

ONE GIANT LEAP TO PROTECT ALL MANKIND:

AN OVERVIEW OF THE
LUNAR RECEIVING LABORATORY

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DISCLOSURE INFORMATION

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Judith Hayes

I have no financial relationships to disclose.

I will not discuss off-label use and/or investigational use in my presentation.

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AGENDA

- Why? Interagency meeting and directive
- The plan
 - Sample Operations Area
 - Crew Reception Area
 - Administrative & Support Area
- The journey
 - BIGs
 - MQF
 - LRL
- LRL areas
- The release – be free
- The future



THE CHARGE!

May 1961

- President John F. Kennedy Address to Congress on Urgent National Needs
- *"I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."*

September 1962

- President Kennedy charges a nation @ Rice University
- *"...to go to the moon in this decade..."*





THE TIMELINE

Early 1964

- NASA perceives a need for a lunar sample processing facility
- Initial design was a **modest clean room**
- NASA **lacked consideration of quarantine**
- US Geological Survey **identified back contamination concerns**

Summer 1964

- Interagency Conference on Potential Hazards of Back Contamination from Planets
- Health, Education & Welfare
- National Academies of Science
- US Public Health Service
- US Department of Agriculture

Fall 1964

- Office of Space Science Ad Hoc Committee on Lunar Sample Receiving Laboratory recommendations for sterilization and quarantine procedures



OVERSIGHT TEAMS EST. 1966

Intra- and Extramural scientists recruited

- **Lunar Sample Analysis Planning Team (LSAPT)**
 - ✓ Select Principle Investigators
 - ✓ Sample curation, allocation, sample methods, priorities, sequencing and sample return
- **Preliminary Examination Team (PET)**
 - ✓ Oversight of scientific testing during quarantine
- **Biological Advisory Committee**
 - ✓ Led by Dr. Charles Berry
 - ✓ Biological Containment
 - ✓ Quarantine
 - ✓ Lunar Material testing



LUNAR RECEIVING LABORATORY (LRL)



PURPOSE:

Distribution of samples to the scientific community, perform time-critical sample measurements, permanently store under vacuum a portion of each sample, and quarantine testing of samples, spacecraft and astronauts

CUSTOMERS:

In-house biohazard testers, planetary science researchers

WHO DEFINED REQUIREMENTS FOR FACILITY:

US Public Health Service (plus others, making up the Interagency Committee on Back Contamination), Manned Spacecraft Center management (with input from geoscience)

- Used for Apollo as the Lunar Receiving 1969 to 1972.



LRL MAJOR FUNCTIONS

1. **Distribution of lunar samples** to the scientific community
 - ✓ After a period of biologic quarantine
2. Performance of **scientific investigations**
 - ✓ Time-critical studies to be done during quarantine
3. **Permanent storage** under vacuum of a portion of each sample
4. **Quarantining and testing** for potentially harmful effects
 - ✓ Lunar samples, spacecraft, and astronauts



Catalog Date: 25 July 1969
NASA image: S69-40749



LRL DESCRIPTION



- Construction Aug 1966 – June 1967
 - ✓ 3 stories
 - ✓ 85,000 ft²
 - ✓ \$24M (most expensive vacuum system, low level radiation counting)
- Opened for operation July 14, 1969
 - ✓ Lengthy certification
 - ✓ Protocols
 - Quarantine testing
 - Back contamination
 - Operational readiness
- Personnel
 - ✓ 100 NASA & visiting scientists
 - ✓ 200 technicians working 3 shifts

