CAPE CANAVERAL AIR FORCE STATION, LAUNCH COMPLEX 39, SPACE STATION PROCESSING FACILITY HAER FL-8-11-M
(John F. Kennedy Space Center)
Southeast corner of 1st Street SE and E Avenue SE
Cape Canaveral
Brevard County
Florida

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

HISTORIC AMERICAN ENGINEERING RECORD

CAPE CANAVERAL AIR FORCE STATION, LAUNCH COMPLEX 39, SPACE STATION PROCESSING FACILITY
(John F. Kennedy Space Center)
HAER FL-8-11-M

Location:	Southeast corner of 1st Street SE and E Avenue SE John F. Kennedy Space Center Cape Canaveral Brevard County Florida U.S.G.S. 7.5. minute Orsino, Florida, quadrangle, Universal Transverse Mercator coordinates: 17. 535016. 3155289
Date of Construction:	1991-1994
Architect:	Jacobs Engineering Group, Lakeland, Florida
Builder:	Metric Constructors, Inc., Tampa, Florida
Present Owner:	National Aeronautics and Space Administration (NASA) Kennedy Space Center, FL 32899-0001
Present Use:	Aerospace facility-vehicle processing; manufacturing and assembly

Significance: The Space Station Processing Facility (SSPF) is considered eligible for listing in the National Register of Historic Places (NRHP) in the context of the U.S. Space Station Program (1984-2020) under Criterion A in the areas of Space Exploration and Science and under Criterion C in the area of Engineering. Because it has achieved significance within the past fifty years, Criteria Consideration G applies. The period of significance for the SSPF is from 1991, when construction of the facility began, through 2011, the anticipated end date for the on-orbit assembly of the U.S. portion of the International Space Station (ISS). It derives its primary significance from the hardware processing areas, specifically the High Bay, the Intermediate Bay (I-Bay), the Payload Rack Checkout Unit Room, and the Airlock, as well as nine associated Control Rooms. In addition, the Ammonia Vapor Containment Building is considered a contributing ancillary feature to the SSPF.

Under Criterion A, the SSPF is the only building in the United States that was designed and constructed exclusively for the pre-flight checkout, processing, and testing of ISS flight hardware. Under Criterion C, the design of the SSPF focused on providing "infinite flexibility" within the hardware processing areas. This resulted in the use of a conductive floor throughout the High Bay and I-Bay, which can accommodate air bearing pallets, used to move processing hardware. This type of floor also prevents the build-up of static electricity. Additionally, the SSPF High Bay contained a variety of ground support equipment (GSE), some of which was uniquely designed to support the processing requirements of the ISS flight hardware.

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Date: September 2011

Project Information: The documentation of the Cape Canaveral Air Force Station, Launch Complex 39, Space Station Processing Facility was conducted in 2010-2011 for the John F. Kennedy Space Center (KSC) by Archaeological Consultants, Inc. (ACI), under contract to Innovative Health Applications (IHA), and in accordance with KSC's Programmatic Agreement (PA) 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 Shannah Trout, IHA's Cultural Resource Specialist. The written narrative was prepared by Ms. Slovinac; it was edited by Joan Deming, ACI Project Manager; Elaine Liston, KSC Archivist; John Jackson, KSC ISS Transition Manager, and Barbara Naylor, KSC Historic Preservation Officer. The photographs and negatives were processed by Bob Baggett Photography, Inc., an independent studio.

The scope of services for the project, which was compiled based on the Programmatic Agreement, specified a documentation effort following HAER Level II Standards. Information for the written narrative was primarily gathered through informal interviews with current NASA and contractor personnel and research materials housed at the KSC Archives Department. Selected drawings were provided by KSC's Engineering Documentation Center, which serves as the repository for all facility drawings. The available drawings for the SSPF included the "as-built" drawings. KSC does not periodically produce drawings of their facilities to show current existing conditions.

LIST OF ACRONYMS

ACI	Archaeological Consultants, Inc.
CCAFS	Cape Canaveral Air Force Station
CELA	Cargo Element Lifting Assembly
CEW	Cargo Element Workstand
ERS	Element Rotation Stand
ESA	European Space Agency
ET	External Tank
EXPRESS	Expedite the Processing of Experiments to the Space Station
GSE	Ground Support Equipment
I-Bay	Intermediate Bay
ISS	International Space Station
JSC	Johnson Space Center
KSC	Kennedy Space Center
LC	Launch Complex
MEIT	Multi-Element Integration Test
MPLM	Multi-Purpose Logistics Module
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NRHP	National Register of Historic Places
OV	Orbiter Vehicle
PRCU	Payload Rack Checkout Unit
RID	Rack Insertion Device
SRB	Solid Rocket Booster
SSME	Space Shuttle Main Engine
SSPF	Space Station Processing Facility
STS	Space Transportation System
U.S.	United States
VAB	Vehicle Assembly Building

HISTORICAL INFORMATION

NASA's John F. Kennedy Space Center

The John F. Kennedy Space Center (KSC) is the National Aeronautics and Space Administration's (NASA) primary Center for launch and landing operations, vehicle processing and assembly, and related programs in support of manned space missions. It is located on the east coast of Florida, about 150 miles south of Jacksonville, and to the north and west of Cape Canaveral, in Brevard and Volusia Counties; it encompasses almost 140,000 acres. The Atlantic Ocean and Cape Canaveral Air Force Station (CCAFS) are located to the east, and the Indian River is to the west.

Following the launch of Sputnik I and Sputnik II, which placed Soviet satellites into Earth's orbit in 1957, the attention of the American public turned to space exploration. President Dwight D. Eisenhower initially assigned responsibility for the United States (U.S.) Space Program to the Department of Defense. The Development Operations Division of the Army Ballistic Missile Agency, led by Dr. Wernher von Braun, began to focus on the use of missiles to propel payloads, or even a man, into space. The U.S. successfully entered the space race with the launch of the Army's scientific satellite Explorer I on January 31, 1958, using a modified Jupiter missile named Juno I.[1]

With the realization that the military's involvement in the space program could jeopardize the use of space for peaceful purposes, President Eisenhower formed NASA on October 1, 1958, as a civilian agency with the mission of carrying out scientific aeronautical and space exploration, both manned and unmanned. Initially working with NASA as part of a cooperative agreement, President Eisenhower officially transferred to NASA a large portion of the Army's Development Operations Division, including the group of scientists led by von Braun and the Saturn rocket program.[2]

NASA became a resident of Cape Canaveral in 1958 when the Army Missile Firing Laboratory, then working on the Saturn rocket project under the direction of Dr. Kurt Debus, was transferred to the agency. Several Army facilities at CCAFS were given to NASA, including various offices and hangars, as well as Launch Complexes (LC) 5, 6, 26, and 34. The Missile Firing Laboratory was renamed Launch Operations Directorate and became a branch office of Marshall Space Flight Center (MSFC). As the American space program evolved, the responsibilities of the Launch Operations Directorate grew, and NASA Headquarters separated the Directorate from

[1] Charles D. Benson and William B. Faherty. *Gateway to the Moon. Building the Kennedy Space Center Launch Complex* (Gainesville, University Press of Florida, 2001), 1-2.
[2] Benson and Faherty, *Gateway*, 15.

MSFC, officially designating it an independent field installation called the Launch Operations Center.[3]

In May 1961, President John F. Kennedy charged NASA and the associated industries to develop a space program that would surpass the Soviet program by landing a man on the Moon by the end of the decade. With the new, more powerful Saturn V rocket and the accelerated launch schedule, it was apparent that a new launch complex was required, and CCAFS, with twenty-two launch complexes, did not have the space to accommodate new rocket facilities. Merritt Island, an undeveloped area west and north of the Cape, was selected for acquisition, and in 1961, the Merritt Island Launch Area (which, with the Launch Operations Center, would become KSC) was formed. In that year, NASA requested from Congress authority to purchase 80,000 acres of property, which was formally granted in 1962. The U.S. Army Corps of Engineers acted as agent for purchasing the land. NASA began gaining title to the land in late 1962, taking approximately 83,904 acres by outright purchase, which included several small towns, such as Orsino, Wilson, Heath and Audubon, many farms, citrus groves, and several fish camps. Negotiations with the State of Florida provided submerged lands, resulting in the acquisition of property identified on the original Deed of Dedication. Much of the State-provided land was located south of the Old Haulover Canal and north of the Barge Canal. Land acquisition was completed in 1964.

In the meantime, the American program to put a man in space and land on the Moon proceeded rapidly with widespread support. In November 1963, the Launch Operations Center and Merritt Island Launch Area were renamed John F. Kennedy Space Center to honor the late President.[4] The space program developed by NASA was organized into three phases: Project Mercury, Project Gemini, and the Apollo Program. Project Mercury, initiated in 1958, was executed in less than five years. Begun in 1964, Project Gemini was the intermediate step toward achieving a manned lunar landing, bridging the gap between the short-duration Mercury flights and the long-duration missions proposed for the Apollo Program.[5]

Apollo, the largest and most ambitious of the manned space programs, had as its goal the landing of astronauts on the Moon and their safe return to Earth. Providing the muscle to launch the spacecraft was the Saturn family of heavy lift launch vehicles. Three different launch vehicles were used for Apollo: Saturn I, Saturn IB and Saturn V; and three different launch complexes were involved: LC 34 and LC 37 on CCAFS, and LC 39 on KSC. Altogether, there were thirty-two Saturn flights during the Apollo era (including Skylab and the Apollo-Soyuz Test Project); seven launched from LC 34, eight from LC 37, and seventeen from LC 39. Of the total thirty-two, fifteen were manned, and of the seven attempted lunar landing missions, six were successful. No major launch vehicle failures of either Saturn IB or Saturn V occurred. There

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[3] Benson and Faherty, *Gateway*, 136.
[4] Harry A Butowsky. *Reconnaissance Survey: Man in Space* (Washington, D.C.: National Park Service, 1981), 5; Benson and Faherty, *Gateway*, 146.
[5] Butowsky, 5.

were two major command/service module failures, one on the ground (Apollo 1) and one on the way to the Moon (Apollo 13).[6]

The unmanned Apollo 4 mission, which lifted off on November 9, 1967, was the first Saturn V launch and the first launch from LC 39 at KSC. The next launch from LC 39 was Apollo 6, on July 14, 1967. Beginning with the launch of Apollo 8 on August 14, 1968, all manned missions have launched from LC 39.[7] On July 20, 1969, the goal of landing a man on the Moon was achieved when Apollo 11 astronauts Neil Armstrong, "Buzz" Aldrin, and Michael Collins successfully executed history's first lunar landing. Armstrong and Aldrin walked on the surface of the Moon for two hours and thirty-one minutes, and collected 21 kilograms of lunar material. Apollo 17 served as the first night launch in December 1972. An estimated 500,000 people viewed the liftoff, which was the final launch of the Apollo Program.[8]

Skylab, an earth-orbiting mission that was a follow on to 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 command/service modules (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.[9]

The Apollo-Soyuz Test Project of July 1975, the final flight of the Apollo Program, marked the first international rendezvous and docking in space, and was the first major cooperation between the only two nations engaged in manned space flight. As the first meeting of two manned spacecraft of different nations in space, first docking and visits by astronauts and cosmonauts into the others' spacecraft, the event was highly significant. The Apollo-Soyuz Test Project established workable joint docking mechanisms, taking the first steps toward mutual rescue capability of both Soviet and American manned missions in space.[10]

On January 5, 1972, President Richard 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." By commencing work at this time, Nixon added, "we can have

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[6] NASA. *Facts: John F. Kennedy Space Center* (1994), 82.
[7] Apollo 5 launched from CCAFC's LC 37B; Apollo 7 launched from LC 34 at JSC. Benson, Charles D. and William Barnaby Faherty. *Moon Launch! A History of the Saturn-Apollo Launch Operations* (Gainesville, University Press of Florida, 2001), 532.
[8] NASA. *Facts*, 86-90.
[9] NASA. *Facts*, 91.
[10] NASA. *Facts*, 96.

the Shuttle in manned flight by 1978, and operational a short time after that."[11] The Space Task Group, previously established by President Nixon in February 1969 to recommend a future course for the U.S. Space Program, presented three choices of long-range space plans. All included an Earth–orbiting space station, a space shuttle, and a manned Mars expedition.[12] Although none of the original programs presented was eventually selected, NASA implemented a program, shaped by the politics and economic realities of its time that served as a first step toward any future plans for implementing a space station.[13]

During this speech, President Nixon instructed NASA to proceed with the design and building of a partially reusable space transportation system consisting of a reusable orbiter, three reusable main engines, two reusable solid rocket boosters (SRBs), and one non-reusable external liquid fuel tank (ET). NASA's administrators vowed that the Shuttle would fly at least fifty times a year, making space travel economical and safe. NASA gave responsibility for developing the Shuttle orbiter vehicle and overall management of the Space Shuttle program to the Manned Spacecraft Center (now known as the Johnson Space Center [JSC]) in Houston, Texas, based on the Center's experience. MSFC in Huntsville, Alabama, was responsible for development of the Space Shuttle Main Engine (SSME), the SRBs, the ET, and for all propulsion-related tasks. KSC was selected as the primary launch and landing site for the Space Shuttle program; therefore, the Center was responsible for designing the launch and recovery facilities, and was to develop methods for Shuttle assembly, checkout, and launch operations.[14]

The first orbiter vehicle (OV) intended for space flight, *Columbia* (OV-102), arrived at KSC from the Shuttle assembly facility in Palmdale in March 1979. *Columbia* spent 610 days in the Orbiter Processing Facility, another thirty-five days in the Vehicle Assembly Building (VAB), and 105 days on LC 39A before finally lifting off on April 12, 1981. STS-1, the first orbital test flight of the Space Shuttle program, ended with a landing on April 14, 1981, at Edwards Air Force Base in California. *Columbia* flew three additional flights in 1981 and 1982, to complete the Orbital Test Flight Program. After the end of the fourth mission, President Reagan declared that with the next flight the Shuttle would be "fully operational." By the end of the Space Shuttle program, a total of 135 missions were launched from KSC.

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[11] Marcus Lindroos. "President Nixon's 1972 Announcement on the Space Shuttle." (NASA Office of Policy and Plans, NASA History Office, updated April 14, 2000).
[12] NASA, History Office, NASA Headquarters. "Report of the Space Task Group, 1969."
[13] Dennis R. Jenkins. *Space Shuttle, The History of the National Space Transportation System. The First 100 Missions* (Cape Canaveral, Florida: Specialty Press, 2001), 99.
[14] Linda Neuman Ezell. *NASA Historical Databook Volume III Programs and Projects 1969-1978*. The NASA History Series, NASA SP-4012 (Washington, D.C.: NASA History Office, 1988), Table 2-57; Ray A. Williamson. "Developing the Space Shuttle." *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume IV: Accessing Space* (Edited by John M. Logsdon. Washington, D.C.: U.S. Printing Office, 1999), 172-174.

On January 25, 1984, during his State of the Union Address, President Ronald Reagan directed NASA to develop a permanently manned space station, and to do it within a decade; thus, officially creating the U.S. Space Station Program. Although the program would be managed by a Space Station Program Office at JSC, KSC was selected as the location where all of the space station elements and cargo to be flown on the Space Shuttle would be processed.[15] Following a series of study proposals to examine how the ground processing operations would be conducted, KSC decided to build a new facility, the Space Station Processing Facility (SSPF), as a central preflight checkout and processing point for all flight hardware elements of the space station.[16]

By the spring of 1985, Japan, Canada, and the European Space Agency (ESA) each signed a Memorandum of Understanding with the U.S. to participate in the Space Station Program. Subsequently, the partners reached an agreement on their hardware contributions. Canada was responsible for studying a space construction and servicing system, a solar array for a platform or as a potential auxiliary power source, and a remote sensing facility. Japan agreed to conduct studies for an experimental module, and the ESA was responsible for a laboratory module and polar platform.[17] In September 1988, the U.S. signed a formal agreement with its international partners; this same year, President Reagan named the station *Freedom*.

During a September 1993 Vancouver Summit between U.S. President William Clinton and Russian President Boris Yeltsin, Russia was invited to be a partner in the Space Station Program. Upon their acceptance, the station officially became known as the International Space Station (ISS), and a three-phase approach was developed for the new Program.[18] Phase I, scheduled from 1994 through 1997, developed the joint Space Shuttle/*Mir* Program. In Phase II, planned from 1998 through 2000, a station core was assembled using a U.S.-built node, lab module, central truss and control moment gyros, and an interface for the Shuttle. In addition, Russia built the propulsion system, initial power system, and an interface for Russian vehicles, as well as provide crew-return vehicles. Canada was given responsibility for the construction of a remote manipulator arm, to assist in the handling of large payloads. Phase III, scheduled from 2001 through 2004, called for the completion of the station with the addition of U.S. modules, power system, and attitude control, and Russian, Japanese, and ESA research modules and equipment.[19]

Phase I of the ISS Program, the joint U.S./Russian Shuttle-*Mir* Program, officially began in February 1994, when Sergei Krikalev became the first Russian cosmonaut to fly aboard a Space

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[15] Roger D. Launius. S*pace Stations. Base Camps to the Stars* (Smithsonian Institution, Washington, D.C., 2003), 118-121.
[16] NASA. *Facts*, 30.
[17] NASA JSC. "A History of U.S. Space Stations." NASA Facts. 1997; "Initiative Progresses for Space Station." *Spaceport News* (24, 10), May 10, 1985:3; "Japan Joins In." *Spaceport News* (24, 11), May 24, 1985:1; "Space station moves forward." *Spaceport News* (26, 8), April 10, 1987:1 and 8.
[18] NASA JSC, "History."
[19] Launius, 176-181.

Shuttle (STS-60). The first Shuttle approach and flyaround of *Mir* occurred on February 3, 1995 (STS-63) and the first Shuttle-*Mir* docking took place in June 1995 (STS-71). During the Shuttle-*Mir* Program, the Space Shuttle docked with *Mir* nine times. As preparation for the occupation of the ISS, the Shuttle-*Mir* Program served to acclimate astronauts to living and working in space. In 1995, Dr. Norman Thagard was the first American to live aboard the Russian space station. Over the next three years, six more U.S. astronauts served tours on *Mir*. The Shuttle also served as a means of transporting supplies, equipment and water to the space station, and the crews performed a variety of activities to prepare for the assembly of the ISS.[20]

On-orbit assembly of the ISS officially began in November 1998 (see Figure A-33 for a layout of the ISS), when *Zarya,* built by Russia and financed by the U.S., was launched by a Russian Proton rocket from the Baikonur COSMODROME, Kazakhstan.[21] In June 1997, the first U.S.-built element for the ISS, *Unity* (Node 1), arrived at the SSPF for processing. Since then, all payloads destined for the station via a Space Shuttle, regardless of the sponsoring nation, have been processed through the SSPF.[22] On December 4, 1999, *Endeavour* (STS-88) carried *Unity*, along with two pressurized mating adapters, into orbit. This event marked, "at long last the start of the Shuttle's use for which it was primarily designed – transport to and from a permanently inhabited orbital space station."[23] STS-96, launched on May 27, 1999, marked the first Shuttle mission to dock with the ISS (see Table A-1 for a chronology of ISS assembly and supply missions).

