50TH ANNIVERSARY OF JSC BUILDING 31 1966 – 2016

. . . In The Beginning

In 1964, the temporary facilities at Ellington Air Force Base for Science and Applied Technology Development were not adequate to facilitate the Apollo program requirements. The Lunar Mission and Space Exploration Facility, Building 31, was built between 1965 – 1966 to support the critical role of science and applied technology in the Apollo program at NASA's Manned Spaceflight Center (MSC), Houston, TX (now JSC). The Lunar Mission and Space Exploration Facility was specifically designed to permanently house the office space and laboratories required to support applied technology for cislunar space, lunar surface, and planetary environments where Apollo and future human spaceflight would operate. In addition, the facility supported the development of engineering and scientific experiments to be conducted by the astronauts on the lunar surface, and the scientific training required for the operation of these experiments by the astronauts.

(1964 B31 Facility Design Criterion Report)

MSC 1965 Aerial Photo
Bldg. 31 Location Before Ground Breaking

NASA Johnson Space Center (JSC) Building 31 is located northwest of Fifth Street, southeast of Building 9 and Fourth Street and southwest of building 37.

Laying the Foundation

The Fisher Construction Company commenced the construction of MSC Bldg. 31 on April 20, 1965 and concluded on March 23, 1966 at an estimated cost of $1,721,000.00 (FY1965).

The facility was designed in June 1964 by Engineers of the Southwest, Houston, TX; which consisted of Lockwood, Andres & Newman, Inc., Bovay Engineers, Inc., and Turner & Collie, Consulting Engineers, Inc. along with the architectural firm Kenneth Bentsen associates, Houston, TX.

The facility was designed for a permanent staff of 125 personnel and 5 to 10 visiting scientists and experiments. Based on the 1964 MSC Master Plan, the building was designed as a permanent facility requiring minimum maintenance for a 20 year life requirement.

[. . . and it is now 50 years old]

Bldg. 31 Foundation Poured in 1965
(Bldg. 10 in background)

1965 Site Aerial Photo
Bldg. 31
First Floor Complete;
Starting Second Story

Completed March 23, 1966

The finished facility consisted of a two-story office and laboratory wing, a low-bay laboratory wing, and a single story connecting wing housing the mechanical equipment and lobby; all oriented with the long axis on a northwest-southwest direction. The combined gross floor space of this facility was approximately 52,148 square feet in 1966. Expansion of the mezzanine level (second floor) low-bay laboratory wing in June 1968 raised this to approximately 60,000 square feet.

(1964 B31 Facility Design Criterion Report)

1966 Site Aerial Photo: Bldg. 31 Completed

Bldg. 37 Ground Breaking for Lunar Receiving Facility

"Black Sheep" Story

As one walks around JSC, all the 1964 – 1967 office-laboratory buildings are similarly designed with an external architectural motif of standard steel frame construction with white precast exposed aggregate facing (PEAF) panels and glass window walls. However, Bldg. 31 is strikingly different from other buildings with white PEAF first floor columns. The architectural firm chose black first floor PEAF covered columns instead of white columns; "to contrast the white of the second floor and enhance the cantilever of the upper story." Since Bldg. 31 has the only black columns on-site, early MSC scientists who had offices in building 31 would jokingly be called the "black sheep of the family."

Bldg. 31 Black 1st Floor PEAF Columns Today

1967 Site Aerial Photo
Bldg. 31 and Bldg. 37 Completed

In 1966, Building 31 facility was originally designed with the following laboratories to facilitate the Apollo program:

- *Geoscience Laboratory*: To develop and evaluate operational and experimental concepts and to provide the training for geological and geophysical experimentation and exploration of the lunar surface.
- *Cartographic and Photo-Interpretation Laboratory*: To develop lunar surface maps and convert photographic, radar and geophysical data to topographical information. The requirements for development of Gemini and Apollo cartographic support for earth orbital missions would be carried out here.
- *Radiation Environment Laboratory*: To develop Apollo radiation instruments and experimental techniques for Apollo in-flight equipment in the area of environment measurement, dosimetry, space vehicle shield verifications, and nuclear activation analysis.
- *Geo-chemical Laboratory*: To develop and evaluate techniques and experiments that would be used to determine the composition of lunar materials. This includes the development of handling techniques for collecting lunar samples and returning them to earth uncontaminated. Astronauts would be trained in these methods.
- *Mission Experiments*: To test, modify and evaluate experimental packages to be carried on Apollo space flights.
- *Physical Optics Laboratory*: To test and modify for spacecraft uses special scientific experiments which involve optical components. Also included optical devices for detecting micrometerorite impacts on spacecraft surfaces.
- *Astronautic Scientific Training Area*: To instruct the astronauts in the conduct of scientific experiments. This would be primarily a classroom area.
- *Applied Physics Laboratory*: To simulate the lunar surface. This laboratory was equipped with electro-magnetic detectors and general purpose physics laboratory equipment.
- *High Velocity Impact Range*: To investigate cratering phenomena in metallic and non-metallic targets, including representative lunar soils, under simulated meteoroid impact.
- *Particle Physics Laboratory*: To investigate the interaction of the Apollo LEM rocket exhaust and the lunar surface; erosion of optical surfaces such as the windows and telescope of the LEM by meteoroid technology; evaluate, develop and check out flight experiments for evaluating the aforementioned laboratory tests.

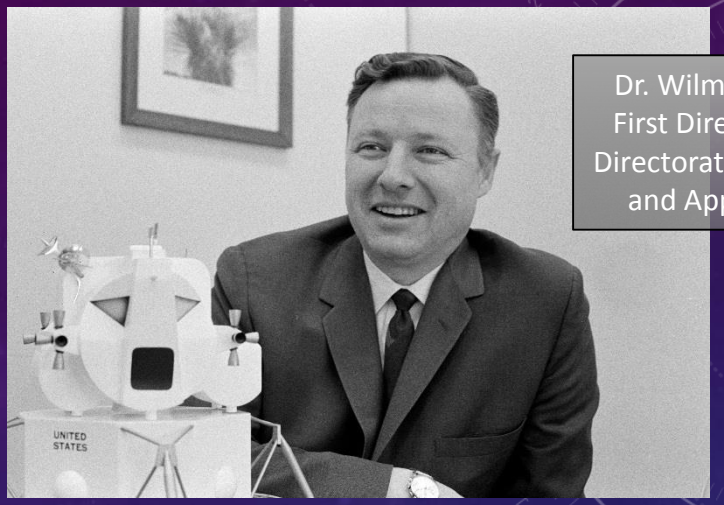
From 1963 to 1966, all Lunar and space science at MSC for the Apollo program was under the Directorate of Engineering and Development (EA) headed by Maxime A. Faget. The majority of the geologists and space scientist in the directorate were located at MSC site 8, building 341 at Ellington Air Force Base. In 1966, upon completion of building 31 at MSC main campus, most scientists at Ellington were moved to their new facility.

With increased demands placed on Apollo surface science program and opening of the Lunar Receiving Laboratory, bldg. 37 in 1967, the Directorate of Science and Applications (TA) was formed in 1967 with Dr. Wilmot N. Hess as Director and Robert O. Piland as Deputy. The Directorate of Science and Applications occupied Bldg. 31 and 37 throughout the Apollo program.

By 1972, the MSC's Directorate of Science and Applications had three distinct divisions, similar to ARES today:

- Earth Observations Division
- Planetary and Earth Sciences Division
- Lunar Receiving Laboratory (Division)

The following slides show the Directorate of Science and Applications laboratories housed in building 31, circa 1972 from the MSC Science and Applications Facility Handbook.