Apollo 11

July 17, 1969 – July 24, 1969



**AUTHORIZED
PERSONNEL ONLY
LUNAR RECEIVING
LABORATORY
QUARANTINE AREA**

LRL FUNCTIONAL AREAS

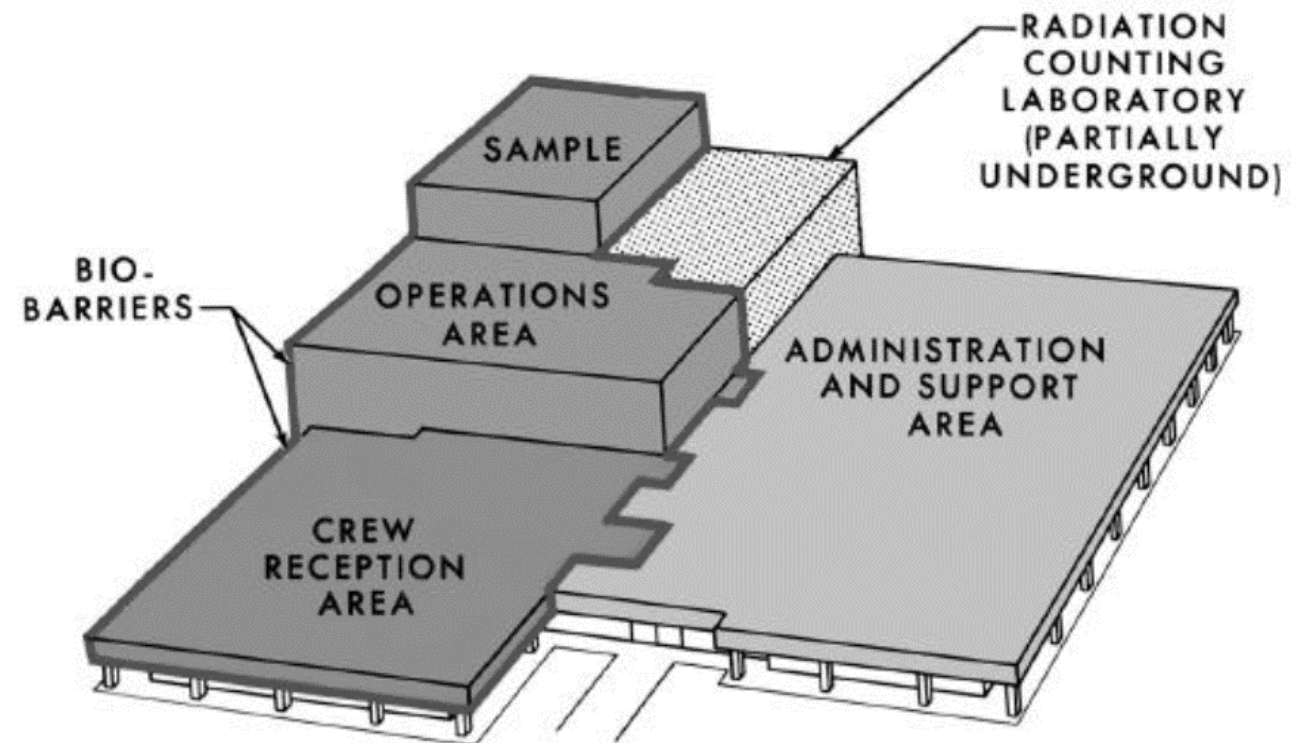


Biological Barrier

- Sample Operations Area
- Crew Reception Area
- Administration and Support Area

NASA-S-67-696

LRL FUNCTIONAL AREAS



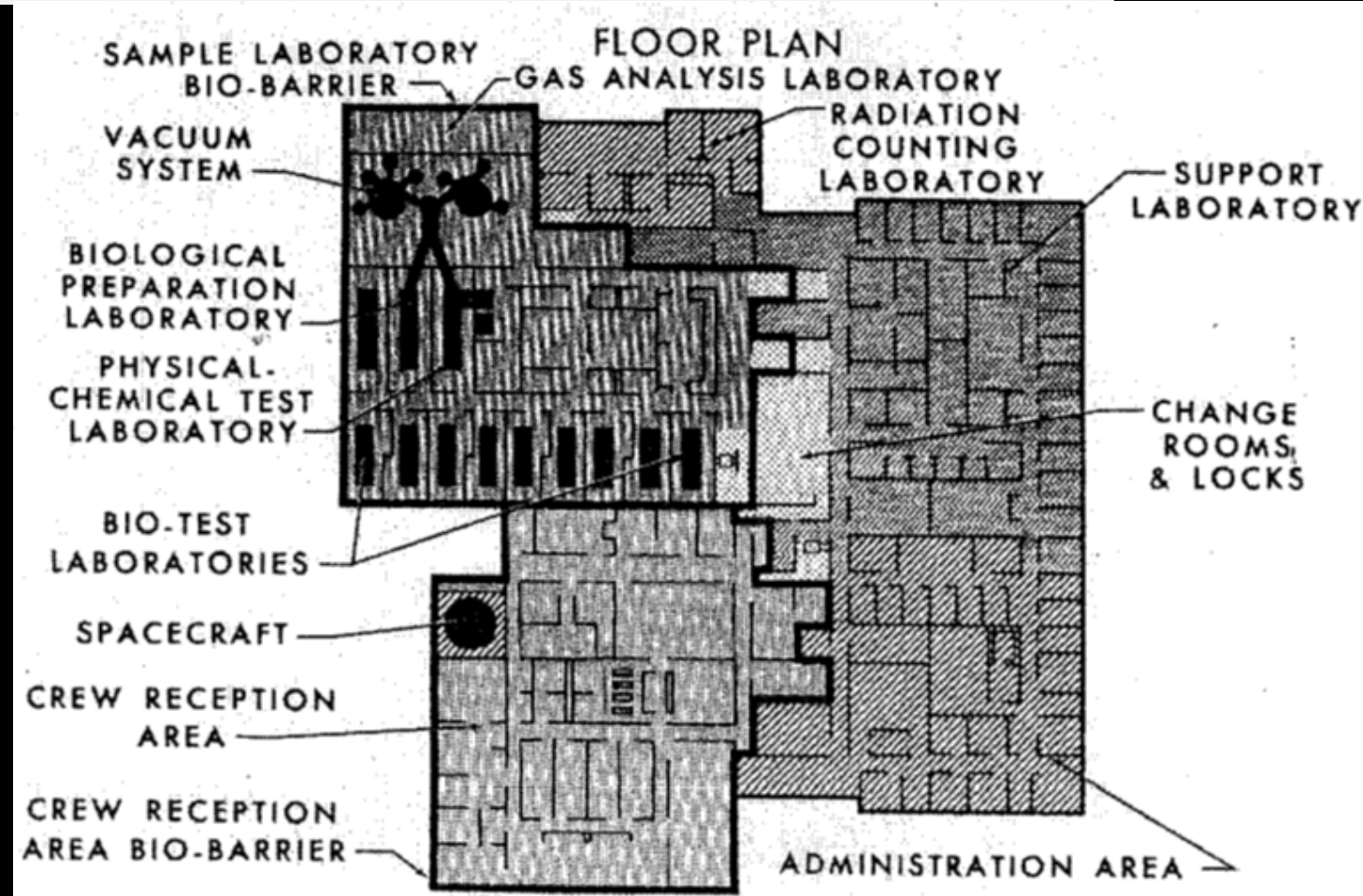
LRL FUNCTIONAL AREAS

- **Sample Operations Area**

- ✓ Physical –Chemical Testing
- ✓ Biological Testing
 - Microbiology
 - Zoology
 - Botany
- ✓ Vacuum Laboratory
- ✓ Radiation Counting Laboratory

- **Crew Reception Area**

- ✓ Debriefing Room separated by glass
- ✓ Living quarters for 17
 - Astronaut bedrooms & offices
 - Dormitory
 - Kitchen and dining room
 - Library and lounge
 - Shower, toilets and locker rooms
- ✓ Contingency quarantine up to 120



