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Resources at the Library of Congress can be used alone or in conjunction with NASA images to promote STEM and space education. Materials can be used as a form of research and inspiration for design challenges. The resources also help students connect to the past of space exploration and the people who made it possible. Students can examine the evolution of space exploration by analyzing past and present documentation. They can then take the next step in imagining the future.

ROCKET ENGINE TESTING FACILITY. OBSERVATION BLOCKHOUSE. NASA GLENN



Reference Link: <http://www.loc.gov/item/oh1925/>

Contributor Names: Historic American Engineering Record, creator

National Aeronautics & Space Administration (NASA)

H. K. Ferguson Company

Cleveland Municipal Airport

National Advisory Committee on Aeronautics (NACA)

Kumar, Rebecca, transmitter

Bates, Jeff, photographer

NASA Information Technology Center (ITC), photographer

Stewart, Robert C, historian

Created / Published: Documentation compiled after 1968

Notes: - Survey number: HAER OH-124-E

- Building/structure dates: 1955-1957 Initial Construction

- Building/structure dates: 1972 Subsequent Work

- Building/structure dates: 2003 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

APOLLO 11 SPACECRAFT COMMANDER NEIL ARMSTRONG (FRONT) AND LUNAR MODULE PILOT EDWIN E. ALDRIN (REAR) PRACTICE LUNAR SURFACE MOBILITY AT THE MANNED SPACECRAFT CENTER, HOUSTON ARMSTRONG HAS A CAMERA ATTACHED TO THE CHEST AREA OF THE SPACE SUIT. THIS METHOD OF ATTACHING THE CAMERA IS UNDER STUDY. THE ASTRONAUTS ARE IN PRESSURIZED SPACE SUITS // PHOTO CREDIT - NASA. CE ADMINISTRATION.



Reference Link: <http://www.loc.gov/item/2019635073/>

Contributor Names: United States. National Aeronautics and Space Administration, photographer
Created / Published: [Washington, D.C.] : [National Aeronautics and Space Administration], [April 1969]
Subject Headings: - Armstrong, Neil,--1930-2012

- Aldrin, Buzz
- Apollo 11 (Spacecraft)--1960-1970
- Astronauts--American--Texas--Houston--1960-1970
- Space suits--1960-1970
- Cameras--1960-1970

Genre: Photographic prints--1970-1980

Notes: - Title from item.

- Accession box no. PR 13 CN 1977:003

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: ppsca 59787 //hdl.loc.gov/loc.pnp/ppmsca.59787

[AERIAL VIEW OF TICKER TAPE PARADE FOR ASTRONAUTS VIRGIL GRISSOM AND JOHN YOUNG (SEATED IN LAST CAR WITH VICE PRESIDENT HUMPHREY), LED BY TRUCKS WITH SIGNS READING "WELCOME ASTRONAUTS". BROADWAY, NEW YORK CITY] / WO. R HIGGINS.



Reference Link: <http://www.loc.gov/item/2001701745/>

Contributor Names: Higgins, Roger, photographer

Created / Published: 1965 [March 29]

Subject Headings: - Humphrey, Hubert H.--(Hubert Horatio)--1911-1978--Public appearances

- Young, John--1930-2018--Public appearances

- Grissom, Virgil I.--Public appearances

- Ticker tape parades--New York (State)--New York--1960-1970

Genre: Aerial views--1960-1970

Photographic prints--1960-1970

Notes: - NYWT&S staff photograph.

- Forms part of: New York World-Telegram and the Sun Newspaper Photograph Collection (Library of Congress).

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

Digital Id: cph 3c28924 //hdl.loc.gov/loc.pnp/cph.3c28924

**SPACE TRANSPORTATION SYSTEM, SOLID ROCKET BOOSTERS, LYNDON B. JOHNSON
SPACE CENTER, HARRIS COUNTY, TX**



Reference Link: <http://www.loc.gov/item/tx1117/>

Contributor Names: Historic American Engineering Record, creator

National Aeronautics and Space Administration, Owner

Created / Published: Documentation compiled after 1968

Subject Headings: - man in space

- national space program

- space exploration

- space flight

- rocket propulsion

- Texas -- Harris County -- Houston

Notes: - Survey number: HAER TX-116-K

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

SPACE TRANSPORTATION SYSTEM, ORBITER DISCOVERY (OV-103), LYNDON B. JOHNSON SPACE CENTER, HARRIS COUNTY, TX



Reference Link: <http://www.loc.gov/item/tx1107/>

Contributor Names: Historic American Engineering Record, creator

National Aeronautics and Space Administration, Owner

Smithsonian Institution, Owner

Groman, Jennifer, Historic Preservation Officer

Severance, Barbara

Allen, Ralph, Historic Preservation Officer

Smart GeoMetrics, contractor

Created / Published: Documentation compiled after 1968

Subject Headings: - national space program

- man in space
- space flight
- Shuttle Program
- space shuttles

- Texas -- Harris County -- Houston

Notes: - Significance: Discovery, NASA's third Orbiter to join the fleet, was named after one of the two ships that were used by British explorer James Cook in the 1770s. It was the first Orbiter built solely for operations and not for testing and benefited from the knowledge gained from the construction, assembly and testing of the Orbiters Enterprise, Columbia and Challenger. When it was completed, Discovery was almost 7,000 pounds lighter than Columbia. Discovery arrived at the Kennedy Center in Florida on November 9, 1983. After checkout, testing and processing, it was launched on August 30, 1984, for its first mission, 41-D, to deploy three communications satellites. Since its inaugural flight Discovery has completed 39 missions,



traveled over 148,000,000 miles.

- Survey number: HAER TX-116-A
- Building/structure dates: 1983 Initial Construction

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

GLENN SPACE SHUTTLE FLIGHT



Reference Link: <http://www.loc.gov/item/2019640268/>

Summary: Caption for frame no. 8: NASA Administrator Daniel Goldin during a news conference to announce the return to the space program of Sen. John Glenn, D-Ohio, in a 1962 photo behind Goldin. Glenn is slated to fly aboard the space shuttle in October.

Contributor Names: Graham, Douglas (Photographer), photographer

Created / Published: [16 Jan. 1998]

Subject Headings: - Glenn, John

- Goldin, Daniel
- Astronauts
- Press conferences
- NASA (National Aeronautics and Space Administration)

Genre: Film negatives--Color--1990-2000

Notes: - Title, date, and photographer based on information provided by Congressional Quarterly (CQ).

Caption/summary only present when provided by CQ.

- LC-CQ06-WR98011603: Frame nos. 7-9.

- Gift; CQ Roll Call; 2011; (DLC/PP-2011:177).

- Forms part of: CQ Roll Call Photograph Collection.


Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: ppmsca 61801 //hdl.loc.gov/loc.pnp/ppmsca.61801

SPACE TRANSPORTATION SYSTEM, LYNDON B. JOHNSON SPACE CENTER, 2101 NASA Boulevard HOUSTON HARRIS COUNTY TX

Space Transportation System Stack Assembly




Orbiter Discovery just after launch of STS-66 from Kennedy Space Center, Florida. Image courtesy of NASA Johnson Space Center. Photographer unknown

Development of the Space Shuttle began in 1969 and a contract for the construction of the Space Shuttle was awarded in July 1972. The Space Shuttle launch configuration or Stack Assembly, was composed of four main components, the Orbiter Vehicle (OV), built by North American Rockwell (later Boeing), three Space Shuttle Main Engines (SSME), built by Rocketdyne (later Boeing), two Solid Rocket Boosters (SRB) built by Thiokol (later ATK Launch Systems) and an External Tank (ET) built by Martin Marietta (later Lockheed Martin). Of these four components only the external tank was not reusable.

During prelaunch preparations in the Vehicle Assembly Building (VAB), the SRBs were attached to the Mobile Launcher Platform (MLP) to bear an skirt with four freestanding mats that were covered by explosive charges at liftoff. The ET was then attached to the SRBs at the booster attachment rings and at a point near the SRBs forward skirt. The Orbiter was then mated to the SRB/ET assembly at the ET via attachment points near the propellant and electrical umbilical connections on the Orbiter's aft fuselage and an attachment point behind its nose landing gear door on the forward fuselage. As a result, the SRBs carried the entire weight of the stack and transferred it through their structure to the MLP.

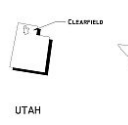
A complete Stack Assembly measured 184.2 feet from the base of the SRB's aft skirt to the nose of the ET. The depth of the assembly, from the exterior edge of the ET to the tip of the Orbiter's vertical stabilizer, was 75.5 feet and the weight of the assembly was 75,000 feet from wing tip to wing tip of the Orbiter.

When the prelaunch activities at the Vehicle Assembly Building were complete, a Carrier Transporter was used to lift the MLP with the Stack Assembly attached, and carry it out to launch complex 39A or 39B for further launch preparations.

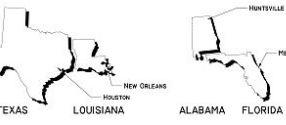


PALMDALE
CANDIDA PARK

CALIFORNIA



UTAH



CLEARFIELD
HOUSTON
NEW ORLEANS
ALABAMA
FLORIDA

At launch, the two SRBs provided the majority of the thrust required for liftoff. With a combined thrust of 6,000,000 pounds of force, the SRBs contributed approximately 72% of the power through the first launch stage, which ended at SRB separation, about 2 minutes after launch. After separation and all predetermined altitude parachutes were deployed to slow the boosters' descent for safe splashdowns in the ocean about 141 nautical miles downrange, where they were retrieved, refurbished and reused for subsequent launches.

The orbiter's Main Propulsion System consisted of the External Tank, propellant delivery and control systems and three SSMEs which produced a combined thrust of 1,181,400 pounds of force at sea level. The liquid hydrogen fuel and liquid oxygen oxidizer were stored in the ET and supplied the SSMEs with propellant from approximately 45 seconds before liftoff until Main Engine Cut Off (MECO) and jettisoned, approximately 8 minutes, and 50 seconds after launch. Under the influence of gravity, the ET would fall towards Earth, eventually disintegrating as it reentered Earth's atmosphere.

After MECO and ET jettison the SSMEs were no longer used. The shuttle relied on the Orbital Maneuvering System (OMS) and the Reaction Control System (RCS) during the orbital phase for velocity changes. The OMS was located in two pods on the aft section of the Orbiter at the base of the vertical stabilizer. The pods also contained the all RCS. The forward RCS was located just past the nose of the Orbiter. The RCS was used for small velocity and orientation adjustments and the two OMS engines were used for large velocity changes.

The Shuttle was designed to transport payloads into low Earth orbit, between 100 and 200 nautical miles, and have nominal mission durations of 1 to 16 days in space. The Orbiter provided accommodation to up to seven astronauts, four seated on the flight deck during the launch while another three were seated in the mid-deck area, although eight astronauts flew on STS-64. After orbital insertion the flight deck, mid deck, additional hardware and software were configured for on-orbit activities.

At the conclusion of orbital operations the payload bay doors were closed, the Orbiter was turned to a roll-first attitude, the OMS engines were fired to reduce the Orbiter's velocity and permit descent, then it was turned back to a nose-first attitude for reentry. During reentry the all RCS was used to control the roll, pitch and yaw until the atmospheric density was sufficient for the aero surfaces to become effective. The Orbiter would perform a series of banking maneuvers, using atmospheric drag, to decrease its velocity. Combined with the descent angle and continued drag these maneuvers reduced the velocity to about 200 mph or main landing gear touchdown.

Spacecraft recovery operations began as soon as the Orbiter stopped rolling. Ground support personnel, wearing protective gear, approached the vehicle with sensors to determine if the area around the Orbiter was safe. After determining the area safe for operations, ground support equipment was attached to the orbiter to begin pararescue systems, dispensing twenty life and preparing for crew egress. After crew egress the spacecraft was powered down and transported to the Orbiter Processing Facility. If the shuttle landed at sites other than Kennedy Space Center (KSC) the spacecraft was carefully inspected and prepared for reflight in the Shuttle Carrier Aircraft and ferried back to KSC for further processing and prelaunch preparations for its next scheduled mission.

This recording project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering, industrial, and maritime works in the United States. The HAER program is administered by the National Park Service, U.S. Department of the Interior. The Space Transportation System Recording Project considered architectural collections, John Wachtel, Iowa State and Joseph Orme, Brooks Institute of Technology. This documentation is based on high-resolution laser scans provided by Smart Geometrics, Houston, Texas and documentation provided by NASA's Headquarters, Johnson Space Center and Marshall Space Flight Center. Written historical and descriptive data was provided by Archaeological Consultants Inc., Sarasota, Florida. Large-format photographs were produced by NASA's Imaging Lab at Johnson Space Center with supplemental images provided by Jet Lowe, HAER photographer.

Reference Link: <http://www.loc.gov/item/tx1106/>

Contributor Names: Historic American Engineering Record, creator
 National Aeronautics and Space Administration, Owner
 Smithsonian Institution, Owner
 Deming, Joan, historian
 Slovinac, Patricia, historian
 Archaeological Consultants, Inc., contractor
 Wolfe, Jeffrey, field team
 Nehr, Adam, field team
 Farrar, Tom, field team
 Behrens, Thomas M, project manager
 Wachtel, John, delineator
 Klimek, Joseph, delineator
 Pierce, Ryan, delineator
 Smart GeoMetrics, field team
 Lowe, Jet, photographer

Created / Published: Documentation compiled after 1968

Subject Headings: - national space program

- space exploration
- space flight
- man in space
- Shuttle Program
- rocket propulsion
- fuel tanks