Dr. Wilmot N. Hess
First Director, 1967
Directorate of Science and Applications

Apollo 12 Astronaut Alan L. Bean unloads the Apollo Lunar Surface Experiment Package (ALSEP)

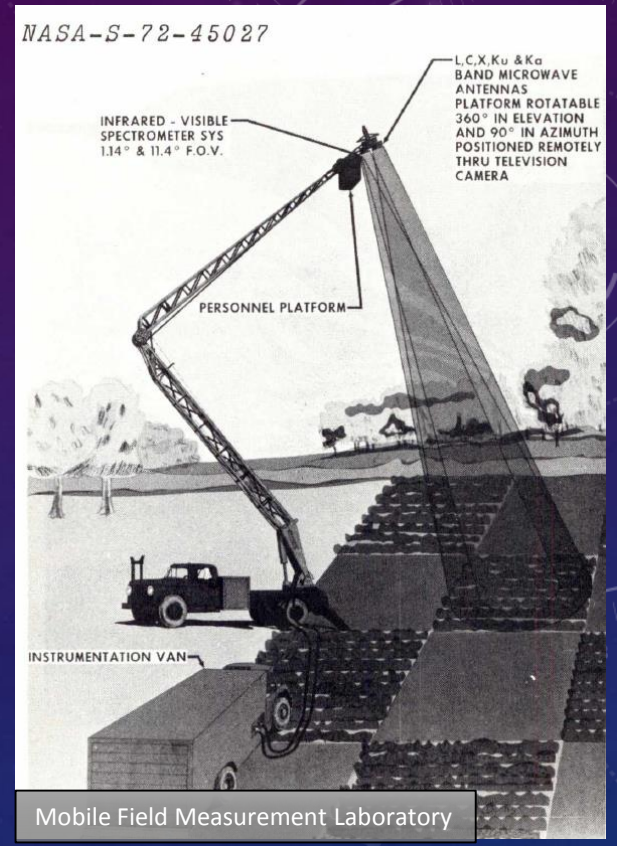
Apollo 16 Lunar sample handling in LRL; "Big Muhley“ sample

Earth Observations Division
Directorate of Science and Applications – Circa 1972

- **Applied Physics Laboratories:** These facilities were formulated for remote sensing technology to determine electromagnetic radiation characteristics of phenomena. The Measurements Laboratory contained the diffraction pattern sampling system used to obtain geometrical pattern information from photographs. The lab also had facilities for the design, fabrication, calibration, and integration of specialized remote sensing systems. The Mobile Field Measurements Laboratory was used to acquire ground-truth measurements of selected targets to calibrate and interpret airborne/spaceborne remote-sensor data. The Camera Calibration Laboratory was used to calibrate the cameras used in the Apollo program and in the earth resources program.

- **Data Applications Analysis Facilities:** This facility was used to display and interpret tape-recorded remote sensor data from aircraft, earth resources technology satellites (ERTS), and earth resources experiment packages (EREP).

- **Mapping Sciences Laboratory:** This facility provided a complete photogrammetric capability and housed the Earth Resources Research Data Facility (REDAF) that provided the resources to access a wide variety of earth resources and Apollo data, maps and photographs.



Mobile Field Measurement Laboratory

AS11 Analytical Stereoplotter

Diffraction Pattern Sampling System

Camera Calibration Laboratory

Data Facility: layout and material breakdown area

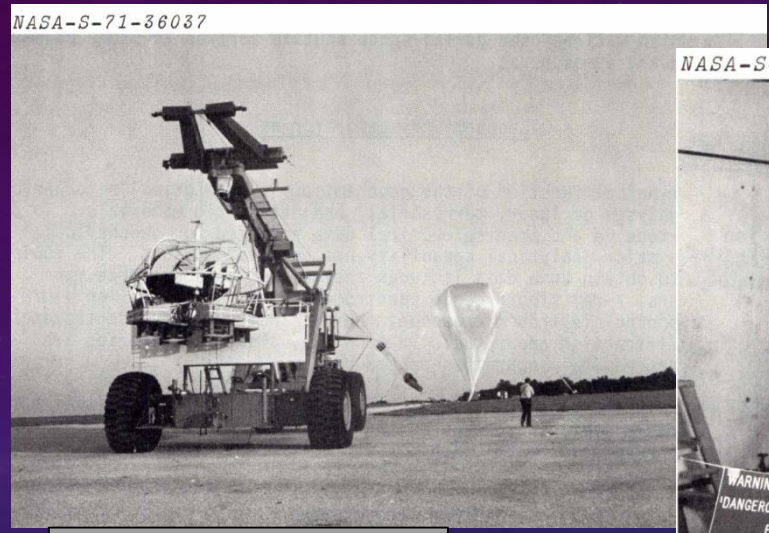
Planetary and Earth Sciences Division
Directorate of Science and Applications – Circa 1972