Since that time, most Space Shuttle missions have supported the continued assembly of the space station. In October 2000, the Z-1 Truss and the third pressurized mating adapter were delivered and connected during the *Discovery* (STS-92) mission, the fifth shuttle mission to the ISS. Following this mission, the ISS was officially declared ready for occupancy. Over the next twenty-five months, U.S. Space Shuttles delivered the P6 Truss and the first set of solar arrays (STS-97), the U.S.-built *Destiny* Laboratory Module (STS-98), the first Multi-Purpose Logistics Module (MPLM), *Leonardo* (STS-102),[24] the Canadarm 2 (STS-100), the Joint Airlock *Quest* (STS-104), the S0 Truss (STS-110), the S1 Truss (STS-112), and the P1 Truss (STS-113). The configuration of the outpost "froze" at this stage for three-and-one-half years, due in large part to the *Columbia* (STS-107) accident (February 1, 2003), which grounded the U.S. Space Shuttle fleet. The Columbia Accident Investigation Board determined that the physical cause of the accident was a breach in a reinforced carbon-carbon panel on the leading edge of the vehicle's

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[20] Judy A. Rumerman, with Stephen J. Garber. *Chronology of Space Shuttle Flights 1981-2000*. HHR-70 (Washington, D.C.: NASA History Division, Office of Policy and Plans, October 2000), 3.
[21] Launius, 185-187; NASA JSC. "The Zarya Control Module: The First International Space Station Component to Launch." NASA Facts, IS-1999-01-ISS014JSC, January 1999.
[22] NASA JSC. "NASA Signs International Space Station Agreement With Brazil." NASA News Release:H97-233, October 14, 1997; NASA. "International Space Station History." April 10, 2009 (last update).
[23] Williamson, 191.
[24] *Leonardo* was one of three MPLMs constructed by Italy, and used to carry supplies to and from the ISS.

left wing, caused by a piece of insulating foam that separated from the ET.[25] Upon Columbia's reentry, this breach allowed superheated air to penetrate through the leading edge insulation and progressively melt the aluminum structure of the left wing, resulting in a weakening of the structure until increasing aerodynamic forces caused loss of control, failure of the wing, and break-up of the Orbiter."[26]

On January 14, 2004, President George W. Bush outlined a new space exploration initiative in a speech given at NASA Headquarters.

> *Today I announce a new plan to explore space and extend a human presence across our solar system . . . Our first goal is to complete the International Space Station by 2010 . . . The Shuttle's chief purpose over the next several years will be to help finish assembly of the International Space Station. In 2010, the Space Shuttle – after nearly 30 years of duty – will be retired from service. . .*[27]

Following the President's speech, NASA released *The Vision for Space Exploration*, which outlined the Agency's approach to the new direction in space exploration.[28] Part of this initiative directed NASA to continue with the use of the space shuttle fleet to complete assembly of the ISS, after which the Space Shuttle program would be retired.

Following a two-year stand-down due to the loss of *Columbia*, the launch of *Discovery* (STS-114) on July 26, 2005, marked the Space Shuttle program's second Return to Flight since. As part of this mission, *Discovery* carried supplies and equipment to the ISS.[29] On March 2, 2006, the international partners approved a new assembly sequence which dedicated sixteen remaining Shuttle flights to launching ISS elements. Truss segments P3/P4 and P5, as well as S3/S4 and S5 were delivered to the ISS in 2006 and 2007. *Discovery* (STS-120) launched on October 23, 2007 carrying the Italian-built *Harmony* (Node 2). This module increased crew living and working space; provided connecting ports for supply vehicles and the Shuttle; and created a passageway between the U.S. *Destiny* lab, the Japanese Experiment Module *Kibo*, and the ESA-built *Columbus* Laboratory. The *Kibo* and *Columbus* modules, as well as the Canadian-built robotic device *Dextre* arrived at the station in early 2008.

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[25] ACI. *Survey and Evaluation of NASA-owned Historic Facilities and Properties in the Context of the U.S. Space Shuttle Program, John F. Kennedy Space Center (KSC), Brevard County, Florida.* On file, NASA KSC, 2007; ACI. *Historical Survey and Evaluation of the Space Station Processing Facility, John F. Kennedy Space Center, Brevard County, Florida.* On file, NASA KSC, 2010.
[26] Columbia Accident Investigation Board. *Report Volume I* (August 2003), 9.
[27] The White House. "A Renewed Spirit of Discovery – The President's Vision for Space Exploration." (January 2004).
[28] NASA Headquarters. "The Vision for Space Exploration." (February 2004).
[29] Launius, 214-216.

The last major U.S. Truss segment, S6, and the final pair of power-generating solar array wings, were delivered to the station aboard *Discovery* (STS-119) in March 2009. The same year, the *Kibo* Experiment Module Exposed Facility and Experiment Logistics Module Exposed Section were delivered aboard *Endeavour* (STS-127).[30] In February 2010, the *Tranquility* Node 3 and its cupola were delivered aboard *Endeavour* (STS-130). The node and viewing port were built by the Italian company Thales Alenia Space and commissioned by the ESA.[31]

Following the conclusion of *Discovery's* (STS-131) mission, in April 2010, the non-Russian segment of the ISS was virtually complete. In May of the same year, *Atlantis* (STS-132) delivered the Russian-built Mini-Research Module 1, *Rassvet*, to the station. In February and March of 2011, *Discovery* (STS-133), as part of its last mission, delivered *Leonardo* to the ISS, this time as a permanent multi-purpose logistics module. In May 2011, *Endeavour's* last mission (STS-134) included the delivery of the Alpha Magnetic Spectrometer. Although this was the last of the U.S. Space Shuttle missions required for the assembly of the ISS, the final mission of the Space Shuttle program, *Atlantis* (STS-135), which launched in early July 2011, carried supplies, logistics, and spare parts to the station.

Development of KSC's Industrial Area

Today, KSC maintains operational control over 3,800 acres, all located in Brevard County. The major facilities are situated within the LC 39 Area, the VAB Area, the Shuttle Landing Facility Area, and the Industrial Area. The LC 39 and VAB Areas were developed primarily to support launch vehicle operations and related launch processing activities. These areas contain two Launch Pads (39 A and B), the VAB, the Launch Control Center, the Orbiter Processing Facilities, and other support facilities. The Shuttle Landing Facility Area was established at the outset of the Space Shuttle program to provide runway facilities capable of handling the speed and weight of the orbiter. The Industrial Area was built to support administrative and technical functions, spacecraft and payload processing, and also to provide areas in which hazardous operations could be performed on spacecraft components.[32]

The approximately 1,070-acre Industrial Area sits roughly 4 miles south of the VAB. Its site plan was largely developed by a joint Manned Lunar Landing Program Master Planning Board, which consisted of NASA and Air Force personnel, with help from smaller committees that had been established to focus on facilities, instrumentation, and communications. Their site layout was heavily derived from an overall master plan that had been produced by Pan American in December 1962, under contract to the Air Force, for the Merritt Island land acquisition (see page 5). The streets within the Industrial Area were arranged in a grid pattern. Those that run north to

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[30] NASA. "Kibo Japanese Experiment Module." 2007 (last update).
[31] Thales Group. "A Room with a View: Node Tranquility and the Cupola, Both Supplied by Thales Alenia Space, Are Ready for Launch to Complete the ISS Assembly." February 4, 2010.
[32] ACI, *Space Shuttle*, 1-4.

south were given alphabetic designations; those that extend west to east were given numeric designations. The Headquarters Building was centrally positioned, while the spacecraft support facilities were placed to the east and support, storage and maintenance facilities to the south. The hazardous operations facilities were placed at the southeast corner to isolate them from the remainder of the Industrial Area.[33]

In January 1963, ground-breaking ceremonies for the Operations & Checkout Building marked the start of construction within the Industrial Area. Shortly afterwards, "the Corps of Engineers awarded a contract for the construction of primary utilities to provide for a water distribution system, sewer lines, an electrical system, a central heating plant, streets, and hydraulic fill from the Indian River causeway to connect the Industrial Area on Merritt Island with the Florida mainland."[34] Following this, numerous contracts were awarded to firms such as Azzarelli Construction Company of Tampa, Florida; the joint venture of Paul Hardeman of Stanton, California, and Morrison-Knudsen Construction Company of Boise, Idaho; Franchi Construction Company of Newton, Massachusetts; and Blount Brothers Construction Company of Shreveport, Louisiana, for the construction of other buildings within the Industrial Area.[35]

The Operations & Checkout Building was the first facility at KSC to be occupied; the Florida Operations team of JSC (then the Manned Spacecraft Center) moved into the building in September and October 1964. Formal opening ceremonies for the Headquarters Building occurred on May 26, 1965.[36] Other major facilities within the area completed by 1966 included the Central Instrumentation Facility, the Central Supply facility, the Engineering Development Laboratory, two Spacecraft Assembly/Encapsulation facilities, the High Pressure Gas Storage Facility, the Fluid Test Complex, and the Parachute Refurbishment Facility.[37]

Currently, the Industrial Area is comprised of roughly 178 buildings and structures. By the end of the 1960s, roughly 38 percent of these facilities was completed, which included the key structures listed above, as well as numerous support buildings, such as storage sheds, maintenance shops, site utility structures, fuel storage areas, and equipment shelters.[38] During the Apollo Program, these facilities supported the inspection, check-out, and integration of the spacecraft modules; ordnance storage; telemetry data analysis and transmission; testing of hazardous fluids; and testing the Lunar Module's rendezvous radar. The Operations & Checkout Building also provided pre-flight living quarters for the astronauts.[39] The Industrial Area

[33] Benson and Faherty, *Gateway*, 238-241.
[34] Benson and Faherty, *Gateway*, 252.
[35] Benson and Faherty, *Gateway*, 252-268.
[36] Benson and Faherty, *Gateway*, 268-269.
[37] Kenneth Lipartito and Orville R. Butler. *A History of the Kennedy Space Center* (Gainesville: University Press of Florida, 2007), 222-223; Space Gateway Support. *CCAFS/KSC Basic Information Guide*. KSC-CCAFS-6747, Revision B, January 2006. On file, Kennedy Space Center, 3-28 to 3-31.
[38] Space Gateway Support, 3-28 to 3-31.
[39] Benson and Faherty, *Gateway*, 240-242; Lipartito and Butler, 105.

facilities provided similar support for the Skylab missions and the Apollo-Soyuz Test Project of the mid-1970s. Only a few additional support structures (roughly 3 percent of the current total) were constructed during this time frame.[40] Likewise, roughly 95 percent of the facilities constructed from the mid-1970s to the present, are small support structures, such as maintenance shops, storage sheds, and utility buildings.

The Space Shuttle program brought the first major changes to the Industrial Area of KSC. Although many of the existing facilities were modified to meet the needs of this program, new structures were required to accommodate payload processing and launch procedure testing, as well as to provide storage and maintenance for new ground support equipment (GSE).[41] The first major facility designed for the Space Shuttle program, the Launch Equipment Test Facility, was completed in 1975. This was followed in the 1980s by the construction of a Proof Load Test Structure, a Cryogenics Test Laboratory, and a Multi-Mission Support Equipment Building within the spacecraft support area; and a Payload Hazardous Servicing Facility, a Multi-Operation Support Building, and an Operations Support Building within the hazardous operations area.[42] In 1992, the last major facility to be added to the Industrial Area for the Space Shuttle program, the Canister Rotation Facility, was completed. The introduction of the Space Station *Freedom* Program, which later became the ISS program, spurred the construction of the last two major facilities of the Industrial Area: the Space Station Processing Facility, completed in 1992, and the Multi-Payload Processing Facility, finished in 1995.[43]

The Space Station Processing Facility

In 1984, KSC was selected as the location where all space station elements to be flown on the Space Shuttle would be processed.[44] Early the following year, the Center solicited study proposals to analyze how these ground processing operations would be conducted. The proposals were to examine various facets of these operations, including prelaunch processing of elements, and identifying GSE and facility requirements.[45] These studies continued through 1985 and into 1986; by 1987, the decision was made to construct a building specifically for space station hardware processing, as well as to modify at least one Apollo-era structure and both Shuttle launch pads in support of the Space Station program.

Originally, KSC planned that site preparation for the SSPF would begin in January 1988, followed by the construction of its High Bay and Intermediate Bay (I-Bay). After these were finished, work would start on the logistics support area and office complex. Facility occupation

[40] Space Gateway Support, 3-28 to 3-31.
[41] Lipartito and Butler, 186, 201, 222-223; Space Gateway Support, 3-28 to 3-31.
[42] Space Gateway Support, 3-28 to 3-31.
[43] Space Gateway Support, 3-28 to 3-31.
[44] "KSC Looks Toward New Challenge." *Spaceport News* (23, 7), March 30, 1984: 1.
[45] "Study proposals solicited." *Spaceport News* (24, 1), January 4, 1985: 3.

was planned for early 1990, with flight hardware processing starting in 1992.[46] In the end, the design of the facility, by Jacobs Engineering Group, Inc., of Lakeland, Florida, was not begun until 1988, with the first set of plans completed in January 1989.[47] Jose Perez-Morales supported the effort as NASA's lead design engineer. The design of the SSPF focused on providing "infinite flexibility" in the processing areas (see Figure Nos. A-6, A-7, A-8 and Photo Nos. 10, 11), which meant no fixed objects on the floor, and providing workstands that were air bearing compatible. The latter allowed for easy movement and positioning of large fixtures across the facility's conductive floor.[48]

In February 1991, Metric Constructors, Inc, of Tampa, Florida, was awarded the contract for construction of the SSPF, with a winning proposal of $56.2 million.[49] The official groundbreaking ceremonies for the facility were held on March 26, 1991; construction began the following month under the direction of Tommy Mack, NASA's construction manager.[50] After the site was cleared, work began on the underground utility tunnels and the eastern end of the I-Bay (see Figure Nos. A-1, A-2). As work progressed on the I-Bay, construction on the office/laboratory area to its north was started (see Figure No. A-3). This was a divergence from the original plan, due to the fact that the Test Control and Monitoring System software team "needed to have access to their space long before the facility would be finished."[51] Construction of the High Bay was not started until early 1992 (see Figure No. A-4). The final occupational inspections of the facility began early in 1994, allowing the Test Control and Monitoring System software team to become the first occupants of the building in early May. The SSPF (see Figure No. A-5) was officially dedicated on June 23, 1994, with a ceremonial ribbon-cutting; the final construction cost of the building amounted to $72 million.[52]

In the fall of 1994, employees at the SSPF learned of their first job: processing the Russian-built *Mir*-2 Docking Module. The module officially arrived at KSC's Shuttle Landing Facility on June 7, 1995 (see Figure No. A-11). Following approximately five months of preparations, the module was carried on *Atlantis* during the STS-74 mission in November 1995, for NASA's second docking with the Russian station, *Mir*.[53] Afterwards, the hardware processing areas of the SSPF were idle until June 23, 1997, when the first U.S.-built element destined for the ISS, *Unity* (Node

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[46] "KSC funds earmarked for two new buildings." *Spaceport News* (26, 2), January 16, 1987: 6; "Space Station Brings Challenge, Building." *Spaceport News* (26, 11), May 22, 1987: 1 and 3.
[47] Jacobs Engineering Group. "Space Station Processing Facility." June 1994. On file, Engineering Documentation Center, Kennedy Space Center.
[48] Kay Grinter. "Space Station Processing Facility Dedicated 15 Years Ago." *Spaceport News* (49, 13), June 26, 2009: 7; Mitch Varnes. "Space Station Processing Facility contract awarded." *Spaceport News* (30, 4), February 22, 1991: 1; Rob Mayer. Personal communication with Patricia Slovinac and Christine Newman, April 22, 2010.
[49] Grinter; Varnes, 1.
[50] Grinter.
[51] Grinter.
[52] Grinter; "Space station moves ahead." *Spaceport News* (33, 8), April 22, 1994: 1 and 4.
[53] Grinter; "SSPF gets first job: Shuttle/Mir docking module." *Spaceport News* (33, 19), September 23, 1994:5.

1), arrived at the facility. Shortly thereafter, two pressurized mating adapters, set to be attached to *Unity* in the SSPF, were delivered. The assembly was carried into orbit in December 1998 aboard *Endeavour* (STS-88) as part of ISS Assembly Mission 2A.[54]

By early 1997, construction was underway on an approximately 1,600-square foot viewing gallery along the south wall of the High Bay; it had been designed by Jacobs Engineering Group at the same time they designed the SSPF.[55] Viewing windows were inserted into the south wall to allow visitors to look into the High Bay.[56] Since the viewing level was located roughly 30' above grade, two external staircases and an elevator were built to the south of the gallery, for emergency exit purposes. An elevated covered walkway was constructed at the west end to serve as the principle visitor access point. This walkway connected the viewing gallery to the ISS Complex Concession Building, on the other side of the security fence and across the street to the south. The viewing gallery and exhibit, the latter located within the ISS Complex Concession Building, officially opened on January 16, 1998.[57]

Throughout 1998, four permanent ISS components, including the first U.S. Laboratory, *Destiny*, a third pressurized mating adapter, the Z-1 and P6 Truss segments, and a set of solar arrays, arrived at the SSPF for processing. In addition, the first of three MPLMs, *Leonardo*, arrived at the facility. In December 1998, Phase I of the Multi-Element Integration Test (MEIT) program began (see page 22 for a more detailed description of this program). This phase of the MEIT, which included the *Destiny*, Z-1 Truss, and Canadarm II components (which arrived at the SSPF in early 1999), ended in February 2000.[58]

In 1999, Jones Edmonds & Associates, of Gainesville, Florida, completed the design for the Ammonia Vapor Containment Building, also known as the Vapor Containment Facility, to be constructed to the east of the SSPF. This building was designed to house the ammonia servicing equipment necessary for processing the ISS trusses, which contain ammonia that is used by the station's coolant system. The equipment had previously been housed within the I-Bay, but ammonia leaks, some of which caused evacuations of the entire High Bay area, prompted the

[54] NASA KSC. "Kennedy Space Center Annual Report FY 1997," no date, 20-21.
[55] Ira Kight. Personal communication with Patricia Slovinac and Christine Newman. April 22, 2010.
[56] Jacobs Engineering Group.
[57] Elaine E. Liston. "Chronology of KSC and KSC Related Events for 1997." February 1998. On file, KSC Archives, 82; Elaine E. Liston. "Chronology of KSC and KSC Related Events for 1998." October 1999. On file, KSC Archives, 8.
[58] NASA KSC. "Kennedy Space Center Annual Report FY 1998," no date, 11-12; NASA KSC. "Kennedy Space Center Annual Report FY 1999," no date, 10; NASA KSC. "Kennedy Space Center Annual Report FY 2000," no date, 11; "Second phase of Station testing complete." *Spaceport News* (40, 15), July 20, 2001: 1 and 8.

construction of a separate facility where any leaks could be contained. A ribbon-cutting ceremony on July 18, 2000, marked the official opening of this facility.[59]

Beginning in 2000, the work load at the SSPF steadily picked up. By this point, only seven of the fifty-two permanent ISS elements that would be processed in the facility had been delivered, and only three of these had been carried to the station. The remaining forty-five elements, which included additional truss segments, solar arrays, laboratory and experiment modules, and other components, gradually arrived at the SSPF, were processed and tested, and then transported to the launch pads for delivery to the ISS. Two additional phases of the MEIT program were conducted, Phase II between 2000 and 2001, and Phase III in 2003.[60] In addition, the three MPLMs were processed multiple times to carry supplies and equipment to the ISS. The MPLM *Leonardo* was processed one last time between 2009 and 2010 to become a permanent component of the station; it was delivered as part of *Discovery's* final mission (STS-133) from February 24 through March 9, 2011.[61]

SSPF Ground Support Equipment

In addition to the SSPF, numerous pieces of GSE were required to process the ISS flight hardware. This equipment included workstands, both static and rotatable, processing tools, and lifting apparatus. Many of the items were designed and fabricated by KSC's Design Engineering Directorate and their support contractor Dynacs Engineering Company in 1997. This same crew performed validation tests on the GSE elements at KSC's Launch Equipment Test Facility prior to their use.[62] Those items specifically designed for station components are described below.

