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Spaceport News

America's gateway to the universe. Leading the world in preparing and launching missions to Earth and beyond.

http://www-pao.ksc.nasa.gov/kscpao/snews/snewstoc.htm John F. Kennedy Space Center

35 years ago today:

"We have liftoff!"

When Apollo 11 launch commentator Jack King excitedly proclaimed those words on July 16, 1969, at 9:32 a.m. EDT, nearly everyone in the world stopped what they were doing and watched it on television.

Four days later at 10:56 p.m., NASA astronaut Neil Armstrong set foot on the Moon, helping America accomplish its goal of landing a man on its surface before the end of the decade.

Just after the return of Apollo 8 at the beginning of that year, NASA had 12 months remaining to accomplish its goal set forth by President John F. Kennedy in 1962.

"We choose to go to the Moon in this decade - and do the other things - not because they are easy, but because they are hard," Kennedy said in a speech at Rice University in Texas.

The lunar landing craft for Apollo 11 still had to be tested and the lunar module, the space vehicle that would actually land on the Moon, proved to be one of the most complex pieces of hardware ever developed. NASA's workforce answered the challenge.

After the end of the Apollo program in 1972, astronaut Gene Cernan, known as the last man to walk on the Moon, knew America would return to Earth's lone satellite. "It is somewhat of a dubious honor to be the last man to have walked on the Moon," Cernan said in a recent interview.

"I'm waiting for some young boy or girl with an abominable will and courage to take us back out there where we belong. That will happen; I am that kind of optimist."

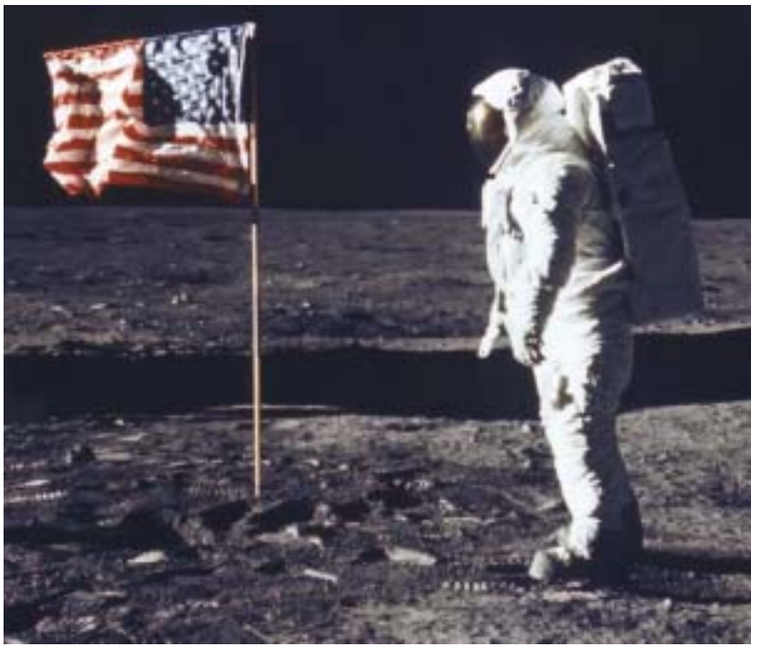
In President George W. Bush's Jan. 14 speech unveiling the vision, he said: "Just as Mercury, Gemini and Apollo challenged a generation of Americans, a renewed U.S. Space Exploration Program with a significant human component can inspire us, and our youth, to greater achievements on Earth and in space."

When Craig Steidle, NASA's associate administrator for Exploration Systems, visited KSC in May to learn more about the Center's workforce and facilities, he stated: "This is certainly the operations center of the future."