- **Administration and Support Area**

- ✓ Offices
- ✓ Conference Rooms



BUILDING 37

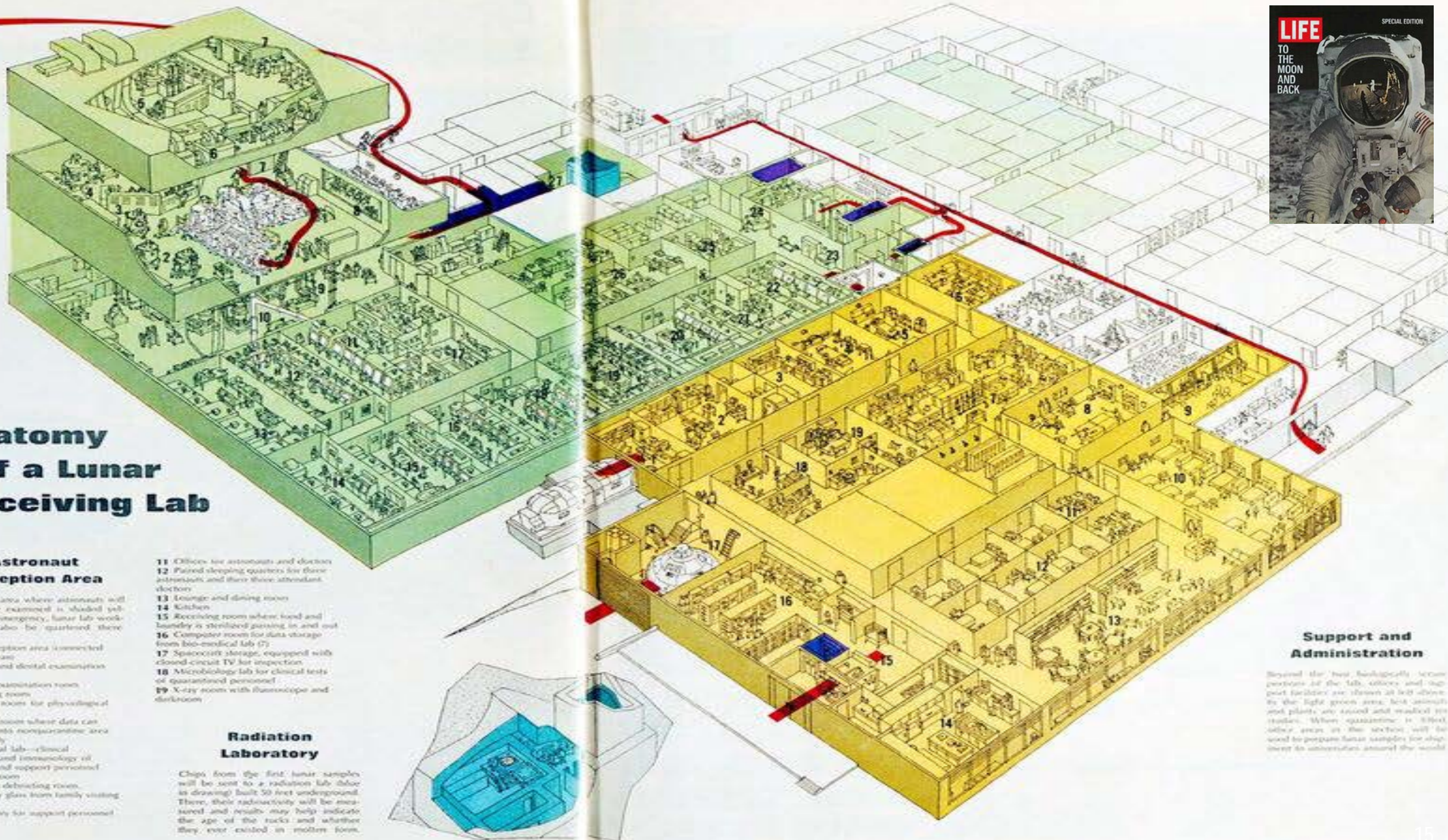
MANNED SPACECRAFT CENTER, HOUSTON, TX



BUILDING 37

MANNED SPACECRAFT CENTER, HOUSTON, TX





Anatomy of a Lunar Receiving Lab

Astronaut Reception Area

Quarantine area where astronauts will live and be examined is shaded yellow; in an emergency, lunar lab workers could also be quarantined there.

- 1. Crew reception area (connected to transfer case)
- 2. Medical and dental examination room
- 3. Medical examination room
- 4. Operating room
- 5. Life-table room for physiological testing
- 6. Tape-out room where data can be passed into non-quarantine area electronically
- 7. Biomedical lab—clinical chemistry and immunology of astronauts and support personnel
- 8. Exercise room
- 9. Astronaut debriding room, separated by glass from family visiting room
- 10. Quaternary lab support personnel

- 11. Offices for astronauts and doctors
- 12. Paired sleeping quarters for three astronauts and their three attendant doctors
- 13. Lounge and dining room
- 14. Kitchen
- 15. Receiving room where food and laundry is sterilized, passing in and out
- 16. Computer room for data storage from bio-medical lab (7)
- 17. Spacecraft storage, equipped with closed-circuit TV for inspection
- 18. Microbiology lab for clinical tests of quarantined personnel
- 19. X-ray room with fluoroscope and darkroom

