School Days, NASA, and the "Space Race"

(Information courtesy of NASA.)

Tom R. Chambers parallels his school years beginning in the fifth grade with NASA activities and the "Space Race". He does this in order to pinpoint his existence as Space activities increased as a part of the "Cold War" and competition with the Soviet Union to enter this "final frontier" of exploration.

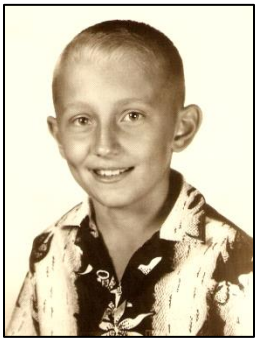
Even at a young age, Chambers was well aware of these activities since his father worked at various missile sites and military bases across the United States and in the Territory of Alaska. As a Space enthusiast, he kept up with the activity of the times as he attended school at various locations.

The occasional school portrait with dates of school attendance and location add a personal touch to the Space goings-on. This chronological journal moves a young boy (Chambers) physically and mentally through the years as a circumstance of his father working at different sites and the tension between the United States and the Soviet Union to "be first" in Space.

Little did Chambers realize that this school and Space journey would come full circle when he joined the research team at the Lunar Receiving Laboratory during Project Apollo in September of 1969.

The information is courtesy of NASA.

1957-1958 School Year (5th grade, Anchorage, Alaska):



The Soviet Union launched "Sputnik 1" and "Sputnik 2" in October and November of 1957, respectively. "Sputnik 1" orbited for three weeks before its batteries died, then silently for two more months before falling back into the atmosphere. The satellite's success precipitated the American Sputnik crisis and triggered the Space Race, a part of the Cold War. The launch was the beginning of a new era of political, military, technological, and scientific developments. "Sputnik 2" carried the dog, "Laika". In January of 1958, the United States (Army Ballistic Missile Agency) launched its first satellite, "Explorer 1".

Summer Break, 1958:

None.

1958-1959 School Year (6th grade, Savannah, Georgia):

NASA began its operations in October, 1958. The agency launched "Pioneer 1" and "Pioneer 3" in October and December of that year, respectively. Later in December of the same year, "Project Score", a communications relay satellite, was placed into orbit. The next day, President Eisenhower's Christmas message was beamed from the satellite - the first voice sent from Space.

In February, 1959, the scientific satellite, "Vanguard 2" and reconnaissance satellite, "Discoverer 1" were launched. In March of that same year, NASA sent "Pioneer 4" to the Moon, successfully making the first U.S. lunar flyby.

In April, 1959, NASA unveiled the Mercury astronaut corps. NASA Administrator T. Keith Glennan publicly introduced the astronauts in a press conference in Washington D.C.: Lt. Col. John H. Glenn, Jr. (Marine Corps), Lt. Cdr. Walter M. Schirra, Jr. (Navy), Lt. Cdr. Alan B. Shepard, Jr. (Navy), Lt. M. Scott Carpenter (Navy), Capt. L. Gordon Cooper (Air Force), Capt. Virgil I. "Gus" Grissom (Air Force), and Capt. Donald K. Slayton (Air Force). They became heroes in the eyes of the American public almost immediately.

In May, 1959, The United States launched and recovered two monkeys, Able and Baker, after launch in a Jupiter nosecone during a suborbital flight. The flight was successful, testing the capability to launch from Cape Canaveral, Florida, and to recover spacecraft in the Atlantic Ocean, but Able later died.

Summer Break, 1959:

In August, 1959, "Explorer 6" was launched by U.S. (first photographs of Earth from orbit).

1959-1960 School Year (7th grade, Lompoc, California):

In September, 1959, the Soviet Union launched "Luna 2" (first impact into another world [Moon]).

In October, 1959, the Soviet Union launched "Luna 3" (first photograph of the far side of the Moon).

In March, 1960, NASA launched "Pioneer 5" (first Solar probe).

In April, 1960, The United States launched "TIROS 1", the first successful meteorological satellite, observing Earth's weather. The U.S. also launched "Transit 1B", the first experimental orbital navigation system.

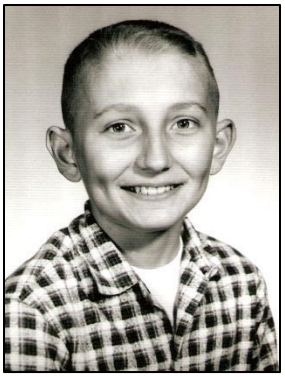
Summer Break, 1960:

In July, 1960, the first launch of the "Scout" launch vehicle took place. Its four-stage booster could place a 330 pound satellite into orbit, and it quickly became a workhorse in orbiting scientific payloads during the 1960s.

In July, 1960, the Army Ballistic Missile Agency of the Redstone Arsenal, Huntsville, Alabama, formally became a part of NASA and was renamed the George C. Marshall Space Flight Center. This organization included the German "rocket team" led by Wernher von Braun that came to the United States at the conclusion of World War II. This group had been instrumental in building the V-2 rocket, the world's first operational long-range ballistic missile.

In August, 1960, NASA successfully orbited "Echo 1", a 100-foot inflatable, aluminized balloon passive communications satellite. The objective was to bounce radio beams off the satellite as a means of long-distance communications. This effort, though successful, was quickly superseded be active-repeater communications satellites such as "Telstar".

1960-1961 School Year (8th grade, Topeka, Kansas):



In December, 1960, NASA launched "Mercury 1", the first Mercury-Redstone capsule-launch vehicle combination. This was an unoccupied test flight.

In January, 1961, NASA launched "Mercury 2", a test mission of the Mercury-Redstone capsule-launch vehicle combination with the chimpanzee Ham aboard during a 16 1/2 minute flight in suborbital space. Ham and his capsule were successfully recovered.

In April, 1961, the Soviet Union launched Yuri Gagarin ("Vostok 1") into Space for three orbits.

In May, 1961, "Freedom 7", the first piloted Mercury spacecraft (No. 7) carrying Astronaut Alan B. Shepard, Jr., was launched from Cape Canaveral by Mercury-Redstone (MR¬3) launch vehicle, to an altitude of 115 nautical miles and a range of 302 miles. It was the first American space flight involving human beings, and during his 15-minute suborbital flight, Shepard rode a Redstone booster to a splashdown in the Atlantic Ocean. Shepard demonstrated that individuals can control a vehicle during weightlessness and high G stresses, and significant scientific biomedical data were acquired. He reached a speed of 5,100 miles per hour and his flight lasted 14.8 minutes. Shepard was the second human and the first American to fly in Space.

In May, 1961, President John F. Kennedy unveiled the commitment to execute "Project Apollo" in a speech on "Urgent National Needs," billed as a second State of the Union message. He told Congress that the U.S. faced extraordinary challenges and needed to respond extraordinarily. In announcing the lunar landing commitment he said: "I believe 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 Earth. No single Space project in this period will be more impressive to mankind, or more important for the long-range exploration of Space; and none will be so difficult or expensive to accomplish."

Summer Break, 1961:

In July, 1961, the second piloted flight of a Mercury spacecraft took place on this date when astronaut "Gus" Grissom undertook a sub-orbital mission. The flight had problems. The hatch blew off prematurely from the Mercury capsule,

"Liberty Bell 7", and it sank into the Atlantic Ocean before it could be recovered. In the process, the astronaut nearly drowned before being hoisted to safety in a helicopter. These suborbital flights, however, proved valuable for NASA technicians who found ways to solve or work around literally thousands of obstacles to successful space flight.

In August, 1961, the Soviet Union launched Gherman Titov ("Vostok 2") into Space for over 24 hours.

In August, 1961, NASA launched "Ranger 1" with the mission of photographing and mapping part of the Moon's surface, but it failed to achieve its planned orbit.