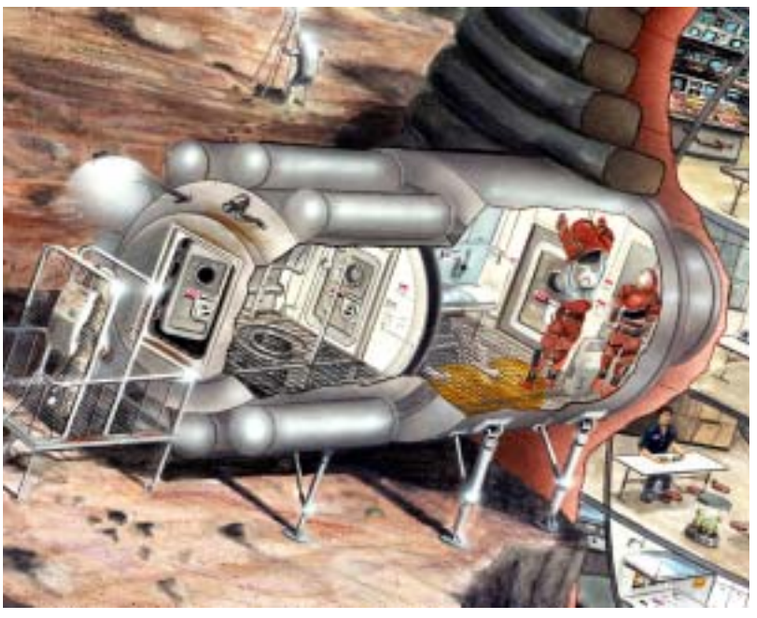
Kennedy Space Center Director Jim Kennedy is also energized the Center's role in the Vision for Space Exploration.

"Our role is so very clear at KSC," Kennedy said. "NASA will play a major role in future space flight operations. I feel very positive about KSC's role in this effort, as well as industry and academia. We will all perform together in this new vision."

This commemorative issue of *Spaceport News* looks back at the accomplishments of Apollo 11 and how the Center will gear up toward achieving the new vision.



APOLLO 11 astronaut Edwin "Buzz" Aldrin stands by the U.S. flag shortly after fellow astronaut Neil Armstrong took the first step on the Moon.



IN FUTURE DECADES after conducting thorough research on the Moon, NASA's next steps are to conduct robotic and human expeditions to Mars to search for evidence of life and to understand the history of the Solar System.

Center employees saw Eagle crew launch to history

The footprints around Tranquility Base lead back to KSC

By Kay Grinter
Staff Writer

On July 16, 1969, everyone employed at the John F. Kennedy Space Center reported to work with essentially the same job to do.

Among them were Kurt Debus, Center director; Rocco Petrone, director of Launch Operations and launch director for the countdown; Paul Donnelly, Launch Operations manager; Jack King, chief of Public Information; and Ron Woods, space suit technician, who all had the same assignment: to perform their individual roles of sending the first Moonwalkers safely on their way.

Jack King arrived in the firing room at 2 a.m., in time for propellant loading of the behemoth Saturn V on Launch Complex 39A. As the "voice of NASA," he was well practiced. He'd been countdown commentator since the Gemini IV launch.

More than 2,700 media representatives showed up to cover the launch, including the most well-known names in the business. In the newsroom in the city of Cape Canaveral, there was an efficient, organized chaos. Jack and his staff had been answering unending questions for days. Compared to this daunting task, being commentator was easy.

"The atmosphere was electric in the firing room," Jack recalls. "The countdown had only two minor glitches: a faulty instrumentation light and a leak in a liquid hydrogen replenishing valve for the third stage. We were 10 or 15 minutes ahead in the count all the way down, one of the smoothest in my experience.

"After Paul polled the team for the final 'go/no-go' status, he recited the Irish prayer, 'May the road rise up to meet you,' to the crew, but it was not broadcast. Back then, my voice was the only voice in the firing room heard over the airwaves.

"Our policy was to report what was happening in real time without embellishment. I ended every Apollo countdown with, 'We have liftoff,' recognizing the efforts of the launch team."

Today, Jack is a communications specialist for United Space Alliance at KSC.

Liftoff occurred exactly on time at 9:32 a.m. EDT. It was televised live to 33 countries on six continents, with an estimated 25 million viewers in the U.S. alone.

Following launch, the United Kingdom's *Daily Express* ran a story headlined "Ho Hum – Anyone for the Moon Today?" about how relaxed the astronauts appeared. Ron Woods was a space suit technician for ILC, the Apollo suit manufacturer.

"Basically, it was our jobs to ensure that the suiting process was a relaxing part of the prelaunch activities. At 23 years old, I was a lot more nervous than the astronauts," he recalls.

"That morning, I helped Buzz Aldrin don his suit, and rode out to the pad and up the elevator to the 320-foot level with the crew. I waited outside with Buzz for his turn in the White Room. He calmly watched the propellant venting and ice falling off the Saturn V."

Today, Ron is the government-furnished equipment representative in the JSC Orbiter Project Support Office and ISS Launch Site Integration Office at KSC.