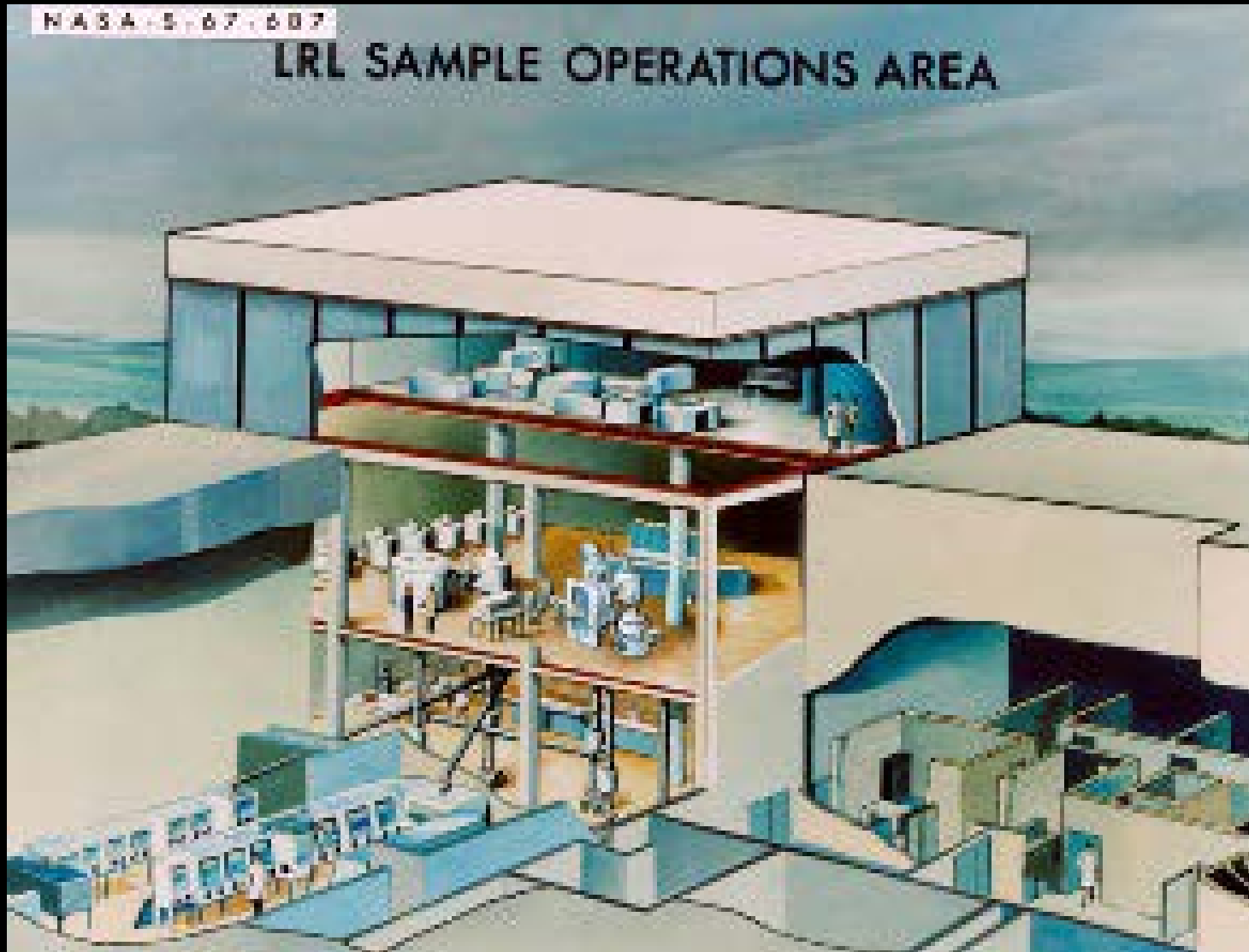
Radiation Laboratory

Chips from the first lunar samples will be sent to a radiation lab (blue in drawing) built 50 feet underground. There, their radioactivity will be measured, and results may help indicate the age of the rocks and whether they ever existed in molten form.

Support and Administration

