated as Apollo 1.[62]

Following the fire and subsequent modifications to the spacecraft, NASA conducted three additional unmanned Earth orbital missions to continue verification testing of the Apollo-Saturn combination, and to begin testing of the Lunar Module. Apollo 4 was launched on November 9, 1967. This flight was the first to use the Saturn V vehicle, and thus, the first to launch from the new LC 39, Pad A, at KSC. Apollo 5 launched on January 22, 1968, from LC 37 carrying the first Lunar Module into space for verification tests. Apollo 6 was the final unmanned mission of the Apollo Program; it launched on April 4, 1968, from LC 39, Pad A.[63]

Although still considered part of the Apollo Program's testing phase, the October 11, 1968, Apollo 7 launch from LC 34 was the first manned mission, which placed astronauts into an Earth orbit for ten days using a Saturn IB vehicle. The crew, Walter M. Schirra, Jr., Donn F. Eisele, and Walter Cunningham, tested the CSM and their guidance and control systems, the instrument unit, the spacecraft lunar adapter, the new spacesuit design, food supplies and work routines. During this flight, the astronauts separated the CSM from the second stage in order to practice rendezvous operations with the booster. The spacecraft and astronauts returned to Earth on October 22, after successfully completing all goals of the mission.[64]

The next mission, designated Apollo 8, launched on December 21, 1968, from LC 39, Pad A, and became the first manned flight to use the Saturn V vehicle. It was the first mission to reach the Moon, which it orbited ten times before returning to Earth. Apollo 9, which launched on March 3, 1969, from LC 39, Pad A, remained in a low-Earth orbit, where its crew, James A. McDivitt, Russell L. "Rusty" Schweickart, and David R. Scott, performed the first EVA of the Apollo Program and the first docking of the Lunar and Command Modules. Apollo 10 was the "final dress rehearsal" for landing on the Moon. Launched on May 18, 1969, from LC 39, Pad B, it reached the Moon, which it orbited thirty-one times. While in orbit, the crew jettisoned the Lunar Module and allowed it to come within 50,000' of the Moon's surface, prior to initializing the ascent stage for its return to the Command Module (the descent stage was left to fall onto the Moon; the ascent stage would be jettisoned into a solar orbit).[65]

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[62] Godwin, *The Test Program*, 7-8, 25-35; Ivan D. Ertel and Roland W. Newkirk (with Courtney G. Brooks), *The Apollo Spacecraft: A Chronology, Volume 4* (Washington, DC: NASA, Scientific and Technical Information Office, 1978), http://www.hq.nasa.gov/office/pao/History/SP-4009/contents.htm#Volume%20IV.
[63] Godwin, *The Test Program*, 9-10, 36-48; Ertel and Newkirk, *A Chronology, Volume 4*.
[64] Godwin, *The Test Program*, 52-55; Ertel and Newkirk, *A Chronology, Volume 4*.
[65] Godwin, *The Test Program*, 12-13, 56-69; Ertel and Newkirk, *A Chronology, Volume 4*.

On July 16, 1969, Apollo 11 launched from LC 39, Pad A, carrying its crew, astronauts Neil A. Armstrong, Edwin E. "Buzz" Aldrin, Jr., and Michael Collins, into a lunar orbit just over three days later. On July 20, 1969, as Collins remained in the Command Module, Armstrong and Aldrin climbed into the Lunar Module and descended to the Moon's surface. Landing at 4:17 p.m., Eastern Standard Time (EST), Armstrong reported to Mission Control, "Houston, Tranquility Base here. The Eagle has landed."[66] Armstrong and Aldrin completed one EVA to collect lunar surface material for scientific analysis. Just over twenty-one hours after landing, the Lunar Module ascent stage lifted-off to successfully dock with the CSM in lunar orbit, and the two astronauts rejoined their colleague in the Command Module, prior to jettisoning the ascent stage. The three astronauts landed in the Pacific Ocean on July 24, 1969, at roughly 12:50 p.m. EST, officially accomplishing the goal set by President John F. Kennedy on May 25, 1961.[67]

Four months later, Apollo 12 launched from LC 39, Pad A, for its rendezvous with the Moon. Essentially a repeat of Apollo 11, the crew remained in lunar orbit for one extra day to take photographs. On April 11, 1970, the ill-fated Apollo 13 lifted-off from LC 39, Pad A. Approximately fifty-six hours after launch, Oxygen Tank No. 2 ruptured, also causing a failure in Oxygen Tank No. 1. The three-man crew of James A. Lovell, Jr., Fred W. Haise, Jr., and John L. "Jack" Swigert, Jr., remained in limbo within the Lunar Module as the ground controllers in Mission Control at the Manned Spacecraft Center frantically worked to bring them home safely. On April 17, they landed on Earth proving the ingenuity of the ground controllers. The event would have repercussions though, as two Apollo flights were removed from the program.[68]