- **Physics Laboratories:** The Cosmic Ray Physics Laboratory was beginning to develop a Space Shuttle Cosmic Ray Physics Laboratory (SSCRPL) that contained a cosmic ray spectrometer with a superconducting magnet producing a field of 50 kilogauss. The facility developed experiments and instrument prototypes for the SSCRPL, developed a Space Shuttle Auroral Observatory, and established a Small Astronomical Facility and an Atmospheric Sciences Facility. Balloonborne cosmic ray and ultraviolet spectrometer experiments were routinely being conducted as precursors to space shuttle programs, and automated data reduction techniques were being developed to analyze nuclear emulsions. These balloons were assembled in the building 31 low-bay using the 2-ton hoist and monorail.

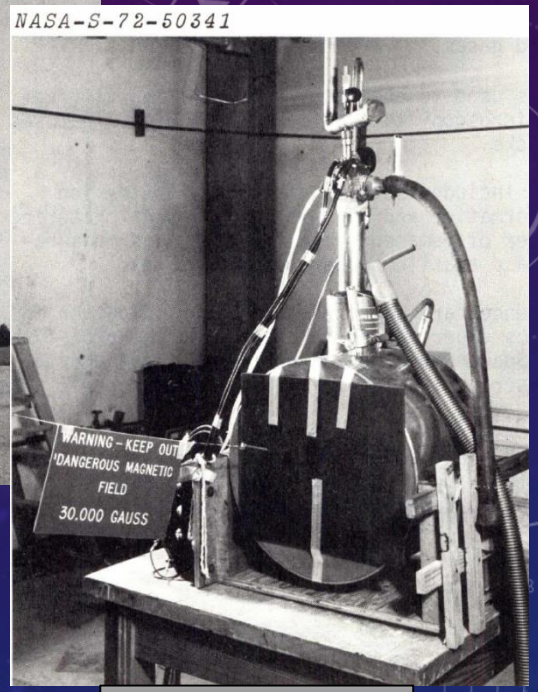
- **Geochemistry Laboratories:** These laboratories performed chemical analyses of lunar, terrestrial, and meteoritic materials. Major instrumentation included thermal ionization-source mass spectrometers, X-ray fluorescence spectrometers, electron and ion microprobes, scanning electron microscope, thermal analyzer/mass spectrometer, and single crystal X-ray diffractometer apparatus.

- **Geology Laboratories:** These laboratories studied meteoroids, their interaction with the earth's atmosphere, the probability of collisions with spacecraft and the effects of such collisions have a direct bearing on the safety of manned spaceflight. The effects of the impact of high-velocity projectiles simulating micrometeoroids on spacecraft materials were conducted in the high-velocity impact lab. During Apollo, command module windows were examined before and after flight to determine meteoroid impact phenomena. These labs also studied shock deformation of geological materials.

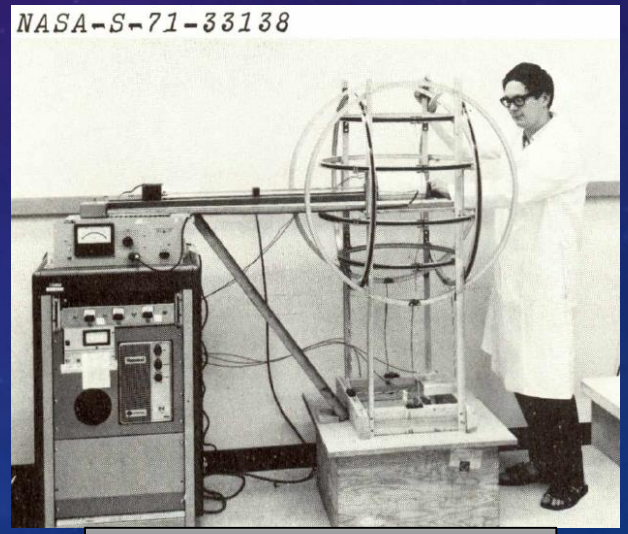
- **Geophysics Laboratories:** These laboratories were mainly comprised of the Magnetics Facility that housed both spinner and vibrating magnetometers for the study of remnant magnetization in lunar and terrestrial samples. In addition, a sophisticated cryogenic magnetometer operating in a static mode is employed for measurements of very weak fields.