1961-1962 School Year (9th grade, Abilene, Texas):

In September, 1961, NASA Administrator James E. Webb announced that the site of the NASA center dedicated to human space flight would be Houston, Texas. This became the Manned Spacecraft Center, renamed the Lyndon B. Johnson Space Center in 1973.

In October, 1961, NASA announced the establishment on a deep south bayou the Mississippi Test Facility, renamed the John C. Stennis Space Center in 1988. This installation became the test site for the large Saturn boosters developed for Project Apollo.

In October, 1961, NASA accomplished the first successful test of the Saturn I rocket.

In November, 1961, the Air Force launched a Titan ICBM from Cape Canaveral carrying target nose cone to be used in Nike-Zeus antimissile-missile tests. This was first Titan ICBM to be fired from Cape Canaveral by a military crew, the 6555th Aerospace Test Wing. The Titan rocket became a standard launch vehicle for the United States in the years that followed, going through several modifications to make it more reliable and capable.

In February, 1962, John Glenn became the first American to circle the Earth, making three orbits in his "Friendship 7" Mercury spacecraft. Despite some problems with spacecraft-Glenn flew parts of the last two orbits manually because of an autopilot failure and left his normally jettisoned retrorocket pack attached to his capsule during reentry because of a loose heat shield-this flight was enormously successful. The public, more than celebrating the technological

success, embraced Glenn as a personification of heroism and dignity. Among other engagements, Glenn addressed a joint session of Congress and participated in several ticker-tape parades around the country.

In April, 1962, "Ranger 4" launched by NASA (First spacecraft to impact the far side of the Moon.).

In May, 1962, astronaut Scott Carpenter flew three orbits in the Mercury spacecraft "Aurora 7".

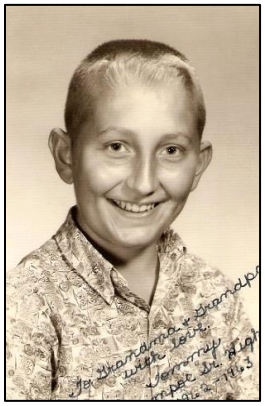
Summer Break, 1962:

In June, 1962, at an all-day meeting at the Marshall Space Flight Center, NASA, leaders met to hash out differences over the method of going to the Moon with Project Apollo, with the debate getting heated at times. The contention was essentially between Earth-orbit versus lunar-orbit rendezvous. After more than six hours of discussion those in favor of Earth-orbit rendezvous finally gave in to the lunar-orbit rendezvous mode, saying that its advocates had demonstrated adequately its feasibility and that any further contention would jeopardize the president's timetable. This cleared the path for the development of the hardware necessary to accomplish the president's goal.

In July, 1962, NASA launched "Telstar I" (The first privately built satellite for communications; first telephone and television signals carried via satellite.).

In August, 1962, the first dual manned spaceflight ("Vostok 3" and "Vostok 4") was launched by the Soviet Union (First communication between two manned space vehicles in orbit.).

1962-1963 School Year (10th grade, Lompoc [California]) and Lincoln [Nebraska])



In October, 1962, astronaut Wally Schirra flew six orbits in the Mercury spacecraft "Sigma 7".

In December, 1962, "Mariner 2" accomplished the first successful planetary flyby of Venus.

In May, 1963, the capstone of Project Mercury took place on this date with the flight of astronaut L. Gordon Cooper, who circled the Earth 22 times in 34 hours aboard the Mercury capsule "Faith 7".

Summer Break, 1963:

In June, 1963, the Soviet Union launched the first woman (Valentina Tereshkova) into Space, "Vostok 6".

In August, 1963, the experimental aircraft X-15 set an altitude record of 354,200 feet (67 miles).

1963-1964 School Year (11th grade, Sedalia [Missouri] and El Paso [Texas]):

In January, 1964, NASA's largest launch vehicle, Saturn SA-5, sent a record of 19 tons into orbit during a test flight.

In April, 1964, the first American Gemini ("Gemini 1") flight took place, an unpiloted test of the structural integrity of the new spacecraft and modified Titan II launch vehicle, and was intentionally destroyed during reentry.

In May, 1964, the United States placed the first Apollo Command Module (CM) in orbit. This Apollo capsule was launched during an automated test flight atop a Saturn I in preparation of the lunar landing program.

Summer Break, 1964:

In July, 1964, the United States' "Ranger 7" sent back to Earth 4,300 close-up images of the Moon before it impacted the surface.

1964-1965 School Year (12th grade, El Paso, Texas):

In October, 1964, the Soviet Union launched "Voskhod 1" into Space (First multi-person crew [3] in orbit.).

In October, 1964, NASA pilot Joseph Walker conducted the first flight in the Lunar Landing Research Vehicle (LLRV), known for its unusual shape as the "Flying Bedstead." Two LLRVs and three Lunar Landing Training Vehicles developed from them provided realistic simulation that was critical for landing a spacecraft on the Moon in the Apollo program. The LLRVs also provided the controls design data base for the lunar module.

In January, 1965, the second American Gemini ("Gemini 2") flight took place, an unpiloted test of the heat shield, and was successfully recovered.

In March, 1965, the Soviet Union launched "Voskhod 2" into Space (First Spacewalk [extra-vehicular activity] by Alexei Leonov).

In March, 1965, following two unoccupied test flights, the first operational mission - "Gemini 3" - of Project Gemini took place. Former Mercury astronaut Gus Grissom commanded the mission, with John W. Young, a Naval aviator chosen as an astronaut in 1962, accompanying him.

In April, 1965, the United States launched "Intelsat I", the first commercial satellite (communications), into geostationary orbit.

Graduated from high school in May and Summer Break, 1965 (In Nocona,Texas with grandmother Meekins, and worked at Nocona Athletic Goods.):

In June, 1965, the second piloted Gemini mission, Gemini IV, stayed aloft for four days, and astronaut Edward H. White II performed the first EVA or spacewalk by an American. This was a critical task that would have to be mastered before landing on the Moon.

In July, 1965, an American space probe, "Mariner 4", flies within 6,118 miles of Mars after an eight month journey. This mission provided the first close-up images of the red planet. The mission had been launched in November, 1964.

In August, 1965, during the flight of Gemini V, American astronauts Gordon Cooper and Pete Conrad set record with an eight day orbital flight.

1965-1966 School Year (Freshman, Texas Western College [now UTEP], El Paso, Texas (Basketball team won NCAA championship.):

In December, 1965, during the flight of Gemini VII, American astronauts Frank Borman and James A. Lovell set a duration record of fourteen days in Earth-orbit that held for five years.

In December,1965, during Gemini VI, U.S. astronauts Wally Schirra and Thomas P. Stafford complete the first true space rendezvous by flying within a few feet of Gemini VII.

In March, 1966, during Gemini VIII, American astronauts Neil A. Armstrong and David Scott performed the first orbital docking of their spacecraft to an Agena target vehicle, becoming the first coupling of two spacecraft. This was a critical task to master before attempting to land on the Moon, a mission that required several dockings and undockings of spacecraft.

In April, 1966, the Soviet Union achieved lunar orbit with its "Luna 10" Space probe, the first such vehicle to do so. This robotic flight had been launched on 31 Mar. 1966 and it provided scientific data about the Moon to Earth for several weeks.

Summer Break 1966 (In Nocona, Texas with grandmother Meekins, and worked at Nocona Athletic Goods.):

In June, 1966, "Surveyor 1" landed on the Moon and transmitted more than 10,000 high-quality photographs of the surface. This was the first American spacecraft to soft-land on the Moon. It had been launched in May, and it touched down on the "Ocean of Storms," a possible site for the Apollo landings.

In July, 1966, during the flight of Gemini IX, American astronauts Tom Stafford and Eugene Cernan make a two-hour EVA.

In July, 1966, during Gemini X, American astronauts Mike Collins and John Young make two rendezvous and docking maneuvers with Agena target vehicles, plus complete a complex EVA.