The next mission, Apollo 14, was launched on January 31, 1971. Astronauts Alan B. Shepard, Jr., and Edgar D. Mitchell spent just over thirty-three hours on the Moon's surface and conducted two EVAs while Stuart A. Roosa remained in the command module. Apollo 15, which launched on July 26, 1971, was the first mission to use the Lunar Rover, an electric-powered, four-wheel drive vehicle, to traverse around the lunar surface. The crew spent just under sixty-seven hours on the Moon collecting lunar samples, including one dubbed the "Genesis Rock." The next mission, Apollo 16, was essentially a repeat of Apollo 15, albeit with a different lunar landing site. Apollo 17, which launched on December 7, 1972, was the final lunar mission and the only one to carry a scientist-astronaut, Harrison H. "Jack" Schmitt, to the Moon.[69]

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[66] Tranquility Base refers to their designated landing site; Eagle was the name given to the Lunar Module. NASA MSC [Manned Spacecraft Center, now JSC], *Apollo 11 Spacecraft Commentary*, July 16-24, 1969, http://www.jsc.nasa.gov/history/mission_trans/AS11_PAO.PDF.

[67] NASA KSC, "Apollo 11," *Apollo website*, 2003, http://www-pao.ksc.nasa.gov/kscpao/history/apollo/apollo-11/apollo-11.htm; Robert Godwin, *Project Apollo: Exploring the Moon* (Burlington, Ontario: Apogee Books, 2006), 3-5, 20-22; Ertel and Newkirk, *A Chronology, Volume 4*.

[68] Godwin, *Exploring the Moon*, 5-10, 23-30; Ertel and Newkirk, *A Chronology, Volume 4*. One flight had already been cancelled following the return of Apollo 12.

[69] Godwin, *Exploring the Moon*, 10-18, 31-49; Ertel and Newkirk, *A Chronology, Volume 4*.

Skylab, an application of the Apollo Program, served as an early type of space station. With 12,700 cubic feet of work and living space, it was the largest habitable structure ever placed in orbit, at the time. The station achieved several objectives: scientific investigations in Earth orbit (astronomical, space physics, and biological experiments); applications in Earth orbit (Earth resources surveys); and long-duration spaceflight. The Skylab 1 orbital workshop was inhabited in succession by three crews launched in modified Apollo CSMs (Skylab 2, 3 and 4). Actively used until February 1974, Skylab 1 remained in orbit until July 11, 1979, when it re-entered Earth's atmosphere over the Indian Ocean and Western Australia after completing 34,181 orbits.[70]

The Apollo-Soyuz Test Project of July 1975, the final application of the Apollo Program, marked the first international rendezvous and docking in space, and was the first major cooperation between the only two nations (the U.S. and USSR) engaged in manned spaceflight. As the first meeting of two manned spacecraft of different nations in space, first docking, and first visits by astronauts and cosmonauts into the others' spacecraft, the project was highly significant. The Apollo-Soyuz Test Project established workable joint docking mechanisms, taking the first steps toward mutual rescue capability of both Russian and American manned missions in space.[71]

The Space Shuttle Program

On January 5, 1972, President Richard M. Nixon delivered a speech in which he outlined the end of the Apollo era and the future of a reusable space flight vehicle, the Space Shuttle, which would provide "routine access to space."[72] During this speech, President Nixon instructed NASA to proceed with the design and building of a partially reusable Space Transportation System (STS; commonly referred to as the Space Shuttle) consisting of a reusable orbiter, three reusable main engines, two reusable solid rocket boosters, and one non-reusable external liquid fuel tank. NASA selected KSC as the primary launch and landing site for the SSP. KSC, responsible for designing the launch and recovery facilities, was to develop methods for shuttle assembly, checkout, and launch operations.[73]

The first orbiter intended for spaceflight, *Columbia*, arrived at KSC from Air Force Plant 42, Palmdale, California, in March 1979. Originally scheduled for liftoff in late 1979, the launch date was delayed by problems with both the main engine components as well as the thermal

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[70] NASA, *Facts*, 91.
[71] NASA, *Facts*, 96.
[72] Marcus Lindroos, ed., "President Nixon's 1972 Announcement on the Space Shuttle," updated April 14, 2000, http://history.nasa.gov/stsnixon.htm.
[73] Linda Neuman Ezell, *NASA Historical Databook Volume III Programs and Projects 1969-1978*, The NASA History Series (Washington, DC: NASA History Office, 1988), 121-24, table 2-57; Ray A. Williamson, "Developing the Space Shuttle," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume IV: Accessing Space*, ed. John M. Logsdon (Washington, DC: U.S. Printing Office, 1999), 172-174.

protection system. *Columbia* spent 610 days in the Orbiter Processing Facility, another thirty-five days in the Vehicle Assembly Building and 105 days on LC 39, Pad A before lifting off on April 12, 1981. STS-1, the first orbital test flight and first SSP mission, ended with a landing on April 14, 1981, at Edwards Air Force Base in California. This launch demonstrated *Columbia's* ability to fly into orbit, conduct on-orbit operations, and return safely.[74] *Columbia* flew three additional test flights in 1981 and 1982, all with a crew of two. The Orbital Test Flight Program ended in July 1982 with 95 percent of its objectives accomplished. After the end of the fourth mission, President Ronald W. Reagan declared that with the next flight the Shuttle would be "fully operational."