Beyond the two biologically secure portions of the lab, offices and support facilities are shown at left above by the light green area; less secure and plants are raised and medical are shown. When quarantine is lifted, other areas in this section will be used to prepare lunar samples for shipment to universities around the world.

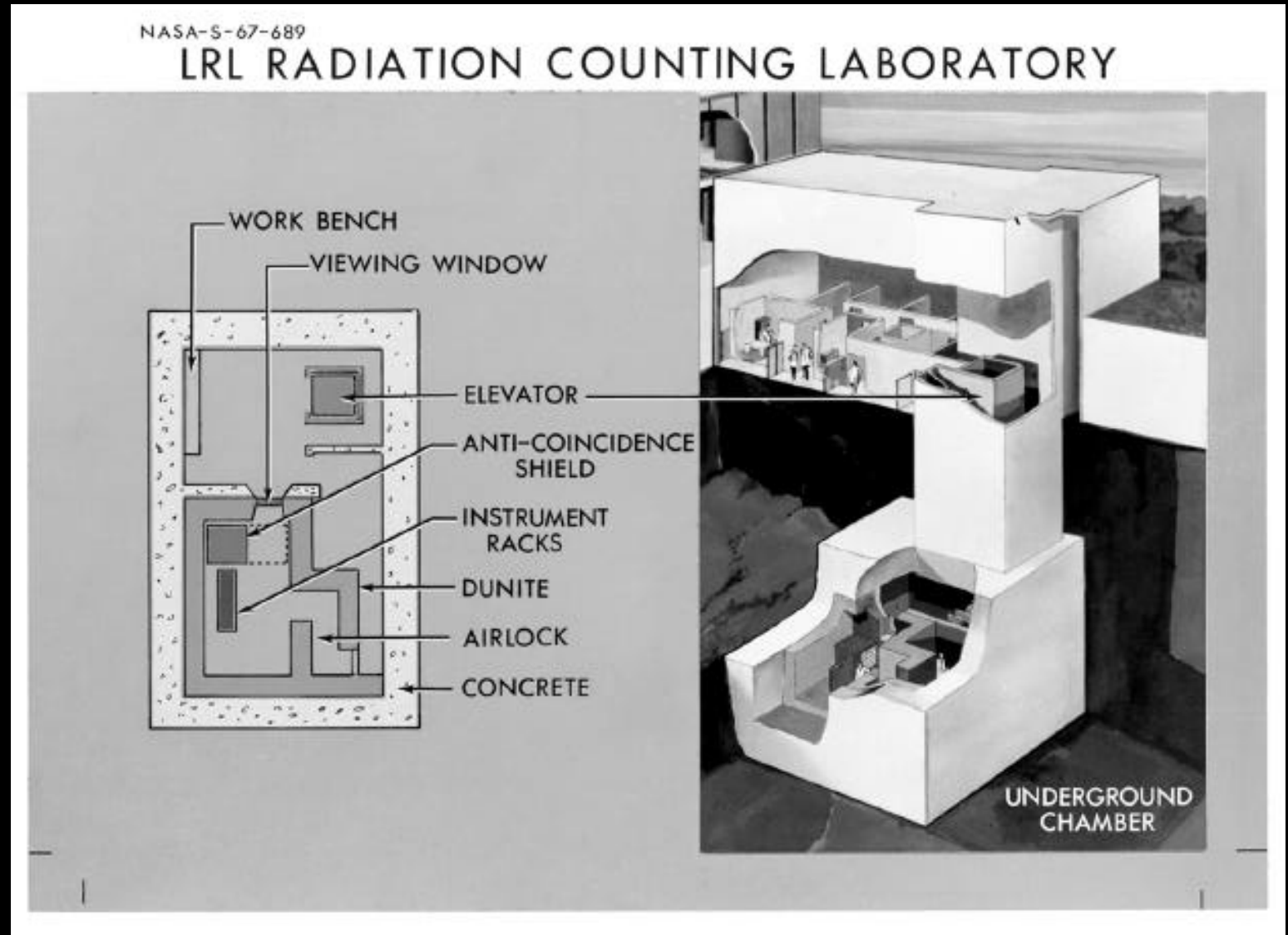
LRL SAMPLE OPERATIONS



YES, THERE IS A BASEMENT!