August, 1966 – August, 196,7 the "Lunar Orbiter" project was conducted for a year between these dates. This project, originally not intended to support Apollo, was reconfigured in 1962 and 1963 to further the Kennedy mandate more specifically by mapping the surface. In addition to a powerful camera that could send photographs to Earth tracking stations, it carried three scientific experiments-selnodesy (the lunar equivalent of geodesy), meteoroid detection, and radiation measurement. While the returns from these instruments interested scientists in and of themselves, they were critical to Apollo. NASA launched five Lunar Orbiter satellites, all successfully achieving their objectives.

1966-1967 School Year (Sophomore, Midwestern University [now Midwestern State University], Wichita Falls, Texas):

In September, 1966, American astronauts Pete Conrad and Dick Gordon piloted "Gemini XI". They established a Gemini record altitude with apogee of 739.2

nautical miles (1,369.0 km) reached using the Agena Target Vehicle propulsion system after first orbit rendezvous and docking. Gordon made a 33-minute EVA and two-hour standup EVA.

In November, 1966, the last Gemini flight, "Gemini XII", was launched and piloted by American astronauts Jim Lovell and Buzz Aldrin. They rendezvoused and docked manually with the target Agena and kept station with it during EVA. Aldrin set an EVA record of 5 hours and 30 minutes for one space walk and two stand-up exercises, and demonstrated solutions to previous EVA problems.

In January, 1967, during a simulation aboard Apollo-Saturn (AS) 204 on the launch pad at Kennedy Space Center, Florida, after several hours of work, a flash fire broke out in the pure oxygen atmosphere of the capsule and flames engulfed the capsule and the three astronauts aboard - Gus Grissom, Ed White, and Roger Chaffee - died of asphyxiation. Although three other astronauts had been killed before this time - all in plane crashes - these were the first deaths directly attributable to the U.S. Space program. As a result of this accident, the Apollo program went into hiatus until the spacecraft could be redesigned. The program returned to flight status during Apollo 7 in October 1968.

In April, 1967, Air Force Col. Joseph Cotton and NASA research pilot Fitzhugh Fulton made the first NASA flight in the XB-70A. The 23 NASA flights in the 129-flight joint program with the Air Force investigated the stability and handling qualities of large, delta-wing aircraft flying at high supersonic speeds. Together these flights contributed data for designing future supersonic aircraft in such areas as environmental noise (including sonic booms), potential flight corridors, flight control, operational problems, and clear-air turbulence. It also validated wind tunnel data and revealed drag components not consistent with or not simulated by wind tunnel testing.

Summer Break, 1967:

None.

1967-1968 School Year (Junior, Midwestern University [now Midwestern State University], Wichita Falls, Texas):

In October, 1967, the X-15 experimental rocket plane set a speed record for piloted vehicles by reaching 4,534 mph (mach 6.72) at a 99,000 feet altitude over the Mojave Desert in California. Piloted by Maj. William J. Knight, USAF, the X-15 no. 2 flight undertook experiments to: (1) test Martin ablative coating and

ramjet local flow; (2) check out stability and control with dummy ramjets and characteristics of external tank separation; and (3) conduct fluidic temperature probes. The previous space record of 4,250 mph (mach 6.33) had been set by Maj. Knight on 18 Nov. 1966.

In November, 1967, during "Apollo 4", an unpiloted test of the launcher and spacecraft was conducted (First test flight of Saturn V, placed a CSM in a high Earth orbit; demonstrated S-IVB restart; qualified CM heat shield to lunar reentry speed; NASA proved that the combination could safely reach the Moon.).

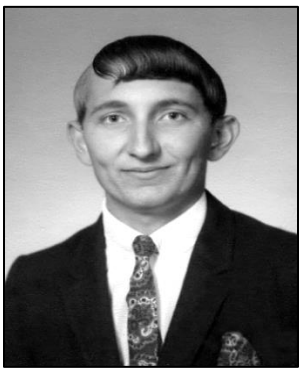
In January, 1968, NASA made the first flight test with "Apollo 5" of the propulsion systems of the Lunar Module ascent/descent capability (Earth orbital flight test of LM, launched on Saturn IB; demonstrated ascent and descent propulsion; human-rated the LM.).

In April, 1968, NASA made a flight test with "Apollo 6" (Un-crewed, attempted demonstration of trans-lunar injection, and direct-return abort using SM engine; three engine failures, including failure of S-IVB restart. Flight controllers used SM engine to repeat Apollo 4's flight profile. Human-rated the Saturn V.).

Summer Break, 1968:

None.

1968-1969 School year (Senior, Midwestern University [now Midwestern State University], Wichita Falls, Texas):



In September, 1968, in a significant first, the Soviet Union sent its "Zond 5", lunar mission capsule around the Moon and brought it back safely to Earth. This was an unpiloted test of the system.

In October, 1968, the first piloted flight of the Apollo spacecraft, "Apollo 7", and Saturn IB launch vehicle, this flight involved astronauts Wally Schirra, Donn F. Eisele, and Walter Cunningham who tested hardware in Earth orbit.

In December, 1968, "Apollo 8" took off atop a Saturn V booster from the Kennedy Space Center with three astronauts aboard - Frank Borman, James A. Lovell, Jr., and William A. Anders - for a historic mission to orbit the Moon. At first it was planned as a mission to test Apollo hardware in the relatively safe confines of low Earth orbit, but senior engineer George M. Low of the Manned

Spacecraft Center at Houston, Texas (renamed the Johnson Space Center in 1973), and Samuel C. Phillips, Apollo Program Manager at NASA headquarters, pressed for approval to make it a circumlunar flight. The advantages of this could be important, both in technical and scientific knowledge gained as well as in a public demonstration of what the U.S. could achieve. In the summer of 1968 Low broached the idea to Phillips, who then carried it to the administrator, and in November, the agency reconfigured the mission for a lunar trip.

After Apollo 8 made one and a half Earth orbits its third stage began a burn to put the spacecraft on a lunar trajectory. As it traveled outward the crew focused a portable television camera on Earth and for the first time humanity saw its home from afar, a tiny, lovely, and fragile "blue marble" hanging in the blackness of Space. When it arrived at the Moon on Christmas Eve this image of Earth was even more strongly reinforced when the crew sent images of the planet back while reading the first part of the Bible - "God created the heavens and the Earth, and the Earth was without form and void" - before sending Christmas greetings to humanity. The next day they fired the boosters for a return flight and "splashed down" in the Pacific Ocean on 27 December. It was an enormously significant accomplishment coming at a time when American society was in crisis over Vietnam, race relations, urban problems, and a host of other difficulties. And if only for a few moments the nation united as one to focus on this epochal event. Two more Apollo missions occurred before the climax of the program, but they did little more than confirm that the time had come for a lunar landing.

In March, 1969, "Apollo 9" astronauts James McDivitt, David Scott, and Russell Schweickart orbited the Earth and tested all of the hardware needed for a lunar landing (First crewed flight of CSM and LM in Earth orbit; demonstrated portable life support system to be used on the lunar surface.).

In May, 1969, "Apollo 10" astronauts Eugene Cernan, John Young, and Tom Stafford conducted the last dress rehearsal for the Moon landing. They took the Lunar Module (LM) for a test run within 10 miles of the lunar surface.

Summer (graduated from college [MSU] in May) (With my grandmother and parents in Nocona, Texas ... watched Apollo 11 land on the Moon.), 1969:

In July, 1969, the first lunar landing mission, "Apollo 11" lifted off on 16 July, 1969, and after confirming that the hardware was working well began the three day trip to the Moon. At 4:18 p.m. EST on 20 Jul. 1969 the LM - with astronauts Neil A.