- Texas -- Harris County -- Houston

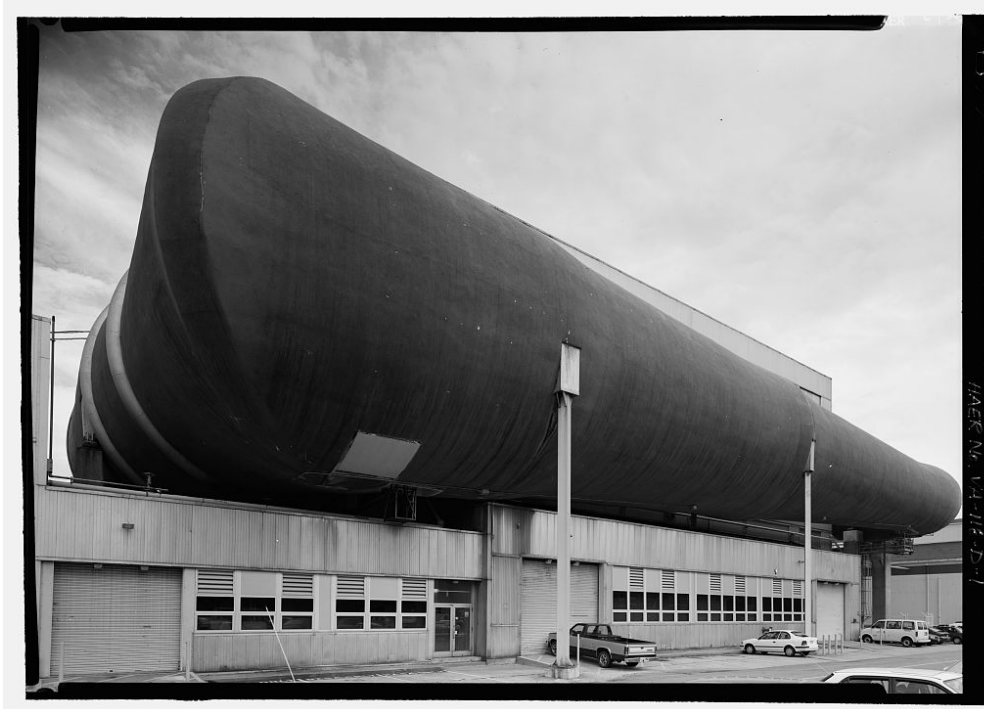
Notes: - Significance: The Orbiter Discovery, OV-103, is considered eligible for listing in the National Register of Historic Places (NRHP) in the context of the U.S. Space Shuttle Program (1969-2011) under Criterion A in the areas of Space Exploration and Transportation and under Criterion C in the area of Engineering. Because it has achieved significance within the past fifty years, Criteria Consideration G applies. Under Criterion A, Discovery is significant as the oldest of the three extant orbiter vehicles constructed for the Space Shuttle Program (SSP), the longest running American space program to date; she was the third of five orbiters built by NASA. Unlike the Mercury, Gemini, and Apollo programs, the SSP's emphasis was on cost effectiveness and reusability, and eventually the construction of a space station. Including her maiden voyage (launched August 30, 1984), Discovery flew to space thirty-nine times, more than any of the other four orbiters; she was also the first orbiter to fly twenty missions. She had the honor of being chosen as the Return to Flight vehicle after both the Challenger and Columbia accidents. Discovery was the first shuttle to fly with the redesigned SRBs, a result of the Challenger accident, and the first shuttle to fly with the Phase II and Block I SSME. Discovery also carried the Hubble Space Telescope to orbit and performed two of the five servicing missions to the observatory. She flew the first and last dedicated Department of Defense (DoD) missions, as well as the first unclassified defense-related mission. In addition, Discovery was vital to the construction of the International Space Station (ISS); she flew thirteen of the thirty-seven total missions flown to the station by a U.S. Space Shuttle. She was the first orbiter to dock to the ISS, and the first to perform an exchange of a resident crew. Under Criterion C, Discovery is significant as a feat of engineering. According to Wayne Hale, a flight director from Johnson Space Center, the Space Shuttle orbiter represents a "huge technological leap from expendable rockets and capsules to a reusable, winged, hypersonic, cargo-carrying spacecraft." Although her base structure followed a conventional aircraft design, she used advanced materials that both minimized her weight for cargo-carrying purposes and featured low thermal expansion ratios, which provided a stable base for her Thermal Protection System (TPS) materials. The Space Shuttle orbiter also featured the first reusable TPS; all previous spaceflight vehicles had a single-use, ablative heat shield. Other notable engineering achievements of the orbiter included the first reusable orbital propulsion system, and the first two-fault-tolerant Integrated Avionics System. As Hale stated, the Space Shuttle remains "the largest, fastest, winged hypersonic aircraft in history," having regularly flown at twenty-five times the speed of sound.

- Survey number: HAER TX-116

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

NASA LANGLEY RESEARCH CENTER, 8-FOOT TRANSONIC PRESSURE TUNNEL, 640



Reference Link: <http://www.loc.gov/item/va1899/>

Contributor Names: Historic American Engineering Record, creator
Stack, John

Draley, Eugene C

Wright, Ray H

Mattson, Axel T

National Aeronautics and Space Administration

Whitcomb, Richard T

National Advisory Committee for Aeronautics

Langley Memorial Aeronautical Laboratory

Flechner, Stuart G

Patterson, James C, Jr

Fournier, Paul G

Davidson, Lisa, transmitter

Lowe, Jet, photographer

National Aeronautics and Space Administration, sponsor

Laird, Matthew R, historian

Cunningham, Chris, photographer

Newbill, Michael, researcher

Dutton, David H, researcher

Anderson, Richard K, Jr, researcher

Created / Published: Documentation compiled after 1968



- aeronautics
- pipes (conduits)
- motors
- offices
- control rooms
- catwalks
- steel structural frames
- testing
- Virginia -- Hampton -- Hampton

Notes: - Significance: The 8-Foot Transonic Pressure Tunnel was the first of Langley's wind tunnels to be built incorporating the new slotted throat tunnel design from its inception. A significant improvement over its retrofitted predecessors, the new tunnel allowed transonic testing in a more stable environment. In the 1960s, Langley engineer Richard T. Whitcomb and his research team used the tunnel to develop the "supercritical airfoil," which would revolutionize military and civilian aircraft design. The 8-Foot Transonic Pressure Tunnel is significant at a national level because of its role in the early development of transonic tunnels and its later role in testing aircraft designs.