Small Astronomical Facility (SAF)



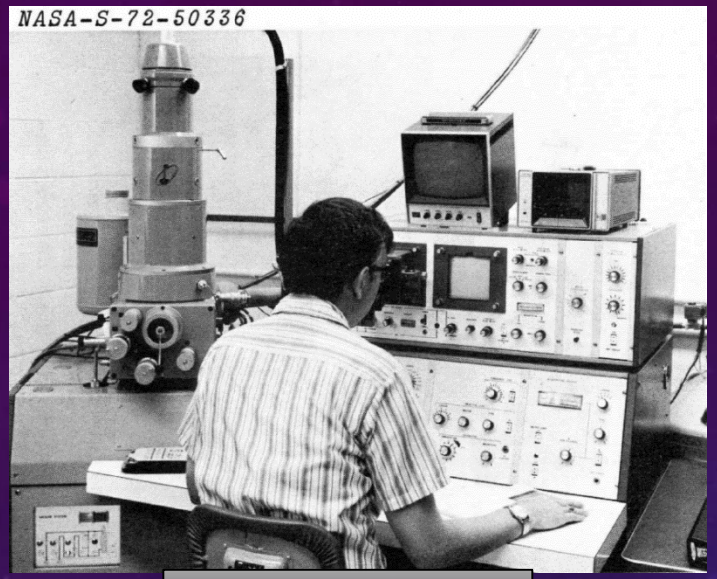
Superconducting Magnet



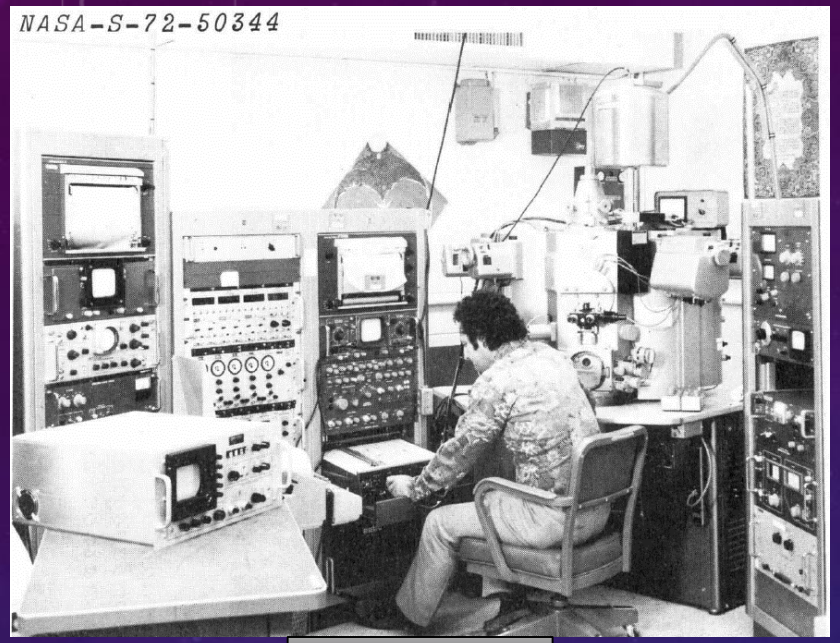
Alternating Current Field Demagnetizer

Vibrator Magnetometer

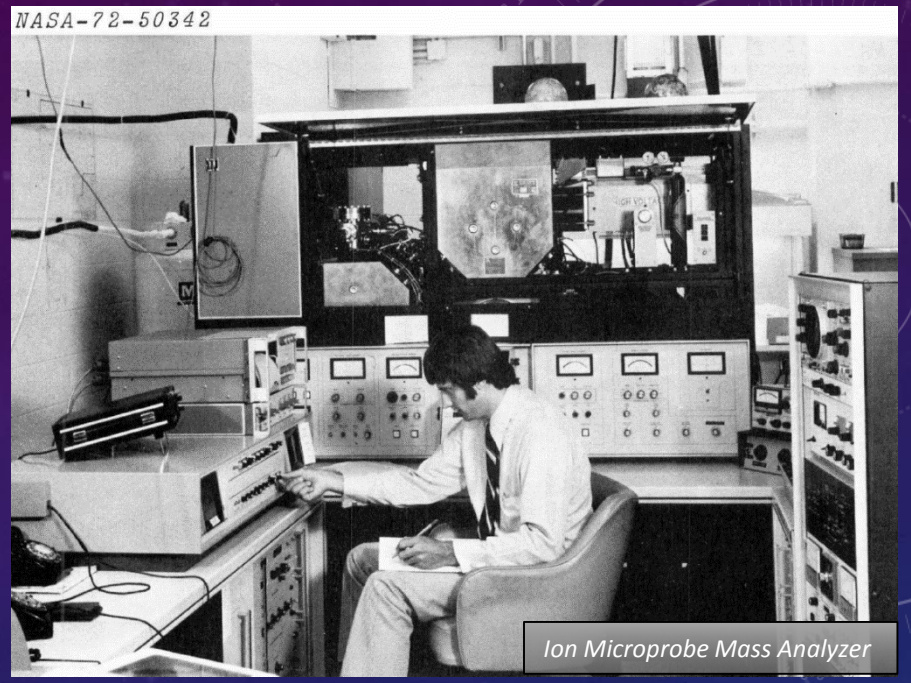
1972 Sample Science . . .



Scanning Electron Microprobe