Armstrong and Edwin E. Aldrin - landed on the lunar surface while Michael Collins orbited overhead in the Apollo command module. After checkout, Armstrong set foot on the surface, telling the millions of listeners that it was "one small step for man, one giant leap for mankind." Aldrin soon followed him out and the two plodded around the landing site in the 1/6 lunar gravity, planted an American flag but omitted claiming the land for the U.S. as had routinely been done during European exploration of the Americas, collected soil and rock samples, and set up some experiments. After more than 21 hours on the lunar surface, they returned to Collins on board "Columbia," bringing 20.87 kilograms of lunar samples with them. The two Moonwalkers had left behind scientific instruments, an American flag and other mementos, including a plaque bearing the inscription: "Here Men From Planet Earth First Set Foot Upon the Moon, July, 1969 A.D. We came in Peace For All Mankind." The next day they began the return trip to Earth, "splashing down" in the Pacific on 24 July.

Joined Project Apollo at the Lunar Receiving Laboratory (Research Analyst, Biological Sciences Section), JSC, Houston, Texas in September, 1969:

In September, 1969, the presidentially-appointed Space Task Group issued its report on the post-Apollo space program on this date. Chartered on 13 Feb. 1969 under the chairmanship of Vice President Spiro T. Agnew, this group met throughout the spring and summer to plot a course for the space program. The politics of this effort was intense. NASA lobbied hard with the Group and especially its chair for a far-reaching post-Apollo space program that included development of a space station, a reusable Space Shuttle, a Moon base, and a human expedition to Mars. The NASA position was well reflected in the group's September report, but Nixon did not act on the Group's recommendations. Instead, he was silent on the future of the U.S. space program until a March 1970 statement that said "we must also recognize that many critical problems here on this planet make high priority demands on our attention and our resources."

In November, 1969, “Apollo 12” U.S. astronauts Charles Conrad, Richard Gordon, and Alan Bean go to the Moon for the second manned landing. They landed near the “Surveyor 3” landing site on 18 Nov. They spend 7.5 hours walking on the surface, including an inspection of the Surveyor probe.

In April, 1970, the flight of “Apollo 13” was one of the near disasters of the Apollo program. At 56 hours into the flight, an oxygen tank in the Apollo service module ruptured and damaged several of the power, electrical, and life support systems. People throughout the world watched and waited and hoped as NASA

personnel on the ground and the crew, well on their way to the Moon and with no way of returning until they went around it, worked together to find a way safely home. While NASA engineers quickly determined that sufficient air, water, and electricity did not exist in the Apollo capsule to sustain the three astronauts until they could return to Earth, they found that the LM - a self-contained spacecraft unaffected by the accident - could be used as a "lifeboat" to provide austere life support for the return trip. It was a close-run thing, but the crew returned safely on 17 April 1970. The near disaster served several important purposes for the civil space program - especially prompting reconsideration of the propriety of the whole effort while also solidifying in the popular mind NASA's technological genius.

In January/February, 1971, “Apollo 14” was the third U.S. lunar landing mission, and the first since the near disaster of Apollo 13. Alan Shepard and Edgar Mitchell went to the Moon while Stuart Roosa piloted the CM. They performed nine hours of moonwalks and brought back 98 pounds of lunar material.

In July/August, 1971, the first of the longer, expedition-style lunar landing missions, “Apollo 15” was the first to include the lunar rover to extend the range of the astronauts on the Moon. They brought back 173 pounds of Moon rocks, including one of the prize artifacts of the Apollo program, a sample of ancient lunar crust called the "Genesis Rock."

In November, 1971, “Mariner 9” was the first mission to orbit another planet (Mars).

In January, 1972, NASA Administrator James C. Fletcher met with President Richard M. Nixon at the "Western White House" in San Clemente, California, to discuss the future of the Space program, and then issued a statement to the media announcing the decision to "proceed at once with the development of an entirely new type of space transportation system designed to help transform the space frontier of the 1970s into familiar territory, easily accessible for human endeavor in the 1980s and '90s." This became the Space Shuttle, first flown in Space on 12-14 April, 1981.

In March, 1972-present, to prepare the way for a possible mission to the four giant planets of the outer Solar System, “Pioneer 10” and “Pioneer 11” were launched to Jupiter. Both were small, nuclear-powered, spin-stabilized spacecraft that Atlas-Centaur launched. The first of these was launched on 3 March, 1972, traveled outward to Jupiter, and in May 1991 was about 52 Astro

Nautical Units (AU), roughly twice the distance from Jupiter to the Sun, and still transmitting data. In 1973, NASA launched Pioneer 11, providing scientists with their closest view of Jupiter, from 26,600 miles above the cloud tops in December 1974.

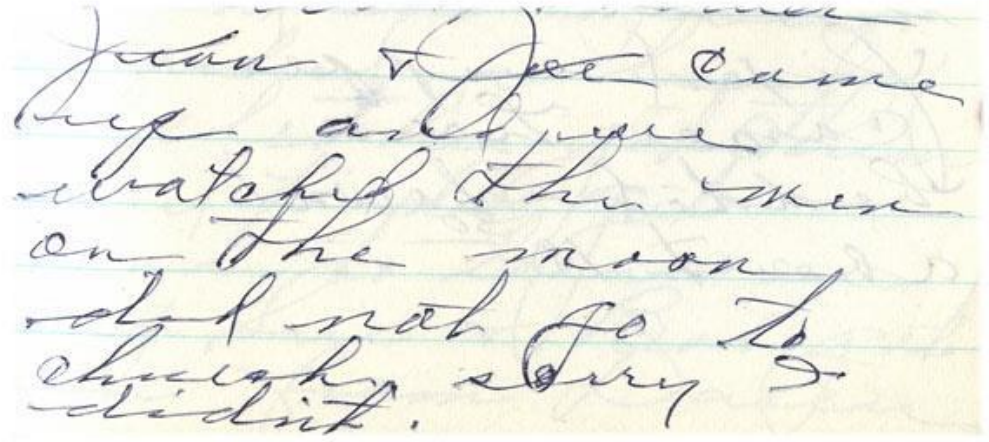
In April, 1972, during "Apollo 16", astronauts John Young, Thomas Mattingly II, and Charles Duke made the fifth American landing on the Moon. Young and Duke spent 3 days with the lunar rover near the Descartes crater.

In July, 1972-present, "Landsat 1" was launched from Kennedy Space Center, to perform an Earth resource mapping mission. Initially called the Earth Resources Technology Satellite (ERTS) and later renamed, "Landsat 1" changed the way in which Americans looked at the planet. It provided data on vegetation, insect infestations, crop growth, and associated land-use information. Two more Landsat vehicles were launched in Jan. 1975 and Mar. 1978, performed their missions and exited service in the 1980s. "Landsat 4", launched 16 July, 1982, and "Landsat 5", launched 1 March, 1984, were "second generation" spacecraft, with greater capabilities to produce more detailed land-use data. The system enhanced the ability to develop a worldwide crop forecasting system, to devise a strategy for deploying equipment to contain oil spills, to aid navigation, to monitor pollution, to assist in water management, to site new power plants and pipelines, and to aid in agricultural development.

In December, 1972, "Apollo 17" was the last of the six Apollo missions to the Moon, and the only one to include a scientist-astronaut/geologist Harrison Schmitt - as a member of the crew. Schmitt and Eugene Cernan, had extended EVAs on the Moon, 22 hours, 4 minutes for each. Ronald Evans piloted the CM.

For the 50th Anniversary of the Apollo 11 mission … 1969 - 2019 … Chambers was invited by the Wings Over the Rockies Air and Space Museum in Denver, Colorado to give his presentation, "Fifty Years Ago at the Lunar Receiving Laboratory (LRL) - Project Apollo". This presentation detailed his work experiences at the LRL, and it follows:

I thought I would begin with a diary entry made by my grandmother on July 20, 1969. She doesn't mention me, but I was there that evening with her and my parents watching the Apollo 11 astronauts land on the Moon, and Commander Neil Armstrong make that "one giant leap for mankind."