<u>Workstands</u>

Cargo Element Workstands

The Cargo Element Workstand (CEW; see Photo Nos. 17, 18) was a generic workstand capable of supporting a single cargo element with trunnions. The workstand had a "U"-shaped cross-section, which mimicked the Space Shuttle orbiter's payload bay. The stand consisted of a rectangular base with a truss at either end that supported an access platform. The CEW had two

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[59] Elaine E. Liston. "Chronology of KSC and KSC Related Events for 2000." February 2001. On file, KSC Archives, 33; Kight; Jones Edmonds & Associates. "Ammonia Vapor Containment Facility." August 31, 1999. On file, Engineering Documentation Center, Kennedy Space Center.
[60] NASA KSC, "Annual Report 2000," 11; NASA KSC. "Kennedy Space Center Annual Report FY 2003," no date, 22; "Second phase," 8.
[61] NASA KSC. "Kennedy Space Center Annual Report FY 2010," no date, 14-15.
[62] NASA KSC, "Annual Report 1997," 21; "KSC ingenuity, experience are tackling ISS ground support equipment needs." *Spaceport News* (37, 4), February 27, 1998: 1-2.

widths: 10’ and 15’. Two or more of these stands could be joined together to support larger components or multiple flight hardware elements.

Element Rotation Stand

The Element Rotation Stand (ERS; see Figure No. A-19; Photo Nos. 19, 21, 22) assembly was an arrangement of access/work support stands used to rotate a variety of ISS elements for processing activities. It consisted of three basic parts, a rotating support ring assembly, a support stand, and a control panel. The rotating support ring assembly contained two rings, one at each end, which connect to one another by three pairs of longeron trunnions. The support stand was a rectangular frame, which provided a base for the rotation ring assembly. The stand assisted with rotation activities by providing leveling jacks, guide assemblies, and track roller structures. A group of moveable work platforms complemented the ERS by providing access to the entire perimeter of the stand and ISS flight hardware. These structures consisted of two work platforms, an elevator (6000 lb. capacity), two stair structures, and four corner platforms. The ERS structure was horizontally movable, both loaded (element) and unloaded, with the use of air bearing pallets or air bearing casters. The drive and brake assemblies were designed to accommodate structure deflections and lock the drive ring into any of the 360-degree rotation positions required.

The top-half of the ERS was removable to allow ISS hardware, such as MPLMs, nodes, or laboratories, to be inserted into, or removed from, the stand with the use of the overhead crane system. The element was supported by the rotating support ring assembly with trunnions. The ERS can rotate the element in either the clockwise or counterclockwise direction at a rate of 6 degrees per minute. Rotation activities can be controlled automatically, through the control buttons on the control panel, or manually, by attaching a handwheel onto the manual ring rotation drive shaft.

Express Logistics Carrier Rotation Stand

The Express Logistics Carrier Rotation Stand (see Photo Nos. 30, 31, 32) was a smaller version of the ERS, which was used to rotate the Express Logistics Carriers while they were being processed.

Processing Tools

Rack Insertion Device

The Rack Insertion Device (RID; see Figure No. A-17; Photo Nos. 23, 24) was one of the first pieces of GSE to be designed by the Engineering Directorate. It was an electro-mechanical, moveable, handling and positioning device comprised of three main parts: an extendible boom with various interchangeable end effectors, a base, and a control station. The extendible boom was capable of moving 27’ in the horizontal direction and 7’-6” in the vertical direction. It could be fitted with five different end effectors, each of which was designed for a specific type of task. One allowed for weight and center of gravity measurements, another assisted in removing and installing the MPLM’s aft access closure. The third was used for handling 50” hatch racks, while the fourth held orbital replacement units. The fifth end effector enabled personnel to enter and exit the MPLM. The RID’s base encased these elements, while providing 360-degree rotational and 72” side-to-side translational capabilities. The control station was situated on a rotating arm that extended out from the base; it was capable of commanding all functions and abilities of the RID.

The main function of the RID was to insert payload racks into the MPLMs. The first step in the process was to attach the correct end effector (using a lift accessory if necessary) to the end of the boom. Then, the rack (or other device) would be mounted to the end effector, and the boom would lift the load. The base would then rotate, so that the end effector/rack was next to the MPLM’s opening. Then, the boom was extended into the opening, where it continued to support the rack while the MPLM itself was rotated to the proper position via the ERS. The rack was subsequently inserted into its designated space within the MPLM, and the boom was retracted and either returned to its storage position, or readied for the next rack insertion.

<u>Lifting apparatus</u>

Cargo Element Lifting Assembly

The Cargo Element Lifting Assembly (CELA; see Figure No. A-11; Photo No. 39) was developed specifically for ISS payloads. It was a rectangular frame that had a maximum payload envelope of 15’ in diameter and 20’ in length, with a maximum weight of 36,500 pounds. Only requiring one crane to lift, the CELA was adjustable for different sizes through the use of moveable trunnions, which attached to the payload. It was utilized during payload installation/removal operations to and from payload workstands, a multi-mission support equipment canister, or other payload containers.

Functions and Operations

ISS Component Processing

The SSPF served as the point of final checkout, assembly, and processing of all ISS elements destined to fly on a Space Shuttle vehicle. Processing of ISS flight hardware typically followed four or five major steps: pre-Shuttle integration, MEITs, Launch Package Physical Integration, Shuttle integration, and post-landing/deintegration (if required). These preparation activities could last a few months or several years, as the technicians worked to ensure that the elements were ready for delivery to the station.[63]

ISS flight hardware, and other large pieces of equipment, typically entered the SSPF through the Airlock encased within a transporter canister (Figure No. A-9).[64] Once inside the Airlock, the shipping container was opened, and the item was thoroughly cleaned through the use of built-in vacuums. This helped prevent contamination of the High Bay, which was designated as a clean work area. Afterwards, the item was then moved from the Airlock into the west end of the SSPF High Bay (Figure A-10).[65]

When the component was situated within the High Bay, one or both of the overhead cranes, fitted with the appropriate cargo sling, were used to lift the component and move it to its designated workstand (see Figure Nos. A-11, A-16, A-18, A-20). The High Bay was designed with eight rectangular work areas, called “footprints,” which were the designated processing areas for station components (see Photo Nos. 97, 99). Each footprint had a total area of 4,050-square feet, at the center of which was a 900-square foot ‘element envelope;’ surrounding this element was the GSE envelope, where the connections to the facility services (water, gaseous nitrogen, gaseous helium) were recessed into the floor. Other than these interfaces, the floor space of each footprint contained no permanent workstands, or other fixtures. All of the workstands were designed to be moveable, through the use of an air bearing pallet system (see Photo No. 45). In addition, each of the footprints was fitted with a mechanical service console, located within a wall niche, to supply additional power, mechanical, utility and gaseous commodities required for processing ISS hardware. Each was also fitted with an interface panel, which was connected to the main systems panel for the Control Rooms. The only divergence from this flexibility was that any ammonia-containing element, such as the ISS truss segments, had to be processed in one of two footprints at the east end of the High Bay, which were fitted with ammonia supply and return pipes. To keep the floor space open and usable for other elements, these pipes were mounted onto the walls (see Photo Nos. 35, 36).[66]

Once the flight hardware was situated within its workstand, any protective coverings were removed and the post-delivery checkout was performed, to ensure that the component had not been damaged during its travel to KSC. Following inspection, any remaining assembly tasks were completed, many of which were interwoven with various testing requirements. For

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[63] NASA KSC. “Kennedy Space Center Annual Report FY 2006,” no date, 14.

[64] Many of the foreign partners of the program provided test stands for their particular components, which were brought into the SSPF in the same manner. Matt Czech. Personal communication with Patricia Slovinac, September 16, 2010.

[65] Mayer 2010; Czech 2010; NASA KSC. “Space Station Processing Facility Processing and Support Capabilities.” Contract NAS10-11400, April 1995, 3-21.

[66] Mayer 2010; NASA KSC, “Processing and Support Capabilities,” 3-1, 3-22; Matt Fields. Personal communication with Patricia Slovinac, September 16, 2010.

example, two pressurized mating adapters were connected to the *Unity* node in the SSPF as part of its preparations for delivery to the ISS (see Figure Nos. A-12, A-13). In between this work, the node with only PMA-1 attached, was moved to the payload canister for a leak test. The Truss segments required the installation of all major subcomponents, including electrical harnesses, connection panels, cables and batteries, solar panels, and orbital replacement units (see Figure No. A-14).[67]

Testing procedures varied greatly, depending mostly upon how the element was to support the station and its crew; some tests, however, were standard among the elements. One such test was the simulated orbiter interface test, to ensure that there would be no problems between the hardware and the orbiter's payload support systems. Another test performed on all pieces of flight hardware was the measurement of the hardware's weight and center of gravity (Figure No. A-15), which were required to fall within designated parameters based on the mission's cargo capacity. All of the elements were also subjected to a variety of verification and validation testing, to ensure that all of their internal systems were properly functioning.[68]

Many testing requirements were common to a specific type of ISS flight hardware (truss, airlock, etc.), or elements that had similar functions (nodes, laboratories). Some components were subject to the MEIT program (Figure Nos. A-23, A-24), which is discussed below. Integration systems tests were also fairly common for inhabited components.[69] These tests emulated the on-orbit configuration, in order to test such features as the command and tracking systems and the caution and warning systems.[70] Another type of test performed in the SSPF was an "end-to-end" test, in which the on-orbit control center transmitted commands to the module, and in turn, the module relayed telemetry data to the center. This served to validate flight hardware, its control system, and on-orbit procedures.[71] An additional test that was common to many pieces of ISS flight hardware, was the Crew Equipment Interface Test, which allowed astronauts to conduct "hands-on" testing in preparation for their assembly activities (Figure No. A-26).[72] One testing sequence performed in the SSPF, the Active Thermal Control System servicing test, was particular to the truss components. This required filling the system with liquid ammonia to mimic on-orbit operation of the radiators. Other components, such as the solar panels and arrays, were simulated

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[67] Fields 2010.
[68] Czech 2010; NASA KSC. "Kennedy Space Center Annual Report FY 2005," no date, 15.
[69] The inhabited components of the ISS include any elements in which a crew member can reside, such as service modules, nodes, airlocks, and laboratory modules.
[70] NASA KSC, "Annual Report 2003," 22.
[71] Typically, the nation who sponsors a particular node, laboratory, etc., is responsible for the on-orbit control of that element. Similarly, the nation who sponsors any scientific experiments, provides on-orbit control and operation of that experiment. Currently, there are individual control centers in the U.S., France, Germany, Russia, and Japan. NASA KSC, "Annual Report 2006," 15-16; NASA. *Reference Guide to the International Space Station, Assembly Complete Edition* (Washington, D.C.: NASA, November 2010), 63-70.
[72] Fields; NASA. "Space Station Processing Facility." *NASAfacts*. 2005, Rev. 2006; "STS-120 astronauts train with Node 2 elements." *Spaceport News* (46, 9), May 4, 2007: 4.

with computer equipment as required. The systems were then operated "around-the-clock" to test the batteries, coolant systems, software operations, and communications.[73]

Nearly all of the tests performed in the SSPF were monitored from one of nine Control Rooms located on the second floor of the High Bay area (see Figure No. A-25; Photo Nos. 94, 100, 101). Similar to the footprints in the High Bay, each of the Control Rooms was fitted with the same support provisions (electrical power, closed circuit television, operational intercommunication system) and standard interface panels, which could be patched into similar panels within any of the footprints. However, only one of the Control Rooms, the second from the west, was fitted with an ammonia control panel, requiring it to be used for all tests on the station's truss components. Because of the flexibility in design, one control room could monitor multiple footprints, which was common during MEIT testing. To prepare for a test, all necessary equipment was connected to the interface panels next to the footprint, while the test conductor's station was patched into the appropriate panel. In addition, any additional computers and monitors were arranged within the control room per the test's requirements.[74]

After all checkout, assembly, and tests were completed, the components underwent their final preparations for launch. Typically, this involved a series of hardware close-outs followed by another weight and center of gravity measurement. If these attributes fell within the designated parameters, the component was then placed inside one of two payload canisters for delivery to the orbiter, either while it was in the Orbiter Processing Facility or at the launch pad, if the vehicle was ready (see Figure A-16), or the element was stored within a workstand or elsewhere in the SSPF until the proper time in the Space Shuttle processing sequence. If there were problems, the component was returned to its workstand, where it underwent further evaluation.

Multi-Element Integration Test Program

One of the largest test endeavors of the ISS program was the MEIT program, performed in the SSPF. Preparations for the test program began in 1997; it was completed in three major phases from December 1998 through September 2003. Each phase was further subdivided into different test configurations and subsets. Phase I, December 1998 through February 2000, focused on the *Destiny* lab, Z-1 Truss, and Canadarm II components. Phase II of the MEIT program involved five of the Truss segments, the S0, S1, P1, P3, and P4 Trusses, and their compatibility to the *Destiny* lab; this phase was conducted between April 2000 and June 2001. Phase III occurred between May and September 2003 and focused on *Destiny*, U.S. Node 2, *Harmony*, and the

[73] NASA KSC, "Annual Report 2006," 16.
[74] Mayer 2010; NASA KSC, "Processing and Support Capabilities;" Shirish Patel. Personal communication with Patricia Slovinac, September 7, 2010.

Japanese Experiment Module, *Kibo*.[75] Any flight hardware already in orbit, such as *Destiny* for Phases II and III, was simulated with a Flight Emulator.[76]

The main purpose of the program was to test the compatibility between actual interfacing flight elements prior to sending them into space.[77] In order to accomplish this task, the three phases of the MEIT included end-to-end tests, mission sequence tests, and regression tests. The end-to-end tests were similar to those performed on individual components, as described above. The mission sequence tests served as a dress rehearsal of activities to be performed once the elements were in orbiter. These tests typically included flight crew members and flight controllers, and helped to validate mission timelines. Regression tests were conducted on hardware and software following adjustments made as a result of previous tests. For the individual tests, the appropriate ISS flight hardware was "soft-mated" on the high bay floor in the same configuration it would have on orbit. This entailed connecting the elements with various interface cables for systems such as communications and tracking, command and data handling, electrical power, and fluid lines. In the end, hundreds of hardware and software problems were discovered and corrected during the MEIT program, preventing countless hours of potential re-working in orbit.[78]

Experiments/General Cargo Processing

Experiments or general cargo payloads generally entered the SSPF either through the shipping and receiving area or the hardware inspection area. Typically, these payloads were then taken to one of eighteen smaller processing laboratories, which contractors could use to inspect and/or finish processing their payload, prior to officially handing the items over to NASA. Eight of these rooms are referred to as Off-line Processing Labs (see Photo Nos. 76, 77) and were used on general hardware items, such as EXPRESS (Expedite the Processing of Experiments to the Space Station) racks.[79] The remaining ten rooms were designated as Bio Labs (see Photo Nos. 73, 74, 75), and were equipped with standard biological equipment to support the pre-launch and post-flight off-line processing of experiment-specific hardware.[80]

Once the contractor finished processing their payload, and it was turned over to NASA, the payliad was then moved to the Low Bay (see Photo Nos. 69, 70), the I-Bay, or the rack

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[75] "Second phase;" "Destination: Station – MEIT places ISS one step closer to next launch." *Spaceport News* (38, 19), September 17, 1999: 6; "Putting the station to the test: some assembly required, but batteries are included." *Spaceport News* (38, 9), April 30, 1999: 1 and 5.
[76] NASA KSC, "Annual Report 2003," 22.
[77] NASA KSC, "Annual Report 2000," 11.
[78] NASA KSC, "Annual Report 2000," 11; "Destination: Station;" ACI, 2010.
[79] One of these rooms is referred to as the Multi-Layer Insulation Sew Shop, which is specifically used to fabricate and repair multilayer insulation blankets for station hardware. Mayer 2010; Johnny Middleton. Personal communication with Patricia Slovinac and Christine Newman, April 22, 2010.
[80]Mayer 2010; Matt Galloway. Personal communication with Patricia Slovinac and Christine Newman, April 22, 2010; Eirik Holbert. Personal communication with Patricia Slovinac, September 7, 2010.

processing area (see Photo Nos. 71, 72), for further preparations prior to installation into a flight element. Typically, this additional work consisted of loading the experiment or cargo into a rack for transportation to the ISS. Afterwards, those racks containing general cargo were generally taken into the High Bay and placed in one of the three Italian-built MPLMs. Those racks that contained experiments were taken to the Payload Rack Checkout Unit (PRCU) Room to undergo testing. Within the PRCU Room is a set of equipment that mimics the U.S Laboratory, *Destiny*. The racks are patched to one of three interface panels, which are connected to the equipment, and various tests are performed to ensure the experiments will work properly on *Destiny*. Once all test requirements were satisfied, the racks were taken into the High Bay for installation into a MPLM or other carrier.[81]

[81] Mayer 2010; Patel 2010; Holbert 2010; Bryan Onate. Personal communication with Patricia Slovinac and Christine Newman, April 22, 2010.

Physical Description

The SSPF is an Industrial Vernacular-style building with approximate overall dimensions of 551' in length (east-west; excluding the cafeteria to the east), 367' in width (north-south), and 90' in height. The entirety sits on a reinforced concrete slab, which is supported by roughly 225 reinforced concrete pier and footer combinations. Portions of the walls are formed of concrete block; the remainder are comprised of a steel skeleton faced with both insulated and uninsulated metal sheeting and composite wall panels. The facility has a flat roof comprised of metal decking, rigid insulation, and a four-ply built-up roof system with gravel topping. The SSPF derives its primary significance from its hardware processing areas, specifically the High Bay, the I-Bay, the PRCU Room, and the Airlock, as well as nine associated Control Rooms. In addition, the Ammonia Vapor Containment Building, situated to the east of the High Bay, is considered a contributing ancillary feature to the SSPF.

Exterior

The north elevation of the SSPF (Photo Nos. 1, 2, 8) serves as the principal façade of the building. The main entrance to the facility sits roughly 50' east of the elevation's centerline, and is comprised of two pairs of mechanically-operated glass swing doors, which are framed by fixed-window sidelights and a transom. To the west of the main entrance is a 12'-high, 12'-wide expanse of glass curtain wall, which correlates with the building's main lobby area. The entrance is shaded by an approximately 65'-deep, dual-width concrete canopy, supported on each side by three columns. The 30' of the canopy closest to the elevation are about 60' wide; the remaining 35' have a width of roughly 40'. At the east end of the north elevation, the internal first floor and mezzanine levels are each denoted by a ribbon of thirty-eight, one-light windows with aluminum frames; there are no corresponding windows at these levels within the west portion of the elevation. Both the second and third floor levels have a ribbon of windows that extends across the entire façade. At the second floor level, the east end of the ribbon begins with six, two-light windows, followed by thirty-eight, one-light windows. Centered above the entrance canopy, this ribbon changes to an expanse of nineteen, three-light windows, which is followed by a group of fifty-two, one-light windows, before ending with six, two-light windows. A similar ribbon of windows extends across the façade at the third floor level. This ribbon begins and ends with six, three-light windows, and contains an expanse of forty-seven, three-light windows, centered above the entrance canopy. The central section of the ribbon is connected to the east end by twenty-six one-light windows, and to the west end by fifty-two one-light windows. Other features of the north façade include faux pilasters and a few wall-mounted lights.