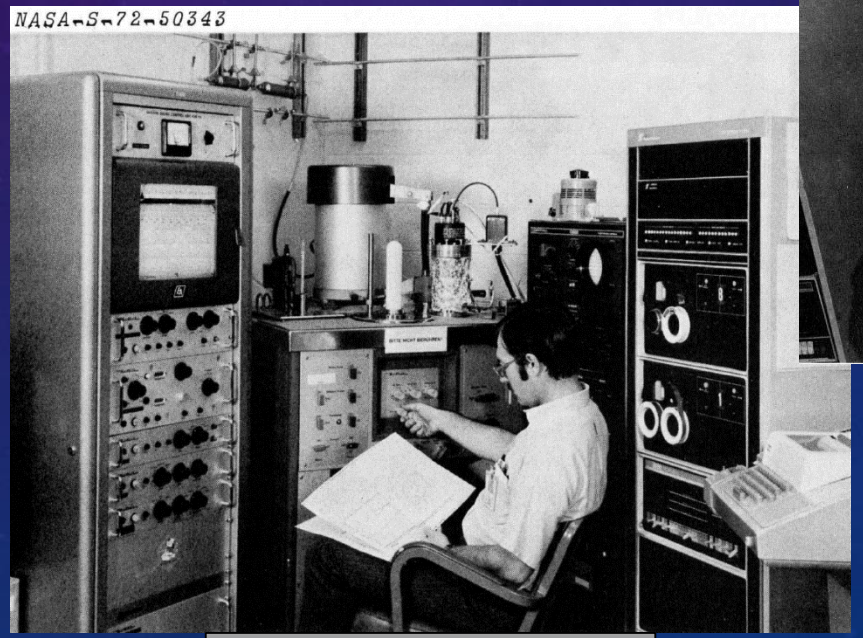


Electron Microprobe



Ion Microprobe Mass Analyzer

Mass *Spectrometer*



Thermal Analyzer/Mass Spectrometer

X-ray *Fluorescence Spectrometer*

Single-crystal X-ray Diffractometer

Lunar Receiving Laboratory (Division)
Directorate of Science and Applications – Circa 1972