- Survey number: HAER VA-118-D
- Building/structure dates: 1953 Initial Construction
- Building/structure dates: 1981 Subsequent Work
- Building/structure dates: 1958 Subsequent Work
- Building/structure dates: 2011 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

NASA LANGLEY RESEARCH CENTER, 8-FOOT HIGH SPEED WIND TUNNEL, 641



Reference Link: <http://www.loc.gov/item/va1795/>

Contributor Names: Historic American Engineering Record, creator

Robinson, Russell G

Hood, Manley J

Jacobs, Eastman N

Public Works Administration

Stack, John

Orlin, William

Wright, Ray H

Ritchie, Virgil S

Whitcomb, Richard

Becker, John

National Advisory Committee for Aeronautics

Lewis, George W

Langley Memorial Aeronautical Laboratory

National Aeronautics and Space Administration

Wang, Charissa Y, field team

Durst, Donald M, field team

Herrin, Dean A, project manager

Lowe, Jet, photographer

Hardlines: Design & Delineation, delineator

Stewart, Robert C, historian



Newbill, Michael, researcher

Dutton, David H, researcher

Anderson, Richard K, Jr, researcher

Laird, Matthew R, historian

Lowe, Jet, photographer

National Aeronautics and Space Administration, sponsor

Created / Published: Documentation compiled after 1968

Subject Headings: - wind tunnels

- aeronautics
- reinforced concrete construction
- motors
- offices
- Art Deco architectural elements
- testing
- Works Progress Administration
- Virginia -- Hampton -- Hampton

Notes: - Significance: The facility was authorized in July 1933 and built by the Public Works Administration for \$26,000. It tested complete models of aircraft and aircraft components in a high-speed airstream approaching the speed of sound. Originally capable of testing at Mach 0.75, it was repowered in the 1940s and early 1950s to have a Mach 1.2 potential. The most important contribution of the HST was defining the causes and cures for the severe adverse stability and control problems encountered in high-speed dives. This tunnel also produced the high-speed cowling shapes used in World War II aircraft, and efficient air inlets for jet aircraft. The first 500-MPH analyses of propellers were made here early in the war. After repowering, the 8-Foot Tunnel produced precise transonic data up to Mach numbers as high as 0.92 for such aircraft as the X-1, D-558, and others. Its final achievement was the development and use in routine operations of the first transonic slotted throat. The investigations of wing-body shapes in this tunnel led to Richard Whitcomb's discovery of the transonic area rule. The HST developed an impressive record in aviation history as an example of accomplishment by imaginative researchers.

- Survey number: HAER VA-118-B
- Building/structure dates: 1936 Initial Construction
- Building/structure dates: 1944 Subsequent Work
- Building/structure dates: 1945 Subsequent Work
- Building/structure dates: 1950 Subsequent Work
- Building/structure dates: 1946 Subsequent Work
- Building/structure dates: 1966 Subsequent Work
- Building/structure dates: 1985 Subsequent Work
- Building/structure dates: 2011 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

NASA INDUSTRIAL PLANT, MISSILE RESEARCH LABORATORY, 12214 LAKEWOOD



Reference Link: <http://www.loc.gov/item/ca3134/>

Contributor Names: Historic American Engineering Record, creator

Onyx Architects, contractor

Positive Image Photographic Services, contractor

Jackson-Retondo, Elaine, transmitter

Kaplan, Mark, historian

Olmos, Tavo, photographer

Created / Published: Documentation compiled after 1968

Subject Headings: - laboratories

- California -- Los Angeles County -- Downey

Notes: - Significance: Building 41 was used for missile research and construction and is a contributing factor to the historic value of the NASA site.

- Survey number: HAER CA-310-G

- Building/structure dates: 1942 Initial Construction

- Building/structure dates: 1940- before 1950 Subsequent Work

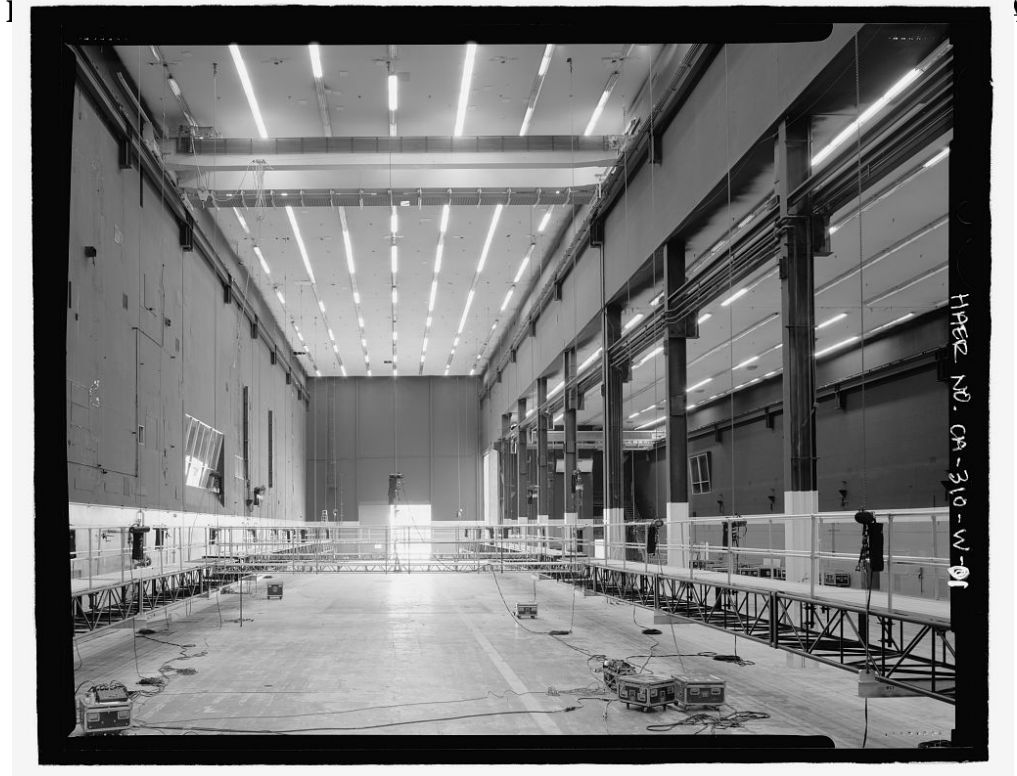
- Building/structure dates: 1950 Subsequent Work

- Building/structure dates: 1960-1961 Subsequent Work

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

NASA INDUSTRIAL PLANT, SYSTEMS INTEGRATION & CHECKOUT FACILITY, 12214



Reference Link: <http://www.loc.gov/item/ca3478/>

Contributor Names: Historic American Engineering Record, creator

Created / Published: Documentation compiled after 1968

Subject Headings: - national space program

- space exploration

- space flight

- assembly plants

- California -- Los Angeles County -- Downey

Notes: - **Significance:** Building 290 was constructed in 1965 and was significantly used until 1999 when the Downey plant was closed. It was very significant during the Apollo and Space Shuttle programs as a Systems Integration and Checkout facility and served as the final assembly facility for the service and command modules of the Apollo program. Building 290 "was the heart of the Apollo program, combined with Building 6."¹ Building 290 is also known for housing the world's largest clean room for 9 months before the Soviet Union superseded it with a similar building. Building 290 was the location where the crew module and aft thrust structures were developed for the Apollo program. "In total over 20 vehicles were constructed in the building."² At one time, a section of Building 290 was converted into dormitories for the astronauts during testing and training for the Apollo Mission. Building 290 was the location of spacecraft assembly and integration for the American Space-Age. Building 290 was used by assemblers, technicians and engineers who worked to create the hardware that was responsible for taking men to the moon and made the International Space Station possible.³ Memorial plaques for all of the astronauts who flew into space during



bravery and good works. 1 National Aeronautics and Space Administration. "Final Historic Buildings and Structures Inventory and Evaluation, National Aeronautics and Space Administration, Industrial Plant Parcels I and II Downey, California." November 1999. Appendix G. 2 Ibid. 3 Ibid.