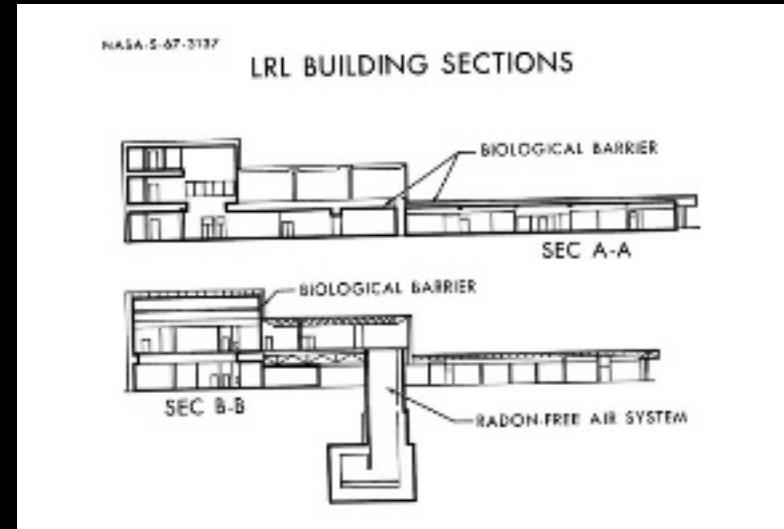
Radiation Counting Laboratory

- ✓ 50 feet below the building
- ✓ Separate air-handlers with an air/radon filter
- ✓ Lined stainless steel plate walls



LRL BIOLOGICAL BARRIERS

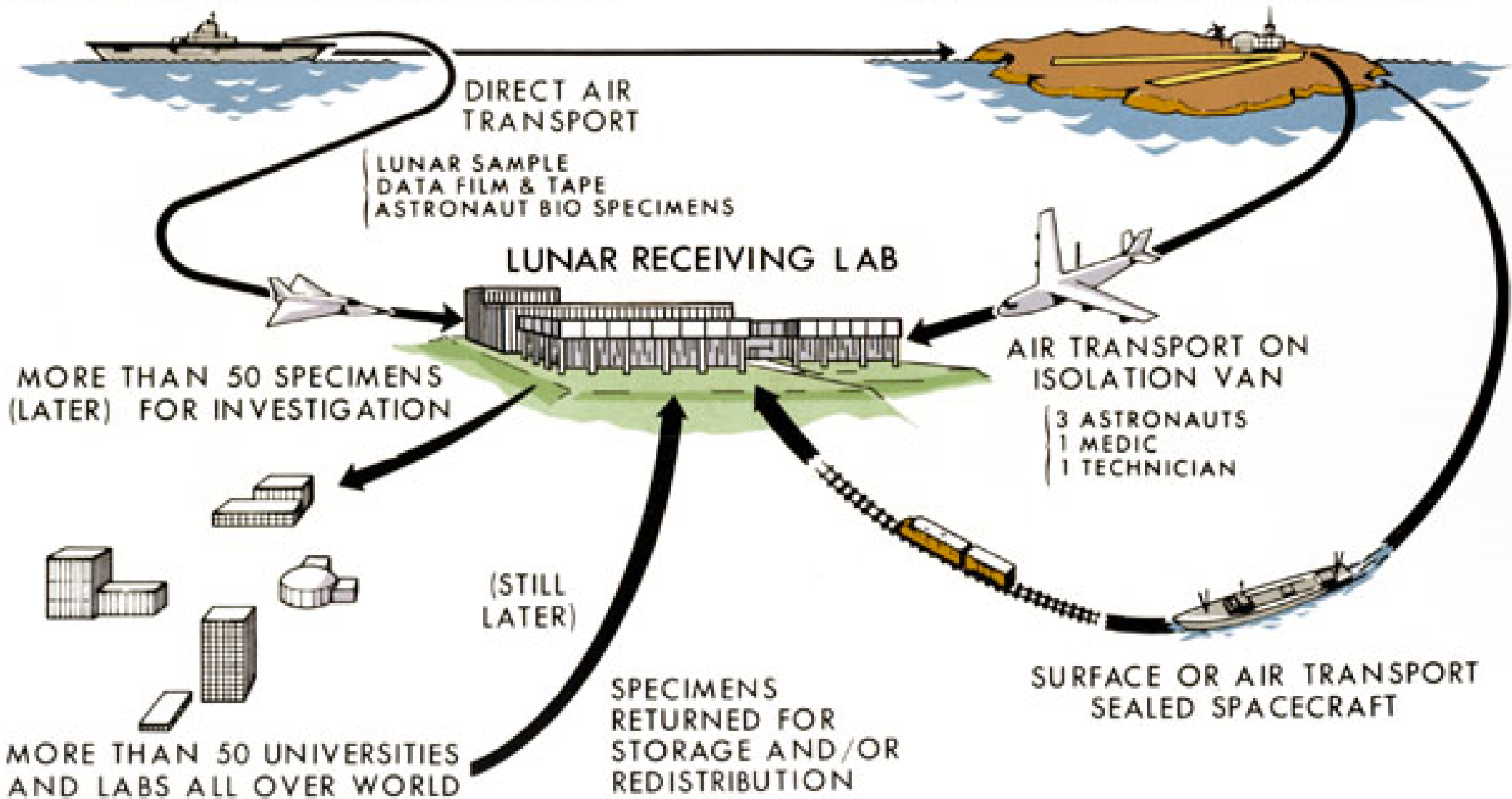
Physically, the main divisions of the LRL behind the biological barrier were the samples operations areas and the Crew Reception Area, consisting of crew living areas and medical examination facilities. The sample operations areas included the vacuum sample handling system, laboratories for quarantine testing, laboratories for analysis of samples and the subsurface facility for counting low levels of radiation. Complex plumbing spanning 3 floors was required to operate the sophisticated vacuum system constructed for lunar sample handling