July 20, 1969

"Jean and Joe came up, and we watched the men on the Moon; did not go to church, sorry I didn't."

Note: Apollo 11 landed the first humans on the Moon, Americans Neil Armstrong and Buzz Aldrin, on July 20, 1969. Armstrong became the first to step onto the lunar surface.

Jean and Joe are Tom R. Chambers' parents; Jean is Mrs. Meekins' daughter.

I had graduated from college two months earlier, and little did I realize that I would be working as a research analyst at the Lunar Receiving Laboratory two months later.

Team Leader, Landrum Young injects a quail as I assist him. A suspension of saline and lunar soil … brought back from the Moon by the Apollo 11 astronauts … was prepared for the injection. Notice the containment cabinet that we were working in as a part of the lunar quarantine program.

I joined the Biological Sciences research team near the end of the Apollo 11 process, because one of the team members breached the containment protocol, and was then quarantined with the astronauts. I had been working as a research analyst at the M.D. Anderson Cancer Center in Houston … first job out of college.

NASA

This NASA photograph shows again, the team leader, Landrum Young working with mice in the containment cabinet during Apollo 11. You'll notice the double barrier (isolator) that indicates the mice were germ-free. Germ-free mice lack all microorganisms, and they are housed in tightly controlled and monitored isolators to prevent contamination.

The image below shows the biological or containment cabinets. I spent a great deal of time working in these cabinets during missions 11, 12, and 14. This quarantine approach was to help prevent "forward contamination" (the transfer of life and other forms of contamination from Earth to another celestial body … in this case, the Lunar rocks and soil), and more importantly, "back contamination" (the introduction of extraterrestrial organisms and other forms of contamination into Earth's biosphere).

NASA

Although the formal quarantine for the crew, spacecraft, and lunar samples was over after Apollo 14, procedures for handling lunar material and protecting it from contamination remained in effect for the Apollo 15, 16, and 17 missions.

I remember the first day ... actually, night ... of work. When I joined the team, they were in the midst of processing the lunar soil (core sample) by the Apollo 11 astronauts. That first night was as surreal as it gets. I entered a change room, and put on a "bunny suit" ... similar to a surgical uniform ... walked through a UV wash (dry shower), and then ended up at the beginning of a long, corridor. There were doors running to the left and right all the way to the end with autoclaves (sterilization units) interspersed on the walls. The laboratory where I would be working was at the very end. The team leader entered a combination code to open the door, and then we entered.

This NASA publicity photograph shows the corridor that I mention above. The autoclaves seen on the wall to the left sterilized all items brought into and taken out of the containment cabinets. I walked this corridor over a three-year period too many times to count.

When I entered the laboratory, the first things to catch my eye were the large containment cabinets - metallic, glassed, see-through working areas with glove ports. I had never seen anything like this before except for a hooded work area in a microbiology laboratory. I would spend the next several months with my arms inserted into those glove ports working with the lunar soil from Apollo 11, 12, and 14 and various animal models (species). The team leader and other analysts would be at my side as we worked the samples for analyses.

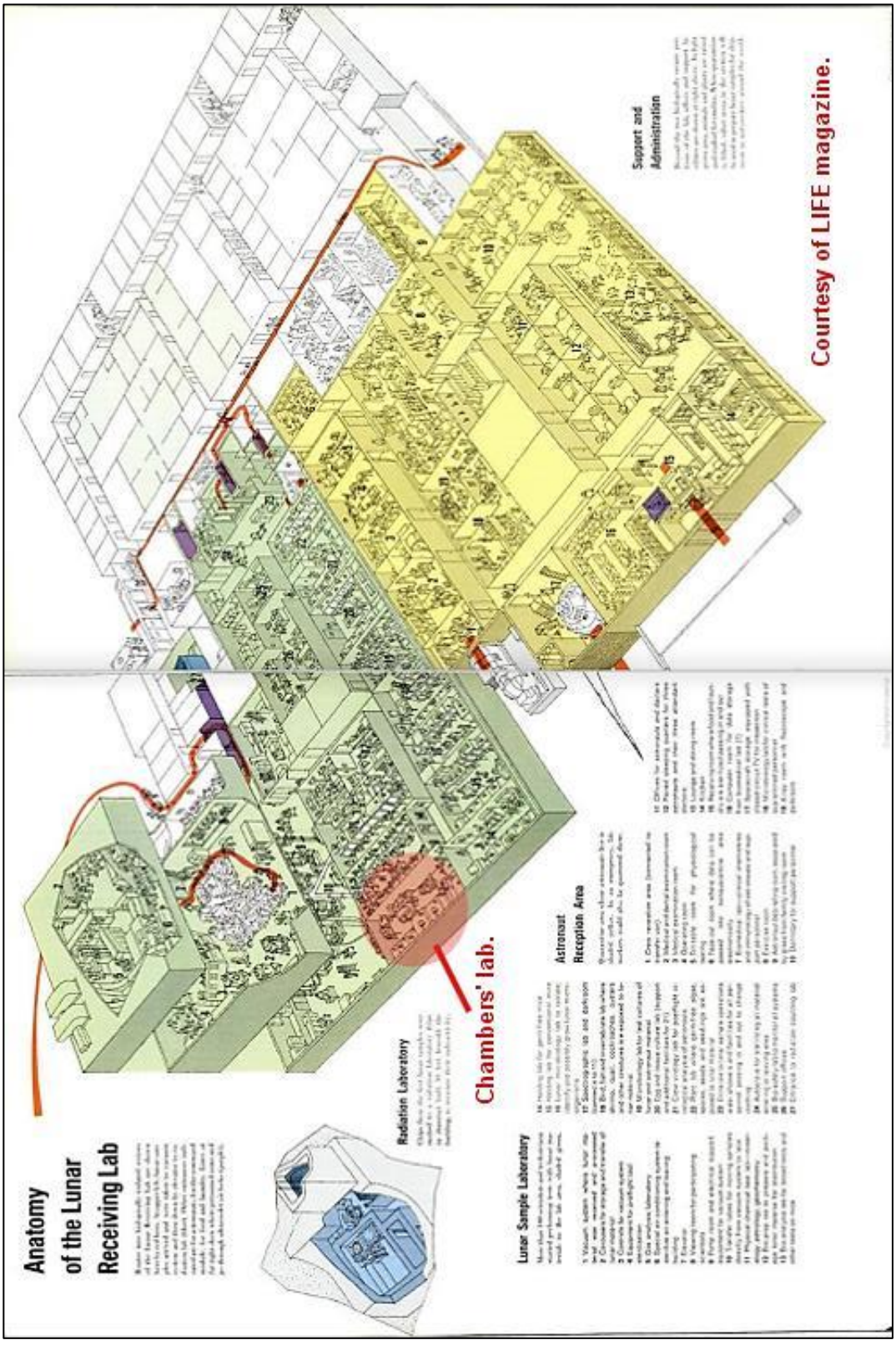
That first night on the job of a lifetime left me a bit "numb" after eight hours working in a surreal setting of "bunny suits", UV wash, containment cabinets, sterilization units, the tension of having to be very careful not to breach the containment protocol, and of course the lunar soil sample on the other side of the glass.

This image shows the cabinets with positive pressure (gloves extended). For missions 11, 12, and 14, the cabinets were under negative pressure to prevent "back contamination". This kind of contamination … the introduction of extraterrestrial organisms and other forms of contamination into Earth's biosphere ... were most pressing as we worked the samples for analyses. Again, we had to be extremely careful not to breach this protocol.

As I have mentioned, the lunar samples were tested within biological or containment cabinets. These cabinets were gastight enclosures through which all manipulations were performed using neoprene gloves. Air or nitrogen entered the cabinets through absolute biological filters, and was filtered again before being vented to the outside. All material entering the cabinets was sterilized. The cabinets were operated at a pressure negative with respect to the laboratory to ensure that any leak that developed would be directed into the cabinets rather than into the laboratory.