THE VIEW of Apollo 11 from the Launch Control Center.

Four days into the mission, on July 20, Neil Armstrong stepped out onto the surface of the Moon at 10:56 p.m. EDT and pronounced, "That's one small step for man, one giant leap for mankind."

One-fifth of the world's population - 600 million people - watched live as he took that step. Ironically, Michael Collins, circling the Moon overhead, was not among the viewers. The Command Service Module was not equipped to receive television transmissions.

Although their surface stay was the shortest in the program - only 21 hours, 36 minutes - all objectives were achieved. Apollo 11 splashed down in the Pacific Ocean at 12:51 p.m. EDT July 24, a distance of 15 miles from the recovery ship *U.S.S. Hornet.*

JACK KING (left) served as launch commentator for the Apollo 11 launch. Ron Woods was a space suit technician for ILC, the Apollo suit manufacturer. Woods painted the picture behind him.

Infrastructure from Apollo to Shuttle evolved by quantum leap

By Jennifer Wolfinger
Staff Writer

Imagine an optical illusion portrait: At first, it appears to be made of endless dots of various sizes and colors. After studying it a little longer, the specks appear to move like charged molecules and shape into a concrete image.

In the case of the Space Program, those dots represent the processing of hardware. Once the steps are complete, a functional launch vehicle is sculpted and ready to foster its mission.

By pioneering the concept of mobile processing, the Apollo Program sketched the beginning of the processing that still shapes today's methods. The vehicle was primarily processed indoors in the Launch Complex 39 area.

"Most of the flight readiness was done here at Kennedy," said Bob Sieck, a NASA engineer who retired in 1999. "We had the vehicle for months, similar to an orbiter. When we went into the Vehicle Assembly Building (VAB), we didn't spend much time in there.

"When we left, we were ready to fly, with the exception of the hazardous gas, again similar to Shuttle."

In January 1969, Kennedy Space Center received the first hardware components. The hardware was assembled in the VAB. The lunar module arrived first. When combined with the remaining modules, the vehicle was known as Columbia.

IN JANUARY 1969, Kennedy Space Center received the first hardware components for Apollo 11. The hardware was assembled in the VAB.

The spacecraft was erected on the mobile launcher. On May 20, the vehicle, mobile service structure and mobile launcher began traveling along the crawlerway to the launch pad. Once at its launching destination, the processing didn't stop.

Workers constantly monitored Columbia and its supporting communication hubs.

Our modern flight readiness reviews and countdown demonstration tests were defined during the Apollo age, too. Conducted from the Launch Control Center, the launch team completed dozens of processing milestones, including system and altitude testing, and module and electrical mating.

Some repairs and modifications were made directly at the pad. From the mobile service structure, workers could access the vehicle to perform their work. During the Apollo 10 mission, insulation material loosened in the tunnel adjoining the command and lunar modules.

This insulation was stripped at the pad during Apollo 11. Workers also remedied a leaky valve and a faulty signal light.

Apollo workers began looking toward the future, as well. "I started working on Shuttle during Apollo," said the Apollo Program Office's Sam Beddingfield, who in 1969 became the first at the Center assigned to the Shuttle Program. "When we started the Shuttle, it was just one small piece of a much larger program."

Beddingfield, who retired in 1985, said one of the main differences between Apollo and Shuttle processing is the paneling of the Apollo rockets. "Shuttle had solid rockets, Apollo did not," he said, citing the importance of juggling personnel and growing requirements while utilizing existing resources.

Launch Complex 39 engineering manager Don Buchanan, who retired in 1981, described the change as a quantum leap.

"Lots of times, it's easier to start over than to use what's already there, but we had time to do it and saved a lot of money," he said. "The transition required using what we had, but some things were extensively modified, because we didn't have the same loads. It required beefing up the structures."

Aside from additions such as the Shuttle Landing and Orbiter Processing facilities, workers faced additional changes embracing the Shuttle Program.

"Dealing with high mileage hardware was the first issue. The rules for Apollo were simple," Sieck said. "It had to look new and perform like new. Like a car, with the Shuttle there's going to be wear and tear. We needed to make sure as hardware got older, the requirements kept pace with that.

"The hardware Shuttle deals with is more complex, older, has fewer resources, flies more often, and has less external commitment," he said.