During the SSP, 135 missions were launched from KSC. The Space Shuttle carried a number of planetary and astronomy missions including the Hubble Space Telescope, the Galileo probe to Jupiter, Magellan to Venus, and the Upper Atmospheric Research Satellite. In addition, a series of Spacelab research missions were flown, which carried dozens of international experiments in disciplines ranging from materials science to plant biology. Between 1995 and 1998, NASA conducted a joint U.S./Russian Shuttle-*Mir* Program as a precursor to construction of the International Space Station (ISS). The Shuttle-*Mir* program served to acclimate the astronauts to living and working in space. Many of the activities carried out were types they would perform on the ISS.[75] Construction of the ISS began in 1998; it was completed in 2011.

The SSP suffered two major setbacks with the tragic losses of the *Challenger* and *Columbia* on January 28, 1986, and February 1, 2003, respectively. *Challenger* was destroyed seventy-three seconds after launch due to a faulty O-ring seal in the right solid rocket booster; the crew of seven astronauts all perished. *Columbia* was lost on February 1, 2003, following a sixteen-day mission. The physical cause of the accident was a breach in the thermal protection system on the leading edge of the left wing, caused by a piece of insulating foam, which separated from the external tank after launch and struck the wing.[76] Sixteen minutes prior to its scheduled touchdown at KSC, the spacecraft broke apart during reentry over eastern Texas and all seven members of the crew perished.

USAF/DoD Support of NASA's Manned Space Programs

When NASA was established in 1958, several Army facilities at CCAFS were given to the agency, including various offices and hangars, as well as LCs 5, 6, and 26.[77] In addition, aside from allowing NASA to use various launch complexes and buildings at CCAFS, the USAF (and

[74] Dennis R. Jenkins, *Space Shuttle, The History of the National Space Transportation System. The First 100 Missions* (Cape Canaveral, FL: Specialty Press, 2001), 99.
[75] Judy A. Rumerman, with Stephen J. Garber, *Chronology of Space Shuttle Flights 1981-2000* (Washington, DC: NASA History Division, 2000), 3.
[76] Columbia Accident Investigation Board, *Report, Volume I*, (Washington, DC: U.S. Government Printing Office, 2003), 25, http://history.nasa.gov/columbia/CAIB_reportindex.html.
[77] Benson and Faherty, *Gateway to the Moon*, 1-2.

the DoD in general) would provide launch vehicles, and operational and administrative assistance to this fledgling agency as required.

When Project Mercury first started, DoD support was divided into two phases: operational, which covered the period between the launch and recovery phases, and preoperational, which included all other times. In June 1962, this was revised so that the operational phase was divided into a coordinating phase and an operational control phase. The former extended through the timeframe in which mission plans were developed and resources arranged, as well as astronaut training and simulation exercises; the latter incorporated the timeframe between launch and recovery. The various aspects of support provided by the DoD included launch support, recovery operations, communications network, aeromedical, training, and public information.[78]

Launch support generally included launch vehicles, the use of the USAF's launch complexes, and assistance with vehicle processing. The Army provided Redstone rockets for the suborbital phase of Project Mercury; the USAF supplied the Atlas rockets for the orbital phase of the program. All of the vehicles launched from CCAFS, LC 5 for the suborbital flights and LC 14 for the orbital flights. Flight vehicle processing, including installations, prelaunch checkouts, and the actual launch commands, for the suborbital missions was provided by the Army Ballistic Missile Agency. The 6555th Aerospace Test Wing of the Space Systems Division of the USAF, which was stationed at Patrick AFB, assisted with vehicle processing for the orbital missions.[79]

The communications network allowed flight controllers to monitor the status of the vehicle and monitor the condition of, and communicate with, the astronaut. There were eighteen worldwide stations, fourteen land-based and two USAF tracking ships, as well as two accessory stations. Of these eighteen facilities, seven were operated by the USAF, four by NASA, three by the Navy, two by the Army, and two by the Australian Weapons Research Establishment. In addition, relay aircraft were flown by USAF and Naval aviators to assist in spacecraft-to-ground voice relay.[80]

Recovery operations included the retrieval of both the astronaut and the spacecraft after a planned or contingency landing; the recovery forces ranged from eight ships and fifteen aircraft for the first ballistic launch and twenty-eight ships and 171 aircraft for the final flight of the program. The suborbital flight landings, as well as all but the last two orbital landings, occurred in the Atlantic Ocean. For these operations, Navy ships and aircraft formed the recovery task force, with assistance from USAF aircraft furnished by the Air Rescue Service and the Air Force Missile Test Center. The last two missions of Project Mercury landed in the Pacific Ocean, with recovery forces stationed in the Atlantic Ocean as a precaution. For these missions, the Navy