There was also a secondary biological barrier. The rooms (labs) in which the cabinets were housed were also maintained at a pressure negative with respect to the adjacent corridors. This guaranteed that any escaping lunar material would be contained. This secondary biological barrier which surrounded the sample laboratory included facility systems and operational procedures. All solid materials including waste, clothing, and trash were sterilized. The sample laboratory area received supplies during quarantine operations through ultraviolet-lighted (UV) airlocks (BIOMEDICAL RESULTS OF APOLLO - THE LUNAR QUARANTINE PROGRAM (Sec.5,Ch.1), NASA).

The following image shows a schematic of the Lunar Receiving Laboratory. My work area is circled in red:



There were three main elements as part of the Biological Protocol: crew microbiology; in vitro attempts to culture microorganisms from the lunar sample; and the direct challenge of the lunar sample in biological systems. I was involved in the third element. The group of hosts involved higher and lower vertebrates, invertebrates, unicellular organisms, and plants. (NASA)

GUIDELINES

1. The existence of hazardous, replicating microorganisms on the moon would be assumed.

2. Biological containment requirements should be based on the most stringent means used for containment of infectious terrestrial agents.

3. The sterilization requirement should be based on methods needed for the destruction of the most resistant terrestrial forms.

4. Hazard detection procedures should be based on an alteration of the ecology and classical pathogenicity.

5. The extent of the biological test protocol would be limited to facilities approved by the Congress, to well-defined systems, and to biological systems of known ecological importance. (NASA)

NASA

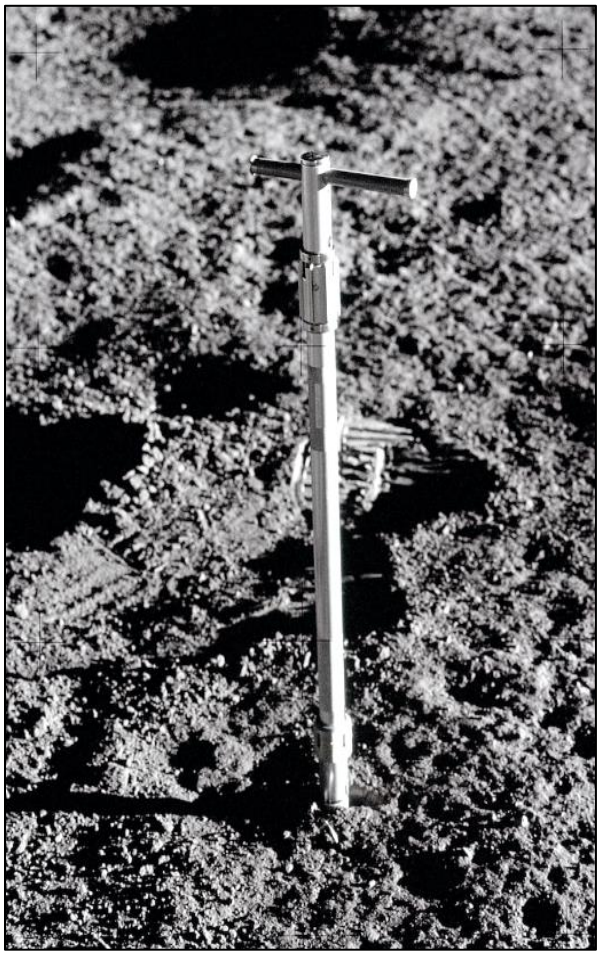
NASA

These guidelines provided the basis for the Lunar Quarantine Program. Although the probability that life existed on the Moon was extremely low, the risk was sufficiently high that a quarantine program was justified.(NASA)

The term "hazard" had to be defined before a method of detection could be developed. Procedures were limited to those capable of detecting an agent that would exhibit classical pathogenicity to some terrestrial life form or that could establish itself in a terrestrial environment and thereby alter the ecology. This guideline limited the search to the detection of replicating microorganisms. (NASA)

As it related to my responsibilities in the Biological Sciences section, the methods used for the detection of replicating microorganisms that could cause disease or establish and replicate themselves in some terrestrial environment /organism were as follows:

Lunar soil (core sample) /saline suspensions were prepared for injections and administered; and the various animal species (models) were sampled at various time cycles: bled for blood analyses and chemistries; dissected for light and electron microscopy of various tissues to look for changes in morphology; and cultured for microbial procedures.