The east elevation of the SSPF (Photo Nos. 2-4) contains a continuation of the four ribbons of windows from the east side of the north elevation. At the first floor and mezzanine levels, this continuation is in the form of ten, one-light windows at the first floor and mezzanine levels, which ends just prior to the cafeteria foyer. The ribbon at the second floor level begins with six, two-light windows, which are followed by forty, one-light windows, while the ribbon at the third floor level starts with six, three-light windows, that are succeeded by forty, one-light windows. The southern terminus of these two ribbons of windows is situated roughly 32' prior to the beginning of the High/Intermediate Bay area. Other features within the north end of the east elevation include three pairs of metal swing doors and one single metal swing door that open into either individual rooms or corridors, and a series of six horizontal louvers. The southern portion of this elevation, which corresponds to the High Bay area, contains one metal swing door and one metal rolling door. Above these doors is a 104'-long by 28'-high section of removable wall panels that provide access to the internal bridge cranes.

Similar to the east elevation, the west elevation of the SSPF (Photo Nos. 6-8) contains a continuation of the two ribbons of windows from the western part of the north elevation. The ribbon at the second floor level begins with six, two-light windows, and the one at the third floor level begins with six, three-light windows; both ribbons then continue with thirty-nine, one-light windows. Like the east elevation, the ribbons of windows terminate prior to the High Bay area of the building. Additional features within the northern portion of this elevation include two pairs of metal swing doors, a series of six horizontal louvers, and two individual horizontal louvers, as well as faux pilasters. At the south end of the west elevation, which denotes the High Bay's Airlock, is a four-section vertical lift door, with a personnel opening. To the north of this door is a loading dock area, which contains one metal swing door into the SSPF, above which is a horizontal louver.

The south elevation of the SSPF (Photo Nos. 4-6) is faced entirely with insulated metal panels, and contains very few openings. There are three metal swing doors, one roughly in the center of the elevation, and one each towards the east and west ends. Each of the three doors is accessed by a set of concrete steps. Also along this elevation are three small shed-type enclosures, which serve as emergency exits for the underground utility tunnel system. All three of these enclosures/exits are located within the eastern half of the façade, and each is fitted with a metal swing door that opens onto a set of concrete steps that lead up from the tunnel. Additionally, near the center of the south elevation, there is a covered walkway, roughly 20' above grade, which provides access between the SSPF visitor's gallery and the ISS Center (part of the KSC Visitor Complex) Concession Building.

Interior

Internally, the SSPF is divisible into two sections: an office/laboratory area to the north and a High Bay area to the south. The office/laboratory area has approximate dimensions of 502' in length (east-west) and 195' in width (north-south). The majority of this area contains three floor levels; the northeast corner also has a small mezzanine level between the first and second floors. The first floor of the office/laboratory area contains processing and packing/unpacking areas for Space Shuttle crew and space station equipment within the west end; the remaining areas of this floor contain general office and support rooms, as well as various off-line laboratories. Extending from a corridor near the northeast corner of the office/laboratory area is a small foyer, which provides access to the cafeteria. The entire second and third floor levels of the SSPF's office/laboratory area contain offices and support rooms, as does the small mezzanine level.

On the first floor of the office/laboratory area, near the southeast corner, is the PRCU Room (Photo No. 65), which has approximate dimensions of 45' in length and 20' in width, with a 15' floor-to-ceiling height. It is typically accessed by personnel through a metal swing door on its north wall; on the south wall, there is a large pair of metal swing doors for equipment. The interior of the PRCU Room contains two distinct areas, the testing area to the east and the equipment area to the west. These two areas are separated by a partition wall, which is fitted with a door at the north end to allow the technicians to pass between the two spaces. To the south of this door are two fixed windows that provide a visual connection between the spaces. The testing area (Photo No. 66) is located in the eastern two-thirds of the room, and is capable of operating under the same environmental conditions found on the ISS. Within the area are various work stations, shelves, and vent lines. At the west end of the testing area, there is a 1.5'-high platform level that contains three interface panels (Photo No. 67) on its vertical face. These panels contain various ports and valves for connecting the payload racks to the test support equipment. The top of the platform continues west to serve as the floor of the equipment area; the "raised floor" provides plenum space for all of the piping and wiring between the equipment and the interface panels. The PRCU's equipment area (Photo No. 68) contains power, instrumentation, and mechanical panels, which are used during testing processes and mimic those on the ISS.[82]

The High Bay area of the SSPF has approximate overall dimensions of 550' in length (east-west) and 165' ft in width (north-south); the height throughout the area varies. The first floor level of this area contains the High Bay, the Airlock, the I-Bay, a Low Bay area, a rack processing area, a hardware inspection area, five off-line laboratory areas, and a shipping/receiving area. On the second floor level, which is located at the northwestern portion of the High Bay area, are nine Control Rooms and an office. The third floor level, which extends across the entire northern 65' of the High Bay area and along the west wall, contains mechanical rooms (see Photo Nos. 93, 94, 95).

The High Bay (Photo Nos. 10, 11) sits in the southeast corner of the SSPF, and measures roughly 435' in length and 112' in width, and has a floor to ceiling height of 61.5'. Its walls and ceiling are composed of gypsum board, covered with a white epoxy paint. The entire space is fitted with a conductive floor, which allows for the easy relocation of different pieces of equipment with the use of air bearing pallet mover (Photo No. 45). The west wall of the High Bay (Photo No. 104) is fitted with a 41'-5"-wide x 50'-high, four-section steel vertical lift door (Photo No. 12), which opens into the Airlock. In its lowest section, near the south end, is a personnel access door. To

[82] Patel, 2010.

the north of this vertical lift door is a 20’-wide x 17’-high steel sliding door, that opens into the hardware inspection area. This door is also fitted with a personnel door. The east wall of the High Bay (Photo No. 106) contains a 15’-wide x 18’-high steel rolling door, with a personnel access door to its north. Also mounted to this wall are a cluster of ten ammonia supply/return pipes; four of these pipes extend along a portion of the south wall (see Photo Nos. 14, 35).

The north wall of the High Bay (Photo Nos. 105, 107) contains six large openings, which provide personnel and equipment access between the High Bay and either the Low Bay or the I-Bay. There are four openings to the Low Bay, located towards the west end, which range between 14’ and 22’ in width; all have a height of 12’. Towards the east end of the High Bay are the two openings into the I-Bay, both of which are 20’ in height. One opening has a width of 30’, while the other has a width of 18’. Also along the north wall are four cut-outs, each of which has a height of 7’-6” and a width between 11’ and 14’. Each of the cut-outs holds two mechanical service consoles, one oriented for use in the High Bay, and the other for use in the Low Bay or I-Bay (depending upon its location). These consoles (Photo No. 57) are fitted with valves and gauges for all of the major commodities, such as helium, nitrogen, chilled water, and chilled air, used in the processing of ISS components. Another prominent feature of the north wall is an observation booth near the center, which takes the form of a bay window and looks down to the High Bay from the easternmost control room on the second floor level. Additional features of the north wall include various access doors into mechanical equipment areas, ventilation louvers, and wall-mounted electrical panels. The south wall of the High Bay is similar to the north wall, in that it features four cut-outs for mechanical service consoles, although each of these only holds one panel that is oriented to the High Bay. The most prominent feature of the south wall is a line of windows at the second floor area, which corresponds to the visitor’s viewing gallery. Like the north wall, additional features of the south wall include various access doors into mechanical equipment areas, ventilation louvers, and wall-mounted electrical panels.

In the northwest corner of the High Bay, there is a partitioned enclosure, with approximate dimensions of 76’ in length, 26’ in width, and 24’ in height. Within this enclosure are two off-line laboratories, separated by a corridor. A set of steps at the west end of this enclosure provides access to its ceiling, which serves as a storage area for the lifting strongback (Photo No. 39), used in conjunction with the overhead cranes for moving ISS elements into, and out of, different workstands and canister transporters. The High Bay contains two overhead bridge cranes (see Photo No. 13), each rated at 30-tons. In order to support the crane rails, the north and south walls of the High Bay were designed to have a thickness of roughly 6’ from the finished floor to a height of roughly 47’, where the wall thickness changes to 4’. This change in thickness creates a horizontal surface, on which the crane rails sit.

The floor of the High Bay is divided into eight designated work areas, called “footprints,” which are denoted by lines painted on the floor (Photo Nos. 93, 97, 99). From west to east, Footprint Nos. 1, 3, 5 and 7 are located along the south wall, and Footprint Nos. 2, 4, 6 and 8 are along the north wall; a 15'-wide aisle separates them. Each footprint measures roughly 90' in length (east-west) and 45' in width (north-south), and has one of the afore-described mechanical service consoles next to it. Since the consoles are identical, any of the footprints can be arranged to process any ISS element with one exception; only Footprint Nos. 7 and 8 can be used to process ISS elements that contain ammonia. At the time of documentation, the footprints were arranged as follows:

- Footprint No. 1 was being used as storage space for a weight machine and a spare MPLM (Photo No. 15);
- Footprint No. 2 contained the Payload Rotation Stand and the Composite Overwrapped Pressure Vessel Workstand (Photo Nos. 16, 17);
- Footprint No. 3 had two ERSs, each holding a MPLM, between which was the RID (Photo No. 19);
- Footprint No. 4 was being used as a general storage area (Photo No. 26);
- Footprint No. 5 contained the EXPRESS Logistics Carrier Rotation Stand, as well as one CEW (Photo No. 27);
- Footprint No. 6 contained one ERS and one CEW (Photo No. 30);
- Footprint No. 7 had the Alpha Magnetic Spectrometer workstand and was also being used for storage (Photo No. 34); and
- Footprint No. 8 held two CEWs (Photo No. 36).

At the west end of the High Bay is the Airlock (Photo Nos. 42, 43), which has approximate overall dimensions of 107' in length, 46' in width, and 61'-6" ft in height. Like the High Bay, the Airlock's walls and ceiling are composed of gypsum board, covered with a white epoxy paint, and is fitted with a conductive floor. The north wall (Photo No. 105) features a 20'-wide x 17'-high steel sliding door near the east end, which contains a personnel door. This door provides access between the Airlock and the hardware inspection area. In addition, both the north and south walls are fitted with various ventilation louvers and vacuum hook-ups for cleaning and decontaminating each ISS element before it enters the High Bay processing area. Both the east and west walls of the Airlock are fitted with a 41'-5"-wide x 50'-high, four-section steel vertical lift door (Photo Nos. 44, 104). The door on the west wall opens to the exterior of the facility, while the door on the east wall provides access to the High Bay. The lowest section of each door contains a personnel access door (Photo No. 12, bottom left). The most notable feature of the Airlock is the overhead crane, which is rated at 15 tons. The crane moves in the east-west direction via rails mounted to the north and south walls. Similar to the High Bay, the north and south walls of the Airlock were designed to have a thickness of roughly 5'-6" from the finished floor to a height of roughly 47', where the wall thickness changes to 2'-6". This change in thickness creates a horizontal surface, on which the crane's rails sit. Access ladders to the crane service walkway are at the southeast and southwest corners of the Airlock.

The I-Bay (Photo Nos. 46, 47) sits directly to the north of the east end of the High Bay; as previously noted, access between the two bays is provided through two wall openings. The I-Bay has approximate dimensions of 150’ in length and 50’ in width, and has a floor to ceiling height of 30’. The south wall of the I-Bay features the two openings to the High Bay and three mechanical service console openings. In addition, there are numerous ventilation louvers near the ceiling and wall-mounted electrical panels. The north wall of the I-Bay contains two mechanical service console niches, five electrical service panel openings, and three pairs of hollow aluminum swing doors, which lead to various support rooms. In addition, there are various wall-mounted electrical and mechanical panels, as well as ventilation louvers that sit just above the floor. The east wall of the I-Bay (Photo No. 122) contains two niches, one for a mechanical panel and one for an electrical service panel, as well as additional wall-mounted panels. Also mounted to this wall are two groups of ten ammonia supply and return pipes. The top group extends into the High Bay through a small cut-out on the south wall; the lower group wraps around the south wall and into the eastern opening where they turn to enter the High Bay (see Photo No. 52). The bottom 15’ of the I-Bay’s west end opens into the Low Bay, while the upper 15’ is a wall with only one feature, a viewing window from the westernmost second floor control room. Similar to the High Bay, the I-Bay contains two overhead bridge cranes, each rated at 5-tons (Photo No. 48). The rails for the cranes are mounted directly to the north and south walls at a height of roughly 25’ from the finished floor.

Similar to the High Bay, the floor area of the I-Bay is divided into six different work zones, one of which, Zone D, partially extends into the Low Bay. The remaining work zones, from west to east, are Zones E, F, G, and H; the work area at the very east end of the I-Bay does not have an alphabetical designation. All of these work zones extend through the full width of the bay, and have a length of roughly 35’. At the time of documentation, Zone D was being used as a general storage area (see Photo No. 47). All of the equipment sat in the central area of the zone, leaving access aisles all around. Zones E through G of the I-Bay were being used as a component testing area (Photo Nos. 49, 50). Like Zone D, all of the equipment was centralized, with access aisles extending along the north and south walls, at the west end of Zone E, and at the east end of Zone G. Similar to Zone D, Zone H was being used as storage, with all of the components sitting within the center of the area (Photo No. 51). The east end of the I-Bay contained various hazardous fluid consoles, which were used in support of processing operations for ammonia-containing elements (Photo No. 52). Scattered throughout this space are control and monitoring panels (Photo No. 55), movable servicing carts (Photo Nos. 54, 56), and work stations.

Within the second floor level of the High Bay area, which is located above the Rack Processing Area to the west of the I-Bay, are the nine Control Rooms (see Photo No. 61). Each room has approximate dimensions of 51’ in length (north-south) and 30’ in width (east-west), with a floor-to-ceiling height of 9’. The north and south walls of each room are comprised of painted gypsum board, while their east and west walls are formed from moveable partitions to allow for maximum flexibility of the space. Along the west, south, and east walls of each Control Room is a row of console stations (Photo No. 62); the director's console sits at the north end of the room (Photo No. 63). Work tables are positioned in the center of the space allowing for group meetings among all the test engineers and technicians.

Ancillary Feature

To the east of the I-Bay is the Ammonia Vapor Containment Building (M7-0361A), which is considered a contributing ancillary feature to the SSPF (Photo Nos. 78, 79). This facility has approximate dimensions of 75' in length (east-west), 20' in width (north-south), and stands roughly 14' in height. It is comprised of a poured concrete slab foundation, concrete block walls, and a metal shed roof. It contains a metal rolling door on its east elevation, and two metal swing doors on its south elevation. On its west elevation, there are two mechanical bulkheads and one electrical bulkhead, which support the piping and conduit from the Ammonia Vapor Containment Building into the SSPF.

The interior of the building (Photo Nos. 80, 81) is arranged based on the flow of the ammonia. At the east end of the building are three ammonia storage tanks, each of which can hold up to 600 pounds of the liquid (Photo No. 82). To the west of the tanks are a transfer manifold (north; Photo No. 84) and two filter carts (south; Photo No. 83). Directly to the west of the transfer manifold is the Flow Control Instrumentation Cart (Photo No. 85), used to pull the ammonia out of the storage tanks; the transfer manifold controls the flow rate. At the west end of this Flow Control Instrumentation Cart is an Ammonia Sample Panel (Photo No. 86), used to test the purity of the ammonia. If the purity of the ammonia does not meet the specified standard, it is redirected through the filter carts to the storage tank, from which the Flow Instrumentation Cart redraws it.[83]

To the west of the Sample Panel are two ammonia chilling carts (Photo No. 87) with a corresponding liquid nitrogen tank, which cool the ammonia prior to it entering the SSPF. At the very west end of the facility is the Valve and Instrument Module (Photo No. 88), used to route the ammonia into the SSPF, and then back to the Containment Building following its use. The return flow is operated by the Ammonia Recovery Pump (Photo No. 90), which sits along the south wall of the facility.

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[83] This process is repeated until the purity standard is met. Hal Baker. Personal communication with Patricia Slovinac, September 9, 2010.

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Figure A-1. View of SSPF site during initial construction efforts, camera facing north, September 27, 1991.
Source: John F. Kennedy Space Center Archives, KSC-391C-6108_15.

Figure A-2. View of SSPF site, showing construction progress, camera facing southeast, October 30, 1991.
Source: John F. Kennedy Space Center Archives, KSC-391C-6522_19.

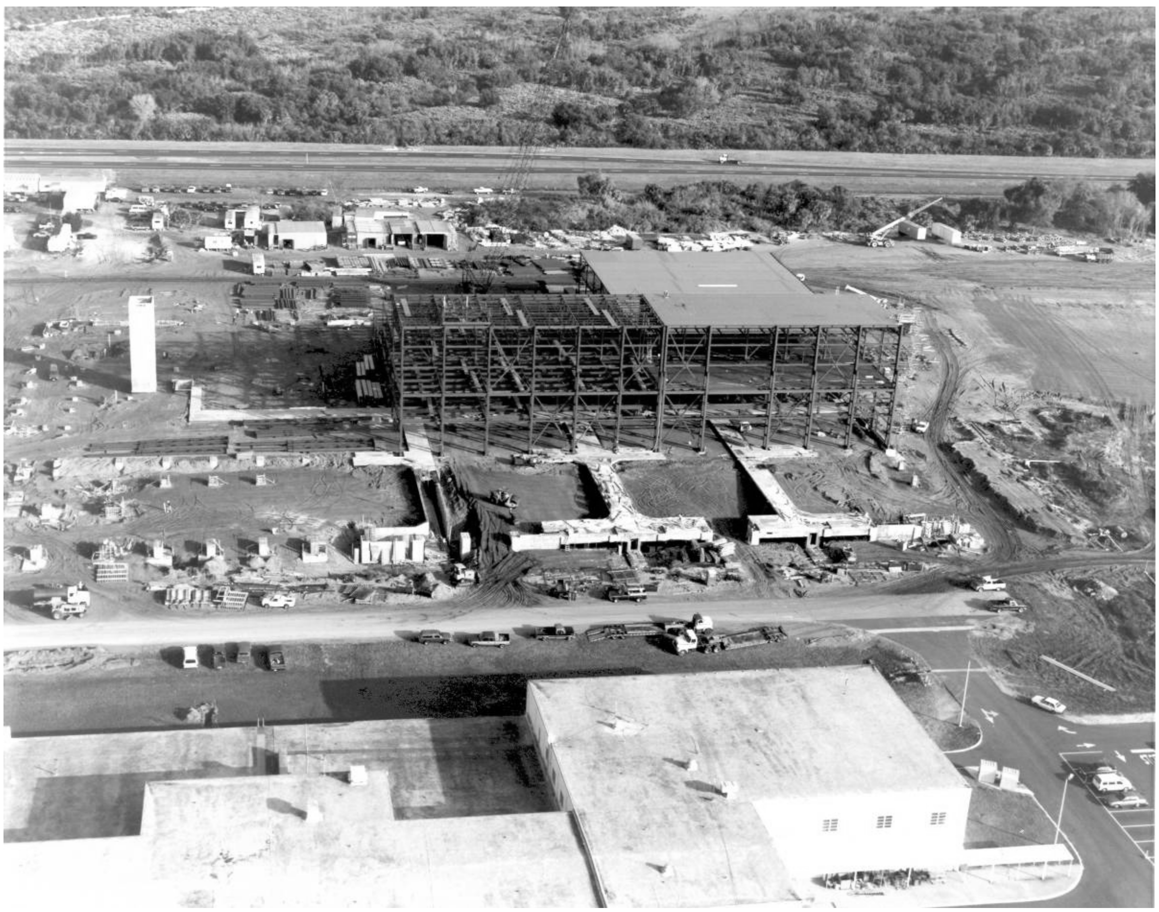


Figure A-3. View of SSPF, showing construction progress, camera facing north, December 23, 1991.
Source: John F. Kennedy Space Center Archives, KSC-391C-7421_01.