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[78] Leigton I. Davis, "Operational Support from the Department of Defense," in *Mercury Project Summary Including the Results of the Fourth Manned Orbital Flight, May 15 and 16, 1963 [SP-45]* (Washington, DC: NASA, Office of Scientific and Technical Information, 1963).
[79] Davis, "Operational Support."
[80] Davis, "Operational Support;" Loyd S. Swenson, Jr., James M. Grimwood and Charles C. Alexander, *This New Ocean: A History of Project Mercury* (Washington, DC: NASA, Office of Technology Utilization, 1966).

provided fifteen ships in the Atlantic and eleven in the Pacific; the aircraft were provided by all branches of the U.S. military, including the Coast Guard.[81]

The DoD also provided aeromedical/bioastronautical support for NASA. This support included administrative, personnel and training, facilities, and equipment. The administrative support consisted of the development of medical plans and programs; the acquisition and preparation of required medical facilities; the requisition, preparation, and deployment of all needed medical personnel and equipment; and the planning of emergency response for an injured astronaut (or non-survival of the astronaut). Throughout Project Mercury, 233 medically trained personnel were provided by the DoD to serve as aeromedical monitors, emergency surgeons, medical assistants, or dietitians; the personnel were stationed at the network tracking stations, CCAFS, on recovery vessels, and in the Bioastronautic Holding Facility within Hangar S.[82] The medical staff at Patrick AFB supplied the first "nurse to the astronauts," Dolores "Dee" O'Hara, to "get to know the astronauts so well that she would certainly know if they were ill," because the astronauts, being military test pilots, were "not about to tell a flight surgeon when they're sick."[83] DoD facilities for medical support included two modified blockhouses and Hanger S at CCAFS; prefabricated hospitals downrange of the landing sites; and the Wilford Hall USAF Hospital (Texas), U.S. Navy Hospital (Virginia), Walter Reed Army Hospital (Washington, DC), and Army's Tripler General Hospital (Hawaii).

The DoD also assisted NASA with astronaut selection and training. On October 27, 1958, NASA formed a special Committee on Life Sciences to oversee the selection of astronauts; Dr. W. Randolph Lovelace II, a flight surgeon who had served in the Air Force, was appointed as Chairman. The Committee screened the service records of 508 military personnel to find 110 candidates, including fifty-eight Air Force pilots, forty-seven Navy aviators, and five Marines. In addition, they oversaw the written tests and interviews, as well as the rigorous physical testing at the Lovelace Clinic in Albuquerque, New Mexico, and the Aeromedical Laboratory of the Wright Air Development Center in Dayton, Ohio, for physical endurance tests and psychological measurements. From this group, the Committee chose eighteen finalists, from which the "Mercury Seven" were selected by Dr. Robert Gilruth, head of the Space Task Group; Charles J. Donlan, a senior NASA engineer and Gilruth's assistant; Warren J. North, a NASA test pilot and engineer; and Stanley C. White, an Air Force flight surgeon.[84] The USAF assisted astronaut training by providing aircraft for the astronauts to maintain their flight proficiency and providing aircraft to simulate zero-g environments. In addition, USAF facilities at Langley AFB, Virginia, CCAFS, and Stead AFB, Nevada, were provided for training activities. U.S. Navy facilities at Johnstown, Pennsylvania, Philadelphia, Pennsylvania, and Pensacola, Florida, were also used for

[81] Davis, "Operational Support."
[82] Davis, "Operational Support."
[83] O'Hara, interview, 4.
[84] James M. Grimwood, *Project Mercury: A Chronology* (Washington, DC: NASA, Office of Scientific and Technical Information, 1963), http://history.nasa.gov/SP-4001/contents.htm.

centrifuge simulations, and water survival training and revolving room simulations, respectively.[85]

Finally, during Project Mercury, the DoD provided NASA with logistic support of news media coverage. The USAF constructed a press site near LC 5 for media representatives to have a direct view of the suborbital Redstone launches; a second press site was later built near the CCAFS landing strip, which offered a better view of LC 14 and the orbital Atlas mission launches. The USAF also provided transportation, escorts, communications lines, and a public-address system to assist in the dissemination of information.[86]

Throughout Project Gemini, the USAF and DoD provided the same support as they had during Project Mercury; in some areas, the support expanded. In general, recovery operations support, public information, and astronaut training remained the same. Launch support during Project Gemini was provided solely by the USAF. DoD support with respect to the communications network changed, as did its bioastronautics support. One additional aspect of support for Project Gemini was in the field of meteorology.[87]

Launch support during this program was mostly provided by the USAF, who gave NASA the use of LC 19 at CCAFS, and provided both the Titan II launch vehicles and the Atlas-Agena target vehicles. As with Project Mercury, the 6555th Aerospace Test Wing assisted with vehicle processing for the missions, including propellant loading, launch pad and range safety, metric and optical tracking, and command and control support for the launches.[88] The communications network for Project Gemini decreased to seventeen worldwide stations, thirteen land-based and two USAF tracking ships, plus the two accessory stations. Of these nineteen facilities, eight were operated by the USAF, eight by NASA, one by the Navy, one by the Army, and one by the Australian Weapons Research Establishment.[89]