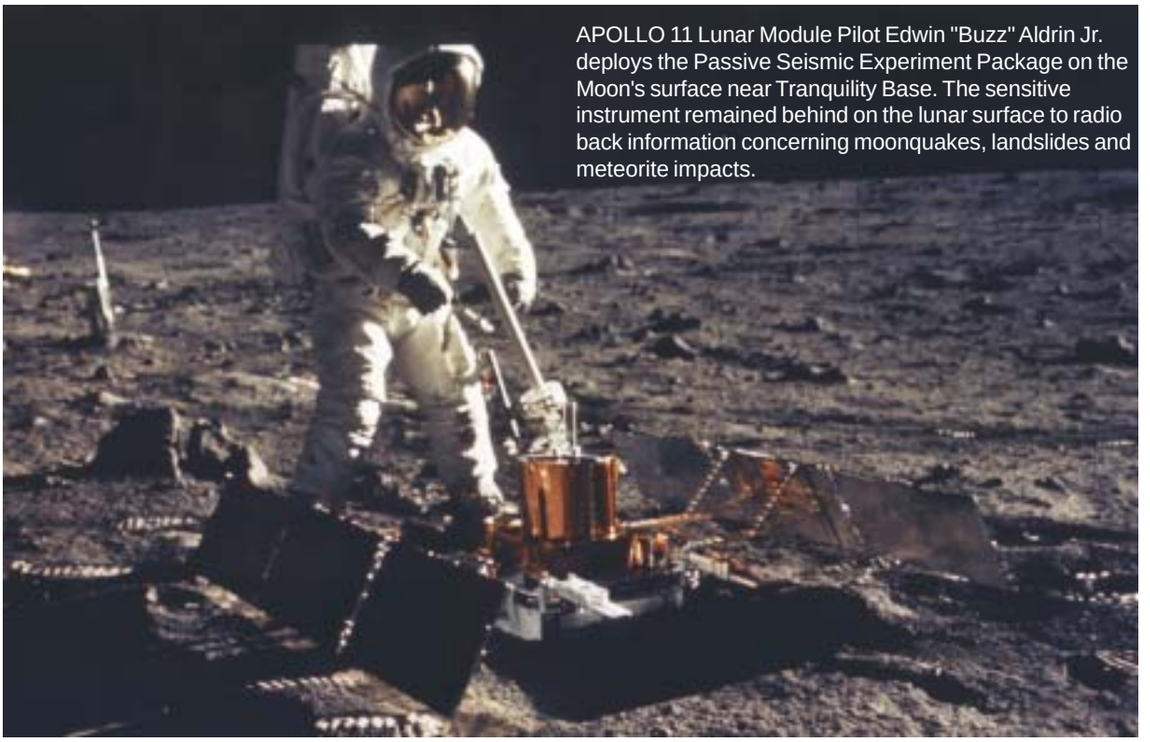
"But it's similar in that regardless of the badge, we were the same team and felt the same responsibility and pride."

ON MAY 20, 1969, the vehicle, mobile service structure and mobile launcher began traveling along the crawlerway to the launch pad. Once at its launching destination, the processing didn't stop.

Lunar leftovers of Apollo: Can we utilize them?

Astronauts and science experiments returned safely from the Moon. But what was left?

By Anna Heiney
Staff Writer



APOLLO 11 Lunar Module Pilot Edwin "Buzz" Aldrin Jr. deploys the Passive Seismic Experiment Package on the Moon's surface near Tranquility Base. The sensitive instrument remained behind on the lunar surface to radio back information concerning moonquakes, landslides and meteorite impacts.

By the time NASA's Apollo Program came to a close in December 1972, six crews of astronauts, six Apollo command modules, and more than 800 pounds of Moon rocks and lunar soil had been brought back to Earth. But some things were intentionally left behind.

Apollos 11, 12 and 14 through 17 each landed successfully in a different region of the Moon, and evidence of our visit remains at each landing site. There are portions of six spindly Lunar Modules, three electric Lunar Roving Vehicles and an array of scientific instruments.

Weight limits forced so much material to be left on the Moon. "The more they threw out, the more rocks they could bring back," explained Stan Starr, deputy project director and chief engineer with Dynamac at Kennedy Space Center.

The lower half of the Lunar Module (the descent stage) allowed the crew to land on the Moon and served as a launch pad when crews left the lunar surface.

An American flag was implanted at each landing site, and commemorative plaques were affixed to one leg of each Lunar Module bearing the message that humans from Earth visited with peaceful intentions.