TRANSPORTATION TO AND FROM LRL

AIRCRAFT CARRIER IN RECOVERY ZONE

NEAREST LAND BASE WITH RUNWAYS



BIGs!



Biological Isolation Garment

- Ventilation
- Communication
- Soap scrub inside the capsule
- Don before hatch opening



Apollo 11 astronauts go into quarantine



MOBILE QUARANTINE FACILITY @ ELLINGTON AFB



Catalog Date: 27 July 1969
NASA image: S69-40132

MOBILE QUARANTINE FACILITY @ ELLINGTON AFB



The MQF with the three Apollo 11 crewmen inside, is unloaded from a U.S. Air Force C141 transport at Ellington Air Force Base after a flight from Hawaii.



Catalog Date: 27 July 1969
NASA image: S69-40152

MOBILE QUARANTINE FACILITY @ ELLINGTON AFB



MQF unloaded at Ellington Air Force Base, Texas still under a 21-day quarantine, are greeted by their wives after a flight aboard a U.S. Air Force C141 transport from Hawaii.



Catalog Date: 27 July 1969
NASA image: S69-40147 23

LRL VIDEO



<https://io.jsc.nasa.gov/app/info.cfm?pid=26361518>





SAMPLES RECEIVED FIRST @ LRL

The first Apollo 11 sample return container, with lunar surface material inside, is unloaded at the Lunar Receiving Laboratory, Building 37, Manned Spacecraft Center (MSC).

The rock box had arrived only minutes earlier at Ellington Air Force Base by air from the Pacific recovery area.