Lunar Sample Curatorial Facility

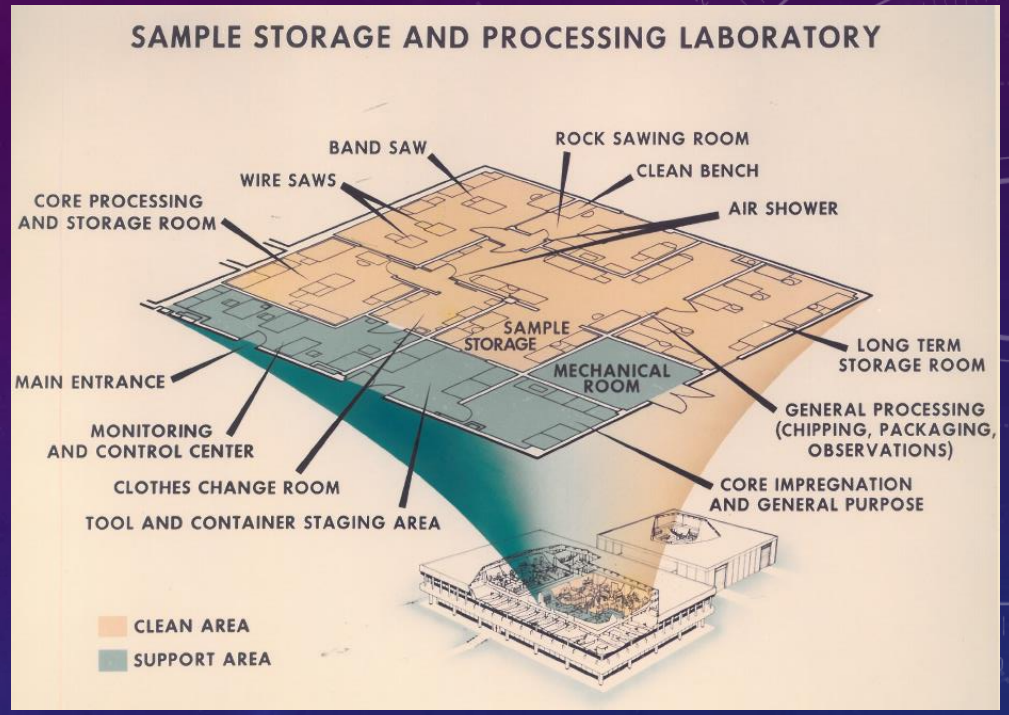
- **Sterile Nitrogen Atmosphere Processing Laboratory (Bldg. 37):** This laboratory was designed to accommodate the initial processing of the contents of the two Apollo Lunar Sample Return Containers (ALSRC) returned by Apollo missions. This consists of sample identification and sorting, orthogonal and stereophotography, scientific description, and rock modeling, chipping, and packaging. Decommissioned at the end of Apollo Program in 1972.

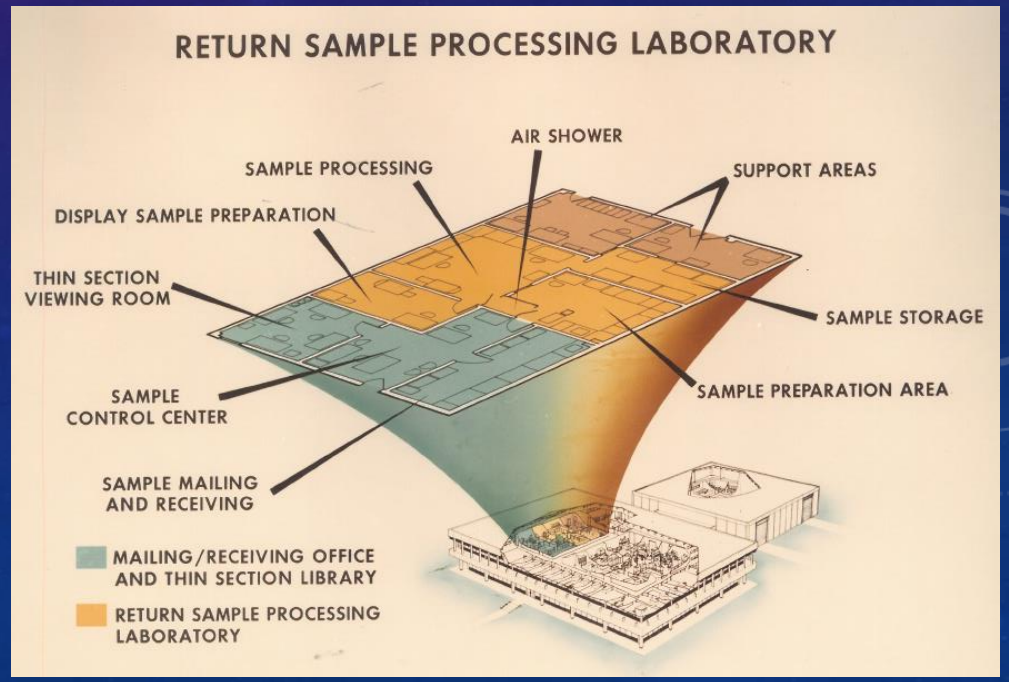
- **Nonsterile Nitrogen Processing Laboratory (Bldg. 37):** This laboratory provides the same functions as the Sterile Nitrogen Atmosphere Processing Laboratory, except that only the contents of sample collection bags (SCB) are processed. Decommissioned at the end of Apollo Program in 1972.