Apollo science was dedicated largely to lunar geology. Seismometers, instruments that detect and measure moonquakes and meteor impacts, were left by each lunar landing crew. Once they were no longer needed, the Lunar Module ascent stages were deliberately aimed at the lunar surface to provide scientists with a controlled seismic event.

Other instruments monitored lunar gravity changes and temperatures beneath the surface. A wide variety of geological tools, such as long-handled scoops, core tubes and other gear also were discarded.

The lunar crews even left behind most of their cameras, through which millions of people shared in these missions from Earth, and conserved space by bringing home only the film. Apollo 16 also left a gold-plated extreme ultraviolet telescope that performed the first astronomical observations from another heavenly body.

Apollos 11, 14 and 15 left behind Laser Ranging RetroReflectors that are still working after three decades. These arrays provide information about the distance to the Moon and how that distance expands over time. The reflectors are so small that aiming lasers at them from Earth is like using a rifle to hit a moving dime two miles away.

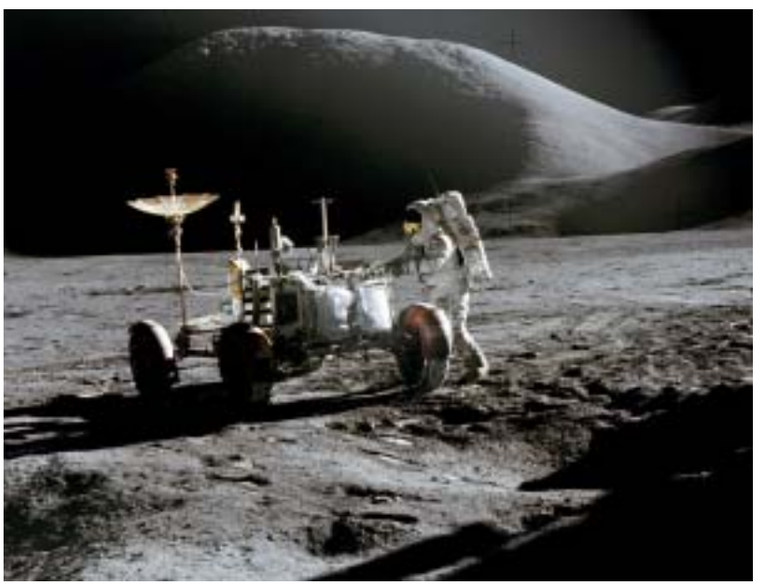
The astronauts had some fun, too. Alan Shepard, commander of Apollo 14, hit three golf balls that still remain in the Moon's Fra Mauro region.

The nation's Vision for Space Exploration calls for NASA to return to the Moon as a stepping stone toward Mars and beyond. Could any of the abundant materials left on the Moon from the Apollo Program have any use?

"Astronauts could potentially replace the batteries in the rovers and reuse them, if their gears and other moving parts are not full of dust," Starr said. "Perhaps they could recharge the oxygen and carbon dioxide scrubbers in the Apollo backpacks, or get some use out of the helmets and gloves.

"But after all this time on the surface, dust could have gotten into everything. Use of this equipment would require careful analysis and planning, since it wasn't designed to be reused."

In the meantime, the hardware we left behind will remain exactly where we left it, waiting in the dusty silence for us to return.



APOLLOS 11, 12 and 14 through 17 each landed successfully in a different region of the Moon, and evidence of our visit remains at each landing site, including three electric Lunar Roving Vehicles.

Apollo's small steps are giant leap for modern technology

Spin-off technology helps us work and play

By Charlie Plain
Staff Writer

Ask most people to name consumer products that were originally designed for the Apollo missions, and they'll mistakenly mention Tang and Teflon.

While Tang and Teflon didn't come from NASA, the Agency has developed many items we use every day without ever realizing their fascinating origins. The lunar era helped to create products most of us would be surprised NASA had anything to do with and that we probably wouldn't like living without. These items protect us, increase performance and make work easier.

Working in the hostile, airless environment of space, Apollo astronauts needed equipment for doing a tough job under unforgiving circumstances. Like working in space, firefighting also requires specialized equipment to keep fire crews safe.

Before 1971, the average weight of a firefighter's breathing system was more than 30 pounds. With that amount of weight on their backs, firefighters were battling their equipment along with the flames.