Figure A-4. View of SSPF, showing construction progress, camera facing northeast, July 13, 1992.
Source: John F. Kennedy Space Center Archives, KSC-392C-3756_23.

Figure A-5. Aerial view of SSPF, camera facing northeast,
February 21, 1996.
Source: John F. Kennedy Space Center Archives, KSC-396C-0960_32.

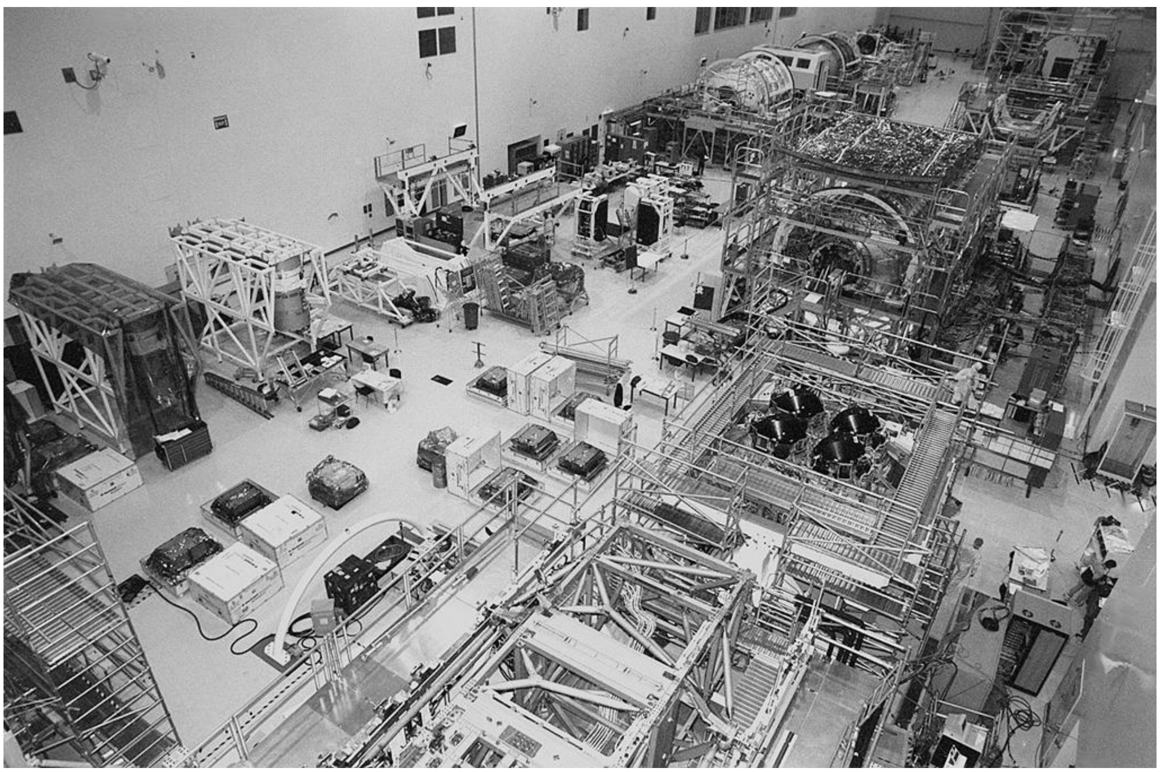


Figure A-6. View of SSPF High Bay, camera facing southwest,
March 1, 2000.
Source: NASA Image Exchange (NIX), http://nix.nasa.gov/, KSC-00PP-0298.

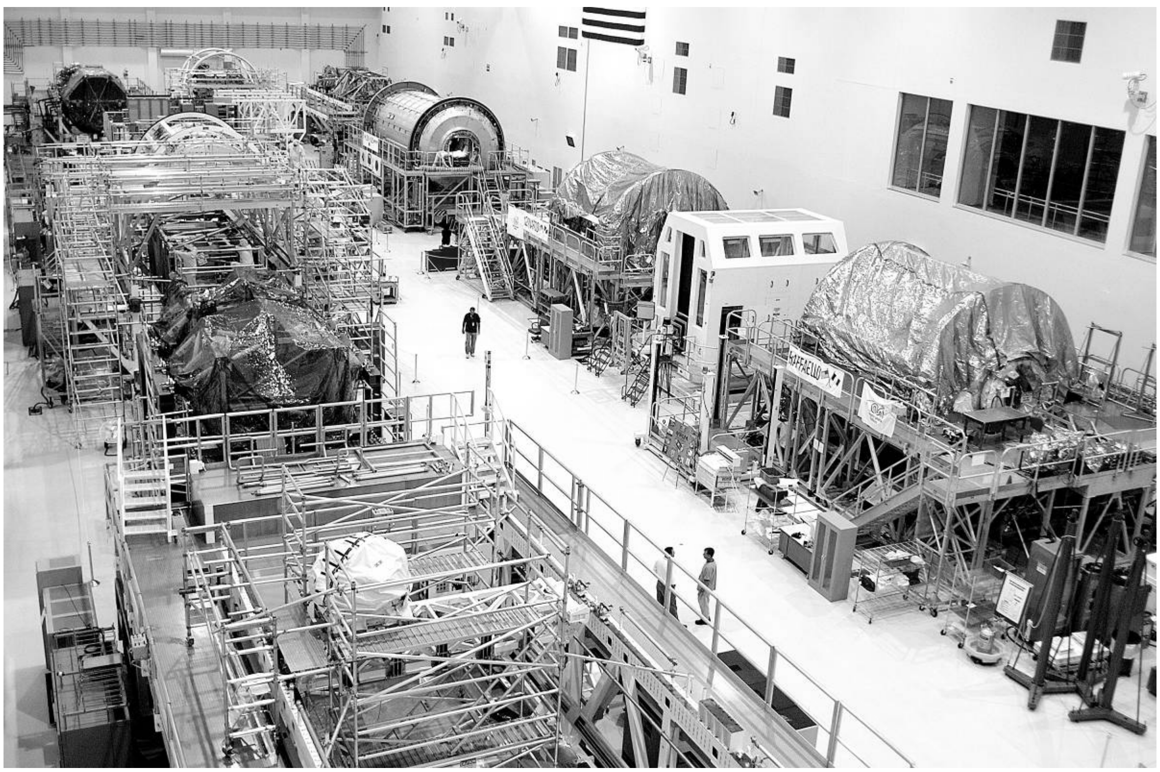


Figure A-7. View of SSPF High Bay, camera facing southeast,
June 19, 2003.
Source: NIX, http://nix.nasa.gov/, KSC-03PD-1992.

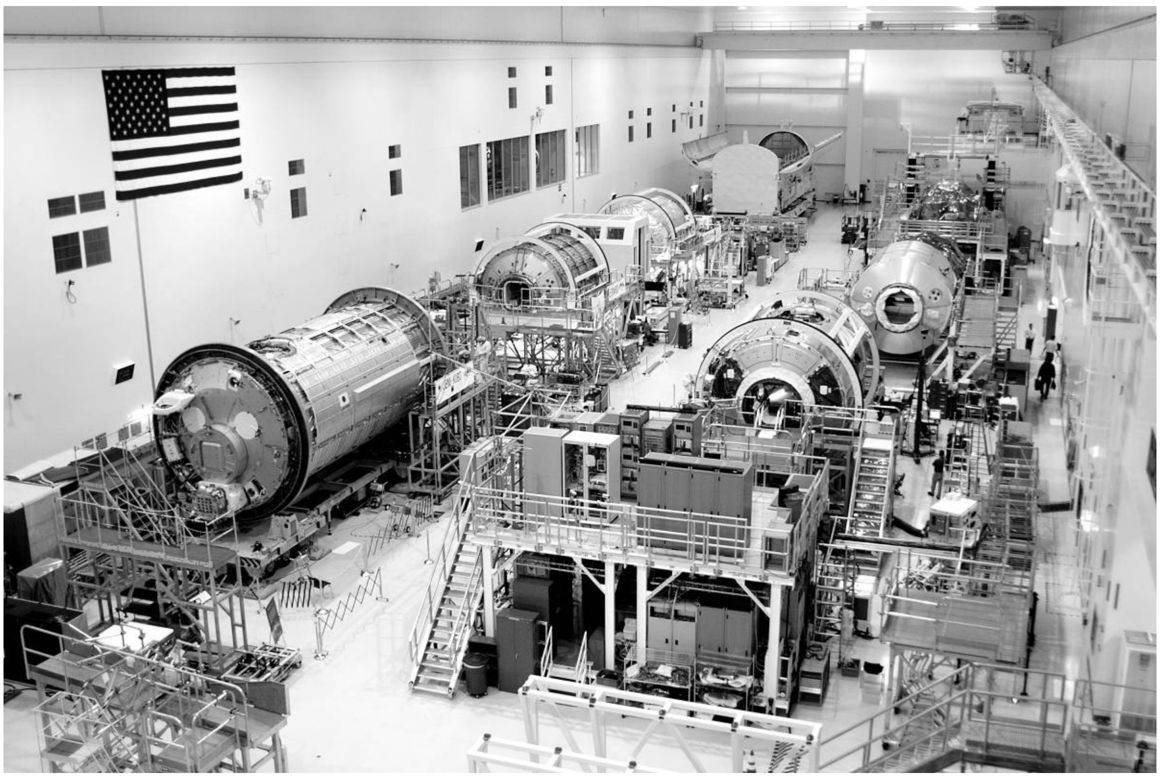


Figure A-8. View of SSPF High Bay, camera facing southwest,
February 18, 2004.
Source: NIX, http://nix.nasa.gov/, KSC-04PD-0246.

Figure A-9. Lid of Node 1 transportation canister being removed in SSPF Airlock, camera facing southwest, June 24, 1997.
Source: NIX, http://nix.nasa.gov/, KSC-97PC-0931.

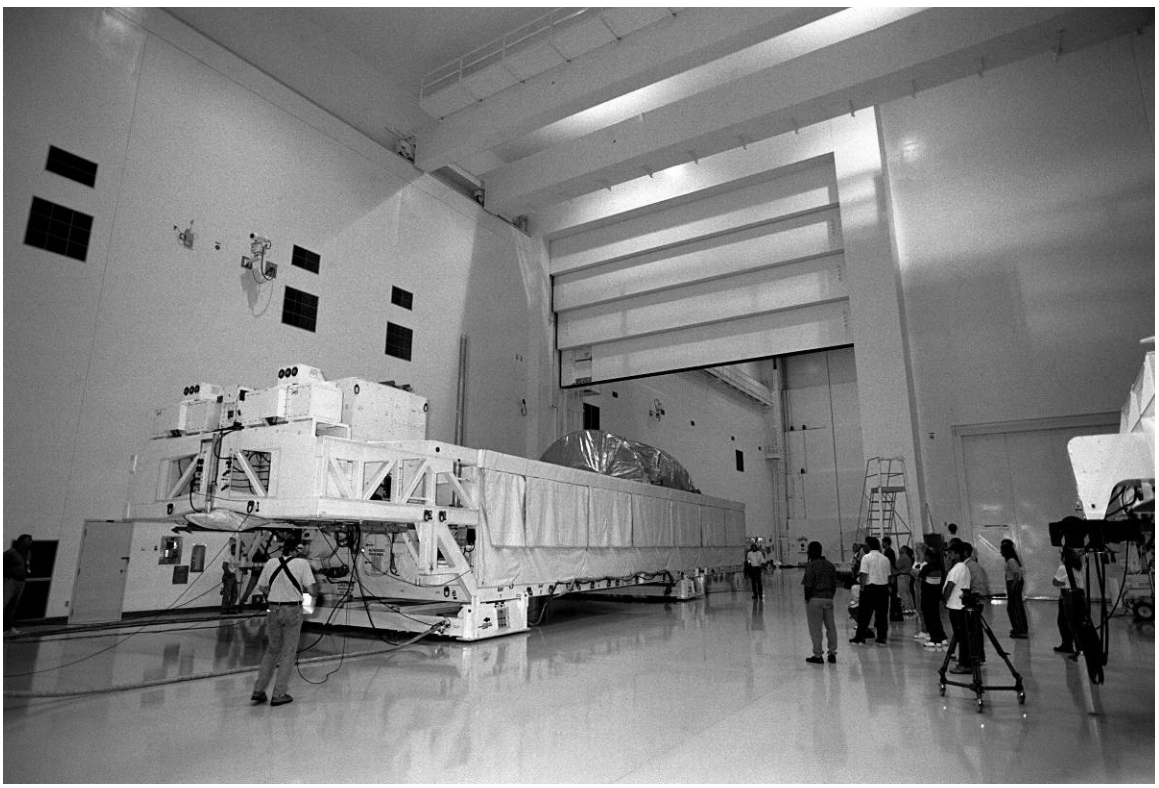


Figure A-10. Node 1, still within its transportation canister, being moved from the SSPF Airlock, into the SSPF High Bay, camera facing southwest, June 24, 1997.
Source: NIX, http://nix.nasa.gov/, KSC-97PC-0929.

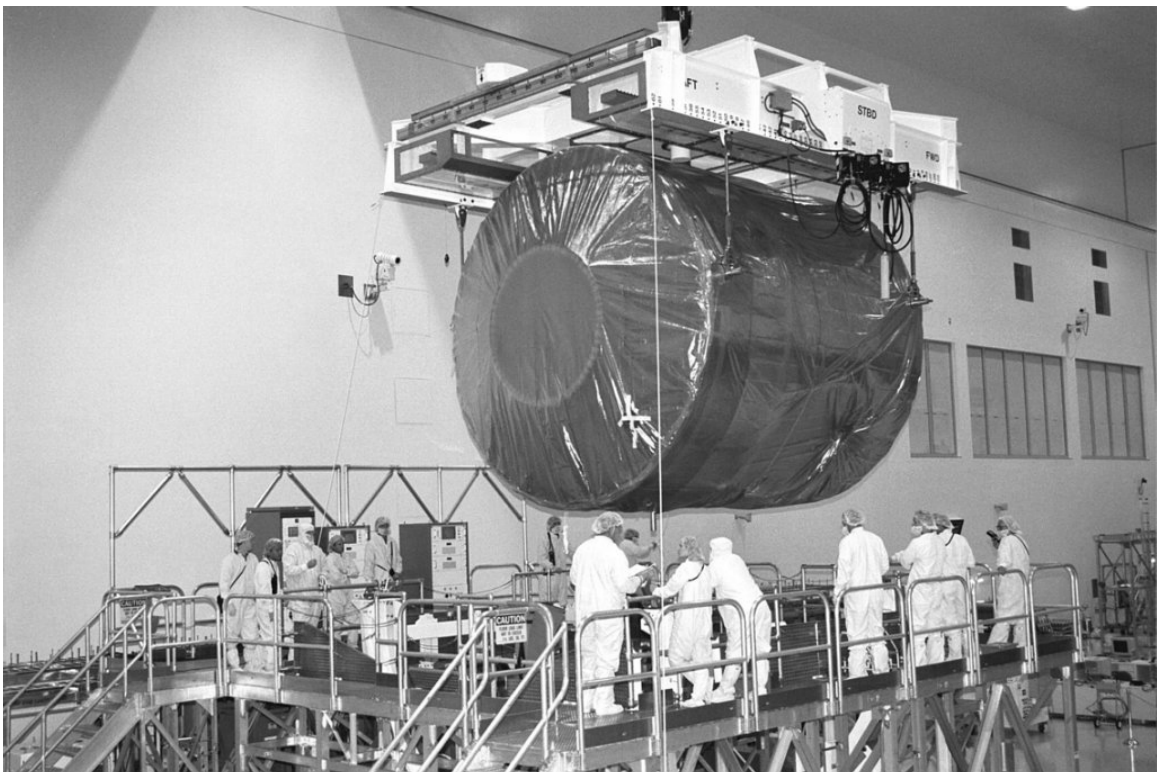


Figure A-11. The Cargo Element Lifting Assembly lowering Node 1 into its designated workstand, camera facing southwest, June 25, 1997.
Source: NIX, http://nix.nasa.gov/, KSC-97PC-0933.

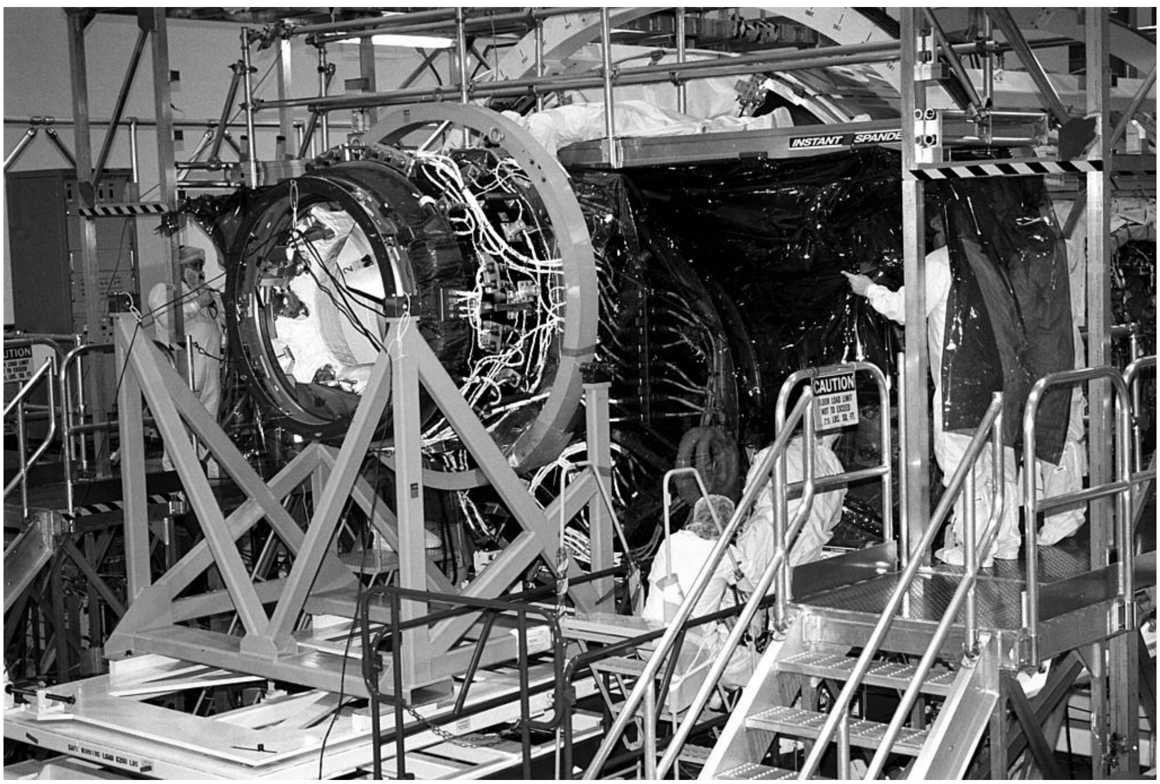


Figure A-12. Pressurized Mating Adapter-1 being attached to Node 1, camera facing southwest, November 21, 1997.
Source: NIX, http://nix.nasa.gov/, KSC-97PC-1711.