One key difference in bioastronautics support for Project Gemini was the construction of the BOSU, completed in time to support the Gemini III mission (March 23, 1965). This facility included a state-of-the-art surgical suite, complete with areas for major and minor surgery, intensive care, recovery, and an x-ray laboratory. Its medical staff assisted NASA with prelaunch evaluations of the flight crew, biomedical monitoring throughout the mission, medical support during recovery operations, and postflight medical evaluations. Additionally, in March 1963, CCAFS' Office of the Deputy for Bioastronautics was charged by the USAF Surgeon General with developing a curriculum for the third year of residency training in aerospace medicine.[90]

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[85] Robert B. Voas, Harold I. Johnson, and Raymond Zedekar, "Astronaut Training," in *Mercury Project Summary*.
[86] Davis, "Operational Support."
[87] Olson, "Mission Support."
[88] Hacker and Grimwood, *On the Shoulders of Titans*; Olson, "Mission Support."
[89] Olson, "Mission Support."
[90] Olson, "Mission Support."

Meteorology was a new area of DoD support for Project Gemini. With Project Mercury, the longest mission, MA-9, lasted just over thirty-four hours, requiring little monitoring of weather conditions. Gemini missions, however, would extend up to fourteen days, and therefore, the weather at each planned recovery area would have to be continuously monitored to determine its suitability. Both the USAF and Navy provided weather reconnaissance aircraft, which had special equipment for monitoring hurricanes and typhoons. In addition, weather balloons were used at select locations.[91]

Similar to Projects Mercury and Gemini, DoD support for the Apollo Program included areas of launch and recovery operations, communications, medicine, meteorology, and public affairs. At CCAFS, LC 34 was used for launches involving the Saturn I Block I and the Saturn IB rockets; LC 37 supported launches that utilized the Saturn I Block II and Saturn IB rockets. Apollo 7, launched on October 11, 1968, was the last manned mission to lift off from CCAFS. Likewise, similar support extended through the SSP. One area that was added during the SSP was the deployment of USAF aeromedical personnel from CCAFS to Ramstein Air Force Base in Germany whenever a U.S. astronaut returned from the ISS aboard a Russian Soyuz spacecraft.[92]

[91] Olson, "Mission Support."
[92] United States Strategic Command (USSC), "Human Space Flight Support," Factsheets, December 2011, http://www.stratcom.mil/factsheets/Human_Space_Flight_Support/.

Part II. Structural/Design Information

A. General Statement:

1. **Architectural Character:** The BOSU is a one-story, Masonry Vernacular style structure with approximately 19,440 square feet of space. Its longitudinal axis is oriented about 35 degrees east of due north; for ease of reference, the description will assume the longitudinal axis follows true north. The walls are comprised of concrete block, and are topped with a slightly gabled roof that rests on steel joists. It is rectangular in plan and the interior room arrangement is based on a double-loaded corridor layout.

2. **Condition of fabric:** The BOSU is in good condition due to periodic maintenance.

B. Description of Exterior:

1. **Overall dimensions:** The BOSU (Photo Nos. 1-8) has approximate overall measurements of 324’ in length (north-south), 60’ in width (east-west), and 13’ in height. The structure is rectangular in plan.

2. **Foundation:** The foundations of the BOSU are comprised of a 5”-thick steel reinforced poured concrete slab on compacted fill with steel reinforced poured concrete footers.

3. **Walls:** The exterior walls of the BOSU are constructed of 8”, painted concrete masonry units, and a painted poured concrete soffit. On the west elevation, a 32’-wide expanse of wall around the main entrance is faced with exposed aggregate facing block; at either end of this expanse is a concrete fin. The west elevation also features a continuous reinforced poured concrete canopy extending for 230’, starting roughly 16’ from the north end. In addition, roughly 101’ to the south of the main entrance is a 5’-4”-wide recess that originally held a doorway.

4. **Structural system, framing:** The structural framing system of the BOSU is comprised of concrete masonry units and steel truss roof joists.

5. **Porches, patios, stoops:** The main entrance to the BOSU (Photo No. 9) features an inset porch, roughly 11’ wide, and 4’ deep. The porch is further shielded by the continuous concrete canopy. The floor of the porch is comprised of poured concrete. All other entrances to the BOSU feature a small concrete stoop; those on the west elevation also have a concrete canopy, with the exception of the southernmost entrance, which has a metal canopy (seen in Photo No. 8).

7. Openings:

a. Doorways and doors: The main entrance to the BOSU is located on the west elevation (Photo No. 9). It features one set of glass and aluminum double swing doors with a plate glass transom and sidelights. Aside from the main entrance, there are two additional doorways on the west elevation, both near the south end. One is a set of honeycomb aluminum double swing doors with a wire glass transom, and the other is a hollow metal single swing door. There are no doors on the north or south elevations, but there are seven sets of double swing doors on the east elevation. Four are comprised of aluminum honeycomb doors, one is made of wood, and two are hollow metal.[93]

b. Windows: The BOSU features independent and paired, two-over-two double hung sash windows along the west and east elevations. The two independent windows to either side of the main entrance are 4’ in width and have wood frames. All other independent windows have a width of 3’ and feature aluminum frames. The paired windows are 6’ in width and have aluminum frames. All of the windows feature precast concrete sills.[94]

8. Roof:

a. Shape, covering: The BOSU has a slightly gabled roof comprised of layers of insulating form board, gypsum board, and built-up gravel roofing. The entirety is supported by steel trusses.