July 26, 1969

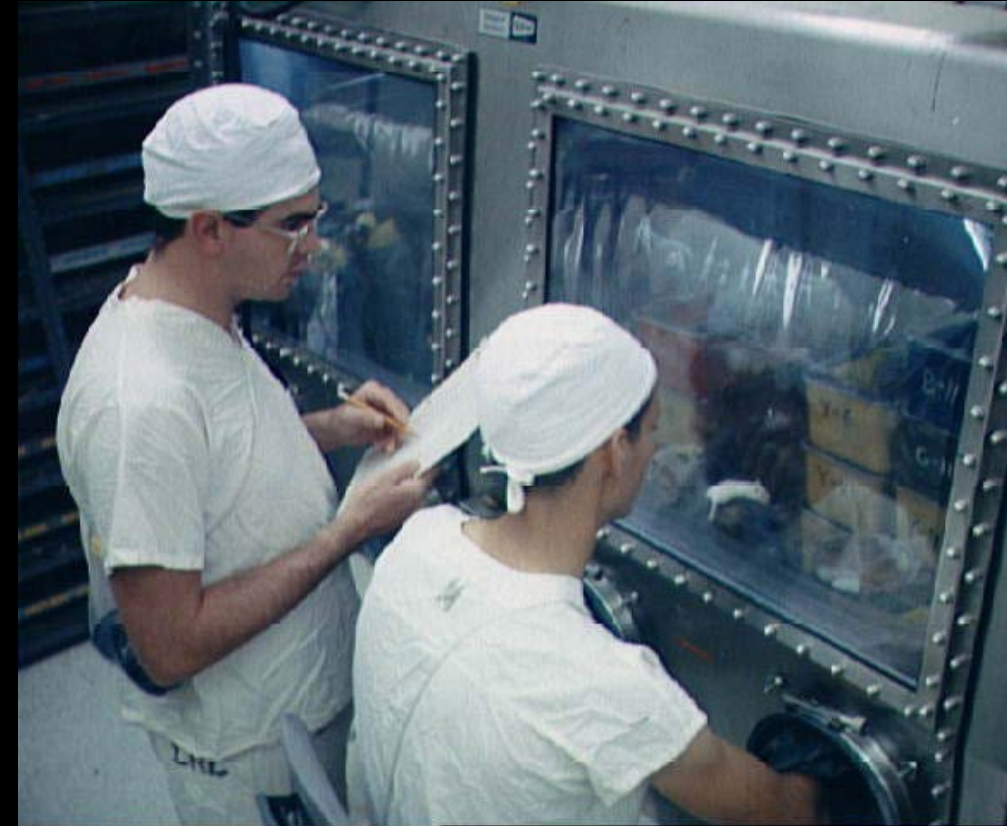


LRL ANIMAL LABORATORY

Apollo 11 mice which have been inoculated with lunar sample material are examined.



Catalog Date: 05 August 1969
NASA image: S69-40751



Catalog Date: 08 May 1969
NASA image: S69-40940





LRL VACUUM LABORATORY

Close-up view of lunar rocks contained in first Apollo 11 sample container

The rock box was opened for the first time in the Vacuum Laboratory of the Manned Spacecraft Center's Lunar Receiving Laboratory, Bldg 37, at 3:55 p.m., July 26, 1969.



Catalog Date: 26 July 1969
NASA image: S69-45002

LRL VACUUM LABORATORY

Apollo 11 the second sample return container opened for the first time at 1 p.m., August 4, 1969.

Close-up view of lunar rocks contained in first Apollo 11 sample container

This is the first lunar sample that was photographed in detail showing a coarse-grained, mafic (iron magnesium) rock.

Sample number is 10003.



Catalog Date: 04 August 1969
NASA image: S69-45507



LRL CREW RECEPTION AREA

Apollo 11





ARRIVING @ THE LRL

Neil Armstrong
arrives at the LRL



LRL DEBRIEFING ROOM

LRL Debriefing Room





APOLLO 11 CREW FIRST POSTFLIGHT DEBRIEFING

The crewmen of the Apollo 11 lunar landing mission go through their postflight debriefing session on Sunday, July 27, 1969.

They are seated in the Debriefing Room of the Crew Reception Area of the Lunar Receiving Laboratory at the Manned Spacecraft Center.



Catalog Date: 27 July 1969

NASA image: S69-40205



The Apollo 11 crew give their post flight debriefing session on Sunday, July 27, 1969.

LIFE IN QUARANTINE



Mike Collins B37 bedroom

Staff Dormitory



LIFE IN QUARANTINE



Neil celebrates a birthday!



COLUMBIA

RETURNS TO
THE
LUNAR
RECEIVING
LABORATORY



APOLLO 11 COMMAND MODULE - COLUMBIA



Collins with the Command Module after its return to the Lunar Receiving Laboratory



"Spacecraft 107 — alias Apollo 11 — alias *Columbia*. The best ship to come down the line.
God Bless Her. Michael Collins, CMP"



EGRESS FROM QUARANTINE



Apollo 11 release from quarantine on August 9, 1969 greet MSC Director Robert Gilruth.



APOLLO 11 RELEASED FROM QUARANTINE



Neil
Armstrong
greet the
Media

WE'RE ALL IN THIS TOGETHER!

Apollo 11

- Three crew
- 17 staff
 - ✓ Flight surgeons
 - ✓ Engineers
 - ✓ Photographer
 - ✓ PAO
 - ✓ Cooks & laundry staff
- 1 *contaminated* lab technician





WHAT'S NEXT?



2017

50 Years of Facility Evolution

1967

Heritage B37

- Opened in 1967 as the **Lunar Receiving Laboratory Facility**
- Crew reception & quarantine area, sample containment (i.e., Command Module and moon rocks), underground radiation counting laboratory, and administrative support

1980 - 2017

Present B37 & B200's

- **Retrofitted** into a biomedical laboratory facilities for operations & research.
- In late 1980's increased research forced expansion into **metal buildings** to support Extended Duration Orbiter Medical Project, Shuttle-Mir & ISS Program.
- Longer duration **Space Shuttle** missions expanded the need to characterize physiological & psychological risks to humans and develop countermeasures to preserve astronaut health, performance & safety.

Future B21

Human Health & Performance Laboratories

- Positions JSC to **capitalize on more and better collaborations/future partnerships** due to unique capabilities and laboratory efficiencies
- **Flexible and adaptable** biomedical laboratory facility **configurable** to meet future requirements
- **Environmentally sustainable**
- **Showcases JSC biomedical research and operations** capabilities supporting human exploration
- **Attracts world class scientists** to partner with JSC in addressing human performance risks
- B37 Lunar Receiving Laboratory to be demolished in December 2017



LUNAR RECEIVING LABORATORY

A LEGACY SOON GONE...





FOR MORE INFORMATION ON APOLLO

[HTTP://WWW.APOLLOEXPLORER.CO.UK/](http://www.apolloexplorer.co.uk/)