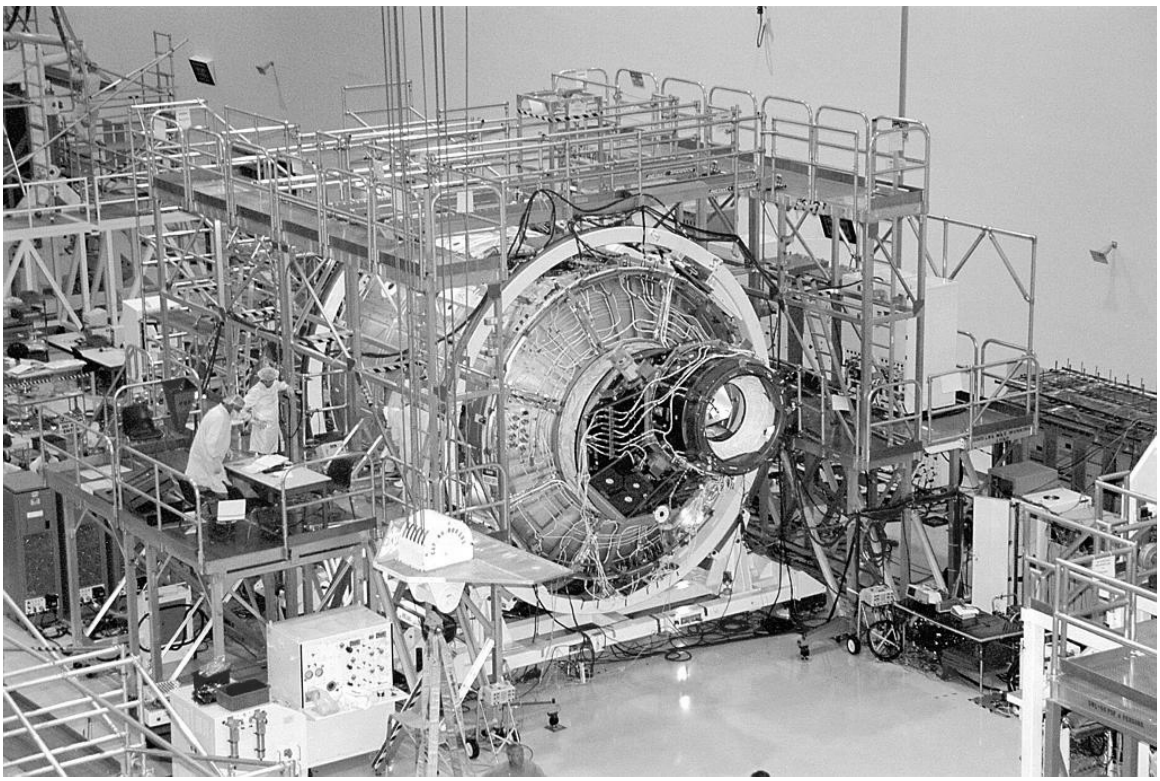


Figure A-13. View of Node 1, Pressurized Mating Adapter 2 at the right, within its workstand, camera facing southeast, May 22, 1998.
Source: NIX, http://nix.nasa.gov/, KSC-98PC-0646.

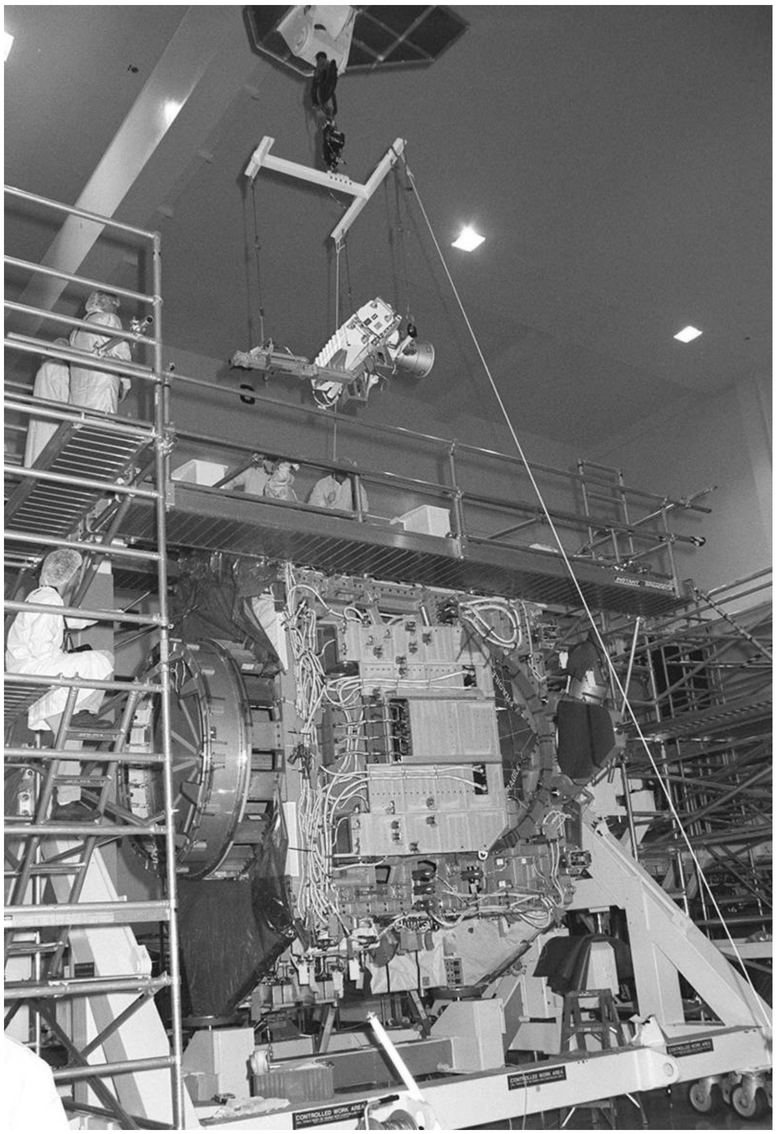
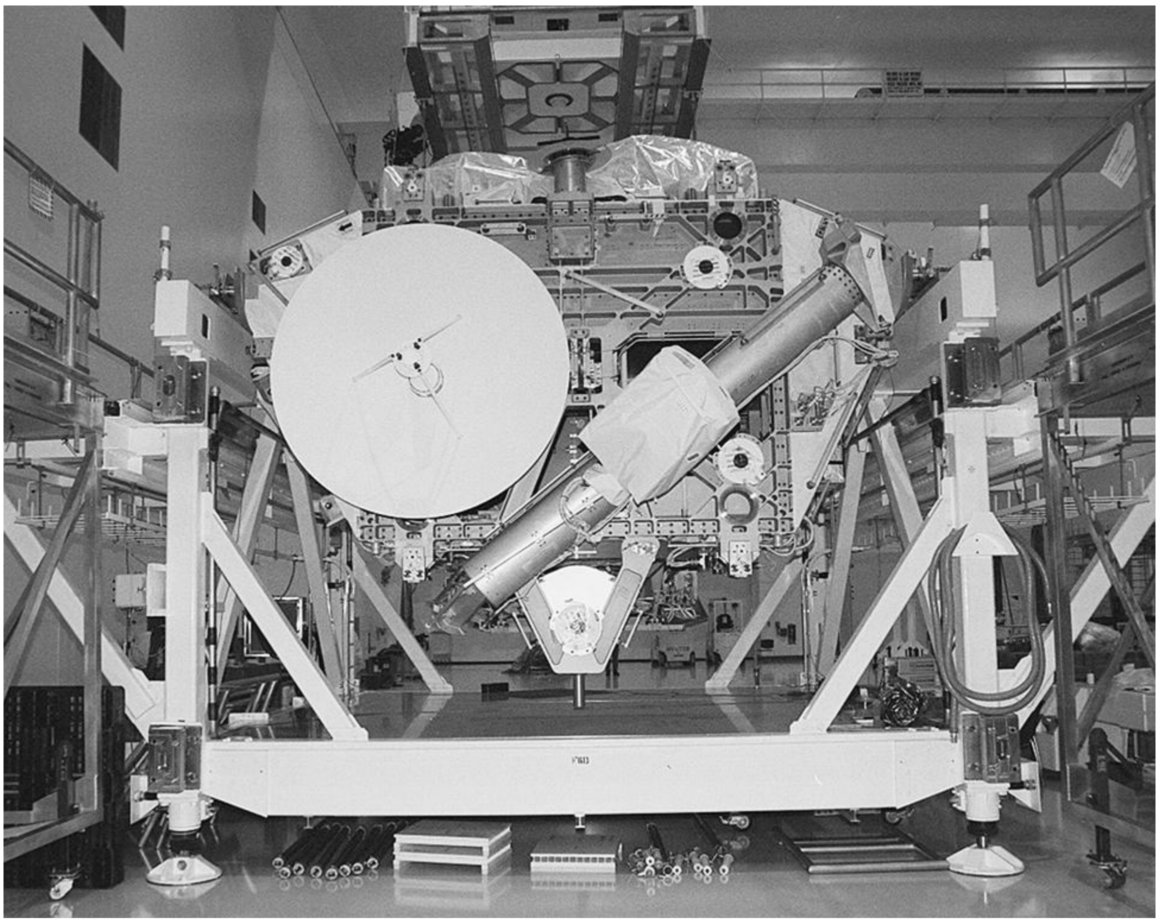


Figure A-14. An S-band Antenna Support Assembly being installed on the Z1 Truss, camera facing northeast, June 6, 2000.
Source: NIX, http://nix.nasa.gov/, KSC-00PP-0759.



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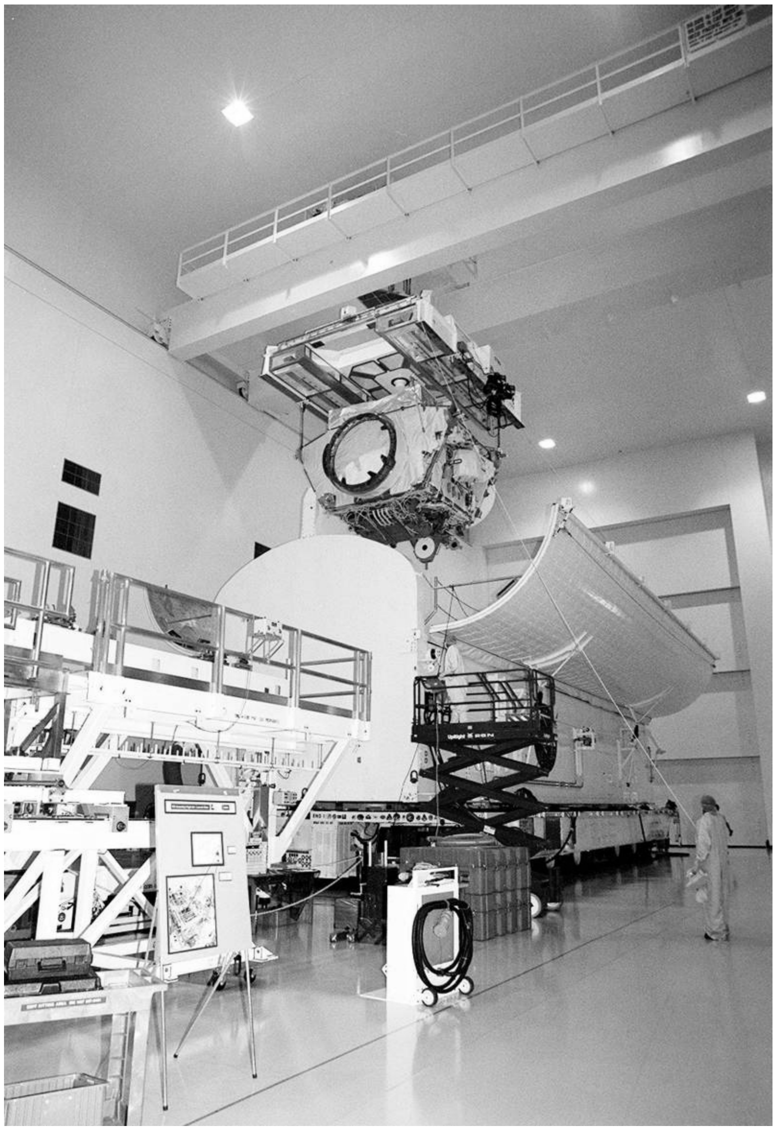
Source: NIX, http://nix.nasa.gov/, KSC-00PP-1392.



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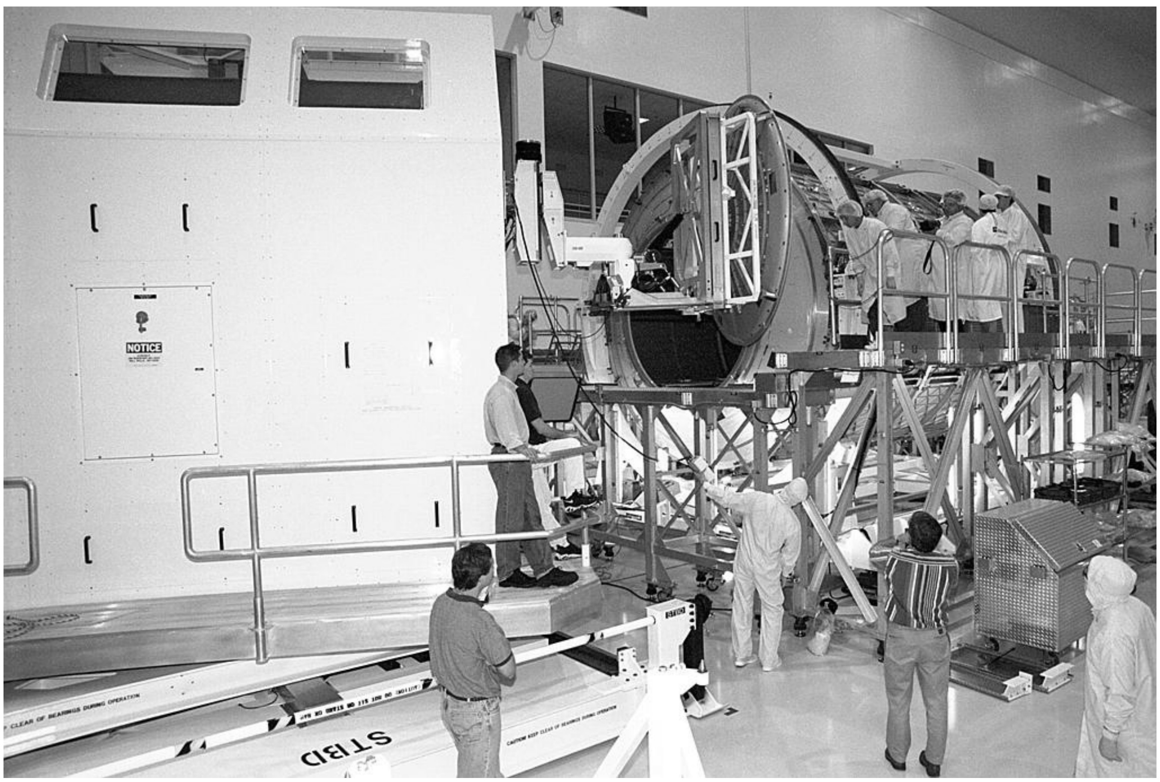

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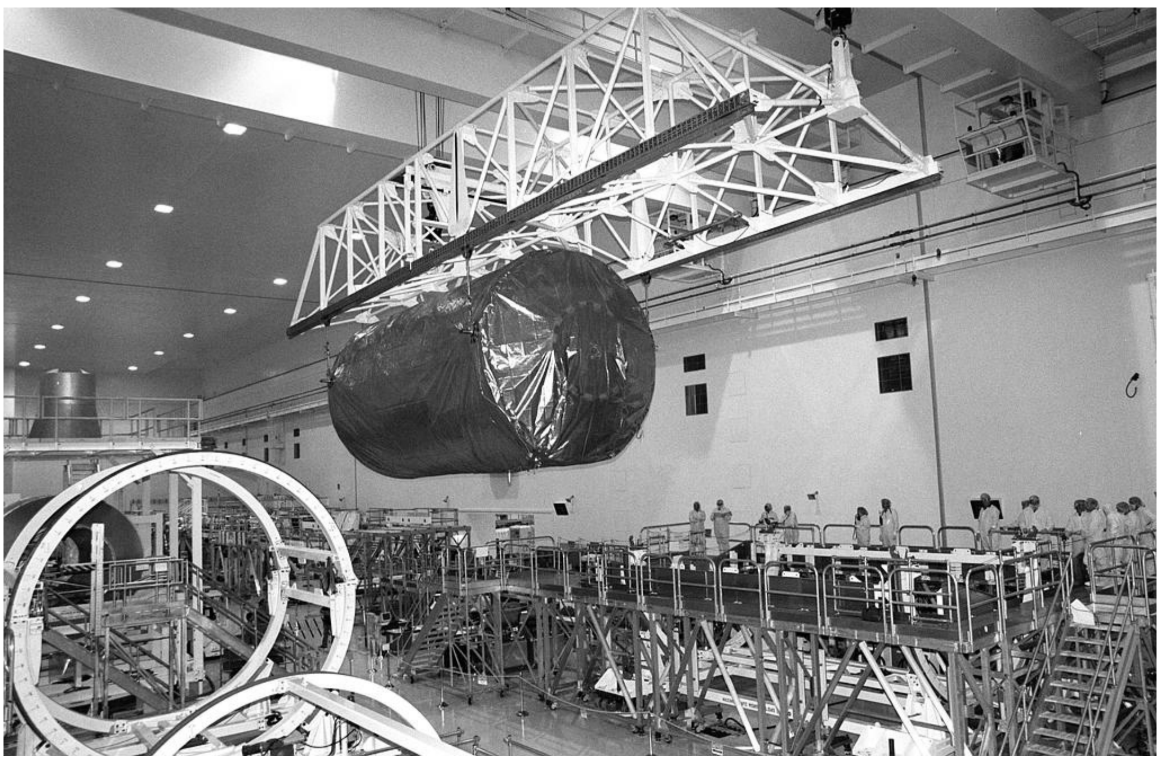
Source: NIX, http://nix.nasa.gov/, KSC-98PC-0896.



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Source: NIX, http://nix.nasa.gov/, KSC-98PC-1711.