- Survey number: HAER CA-310-W

- Building/structure dates: 1965 Initial Construction

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

NASA INDUSTRIAL PLANT. MANUFACTURING & ASSEMBLY PLANT. 12214 LAKEWOOD



Reference Link: <http://www.loc.gov/item/ca3474/>

Contributor Names: Historic American Engineering Record, creator

Kaufmann, Gordon B., Architect

Stanton, J. E., Architect

Stockwell, William F., Architect

Murray, Erick, Engineer

Created / Published: Documentation compiled after 1968

Subject Headings: - military facilities

- war (World War II)

- national space program

- research facilities

- development

- aircraft

- California -- Los Angeles County -- Downey

Notes: - Significance: Building 1 has a long history of construction. Originally built in 1929, it was continuously remodeled, added on to, and modified up until 1996. Building 1 is the largest building on the Downey site being 1 million square feet in size. Built during a very significant period of history when aircraft production was just beginning, Building 1 was responsible for the housing and construction of many aircraft under the companies EMSCO, and Vultee. The innovative construction of the folding-wing plane by Kinner was once produced in Building 1 and during WWII under the company Vultee Aircraft Inc. 15 percent of



the aircraft supplied for the WWII was built at the Downey site. Vultee was the "first aircraft manufacturing plant to use powered assembly lines, including a mechanized overhead conveyor, Vultee was able to produce more planes in a shorter span of time than any other similar plant." 1 This conveyor system was located in Building 1. Not only was Building 1 significant during the aircraft age, but also during the age of missile development and research as well as the Apollo and Space Shuttle programs. Building 1 was used for large subassembly and final assembly operations on both aircraft and spacecraft command and service modules. Building 1 was also the earliest location for astronaut dormitories on the Downey site. Building 1 was utilized during the Space Shuttle program and housed the full-scale mock-up of the space shuttle. Building 1 is considered "the administrative and historical "heart" of the NASA Industrial Plant. Beneath this building's roof there are approximately 22 separate building, some of which are part of the original plant constructed in 1929, and all of which contribute to the plants 70-year history of design, production, and testing for the aircraft/aerospace industry." 2 1 National Aeronautics and Space Administration. "Final Historic Buildings and Structures Inventory and Evaluation, National Aeronautics and Space Administration, Industrial Plant Parcels I and II Downey, California." November 1999. Ch. 13 Historical Context. 2 Ibid.

- Survey number: HAER CA-310-S

- Building/structure dates: 1929 Initial Construction

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

NASA INDUSTRIAL PLANT. 12214 LAKEWOOD BOULEVARD. DOWNEY. LOS ANGELES



Reference Link: <http://www.loc.gov/item/ca3127/>

Contributor Names: Historic American Engineering Record, creator

Smith, E M

Vultee, Jerry

Millar, Richard

Kaufmann, Gordon

Onyx Architects, contractor

Jackson-Retondo, Elaine, transmitter

Olmos, Tavo, photographer

Kaplan, Mark, historian

Created / Published: Documentation compiled after 1968

Subject Headings: - industrial facilities

- California -- Los Angeles County -- Downey

Notes: - Significance: The site was one of the country's earliest airplane manufacturing plants and has been instrumental in the development of flight technology including military, supersonic, and high altitude flight vehicles, the manufacturing process of these vehicles, missile technology, guidance systems as well as the Apollo and Space Shuttle programs. The structures included in this report comprise a fraction of the overall facility and are located in the northeastern region of the site.

- Unprocessed Field note material exists for this structure: N973

- Survey number: HAER CA-310



- Building/structure dates: 1929 Initial Construction
- Building/structure dates: 1941 Subsequent Work
- Building/structure dates: 1948-1958 Subsequent Work
- Building/structure dates: 1996 Subsequent Work
- Building/structure dates: 1999 Subsequent Work

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA
<http://hdl.loc.gov/loc.pnp/pp.print>

ROCKET ENGINE TESTING FACILITY. GRC BUILDING NO. 100. NASA GLENN RESEARCH



Reference Link: <http://www.loc.gov/item/oh1924/>

Contributor Names: Historic American Engineering Record, creator

National Aeronautics & Space Administration (NASA)

H. K. Ferguson Company

Cleveland Municipal Airport

National Advisory Committee on Aeronautics (NACA)

Kerline, H S

Kumar, Rebecca, transmitter

Bates, Jeff, photographer

Stewart, Robert C, historian

Created / Published: Documentation compiled after 1968

Notes: - Survey number: HAER OH-124-D

- Building/structure dates: 1957 Initial Construction

- Building/structure dates: 1985 Subsequent Work

- Building/structure dates: 1991 Subsequent Work

- Building/structure dates: 2003 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

ROCKET ENGINE TESTING FACILITY. GRC BUILDING NO. 205. NASA GLENN RESEARCH



Reference Link: <http://www.loc.gov/item/oh1922/>

Contributor Names: Historic American Engineering Record, creator

National Aeronautics & Space Administration (NASA)

H. K. Ferguson Company

Cleveland Municipal Airport

National Advisory Committee on Aeronautics (NACA)

Kumar, Rebecca, transmitter

Stewart, Robert C, historian

Created / Published: Documentation compiled after 1968

Notes: - Survey number: HAER OH-124-B

- Building/structure dates: 1962-1965 Initial Construction

- Building/structure dates: 1995 Subsequent Work

- Building/structure dates: 2003 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>



Reference Link: <http://www.loc.gov/item/2016646528/>

Contributor Names: O'Halloran, Thomas J., photographer

Created / Published: 1964 April 20.

Genre: Film negatives--1960-1970

Notes: - Title and date from log book.

- Contact sheet available for reference purposes: USN&WR COLL - Job no. 11829, frame 35.

- Forms part of: U.S. News & World Report Magazine Photograph Collection.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: ppmsca 41627 //hdl.loc.gov/loc.pnp/ppmsca.41627

MICHAEL COLL

/SMITHSONIAN



Reference Link: <http://www.loc.gov/item/2019630938/>

Contributor Names: Trikosko, Marion S., photographer

Created / Published: 1974 July 9.

Genre: Film negatives--1970-1980

Notes: - Title and date from log book.

- Contact sheet available for reference purposes: USN&WR COLL - Job no. 29757-A, frame 24A.

- Forms part of: U.S. News & World Report Magazine Photograph Collection.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: ppmsca 55563 //hdl.loc.gov/loc.pnp/ppmsca.55563



Reference Link: <http://www.loc.gov/item/2019631449/>

Contributor Names: Leffler, Warren K., photographer

Created / Published: 1969 January 9.

Genre: Film negatives--1960-1970

Notes: - Title and date from log book.

- Contact sheet available for reference purposes: USN&WR COLL - Job no. 20323, frame 21.