- **Sample Storage and Processing Laboratory (Bldg. 31):** Operational in April 1972, this laboratory was utilized to process, package, and preserve the integrity of lunar material following initial processing in bldg. 37 laboratories described above. This includes storage and processing cabinetry, with provisions for band sawing, wire sawing, core tube milling, core processing, and sample storage. In addition, the numerous other functions are provided which are required to prepare lunar material for allocation to Principal Investigators for detailed analysis.

- **Returned Sample Processing Laboratory (Bldg. 31):** Operational in April 1972, this laboratory was used primarily to process and inventory samples returned by Principal Investigators, to prepare display samples for the Public Affairs Office, and to provide areas for visiting scientists to examine samples.

- **Thin-Section Laboratory (Bldg. 31):** The Thin-section Laboratory was established to prepare a variety of petrographic sections of lunar material. Its operation is similar to the operation of other petrographic thin-section laboratories, except that greater caution is required to conserve and maintain sample integrity.





1972 Lunar Curation . . .

Early Facility Timeline

1960

1963 to 1966: MSC site 8, building 341 at Ellington Air Force Base

1965

1966: Bldg. 31 Offices and Lab Facilities Operational

1967: Bldg. 37 LRL Facility Operational

1968: Bldg. 31 Second Floor low-bay laboratory wing built

1969: Apollo 11 Samples

1970

1972: Bldg. 37 LRL Facility Decommissioned

1972: Bldg. 31 Lunar Curation Facility

1975: Lunar Remote Storage Facility Brooks AFB, San Antonio, TX

1975

1979: Bldg. 31A(N) Lunar Curation Facility

1980

Bldg. 31 MSC/JSC Directorate Timeline

1960

1965

Lunar Surface Technology Branch (ET3) 1963 – 1966
Space Science Division (EF) 1966
In the Advanced Spacecraft Technology Division (ET)
Directorate of Engineering and Development (EA)

1970

Directorate of Science and Applications (TA), 1967 – 1976

1975

Lunar and Planetary Sciences Division (SN) 1977 – 1979
In the Directorate of Space and Life Sciences (SA)

1980

Planetary and Earth Sciences Division (SN) 1980 – 1983
In the Directorate of Space and Life Sciences (SA)

1985

1990

Solar System Exploration Division (SN) 1984 – 1994
In the Directorate of Space and Life Sciences (SA)

1995

Earth Science & Solar System Exploration Division (SN) 1994 – 2001
In the Directorate of Space and Life Sciences (SA)

2000

Office of Astromaterials Research & Exploration Science (ARES) 2002 – 2004
In the Directorate of Space and Life Sciences (SA)

2005

Astromaterials Research & Exploration Science (ARES) Directorate (KA), 2004 – 2014

2010

2015

Astromaterials Research & Exploration Science (ARES) Division, 2014 to Present
In the Exploration, Integration & Science Directorate