Frequently, the added weight was so taxing that some opted to attack the flames without their breathing systems.

That all changed when engineers at NASA's Johnson Space Center in Houston began a program at the request of the nation's fire chiefs to adapt space suit life-support systems for use by firefighters. Four years later, the engineers had a design that weighed one-third less and offered a greatly improved fit and better visibility than the previous system.

Fire departments across the country were quick to adopt the new system, enhancing the safety of the dangerous job.

Since the Apollo era, millions of people worldwide have literally been walking in the shoes of the astronauts. Thanks to clever space suit design, athletic shoes took a major leap forward in quality by incorporating manufacturing and design processes used in NASA's suit construction.

A TECHNICIAN with United Space Alliance works inside orbiter Discovery before power-up of the vehicle in the Orbiter Processing Facility. He uses a cordless power tool made possible from NASA's spin-off technology. These convenient tools help disassemble, inspect and modify systems onboard the Shuttle fleet, where working space is sometimes at a minimum.

NASA changed running shoe construction quite truly where the rubber meets the road. A process known as "blow rubber molding" used in producing helmets was applied to create hollow running-shoe soles designed to be filled with shock-absorbing materials. Following the establishment of this new molding process, former NASA engineer Frank Rudy pitched an idea for a suitable shock absorber to the Nike Corporation.

Rudy's concept used a pad made of interconnected air cells placed under the heel and forefoot to cushion the blow. Sound familiar? With Rudy's pitch, Nike Air was born.

Thanks to the Moon missions, Black & Decker was able to pair cordless electricity with elbow grease and make the job of building America easier than ever. While on the Moon, astronauts were tasked with gathering soil and rock samples for analysis back on Earth.

To help them, NASA asked Black & Decker to build a special drill for boring into lunar rock. The drill had to be small, lightweight and, most importantly, battery powered.

Black & Decker's new drill proved to be a fantastic success and spawned the development of cordless tools for the medical, manufacturing, building and home consumer industries.

Beyond the advancements in science and space flight, the Apollo Moon missions blew open the door for new and practical inventions that revolutionized how we live, work and play.

Thanks to the Moon missions, Black & Decker was able to pair cordless electricity with elbow grease to make the job of building America easier.

AS COMMERCE develops on the Moon, tracts of the lunar surface will be dedicated to various industries such as lunar oxygen production, communications and helium 3 production. Only time will tell what the next technological discovery related to space travel will be.

Apollo 11: One small step for man lead

While Apollo 11 sat on Launch Complex 39A July 16, 1969, an estimated half-million people flocked to the Space Coast for a glimpse of history. When liftoff occurred at 9:32 a.m., the world stopped in its tracks to view the powerful 363-foot Saturn V rocket zoom toward the Moon's surface.

The rocket's first stage and its fuel were over 75 percent of its total weight, with the main engines burning more than four million pounds of fuel in two and a half minutes. Once the rocket cleared the launch tower, the team at Kennedy Space Center was estatic and knew they helped write a new chapter in the history of space flight.

On July 20, at approximately 10:56 p.m. EDT, astronaut Neil Armstrong stepped on the Moon's surface and said those words that will live forever: "That's one small step for a man, one giant leap for mankind."

When President George W. Bush announced the Vision for Space Exploration on Jan. 14, NASA immediately began using a "building block" strategy to explore destinations around our Solar System. "This cause of exploration and discovery is not an option we choose; it is a desire written in the human heart," Bush said.

ABOVE, the massive 3,000-ton Saturn V rocket makes its way out of the Vehicle Assembly Building and toward Launch Complex 39A.
Below, Apollo 11 astronauts (from left) Neil Armstrong, Michael Collins and Edwin "Buzz" Aldrin.

Apollo 11 Firsts

* Crew assisted landing on the Moon and return
* Lunar surface extravehicular activity
* Human footprint on lunar surface (Armstrong's left foot)
* Seismometer and laser reflector deployed on the Moon
* Solar wind experiment deployed on the Moon
* Lunar soil and rock samples returned to Earth
* Test of landing radar and systems on Lunar Module under operational conditions
* First meal on Moon consisted of four bacon squares, three sugar cookies, peaches, pineapple-grapefruit drink and coffee.