- Forms part of: U.S. News & World Report Magazine Photograph Collection.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: [ppmsca 56650](http://hdl.loc.gov/loc.pnp/ppmsca.56650)



Reference Link: <http://www.loc.gov/item/2019631448/>

Contributor Names: Trikosko, Marion S., photographer

Created / Published: 1969 January 9.

Genre: Film negatives--1960-1970

Notes: - Title and date from log book.

- Contact sheet available for reference purposes: USN&WR COLL - Job no. 20319, frame 29A.

- Forms part of: U.S. News & World Report Magazine Photograph Collection.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: [ppmsca 56649](http://hdl.loc.gov/loc.pnp/ppmsca.56649) //hdl.loc.gov/loc.pnp/ppmsca.56649

THE CHRONICLE, IMAGE 14



Reference Link: <https://chroniclingamerica.loc.gov/lccn/sn87065526/1963-08-23/ed-1/seq-14/#date1=1777&sort=relevance&rows=20&words=NASA&searchType=basic&sequence=0&index=3&state=&date1=1777&date2=1777>

Newspaper: The Chronicle. (Pascagoula, Miss.) 1961-1966

Newspaper Link: <https://chroniclingamerica.loc.gov/lccn/sn87065526/1963-08-23/ed-1/seq-14/#date1=1777&sort=relevance...>

Image provided by: Mississippi Department of Archives and History

PDF Link: <https://chroniclingamerica.loc.gov/lccn/sn87065526/1963-08-23/ed-1/seq-14.pdf>

ROCKET ENGINE TESTING FACILITY, NASA GLENN RESEARCH CENTER, CLEVELAND, CUYAHOGA COUNTY, OH

The National Aeronautics and Space Administration (NASA) began construction of the Rocket Engine Test Facility (RETF) in 1955 on land that was formerly part of the Cleveland Municipal Airport. In 1940, the National Advisory Committee on Aeronautics (NACA) selected 200 acres of the airport site for the construction of an Aircraft Engine Research Laboratory. The site of this original lab and the RETF is the present NASA John H. Glenn Research Center at Lewis Field.

The construction of RETF was related to post-war missile development, which required the construction of facilities dedicated to the research and testing of rocket engines and auxiliary equipment. RETF was built between 1955 and 1957 to test rocket engines and to collect the resulting test data. The main rocket engine test stand was located in Building 202, while the control room and data recording equipment were housed in Building 100. Equipment that vaporized and compressed liquid gases and oxidants before they were supplied to the test stand was accommodated in ancillary Buildings 205, 206, and 206A. Photographs taken in 1957 show observers in the Building 100 control room using closed-circuit television to monitor tests. In addition, an observation blockhouse provided a safe location for operators to monitor rocket engine tests during the early years of testing at RETF. In 1972, the installation of a closed-circuit television camera on the roof of the blockhouse reduced the need for observers to witness testing from inside the blockhouse.

The terrain of the site was suited to its function. Building 202 stands in a remote location, on the east side of a deep ravine adjacent to Abram Creek. Building 100, which houses RETF operations facilities and the control rooms, was constructed on flat ground, 1,600 feet north of the test stands, in Building 202.

These tests run in RETF involved the use of hazardous fuels in experimental engine designs, and performance could be unpredictable and dangerous. Test engineers were therefore housed in the protected control rooms in Building 100, where they could run their rocket engine tests at a safe distance. The

ROCKET ENGINE TEST FACILITY


NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LEWIS RESEARCH CENTER, CLEVELAND, OHIO

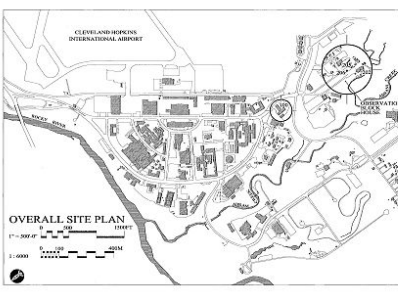
engineering design information collected at this facility made a significant contribution to developing the technology to use liquid hydrogen as a rocket fuel. The RETF was also instrumental in the development of the Contour and Saturn rocket engines used in the Apollo space program as well as the engines for the Space Shuttle vehicle.

The testing procedures used at RETF changed regularly to keep pace with the rapid technological advances in the aerospace industry during the facility's active use from 1957 to 1965. Developments in computer technology required frequent upgrades to the control and data acquisition systems used at RETF. Changing technology and the addition of a high-altitude rocket test stand in 1985 required the addition of new control and recording equipment. In addition, the high-altitude test stand was enclosed inside a horizontal chamber that could be evacuated to simulate the vacuum of outer space. Ejection maintained the vacuum during the test period. Advanced methods for handling cryogenic materials were also incorporated into the test procedures, and in 1991 a test stand was built for the evaluation of cryogenic turbo pump components. RETF personnel designed many of these innovative controls and systems, using technology developed at RETF.


This documentation was initiated on May 15, 2002 in accordance with a Memorandum of Agreement among the Federal Aviation Administration, The National Aeronautics and Space Administration, The Ohio State Historic Preservation Office, and the Advisory Council on Historic Preservation. These drawings are based on Handlines Design Company's field inspection, field measurements, and interpretation/integration of personal interviews, historic photographs, and as-built construction drawings retained by NASA Glenn Research Center, Cleveland, Ohio. The drawings were prepared by Stan Popovich, AICP (Planner), Charlene Wang, AIA (Project Architect), Yvonne Mahony (Architectural Designer), Jo Rutowski (Interior Designer), Felicitas Rahnold (Interior Architect), Roy A. Hampton III (Architectural Historian), and Amy D. Case (Editor), of Handlines Design Company, in Columbus, Ohio. Mr. Robert Stewart of Historical Technologies, West Hartford, Connecticut, provided technical assistance and wrote the historical text.



STATE MAP 1" = 200 MI. 1:600,000



OVERALL SITE PLAN 1997
1" = 200 FT. 1:600



REGIONAL MAP 1" = 50 MI. 1:100,000

DRAWN BY: STAN POPOVICH, AICP
CHECKED BY: CHARLENE WANG, AIA
DATE: 05/15/02
SCALE: AS SHOWN
PROJECT NO.: HAER OH-124
DRAWING NO.: 100-1
REVISIONS: NONE
ISSUED FOR: HISTORIC PRESERVATION
DATE: 05/15/02
DRAWN BY: STAN POPOVICH, AICP
CHECKED BY: CHARLENE WANG, AIA
DATE: 05/15/02
SCALE: AS SHOWN
PROJECT NO.: HAER OH-124
DRAWING NO.: 100-1
REVISIONS: NONE
ISSUED FOR: HISTORIC PRESERVATION
DATE: 05/15/02

Reference Link: <http://www.loc.gov/item/oh1920/>

Contributor Names: Historic American Engineering Record, creator
 National Aeronautics & Space Administration (NASA)
 H. K. Ferguson Company
 Cleveland Municipal Airport
 National Advisory Committee on Aeronautics
 Kumar, Rebecca, transmitter
 Bates, Jeff, photographer
 NASA Information Technology Center (ITC), photographer
 Stewart, Robert C, historian
 Dawson, Virginia P, historian
 Hampton, Roy A, historian
 Created / Published: Documentation compiled after 1968

Notes: - Significance: NASA began construction of the Rocket Engine Test Facility (RETF) in 1955 on land that was formerly part of the Cleveland Municipal Airport. In 1940, the National Advisory Committee on Aeronautics selected 200 acres of the airport site for the construction of an Aircraft Engine Research Laboratory. The site of this original lab and the RETF is the present NASA John H. Glenn Research Center at Lewis Field. The construction of RETF was related to post-war missile development, which required the construction of facilities dedicated to the research and testing of rocket engines and auxiliary equipment...