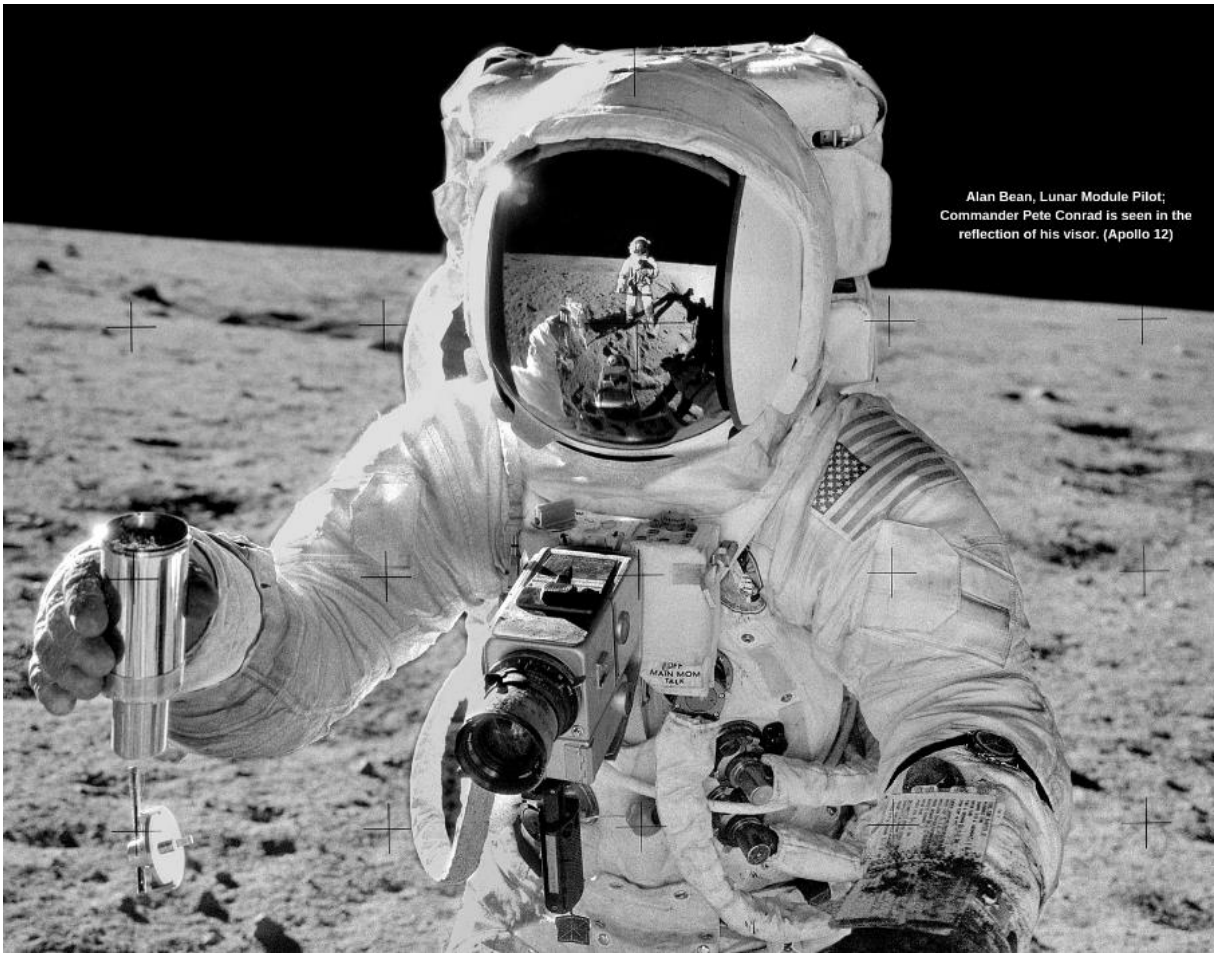
NASA

If I am correct after 50 years, our prepared sample came from this Apollo 12 core tube … sample 12026. It was collected in drive tube 1 (S/N 2013) near the Lunar module (LM) at the end of the first EVA period on the northeast edge of Surveyor Crater. The core was 19. 3 centimeters long and contained 106.6 grams of soil. Three small samples were taken from near the top, middle, and bottom of the core for gas analyses; then the core was dissected and split longitudinally. The split was divided into three samples — the top, middle, and lower thirds. Each sample was sieved, then recombined to form part of the BIOPRIME sample (the sample used by us in the quarantine area) (DESCRIPTION OF CORE SAMPLES RETURNED BY APOLLO 12, NASA TECHNICAL MEMORANDUM, NASA TM X-58066, November 1971).

My main focus when we received the Apollo 12 sample was to prepare saline/Lunar soil suspensions for injection of groups of mice (other species) in staggered fashion for incubation and processing. At various time intervals, the mice (other species) would be bled for blood analyses and dissected for tissue sampling (light and electron microscopy and microbiology).

Keep in mind, all of these precise and tedious procedures were done through "bulky" gloves with restricted movement and viewing limitations in the sense that you had to be careful that you didn't bang your head on the glass window of the containment cabinet. And again, we had to be careful that we didn't "pin prick" our gloves, which would have shut down the entire system. As I have mentioned previously, an analyst in our area did indeed do this during the Apollo 11 procedures, and was quarantined with the astronauts.

This work environment gave me a greater appreciation of the astronauts' work environment when they were on the Moon working with procedures in their "bulky" suits and gloves.

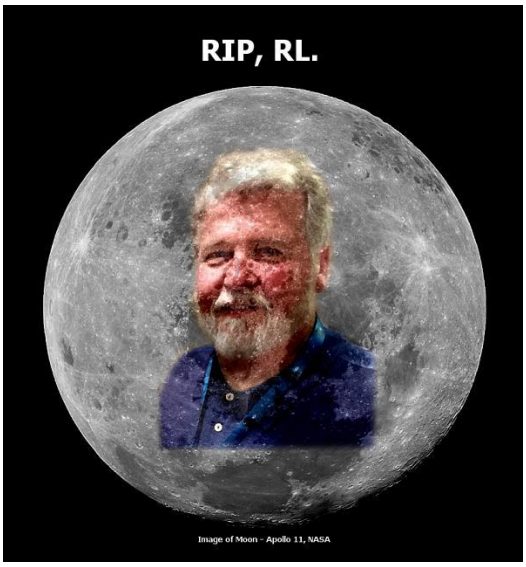


Lunar Module Pilot Alan Bean is seen holding a lunar sample on the Moon's surface. Apollo 12, NASA

As I have mentioned, once the mice (other species) were subjected to the saline/lunar soil suspension, it was an hourly process of macroscopic and microscopic observations with exsanguinations/dissections to be able to do blood and tissue analyses. Over time, I perfected a technique of obtaining optimal blood levels with minimal hemolysis during the exsanguination process, and suggested to the team leader that we publish a paper on this in a scientific journal. We did, and I'll never forget how we decided who should be first on the author credits ... we flipped a coin, and he won, so his name precedes mine on the paper. The paper was not only accepted for publication, but also won first place for best technical paper published in the scientific journal, Laboratory Animal Science.

By observation of plant and animal diseases, it was determined that most terrestrial disease agents were capable of invading a host and causing evident disease symptoms within 21 days after exposure of the host. Most disease agents capable of causing epidemic or rapidly spreading diseases were sufficiently virulent to be transmitted in less than 21 days. It was decided that a crew quarantine period of at least 21 days should be required after each Apollo mission. Intensive medical examinations of the flight crewmembers during quarantine determined if any medical problems existed as a result of exposure to lunar material. (NASA)

Let me stop here and mention a member of the medical team, Rudy Landry. We became very good friends, and his enthusiasm for Project Apollo was infectious … no pun intended. He passed away several months ago, and I want to dedicate this presentation to him.



An image of Rudy Landry and the Moon is seen to the left. After Project Apollo was phased out, he continued his duties in the medical laboratory throughout the "Space Shuttle" program.

Our procedures in the Biological Sciences section followed similar guidelines with a repetitive approach to ensure that the release of the lunar samples to other investigative teams did not represent a hazard.

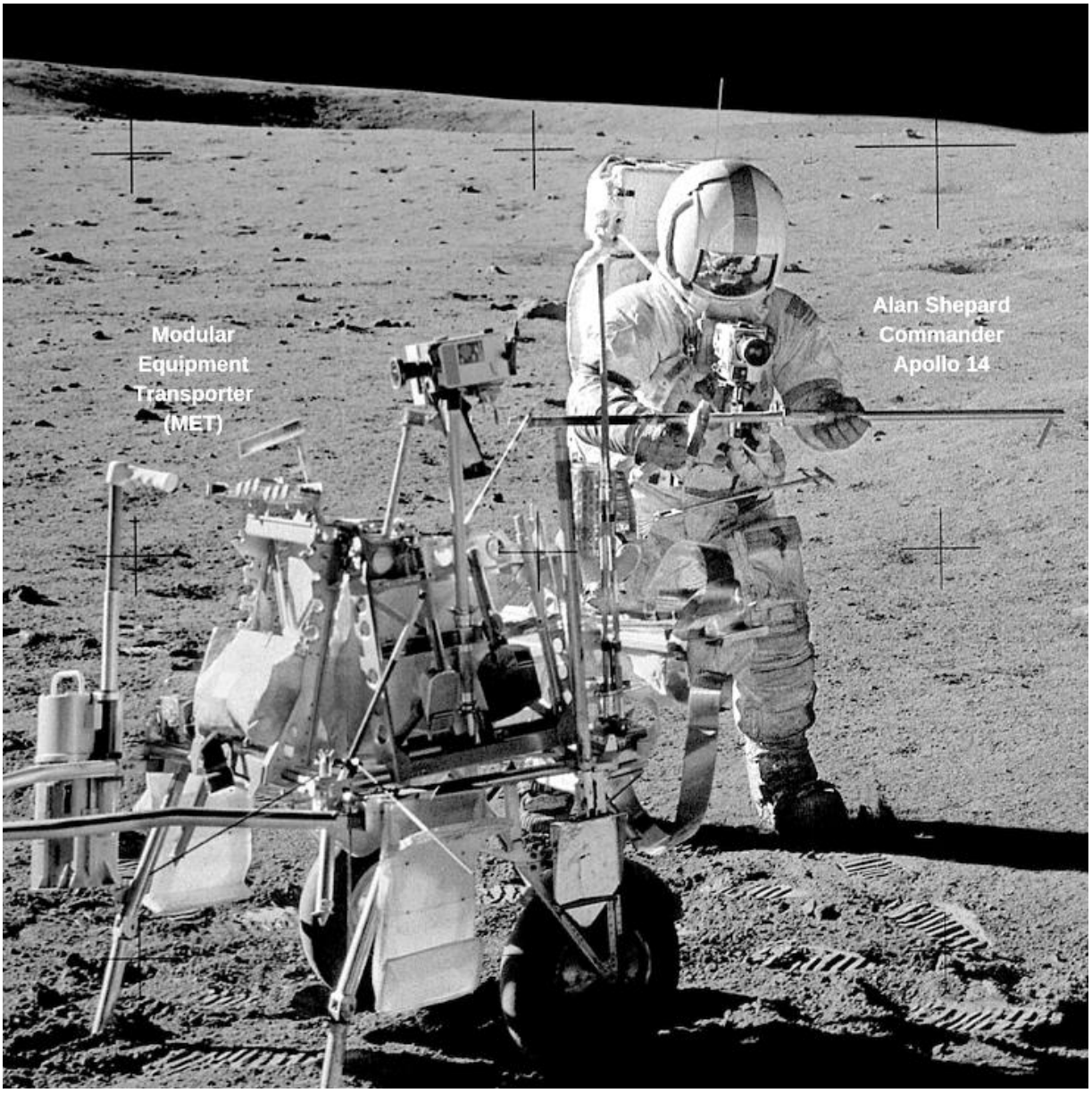
The hourly process of macroscopic and microscopic observations with exsanguinations to be able to do blood and tissue analyses was definitely a grind. We had to be punctual ... right on ... and deliver results at a fast pace to satisfy the "concerns of the day" ... is the Moon safe? And we had to be careful not to contaminate the samples that were brought back.