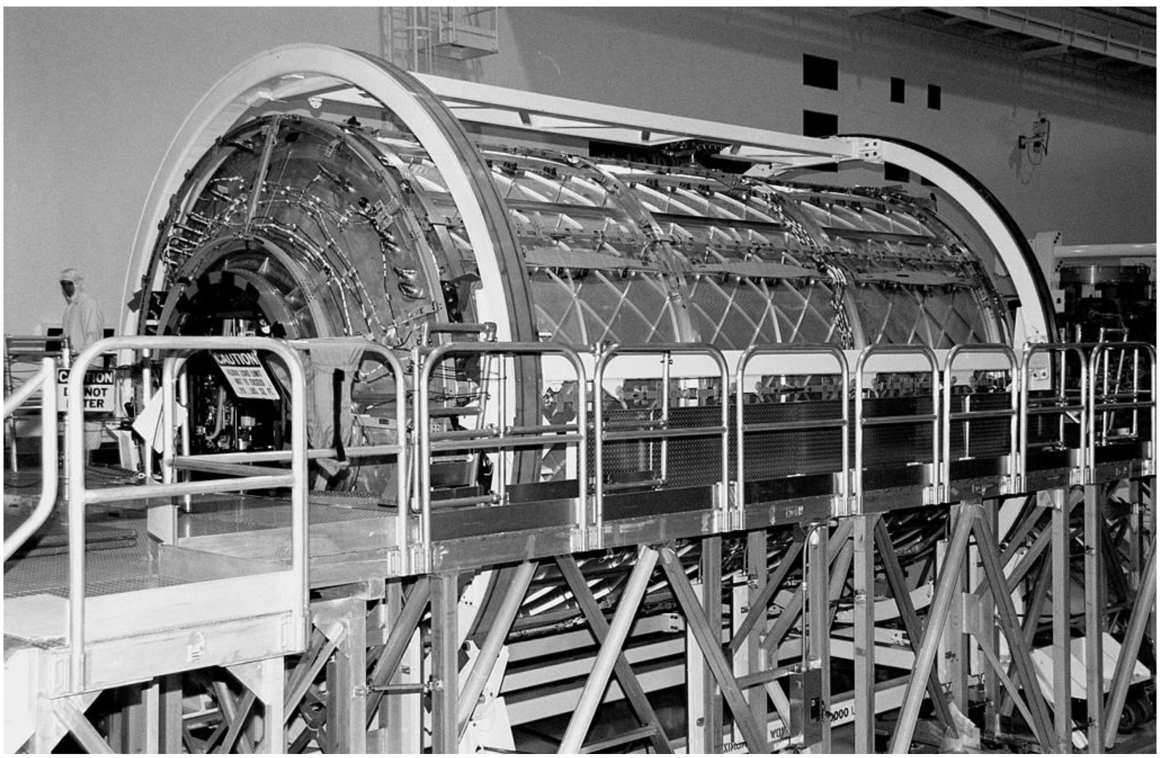

Figure A-19. The U.S. laboratory, *Destiny*, settled within its designated workstand in the SSPF High Bay, camera facing northwest, November 18, 1998.
Source: NIX, http://nix.nasa.gov/, KSC-98PC-1715.

Figure A-20. The Japanese Experiment Module, *Kibo*, being carried to its designated workstand in the SSPF High Bay, camera facing southeast, June 10, 2003.
Source: NIX, http://nix.nasa.gov/, KSC-03PD-1917.

Figure A-21. Solar panels for the ISS being carried to their designated workstand in the SSPF High Bay, camera facing northeast, December 7, 1998.
Source: NIX, http://nix.nasa.gov/, KSC-98PC-1855.

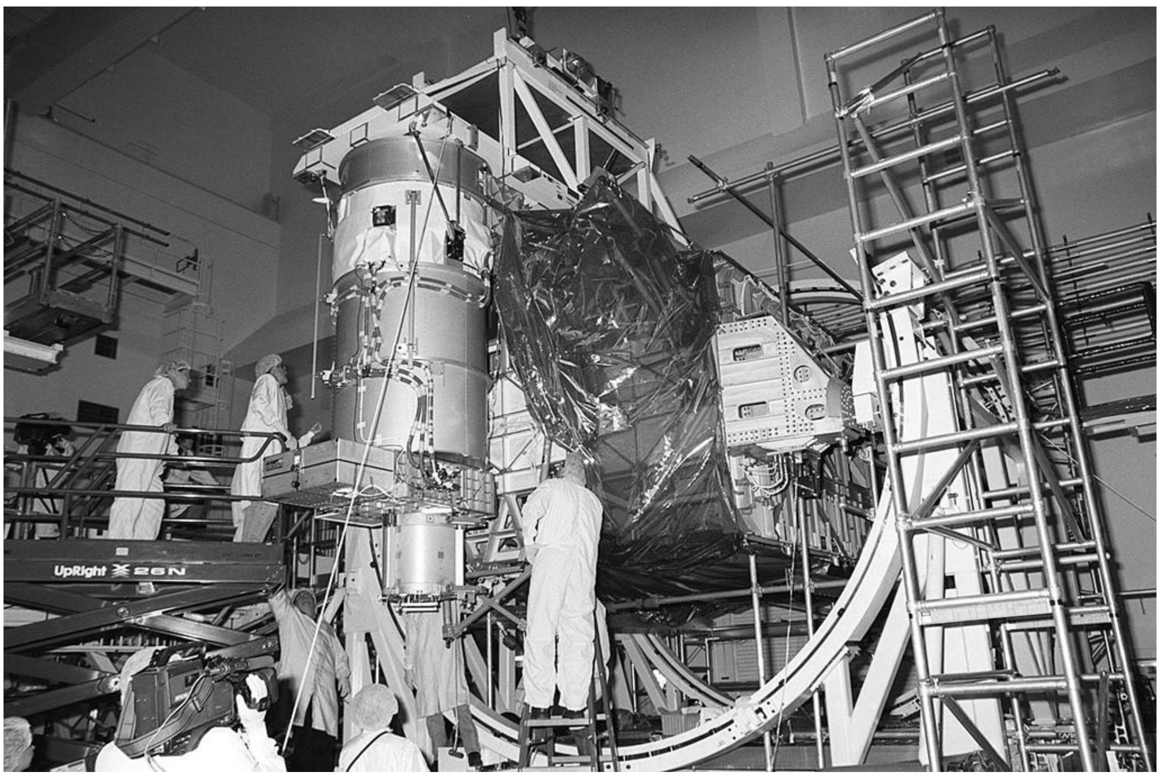

Figure A-22. Solar panels for the ISS being readied for testing in the SSPF High Bay, camera facing northeast, August 22, 2000.
Source: NIX, http://nix.nasa.gov/, KSC-00PP-1197.

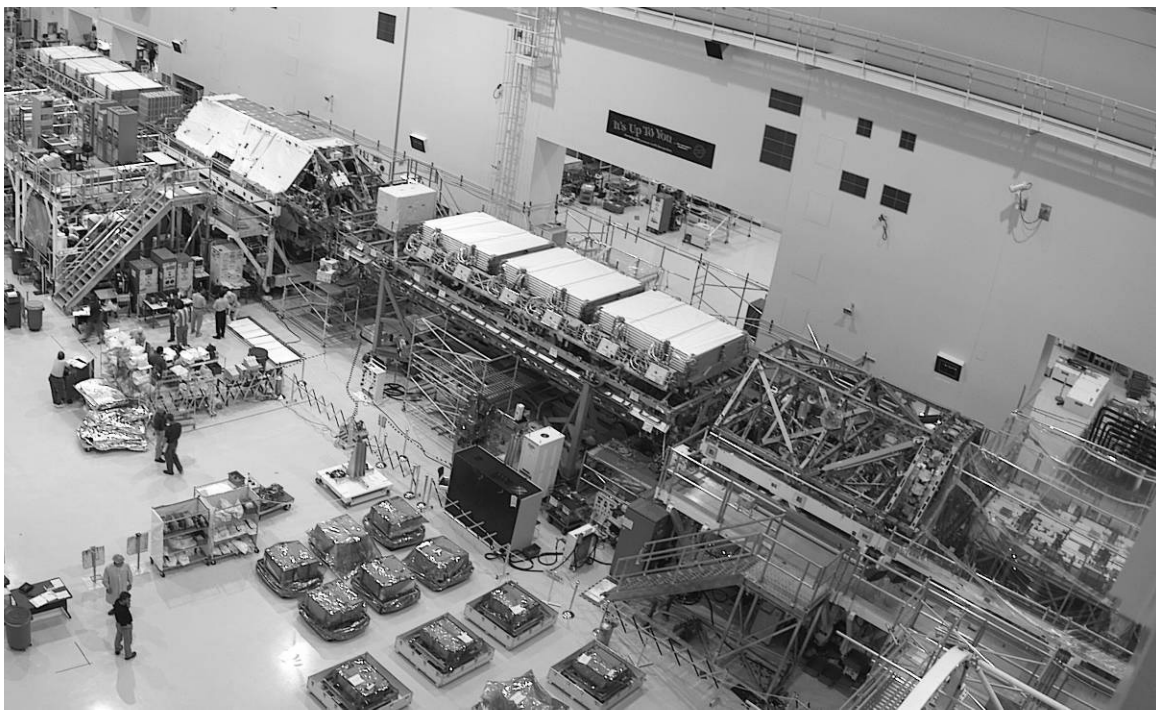

Figure A-23. The Multi-Element Integration Test of the S0 Truss, connected to the S1 and P1 Trusses, with the P1 connected to the P3/P4 Trusses, in the SSPF High Bay, ca. 2002.
Source: John Jackson, KSC ISS Transition Manager, NASA KSC;
photo on file at KSC Archives, Digital Archives Collection,
Directory: JPG PHOTOS 2, Photo No. MEIT2.JPG.

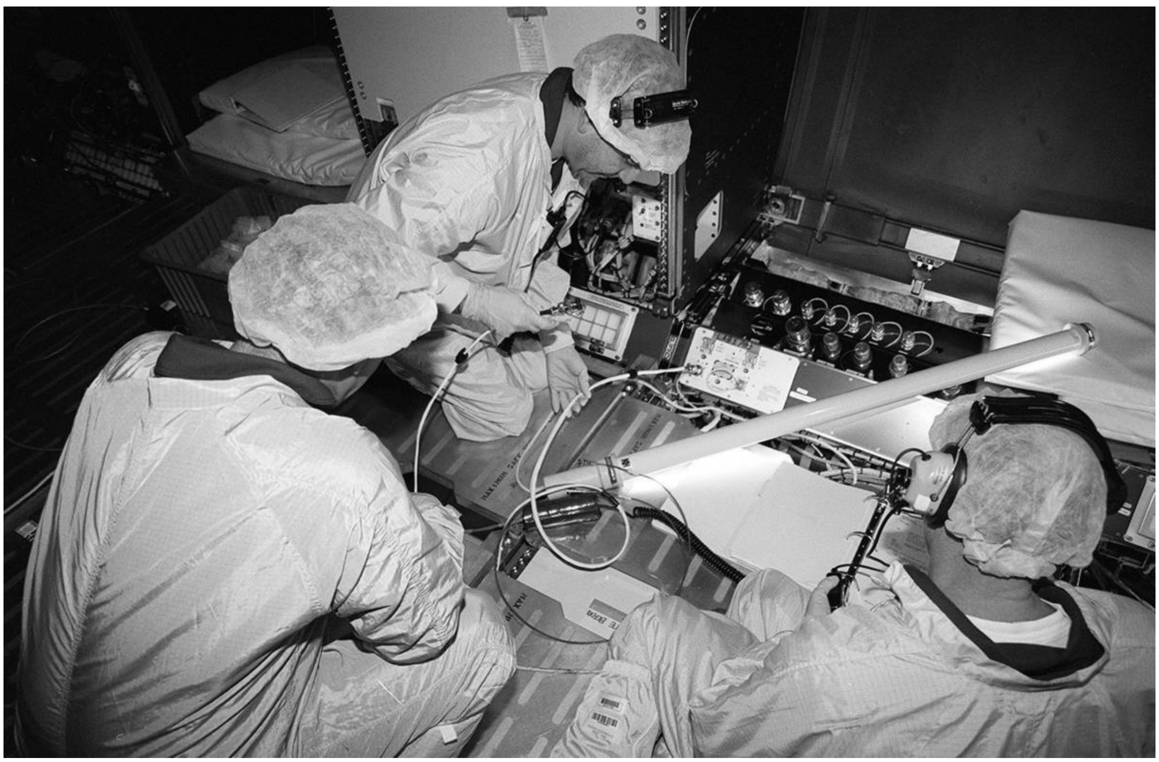

Figure A-24. STS-98 crew members taking part in a Multi-Element Integration Test involving the U.S. laboratory, *Destiny*, February 3, 2000.
Source: NIX, http://nix.nasa.gov/, KSC-00PP-0186.

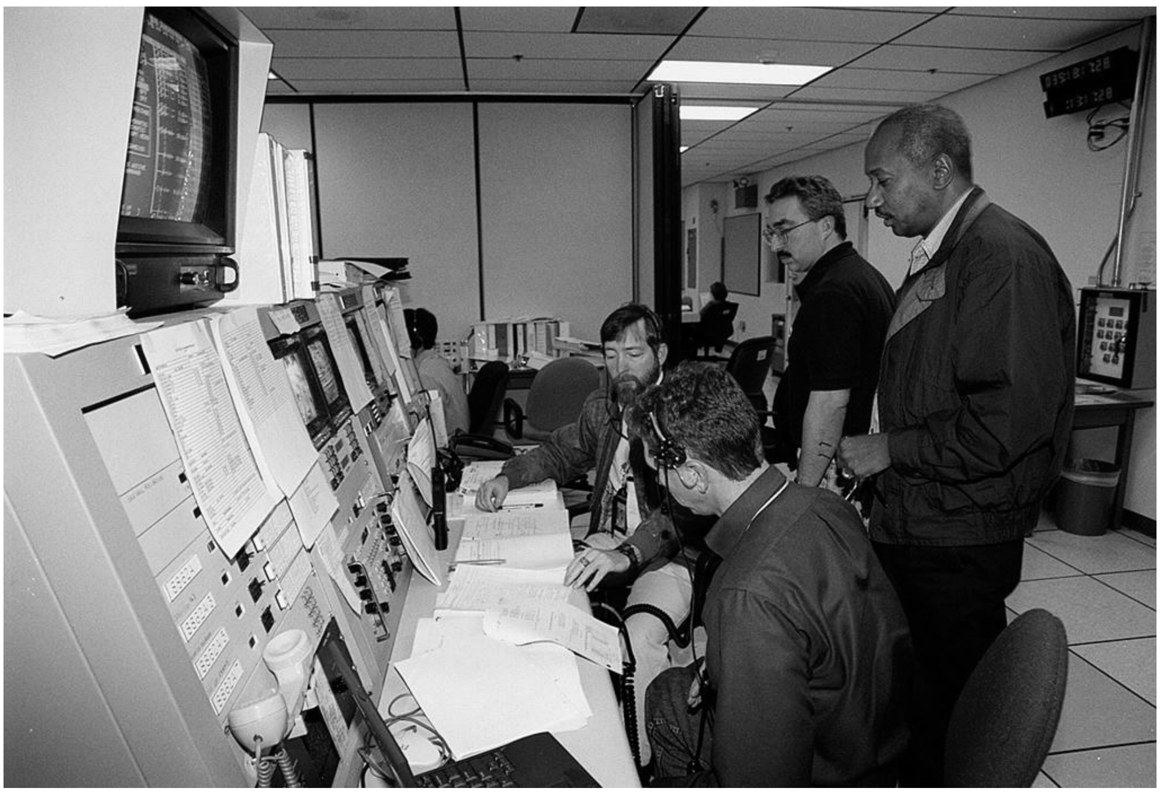

Figure A-25. Control room technicians monitoring a Multi-Element Integration Test involving the U.S. laboratory, *Destiny*, February 3, 2000.
Source: NIX, http://nix.nasa.gov/, KSC-00PP-0189.

Figure A-26. STS-88 crew members taking part in a Crew Equipment Interface Test involving Node 1, December 5, 1997.
Source: NIX, http://nix.nasa.gov/, KSC-97PC-1789.

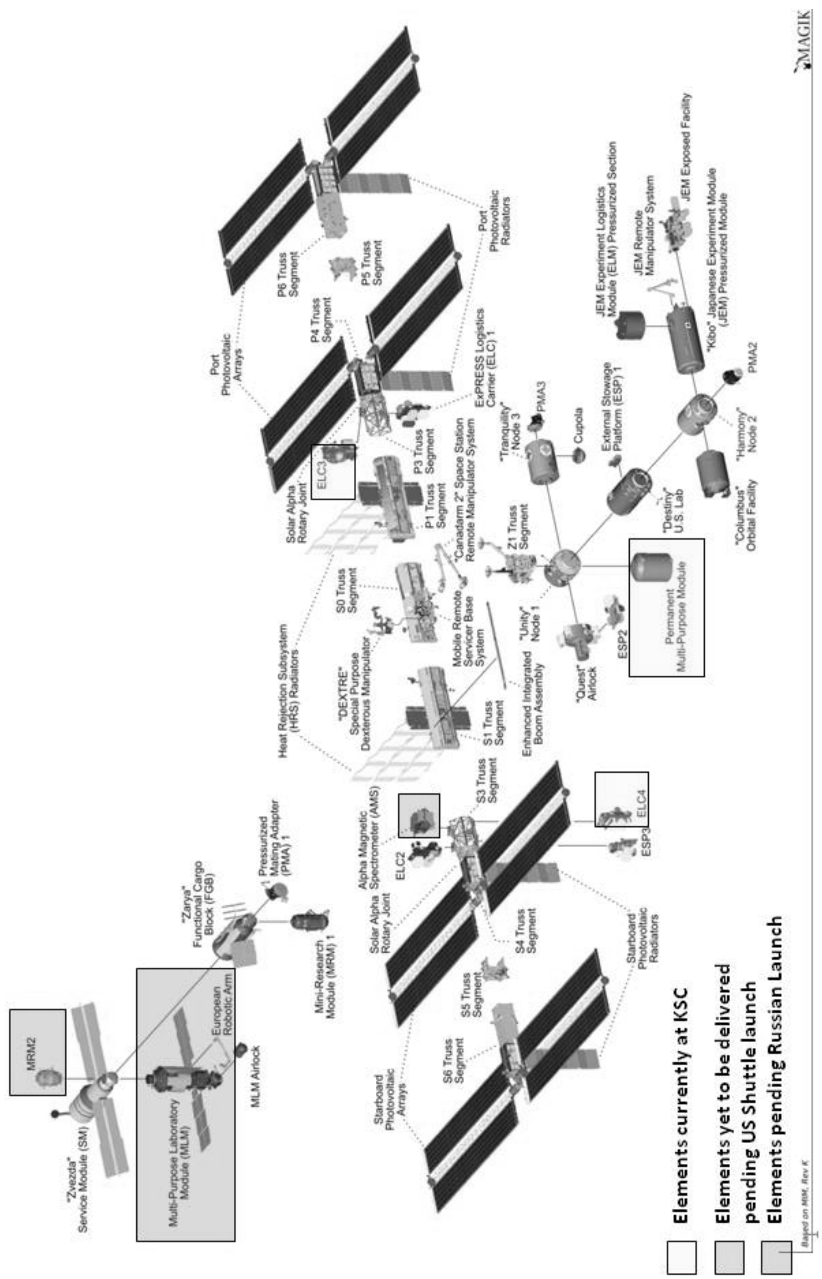

Figure A-27. Diagram of the International Space Station, ca. 2010.
Source: Bill Thomas, Kennedy Space Center;
photo on file at KSC Archives, Digital Archives Collection,
Directory: JPG PHOTOS 2, Photo No. diagramISS.JPG.

Table A-1. Chronology of ISS Assembly and Supply Missions.