- Survey number: HAER OH-124
- Building/structure dates: 1955-1957 Initial Construction
- Building/structure dates: 1995 Subsequent Work
- Building/structure dates: 2003 Demolished



<http://hdl.loc.gov/loc.pnp/pp.print>

ROCKET ENGINE TESTING FACILITY. GRC BUILDING NO. 206. NASA GLENN RESEARCH



Reference Link: <http://www.loc.gov/item/oh1923/>

Contributor Names: Historic American Engineering Record, creator

National Aeronautics & Space Administration (NASA)

NASA Lewis Research Center Engineering Staff

Cleveland Municipal Airport

National Advisory Committee on Aeronautics (NACA)

Kumar, Rebecca, transmitter

Bates, Jeff, photographer

NASA Information Technology Center (ITC), photographer

Stewart, Robert C, historian

Created / Published: Documentation compiled after 1968

Notes: - Survey number: HAER OH-124-C

- Building/structure dates: 1968 Initial Construction

- Building/structure dates: 1995 Subsequent Work

- Building/structure dates: 2003 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

ROCKET ENGINE TESTING FACILITY. GRC BUILDING NO. 202. NASA GLENN RESEARCH



Reference Link: <http://www.loc.gov/item/oh1921/>

Contributor Names: Historic American Engineering Record, creator
National Aeronautics & Space Administration (NASA)

H. K. Ferguson Company

Cleveland Municipal Airport

National Advisory Committee on Aeronautics (NACA)

Kumar, Rebecca, transmitter

Bates, Jeff, photographer

NASA Information Technology Center (ITC), photographer

Stewart, Robert C, historian

Dawson, Virginia P, historian

Created / Published: Documentation compiled after 1968

Notes: - Survey number: HAER OH-124-A

- Building/structure dates: 1955-1957 Initial Construction

- Building/structure dates: 1984 Subsequent Work

- Building/structure dates: 1991 Subsequent Work

- Building/structure dates: 1995 Subsequent Work

- Building/structure dates: 2003 Demolished

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc/pp/pprint>

NASA'S RETIRED SPACE SHUTTLE ENDEAVOUR, INSIDE THE CALIFORNIA SCIENCE CENTER IN LOS ANGELES, CALIFORNIA



Reference Link: <http://www.loc.gov/item/2013631633/>

Contributor Names: Highsmith, Carol M., 1946-, photographer
Created / Published: 2013.

Subject Headings: - United States--California--Los Angeles

- NASA
- Space shuttles
- Endeavour
- California Science Center
- America

Genre: Digital photographs--Color--2010-2020

Notes: - Title, date, and keywords provided by the photographer.

- After more than twenty organizations submitted proposals for the display of an orbiter, NASA announced that Endeavour would go to the Los Angeles museum.

- Credit line: The Jon B. Lovelace Collection of California Photographs in Carol M. Highsmith's America Project, Library of Congress, Prints and Photographs Division.

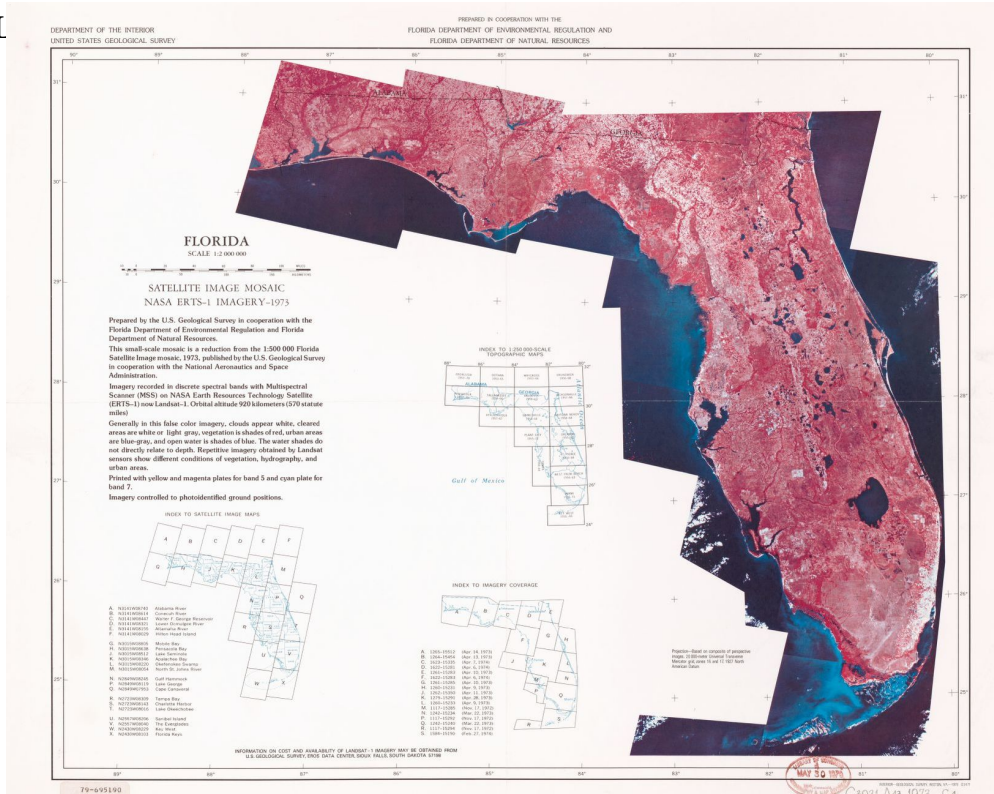
- Gift; The Capital Group Companies Charitable Foundation in memory of Jon B. Lovelace; 2012; (DLC/PP-2012:063).

- Forms part of: Jon B. Lovelace Collection of California Photographs in Carol M. Highsmith's America Project in the Carol M. Highsmith Archive.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: highsm 24455 //hdl.loc.gov/loc.pnp/highsm.24455



Reference Link: <http://www.loc.gov/item/79695190/>

Contributor Names: Geological Survey (U.S.)
Florida. Department of Environmental Regulation.
Florida. Department of Natural Resources.
United States. National Aeronautics and Space Administration.

Created / Published: Reston, Va. : The Survey, 1978.

Subject Headings: - Florida--Remote-sensing images

- United States--Florida

Notes: - Scale 1:2,000,000.

- "Projection--Based on composite of perspective images, 20,000-meter universal transverse Mercator grid ..."