As tests were progressing for the Apollo 12 Lunar soil, we also had to begin preparations for the return of the Apollo 13 samples. We set up procedures and modifications based on prior techniques with missions 11 and 12, and practiced the various approaches so they would become routine. Little did we realize that these projected routines would be broken.

As usual ... like the previous missions ... we were anticipating the launch of Apollo 13, their journey to the surface of the Moon to collect "OUR" sample, and their return to Earth. But, the accident that happened to them along the way changed everything, and a "doom and gloom cloud hung over" the Lunar Receiving Laboratory. We had to be conscious of our ongoing procedures and tests with the mission 11 and 12 samples, but it was a difficult task to get our head around the fact that we might lose our Apollo 13 astronauts over a bunch of rocks. Of course, I remember this distinctly, and I walked into work those few days with nothing else on my mind except concern for Lovell, Haise, and Swigert.

There was about a four-month delay for Project Apollo because of the mission 13 problems, so we did some maneuvering as well, which meant I worked on other research activities. I remember walking into the medical laboratory area to utilize their electrophoresis equipment to do some enzyme work on mice that had been subjected to lunar soil. I began utilizing their equipment to establish enzyme baselines. I got pretty good at this, too, and ended up publishing my results in another scientific journal.

Apollo 14 made it through the process ... everyone on "pins and needles" because of the Apollo 13 mishap ... and we received our lunar soil sample. We were excited as ever as we opened the lid, and witnessed the Moon ... again, but a different part of this celestial body. The Apollo 12 sample was from the southeastern portion of the Ocean of Storms, and our new sample (mission 14) was from the Fra Mauro formation.



NASA

Apollo 14 Commander, Alan Shepard is seen above holding a core tube sampler. His MET (Modular Equipment Transporter) is seen to his right and in the foreground. He and Lunar Module Pilot Ed Mitchell used the MET to transport their tools and lunar samples.

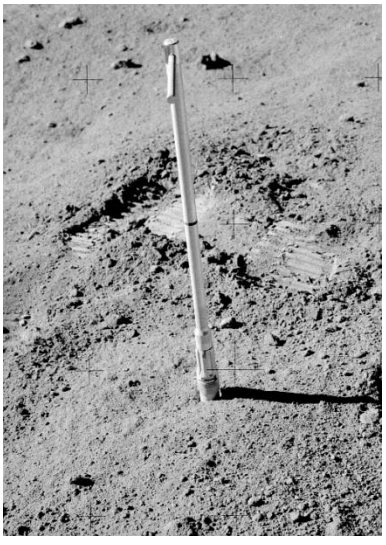
We essentially performed the same procedures subjecting animal species (models) to the lunar soil. The crews of Apollo 11, 12, and 14 experienced no health problems as a result of their exposure to lunar material. The test species, plant and animal, which were exposed to and injected with lunar material showed no adverse alterations or ill effects from exposure. Since exhaustive studies of the astronauts and returned lunar samples indicated there was no hazard to Earth's biosphere, the Interagency Committee on Back-Contamination, in January of 1970, concurred in NASA's recommendation that stringent quarantine rules be abandoned for future Apollo missions to the Moon (BIOMEDICAL RESULTS OF APOLLO - THE LUNAR QUARANTINE PROGRAM (Sec.5,Ch.1), NASA).

And as I have mentioned, although the formal quarantine for the crew, spacecraft, and lunar samples was over after Apollo 14, procedures for handling Lunar material and protecting it from contamination remained in effect for the Apollo 15, 16, and 17 missions.

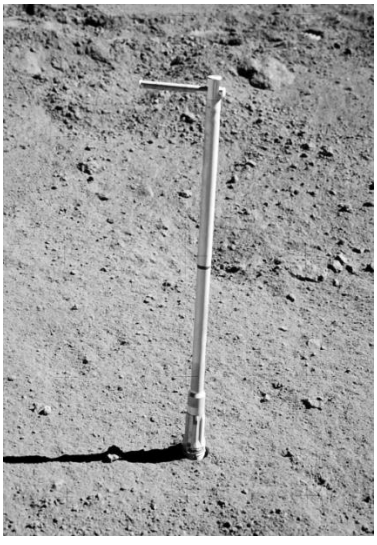
For missions 15, 16, and 17, I moved my focus a bit to also include macrophage studies after lunar soil exposure. The macrophage is an important component of the innate immune system that plays a strong regulatory role as a vital link with adaptive immunity. The procedures involved peritoneal lavages (washes) of mice (other species) after lunar soil/saline injections and incubation.

I also conducted extensive still /cine-film photomicrography of macrophage behavior (ingestion/reaction) to the soil particulates. This exposure to the documentation aspects of the research is probably the main reason that I later moved into medical/scientific media.

Apollo 15, NASA

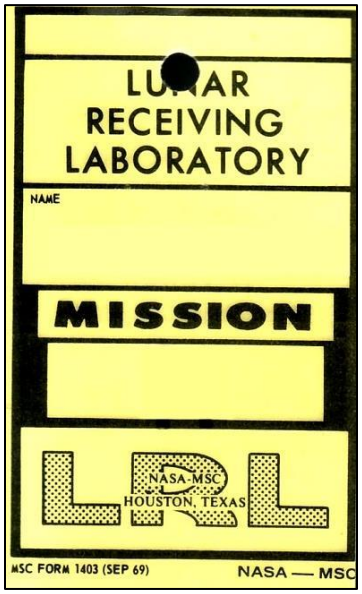


Apollo 16, NASA



Apollo 17, NASA

I refined the peritoneal lavage technique at the Lunar Receiving Laboratory, and published this technical paper in Laboratory Animal Science (Vol. 25, No. 5, 1975) later when I was a Research Associate at the University of Texas Medical Branch at Galveston (Texas), 1975.



To the left is the Lunar Receiving Laboratory badge that was worn for all missions. Unfortunately, I have lost all of my memorabilia over the years.

NASA

This photo shows Phil, research analyst in Botany working with plants in the bio cabinet. Our labs were in close proximity. You'll notice his "bunny suit" that we all wore.

NASA

Phil (shown in the right image above) was small in stature, and he was frequently called over to the spacesuit training area to put on and test the suit for functionality and maneuverability. He asked me to go with him on a couple of occasions to take photographs of him and the process. I did this, and then handed him the camera. I wish I had those photographs today.

On my return to the Lunar Receiving Laboratory (Building 37) in 2016, the interior configuration had changed so much that I couldn't find my way. I eventually figured out the location of my laboratories, crew reception area, etc. I also made it over to the Lunar Sample Laboratory Facility (Building 31) where Andrea Mosie, Lab Manager showed me one of the lunar rocks.

Building 37, TRC

Building 31, EC