ISS Mission No.	Vehicle	Launch Date	Payload/comments
1 A/R	Russian Proton	November 20, 1998	*Zarya* Control Module
2A	*Endeavour* (STS-88)	December 4, 1998	*Unity* Node 1; two Pressurized Mating Adapters (PMA)
2A.1	*Discovery* (STS-96)	May 27, 1999	Logistics delivery. First space shuttle to dock with the ISS.
2A.2a	*Atlantis* (STS-101)	May 19, 2000	Logistics delivery
1R	Russian Proton	July 12, 2000	*Zvezda* Service Module
1P	Progress M1-3	August 6, 2000	Cargo supply
2A.2b	*Atlantis* (STS-106)	September 8, 2000	Logistics delivery
3A	*Discovery* (STS-92)	October 11, 2000	Z-1 Truss, third PMA, Ku-band antenna
2P	Progress M1-4	November 16, 2000	Cargo supply
4A	*Endeavour* (STS-97)	November 30, 2000	P-6 Truss and first set of solar arrays
5A	*Atlantis* (STS-98)	February 7, 2001	*Destiny* Laboratory Module
3P	Progress M-44	February 26, 2001	Cargo supply
5A.1	*Discovery* (STS-102)	March 8, 2001	Supplies, equipment and experiment racks for *Destiny*. First MPLM, *Leonardo*
6A	*Endeavour* (STS-100)	April 19, 2001	Canadarm 2
4P	Progress M1-6	May 21, 2001	Cargo supply
7A	*Atlantis* (STS-104)	July 12, 2001	Joint Airlock *Quest*
7A.1	*Discovery* (STS-105)	August 10, 2001	Supplies, equipment and experiment racks for Destiny
5P	Progress M-45	August 21, 2001	Cargo supply
4R	Progress/DC-1	September 15, 2001	Cargo crane; Russian *Pirs* Docking Compartment
6P	Progress M1-7	November 26, 2001	Cargo supply
UF-1	*Endeavour* (STS-108)	December 5, 2001	Experiment racks for *Destiny*
7P	Progress M1-8	March 21, 2002	Cargo supply
8A	*Atlantis* (STS-110)	April 8, 2002	S0-Truss; Mobile Transporter
UF-2	*Endeavour* (STS-111)	June 5, 2002	Experiment racks for Destiny
8P	Progress M-46	June 26, 2002	Cargo supply
9P	Progress M1-9	September 25, 2002	Cargo supply
9A	*Atlantis* (STS-112)	October 7, 2002	S1 Truss
11A	*Endeavour* (STS-113)	November 23, 2002	P1 Truss; P6 solar arrays deployed
10P	Progress M-47	February 2, 2003	Cargo supply
11P	Progress M1-10	June 8, 2003	Cargo supply
12P	Progress M-48	August 29, 2003	Cargo supply
13P	Progress M1-11	January 29, 2004	Cargo supply

Legend: A/R=American/Russian assembly; A=American assembly; R=Russian assembly; P=Russian cargo; UF= U.S. utilization flight; LF=U.S. logistics flight; ULF=U.S. utilization and logistics flight; E=European Space Agency assembly; ATV=ESA supply flight; J/A=Japanese/American assembly flight; J=Japanese assembly flight; HTV=Japanese supply flight

Table A-1, cont. Chronology of ISS Assembly and Supply Missions.

ISS Mission No.	Vehicle	Launch Date	Payload/comments
14P	Progress M-49	May 25, 2004	Cargo supply
15P	Progress M-50	Aug. 11, 2004	Cargo supply
16P	Progress M-51	Dec. 23, 2004	Cargo supply
17P	Progress M-52	Feb. 28, 2005	Cargo supply
18P	Progress M-53	June 17, 2005	Cargo supply
LF-1	*Discovery* (STS-114)	July 26, 2005	Supplies and equipment
19P	Progress M-54	Sept. 8, 2005	Cargo supply
20P	Progress M-55	Dec. 21, 2005	Cargo supply
21P	Progress M-56	April 24, 2006	Cargo supply
22P	Progress M-57	June 24, 2006	Cargo supply
ULF-1.1	*Discovery* (STS-121)	July 1, 2006	Supplies and equipment
12A	*Atlantis* (STS-115)	Sept. 9, 2006	P3/P4 Truss structure. Solar arrays and radiator deployed
23P	Progress M-58	Oct. 23, 2006	Cargo supply
12A.1	*Discovery* (STS-116)	Dec. 9, 2006	P5 Truss
24P	Progress M-59	Jan. 18, 2007	Cargo supply
25P	Progress M-60	May 12, 2007	Cargo supply
13A	*Atlantis* (STS-117)	June 8, 2007	S3/S4 Truss; third set of solar arrays
26P	Progress M-61	Aug. 2, 2007	Cargo supply
13A-1	*Endeavour* (STS-118)	Aug. 8, 2007	S5 Truss; External Stowage Platform 3 (ESP3)
10A	*Discovery* (STS-120)	Oct. 23, 2007	*Harmony* Node 2
27P	Progress M-62	Dec. 23, 2007	Cargo supply
28P	Progress M-63	Feb. 5, 2008	Cargo supply
1E	*Atlantis* (STS-122)	Feb. 7, 2008	*Columbus* Laboratory
ATV1	ATV-1	March 9, 2008	Cargo supply
1J/A	*Endeavour* (STS-123)	March 11, 2008	*Kibo* Laboratory; Experiment Logistics Module (ELM)-Pressurized Section; Special Purpose Dexterous Manipulator “Dextre”
29P	Progress M-64	May 15, 2008	Cargo supply
1J	*Discovery* (STS-124)	May 31, 2008	JAXA Pressurized Module; *Kibo* robotic arm
30P	Progress M-65	Sept. 10, 2008	Cargo supply
ULF-2	*Endeavour* (STS-126)	Nov. 14, 2008	Supplies and equipment; spare hardware
31P	Progress M-01M	Nov. 26, 2008	Cargo supply
32P	Progress M-66	Feb. 10, 2009	Cargo supply

Legend: A/R=American/Russian assembly; A=American assembly; R=Russian assembly; P=Russian cargo; UF= U.S. utilization flight; LF=U.S. logistics flight; ULF=U.S. utilization and logistics flight; E=European Space Agency assembly; ATV=ESA supply flight; J/A=Japanese/American assembly flight; J=Japanese assembly flight; HTV=Japanese supply flight

Table A-1, cont. Chronology of ISS Assembly and Supply Missions.

ISS Mission No.	**Vehicle**	**Launch Date**	**Payload/comments**
15A	*Discovery* (STS-119)	March 15, 2009	S6 Truss; final set of solar arrays
33P	Progress M-02M	May 7, 2009	Cargo supply
2J/A	*Endeavour* (STS-127)	July 15, 2009	*Kibo* Experiment Module Exposed Facility; ELM - Exposed Section
34P	Progress M-67	July 24, 2009	Cargo supply
17A	*Discovery* (STS-128)	Aug. 28, 2009	Life support and science racks; Lightweight Multi-Purpose Experiment Support Structure Carrier
HTV-1	HTV-1	September 10, 2009	Cargo supply
35P	Progress M-03M	October 15, 2009	Cargo supply
4R	Progress M/MIM-2	November 10, 2009	Mini-Research Module 2 *Poisk* (MRM2)
ULF-3	*Atlantis* (STS-129)	November 16, 2009	Equipment; spare gyroscope
36P	Progress M-04M	February 3, 2010	Cargo supply
20A	*Endeavour* (STS-130)	February 8, 2010	*Tranquility* Node 3 and cupola
19A	*Discovery* (STS-131)	April 10, 2010	Equipment for scientific experiments
37P	Progress M-05M	April 28, 2010	Cargo supply
ULF-4	*Atlantis* (STS-132)	May 14, 2010	Mini-Research Module 1 *Rassvet* (MRM1); Integrated Cargo Carrier
ULF-5	*Discovery* (STS-133)	February 24, 2011	Permanent Multipurpose Module *Leonardo*; Express Logistic Carrier (ELC) 4; spare components
3R	*Endeavour* (STS-134)	May 16, 2011	ELC 3; Alpha Magnetic Spectrometer 2; spare components
ULF-7	*Atlantis* (STS-135)	July 8, 2011	Cargo supply

Legend: A/R=American/Russian assembly; A=American assembly; R=Russian assembly; P=Russian cargo; UF= U.S. utilization flight; LF=U.S. logistics flight; ULF=U.S. utilization and logistics flight; E=European Space Agency assembly; ATV=ESA supply flight; J/A=Japanese/American assembly flight; J=Japanese assembly flight; HTV=Japanese supply flight

HISTORIC AMERICAN ENGINEERING RECORD

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SPACE STATION PROCESSING FACILITY
(John F. Kennedy Space Center)
Southeast corner of 1st Street SE and E Avenue SE
Cape Canaveral
Brevard County
Florida

Penny Rogo Bailes, Photographer; September 2010
(FL-8-11-M-1 through FL-8-11-M-109)

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FL-8-11-M-42 OVERALL VIEW OF THE AIRLOCK, FACING SOUTHWEST.

FL-8-11-M-43 OVERALL VIEW OF THE AIRLOCK, WITH PAYLOAD CANISTER, FACING WEST-NORTHWEST.

FL-8-11-M-44 DETAIL VIEW OF THE PULLEY SYSTEM FOR THE LIFTING DOOR IN THE EAST WALL OF THE AIRLOCK, FACING SOUTH-SOUTHEAST.

FL-8-11-M-45 DETAIL VIEW OF AN AIR-BEARING PALLET MOVER IN STORAGE IN THE AIRLOCK, FACING NORTHWEST.

FL-8-11-M-46 OVERALL VIEW OF THE INTERMEDIATE BAY, FACING WEST.

FL-8-11-M-47 OVERALL VIEW OF THE INTERMEDIATE BAY, FACING EAST-SOUTHEAST.

FL-8-11-M-48 DETAIL VIEW OF THE TWO BRIDGE CRANES WITHIN THE INTERMEDIATE BAY, FACING SOUTHEAST.

FL-8-11-M-49 DETAIL VIEW OF AREAS E THROUGH G, INTERMEDIATE BAY, FACING NORTHEAST.

FL-8-11-M-50 DETAIL VIEW OF AREAS E THROUGH G, INTERMEDIATE BAY, FACING WEST- NORTHWEST.

FL-8-11-M-51 DETAIL VIEW OF AREA H, INTERMEDIATE BAY, FACING NORTHWEST.

FL-8-11-M-52 OVERALL VIEW OF THE HAZARDOUS FLUID AREA, EAST END OF THE INTERMEDIATE BAY, FACING SOUTHEAST.

FL-8-11-M-53 DETAIL VIEW OF AMMONIA SUPPLY AND RETURN PIPES ON EAST WALL OF HAZARDOUS FLUIDS AREA, INTERMEDIATE BAY, FACING EAST.

FL-8-11-M-54 DETAIL VIEW OF PRESSURIZATION UNIT CARTS USED WITHIN THE HAZARDOUS FLUIDS AREA, INTERMEDIATE BAY, FACING SOUTHEAST.

FL-8-11-M-55 DETAIL VIEW OF A GASEOUS NITROGEN/GASEOUS HELIUM/ AMMONIA LOAD PANEL ASSEMBLY USED WITHIN THE HAZARDOUS FLUIDS AREA, INTERMEDIATE BAY, FACING SOUTHEAST.

FL-8-11-M-56 DETAIL VIEW OF THE INTERNAL THERMAL CONTROL SYSTEM MODULE/RACK SIMULATOR USED WITHIN THE HAZARDOUS FLUIDS AREA, INTERMEDIATE BAY, FACING NORTHEAST.

FL-8-11-M-57 DETAIL VIEW OF A TYPICAL MECHANICAL SERVICE CONSOLE POSITIONED THROUGHOUT THE HIGH BAY AND THE INTERMEDIATE BAY, FACING SOUTHWEST.

FL-8-11-M-58 OVERALL VIEW OF ONE OF THE UTILITY TUNNELS BELOW THE HIGH BAY AND INTERMEDIATE BAY, FACING EAST.

FL-8-11-M-59 DETAIL VIEW OF UTILITY PIPES LEADING UP TO THE HIGH BAY, FACING NORTHEAST

FL-8-11-M-60 DETAIL VIEW OF UTILITY PIPES LEADING UP TO THE INTERMEDIATE BAY, FACING NORTHEAST.

FL-8-11-M-61 OVERALL VIEW OF A TYPICAL CONTROL ROOM (ROOM NO. 2387), FACING SOUTHWEST.

FL-8-11-M-62 DETAIL VIEW OF THE USER AREA, TYPICAL CONTROL ROOM (ROOM NO. 2387), FACING SOUTHEAST.

FL-8-11-M-63 DETAIL VIEW OF THE TEST CONDUCTORS CONSOLES, TYPICAL CONTROL ROOM (ROOM NO. 2387), FACING SOUTH.

FL-8-11-M-64 DETAIL VIEW OF THE AMMONIA CONTROL PANELS, CONTROL ROOM (ROOM NO. 2387), FACING NORTH.

FL-8-11-M-65 OVERALL VIEW OF THE PAYLOAD RACK CHECKOUT UNIT ROOM, FACING NORTHWEST.

FL-8-11-M-66 DETAIL VIEW OF THE TESTING AREA, PAYLOAD RACK CHECKOUT UNIT ROOM, FACING SOUTHWEST.

FL-8-11-M-67 DETAIL VIEW OF A TYPICAL ISS STANDARD PAYLOAD RACK INTERFACE PANEL, PAYLOAD RACK CHECKOUT UNIT ROOM, FACING WEST.

FL-8-11-M-68 DETAIL VIEW OF THE EQUIPMENT AREA FOR THE PAYLOAD RACK CHECKOUT UNIT ROOM, FACING SOUTHWEST.

FL-8-11-M-69 OVERALL VIEW OF THE LOW BAY, FACING NORTHEAST.

FL-8-11-M-70 OVERALL VIEW OF THE LOW BAY, FACING NORTHWEST.

FL-8-11-M-71 OVERALL VIEW OF THE RACK ROOM, FACING SOUTHWEST.

FL-8-11-M-72 OVERALL VIEW OF THE RACK ROOM, FACING WEST-NORTHWEST.

FL-8-11-M-73 OVERALL VIEW OF A TYPICAL OFF-LINE BIOLOGICAL LAB (ROOM NO. 1462), FACING NORTHWEST.

FL-8-11-M-74 OVERALL VIEW OF A TYPICAL OFF-LINE BIOLOGICAL LAB (ROOM NO. 1456), FACING NORTHWEST.

FL-8-11-M-75 OVERALL VIEW OF A TYPICAL OFF-LINE BIOLOGICAL LAB (ROOM NO. 1484), FACING SOUTHWEST.

FL-8-11-M-76 OVERALL VIEW OF A TYPICAL OFF-LINE PROCESSING LAB (ROOM NO. 1486), FACING SOUTHWEST.

FL-8-11-M-77 OVERALL VIEW OF A TYPICAL OFF-LINE PROCESSING LAB (ROOM NO. 1495), FACING EAST.

FL-8-11-M-78 VIEW OF THE EAST AND SOUTH ELEVATIONS OF THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING NORTHWEST.

FL-8-11-M-79 VIEW OF THE SOUTH AND WEST ELEVATIONS OF THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING NORTHEAST.

FL-8-11-M-80 OVERALL VIEW OF THE INTERIOR OF THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING WEST.

FL-8-11-M-81 OVERALL VIEW OF INTERIOR OF THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING EAST.

FL-8-11-M-82 DETAIL VIEW OF THE AMMONIA PUMPS WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING NORTHWEST.

FL-8-11-M-83 DETAIL VIEW OF THE AMMONIA FILTER CARTS WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING NORTHWEST.

FL-8-11-M-84 DETAIL VIEW OF THE AMMONIA TRANSFER MANIFOLD WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING SOUTHEAST.

FL-8-11-M-85 DETAIL VIEW OF THE AMMONIA FLOW CONTROL AND INSTRUMENTATION CART WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING SOUTHWEST.

FL-8-11-M-86 DETAIL VIEW OF THE AMMONIA SAMPLE PANEL WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING SOUTHEAST.

FL-8-11-M-87 DETAIL VIEW OF THE AMMONIA CHILLER CARTS WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING SOUTHWEST.

FL-8-11-M-88 DETAIL VIEW OF THE AMMONIA VALVE AND INSTRUMENTATION PANEL WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING SOUTHWEST.

FL-8-11-M-89 DETAIL VIEW OF THE INTEGRATED EQUIPMENT ASSEMBLY SIMULATOR WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING NORTH.

FL-8-11-M-90 DETAIL VIEW OF THE AMMONIA RECOVERY PUMP ASSEMBLY PANEL WITHIN THE AMMONIA VAPOR CONTAINMENT BUILDING, FACING SOUTHEAST.

Photograph Nos. FL-8-11-M-91 through FL-8-11-M-109 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-8-11-M-91 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
TITLE SHEET
Sheet 49 of 793

FL-8-11-M-92 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
COORDINATION/COMPOSITE TUNNEL LEVEL PLAN, AREAS 2,3,5,6
Sheet 52 of 793

FL-8-11-M-93 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
COORDINATION/COMPOSITE FIRST LEVEL PLAN, AREAS 1-9
Sheet 53 of 793

FL-8-11-M-94 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
COORDINATION/COMPOSITE SECOND LEVEL PLAN, AREAS 1-9
Sheet 55 of 793

FL-8-11-M-95 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
COORDINATION/COMPOSITE THIRD LEVEL PLAN, AREAS 1-6
Sheet 56 of 793

FL-8-11-M-96 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
LAYOUT, FIRST LEVEL FLOOR PLAN, AREA 2
Sheet 60 of 793

FL-8-11-M-97 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
LAYOUT, FIRST LEVEL FLOOR PLAN, AREA 3
Sheet 61 of 793

FL-8-11-M-98 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
LAYOUT, FIRST LEVEL FLOOR PLAN, AREA 5
Sheet 63 of 793

FL-8-11-M-99 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
LAYOUT, FIRST LEVEL FLOOR PLAN, AREA 6
Sheet 64 of 793

FL-8-11-M-100 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
LAYOUT, SECOND LEVEL FLOOR PLAN, AREA 2
Sheet 74 of 793

FL-8-11-M-101 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
LAYOUT, SECOND LEVEL FLOOR PLAN, AREA 5
Sheet 77 of 793

FL-8-11-M-102 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
EXTERIOR ELEVATIONS, MAIN BUILDING (NORTH & EAST) AND CAFETERIA
Sheet 117 of 793

FL-8-11-M-103 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
EXTERIOR ELEVATIONS (SOUTH & WEST)
Sheet 118 of 793

FL-8-11-M-104 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
BUILDING SECTION B, AREAS 2 - 3
Sheet 120 of 793

FL-8-11-M-105 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
BUILDING SECTIONS C & D, AREAS 2 - 3
Sheet 121 of 793

FL-8-11-M-106 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
BUILDING SECTION E, AREAS 4 - 6
Sheet 122 of 793

FL-8-11-M-107 Photocopy of drawing
SPACE STATION PROCESSING FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K32598, Jacobs Engineering Group, June 1990
BUILDING SECTIONS F & G, AREAS 4, 6 & 9
Sheet 123 of 793

FL-8-11-M-108 Photocopy of drawing
AMMONIA VAPOR CONTAINMENT FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K35328, Jones Edmonds & Associates, Inc., September 1999
FLOOR PLAN
Sheet 7

FL-8-11-M-109 Photocopy of drawing
AMMONIA VAPOR CONTAINMENT FACILITY
NASA, John F. Kennedy Space Center, Florida
Drawing 79K35328, Jones Edmonds & Associates, Inc., September 1999
ELEVATIONS AND SECTION
Sheet 8