- "This small-scale mosaic is a reduction from the 1:50,000 Florida satellite image mosaic, 1973, published by the U.S. Geological Survey in cooperation with the National Aeronautics and Space Administration.

- Includes text, indexes of satellite and topographic map coverage, and "Index to imagery coverage."

- Available also through the Library of Congress Web site as a raster image.

- AACR2

Repository: Library of Congress Geography and Map Division Washington, D.C. 20540-4650 USA dcu

Digital Id: <https://hdl.loc.gov/loc.gmd/g3931a.ct010189>



Reference Link: <http://www.loc.gov/item/2016646556/>

Contributor Names: Trikosko, Marion S., photographer

Created / Published: 1964 August 4.

Genre: Film negatives--1960-1970

Notes: - Title and date from log book.

- Contact sheet available for reference purposes: USN&WR COLL - Job no. 12331, frame 24.

- Forms part of: U.S. News & World Report Magazine Photograph Collection.

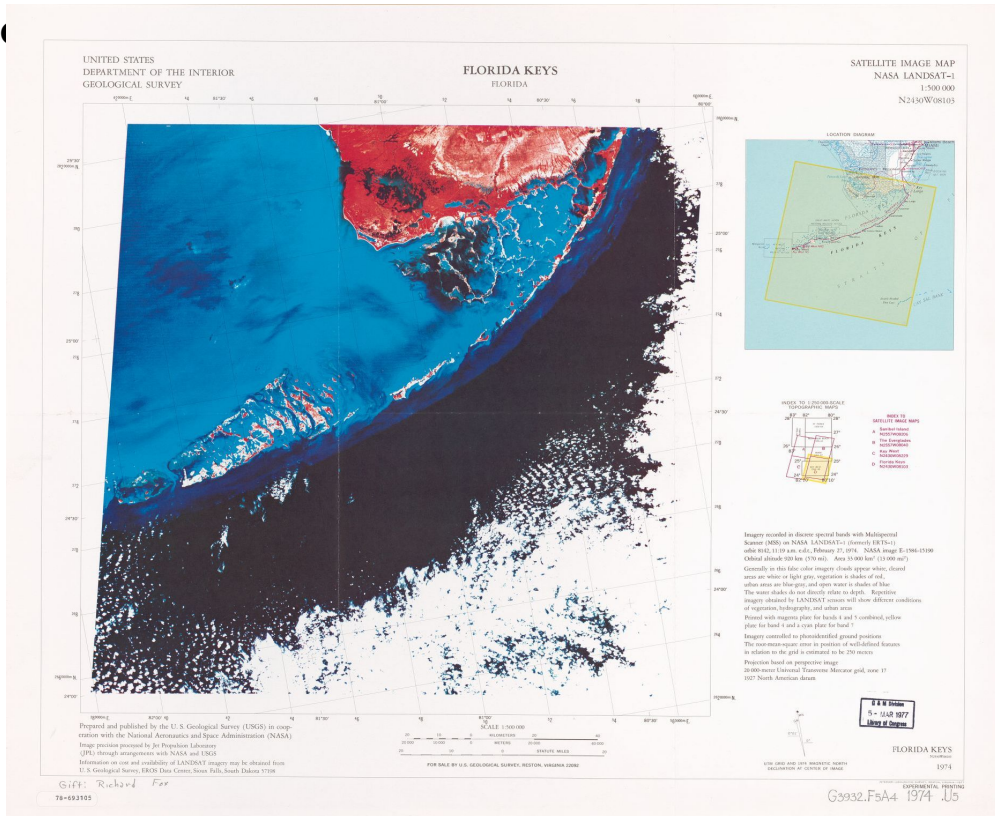
Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: [ppmsca 41655](http://hdl.loc.gov/loc.pnp/ppmsca.41655) //hdl.loc.gov/loc.pnp/ppmsca.41655

FL

T-1.



Reference Link: <http://www.loc.gov/item/78693105/>

Contributor Names: Geological Survey (U.S.)
United States. National Aeronautics and Space Administration.
Created / Published: Reston, Va., 1977.

Subject Headings: - Florida Keys (Fla.)--Remote-sensing maps
- United States--Florida--Florida Keys

Notes: - Scale 1:500,000.

- Alternate title: Florida Keys, N2430W08103, 1974.
- "Projection based on perspective image, 20,000 meter Universal Transverse Mercator grid ... "
- "Experimental printing."
- Includes text, location map, and map "Index to 1:250,000-scale topographic maps."
- Available also through the Library of Congress Web site as a raster image.
- AACR2

Repository: Library of Congress Geography and Map Division Washington, D.C. 20540-4650 USA dcu
Digital Id: <https://hdl.loc.gov/loc.gmd/g3932f.ct010297>

DISPLAY A



MARYLAND

Reference Link: <http://www.loc.gov/item/2011634848/>

Contributor Names: Highsmith, Carol M., 1946-, photographer

Created / Published: [between 1980 and 2006]

Subject Headings: - United States--Maryland--Greenbelt

- America

- National Aeronautics and Space Administration

- NASA

Genre: Transparencies--Color--1980-2010

Notes: - Digital image produced by Carol M. Highsmith to represent her original film transparency; some details may differ between the film and the digital images.

- Title, date, and keywords provided by the photographer.

- Credit line: Photographs in the Carol M. Highsmith Archive, Library of Congress, Prints and Photographs Division.

- Gift and purchase; Carol M. Highsmith; 2011; (DLC/PP-2011:124).

- Forms part of the Selects Series in the Carol M. Highsmith Archive.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: highsm 16655 //hdl.loc.gov/loc.pnp/highsm.16655

[STRUCTURES AT NASA GREENBELT, MARYLAND]



Reference Link: <http://www.loc.gov/item/2011634851/>

Contributor Names: Highsmith, Carol M., 1946-, photographer

Created / Published: [between 1980 and 2006]

Subject Headings: - United States--Maryland--Greenbelt

- America

- National Aeronautics and Space Administration

- NASA

Genre: Transparencies--Color--1980-2010

Notes: - Digital image produced by Carol M. Highsmith to represent her original film transparency; some details may differ between the film and the digital images.

- Title, date, and keywords provided by the photographer.

- Credit line: Photographs in the Carol M. Highsmith Archive, Library of Congress, Prints and Photographs Division.

- Gift and purchase; Carol M. Highsmith; 2011; (DLC/PP-2011:124).

- Forms part of the Selects Series in the Carol M. Highsmith Archive.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: highsm 16658 //hdl.loc.gov/loc.pnp/highsm.16658



Reference Link: <http://www.loc.gov/item/2016647286/>

Contributor Names: Trikosko, Marion S., photographer

Created / Published: 1965 July 12-14.

Genre: Film negatives--1960-1970

Notes: - Title and date from log book.

- Contact sheet available for reference purposes: USN&WR COLL - Job no. 14231, frame 27.

- Forms part of: U.S. News & World Report Magazine Photograph Collection.

Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA

<http://hdl.loc.gov/loc.pnp/pp.print>

Digital Id: ppmsca 49952 //hdl.loc.gov/loc.pnp/ppmsca.49952