C. Description of Interior:

1. Floor plans: The BOSU is comprised of a single floor, which is divisible into north and south areas. The room arrangement is based on a double-loaded corridor plan. The north area of the BOSU retains its original layout of medical examination rooms and surgical rooms (Photo Nos. 12, 13); many of these spaces maintain their original size, room finishes, and equipment. The south end of the facility, which originally housed support areas for the medical staff and LSRT, has been somewhat altered from its original state. A few of the rooms have been subdivided, or otherwise altered, and many of the original room finishes have been replaced. A 2,250 square foot addition was built at the south end of the facility in 1992.

As originally constructed, the north area of the BOSU contained rooms designated for major surgery; evaluation, treatment, and minor surgery; radiology; recovery and

[93] Steward-Skinner Associates, “As Built Drawings,” Sheet 11; Rood & Zwick, “Building No. 49365,” Sheet 8.
[94] Steward-Skinner Associates, “As Built Drawings,” Sheet 4.

intensive care; audio, electrocardiogram, and eye examinations; and physician offices. The major surgery room was located in the northwest corner of the building; at the time of documentation, it contained radioactive materials analysis equipment (Photo Nos. 14-16). This 20’-4” x 19’ room contained many of its original features including the tile floors and walls, the stainless steel shelving along the south wall, and the X-ray illuminator on the east wall. Along the north and west walls are counters and cabinets installed at an unknown date. Two openings on the east wall provided access to the original scrubbing area (south) and sub-sterile clean-up room; at the time of documentation, both rooms were being used for storage. The scrubbing area (Photo No. 17) originally featured two sinks on the east wall, which were removed at an unknown date. The sub-sterile clean-up room (Photo No. 18) retains its original sink and cabinets on the west wall, and original recessed sterilizer (Photo No. 19) and warming cast for medical solutions (Photo No. 20) within the east wall. In addition, at the time of documentation, the equipment room for the sterilizer and warmer remained directly east of the sub-sterile clean-up room (Photo No. 21).

At the northeast corner of the BOSU was the radiology room, which originally contained a radiographic and fluoroscopic machine; it is unclear when the equipment was removed, and at the time of documentation, the room was being used for storage (Photo Nos. 23, 24). This 20’ x 14’ room retained its original lead-lined walls, lead-lined door on its west wall, and the 4’ x 3’-9” control room in the northwest corner, which also maintained its lead-lined walls and door. The west wall of the control room also retained the original pass-through to the dark room, where the X-ray images were developed (Photo No. 25). To the south of the dark room was a film viewing and storage room (Photo Nos. 26, 27). At the time of documentation, both the developing room and viewing/storage room were being used for storage.

Directly to the south of the major surgery room, along the west wall of the BOSU, was the original plaster mixing area, which, at the time of documentation, was being used as storage (Photo No. 28). This room retained its original counter and sink, as well as a plaster trap, along the south wall. Next to this room on the south was the original work utility area (Photo No. 29). At the time of documentation, this room was being used as an office, but still maintained its original sinks and cabinets. On the north wall of the room is a door that opened into the original anesthesia storage area. To the south of the work utility area were two doctors’ offices, which were still used as offices at the time of documentation. Across from these offices, in the center of the north area, was the original 17’ x 13’ evaluation, treatment, and minor surgery room (Photo Nos. 30, 31). Although at the time of documentation this room was used as storage space, it maintained its original X-ray illuminator on the north wall, sink in the southeast corner, and recessed stainless steel cabinets in the south wall.

The original intense care/recovery room (Photo No. 33) sat directly to the south of the doctors' offices. At the time of documentation, it served as a file storage room; however, the walls of this 26' x 13' room retained their original acoustical tile facing and original cabinets and sinks along its north and south walls. Along the west wall were the original three headboards, one for each of the patient beds that were removed at an unknown date (Photo No. 34). These headboards provided reading light for patients, examination lights for doctors, and call button controllers. Between the intense care/recovery room and the vestibule and entrance, from north to south, were the aerospace nurses' office (Photo No. 35), the commander's office, and a reception office. At the time of documentation, all of these were being used as offices. Across from the intense care/recovery room and south of the evaluation, treatment, and minor surgery room, were the original offices for audio, eye (Photo No. 36), electrocardiogram, and electroencephalogram exams. All but the original audio exam office were being used as office space at the time of documentation; the audio exam office was being used for storage.

Within the east area of the north section of the BOSU, south of the radiology room, was a second corridor (Photo No. 37). Originally along this hallway were a medical supply room (Photo No. 38), a clinical laboratory, an aerospace medicine supervisor's office, and three additional staff offices. At the time of documentation, the clinical laboratory was being used as a break room and the other rooms were being used as offices (Photo No. 39). South of these offices was the facility's mechanical equipment room.

The south area of the BOSU, which does not contribute to the building's significance, included a conference room/reference library (Photo Nos. 40, 41), a medical communications center, a supply room, a glassware washing room (Photo No. 42), a bioinstrumentation lab (Photo No. 43), offices for medical personnel, and research laboratories. Also in the south end of the facility was a computer room for the meteorology group and offices for meteorological personnel.

3. **Flooring:** The flooring throughout the BOSU is a combination of different materials, applied to the concrete slab. Finishes include ceramic tile, asbestos tile, vinyl tile, and carpeting. Equipment rooms, janitorial closets, and storage rooms have bare concrete floors.

4. **Wall and ceiling finishes:** The wall finishes throughout the BOSU include ceramic tile, painted gypsum board, plaster, acoustical treatment tiles, and exposed concrete block. The ceiling finishes include acoustic ceiling tile, plaster, and painted gypsum board.

5. **Openings:**

   a. **Doorways and doors:** According to the as-built drawings, there are roughly ninety-two interior doors in the BOSU, about 99 percent of which are constructed of solid wood.[95] Of these, approximately 66 percent are single swing doors, 10 percent are single swing doors with a 10” x 10” window, and 11 percent are double swing doors fitted with 10” x 10” windows. The remaining 13 percent include single metal-covered wood swing doors, double metal-covered wood swing doors with 10” x 10” windows, single aluminum honeycomb swing doors, and wood Dutch doors.

b. Windows: The windows within the BOSU are two-over-two double hung sash, with wood and aluminum surrounds. They are flush with the internal wall surface and are fitted with venetian blinds.

8. Mechanical equipment:

a. Heating, air conditioning, ventilation: The BOSU contains a central heating, ventilating, and air conditioning system, powered by three air handling units.

b. Lighting: The BOSU contains surface-mounted and pendant-mounted fluorescent light fixtures throughout all rooms and corridors.

c. Plumbing: The BOSU features an indoor plumbing system with separate pumps for hot and cold water.

d. Electrical: The BOSU has an electrical system that powers all of the lighting, power outlets, communications systems, and plumbing/mechanical equipment.

D. Site:

1. Historic landscape design: The BOSU was designed with an entrance driveway to the west and a parking lot to the east; no formal vegetation layout was included. To the east of the building is the original helipad, capable of supporting three helicopters (Photo No. 10).

At the time of documentation, shrubs and trees lined the west side of the driveway. In addition, a few trees were situated along the north, west, and south elevations of the facility.

[95] Steward-Skinner Associates, “As Built Drawings,” Sheet 11.

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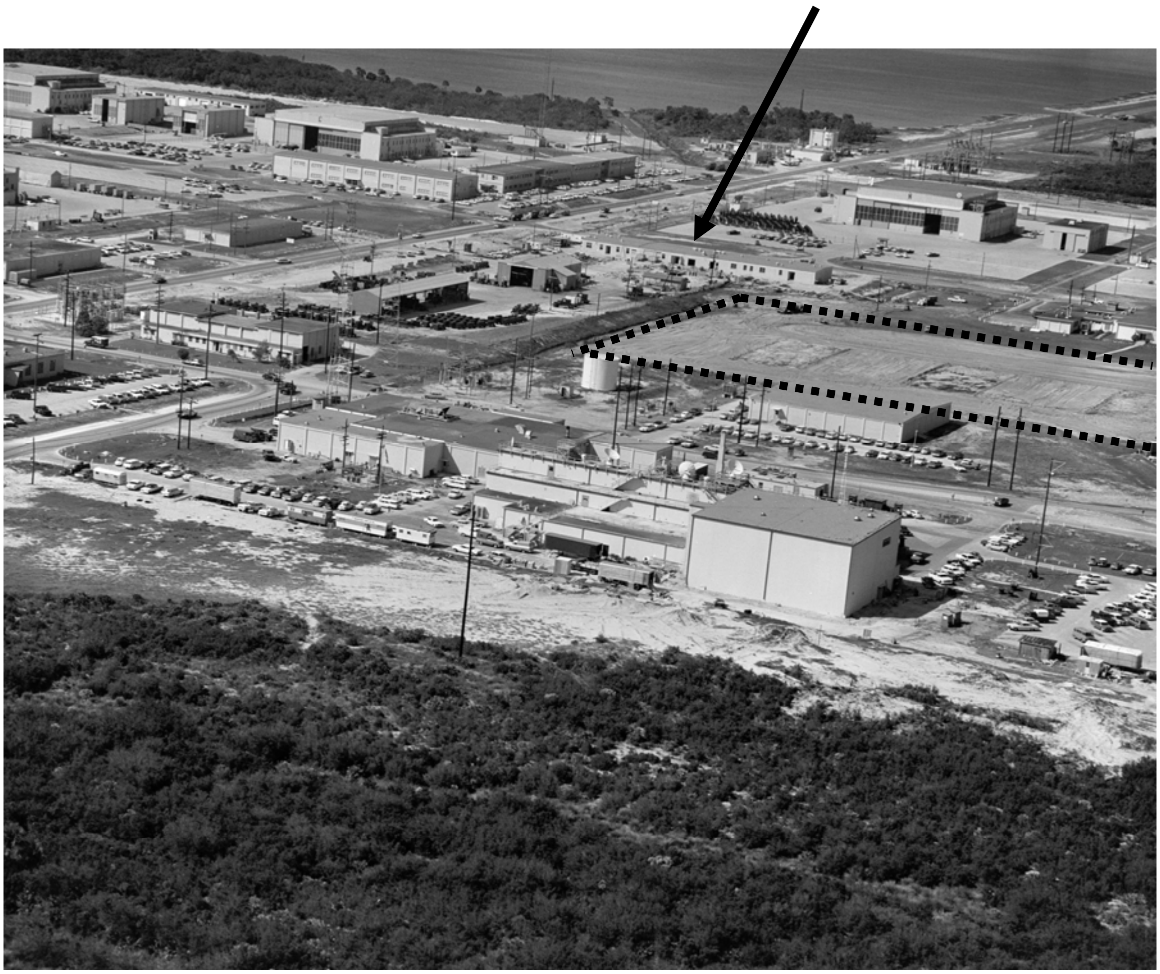

Figure A-1. BOSU (denoted by arrow) under construction circa 1964;
the heliport is denoted by the dashed lines.
Source: John F. Kennedy Space Center, Kennedy Institutional Imaging Facility,
PL64C-82448.

Figure A-2. View of BOSU circa 1965.
Source: John F. Kennedy Space Center, Kennedy Institutional Imaging Facility, PL-65-68513.

Figure A-3. Historic view of the intense care/recovery room, circa 1966.
Source: John F. Kennedy Space Center, Kennedy Institutional Imaging Facility, PL66C-76979.

HISTORIC AMERICAN BUILDINGS SURVEY

INDEX TO PHOTOGRAPHS

CAPE CANAVERAL AIR FORCE STATION, BIOASTRONAUTICS OPERATIONAL SUPPORT UNIT
Cape Canaveral
Brevard County
Florida

HABS No. FL-583-A

Penny Rogo Bailes, Photographer; August 2012
(FL-583-A-1 through FL-583-A-14, FL-583-A-16 through FL-583-A-32, and FL-583-A-34 through FL-583-A-53)

Penny Rogo Bailes, Photographer; January 2013
(FL-583-A-14, FL-583-A-15, and FL-583-A-33)

FL-583-A-1	OVERALL VIEW OF THE WEST ELEVATION, FACING SOUTHEAST.
FL-583-A-2	OVERALL VIEW OF THE WEST AND NORTH ELEVATIONS, FACING SOUTH.
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FL-583-A-4	OVERALL VIEW OF THE NORTH AND EAST ELEVATIONS, FACING SOUTHWEST.
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Photograph Nos. FL-583-A-45 through FL-583-A-53 are photocopies of engineering drawings, and are 8” x 10” enlargements from 4” x 5” negatives. Original drawings are located at the Engineering Documentation Office, NASA KSC, Florida.

FL-583-A-45 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-28, 308, Steward-Skinner Associates, January, 1964
FLOOR PLAN AND DETAILS
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FL-583-A-46 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-28, 308, Steward-Skinner Associates, January, 1964
PARTIAL PLAN AND DETAILS
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FL-583-A-47 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-387, Steward-Skinner Associates, July, 1965
VICINITY MAP AND INDEX SHEET
Sheet 1 of 40

FL-583-A-48 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-387, Steward-Skinner Associates, July, 1965
FLOOR PLAN AND DETAILS
Sheet 4 of 40

FL-583-A-49 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-387, Steward-Skinner Associates, July, 1965
PARTIAL PLAN AND DETAILS
Sheet 6 of 40

FL-583-A-50 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-387, Steward-Skinner Associates, July, 1965
ELEVATIONS AND TYPICAL SECTIONS
Sheet 5 of 40

FL-583-A-51 Photocopy of drawing
BIOASTRONAUTICS-OPERATIONAL SUPPORT UNIT
Patrick Air Force Base, Cape Canaveral Missile Test Annex, Florida
Drawing 201-387, Steward-Skinner Associates, July, 1965
INTERIOR ELEVATIONS AND DETAILS
Sheet 9 of 40

FL-583-A-52 Photocopy of drawing
MODIFICATIONS FOR PLANETARY QUARANTINE LAB
Cape Canaveral Air Force Station, Florida
Drawing 79K05178, NASA John F. Kennedy Space Center, August, 1974
PLANS, SECTIONS, DETAILS & VIEWS
Sheet 2

FL-583-A-53 Photocopy of drawing
ADDITION TO CAPE DISPENSARY, BUILDING NO. 49365
Cape Canaveral Air Force Station, Florida
Drawing 79K32701, Architects in Association Rood & Zwick, July, 1989
FLOOR PLAN AND REFLECTED CEILING PLAN
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