Remembering 1969

• Richard Nixon is preside
• U.S. population is approximately 202,677,00
• *Midnight Cowboy* wins ' Picture' Oscar movie awa
• Children's Television Workshop introduces *Ses Street*
• Simon and Garfunkel w 'Record of the Year' Gra music award for *Mrs. Rob*
• Judith Ford from Illinoi crowned Miss America
• The first in vitro fertiliz of a human egg is perform Cambridge, England
• The scanning electron microscope is developed
• The use of the chemical is banned in residential ar

d to one giant leap for NASA's future

rises over the lunar horizon.

TOP LEFT: Workers at the KSC Launch Control Complex immediately celebrated Apollo 11's successful launch on July 16, 1969.

ABOVE: President Richard Nixon welcomes the Apollo 11 astronauts aboard the *U.S.S. Hornet*. Already confined to the mobile quarantine facility are (from left) Neil Armstrong, commander; Michael Collins, command module pilot; and Edwin "Buzz" Aldrin, lunar module pilot.

A LUNAR CREW refills the propellant tanks on its spacecraft with oxygen produced on the Moon in this artist's concept. This would allow the astronauts to return directly to Earth, reentering the atmosphere in the conical crew module and touching down at a prepared landing site.

KSC MANAGEMENT gather in the Centerís television studio to watch the address by President George W. Bush at NASA Headquarters in Washington, D.C., stating his goals for NASA's new mission: Completing the International Space Station, retiring the Space Shuttle orbiters, developing a new crew exploration vehicle, and returning to the Moon within the next two decades.

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Lesson from Apollo 11 guided later missions to Moon

By Linda Herridge
Staff Writer

AS FOR THE future of America's Vision for Space Exploration, lessons can be learned from the Apollo days. The same kind of effort it took to get to the Moon in the 1960's is needed once again.

Historically, the Apollo 11 mission and lunar landing was a spectacular success. Previous Apollo missions helped lay the groundwork for what is referred to in the book *Milestones of the First Century of Flight* as the "pinnacle of the U.S. Space Program."

The lessons learned from the first lunar landing were invaluable to the success of the six lunar missions that followed. Like building blocks, the steps to achieve the goal of putting a man on the Moon fell into place.

Beginning with Apollo 11, men left the confines of the Earth's gravity and traveled to the Moon. They went to explore, to continue the dream of discovery, and then, miraculously, returned safely to Earth.

What did NASA learn from Apollo 11? In the NASA publication, *The First Lunar Landing ñ As Told by the Astronauts*, a transcript of the first post-Apollo 11 news conference on August 12, 1969, Commander Neil Armstrong, Lunar Module Commander Buzz Aldrin and Command Module Commander Michael Collins shared some of what they learned.

After lunar touchdown, Aldrin said they found it necessary to vent the fuel and oxidizer manifolds quite a bit earlier than they'd planned. Armstrong also added that it took longer to depressurize the lunar module then anticipated.

"It also took longer than expected to get the cooling units in our backpacks operating," Armstrong said. In all, it took the astronauts nearly an hour longer than predicted to leave the lunar module and step onto the Moon's surface.

Aldrin said it would have been nice to have more mobility in the Extra Vehicular Activity suits, with more dexterity in the arms and fingers. NASA took all the information into account for future Apollo missions, he added.

APOLLO 11 astronaut Buzz Aldrin said it would have been nice to have more mobility in the Extra Vehicular Activity suits, with more dexterity in the arms and fingers. NASA took all the information into account for future Apollo missions.

According to the crew, practicing a lunar landing in a simulator greatly differed from accomplishing the real thing.

Charlie Duke, who flew on Apollo 16, was the capsule communicator for Apollo 11. In a post-mission interview, Duke said there were communications and telemetry dropouts and the tracking wasn't quite right, because there wasn't a clear understanding of the gravity anomalies on the Moon at the time.

Explaining what the mission meant to the country, Collins said it was "a technical triumph" because NASA "said what it was going to do and then, by golly, (did) it just like we said we were going to."

He added, "I think, long term, we find for the first time that man has the flexibility or the option of either walking this planet or some other planet, be it the Moon or Mars, or (beyond)."

According to Sam Beddingfield, who worked in the Apollo Program office, the mission was the first of its kind. When problems arose, the crew and those in mission control on the ground were required to make changes in the middle of the mission without preparation.

Paul Donnelly, who was the launch operations manager in the firing room, said knowledge from previous missions helped Apollo 11 become a success. "It's important to understand that the processing and launch of Apollo 9, 10 and 11 were each only 60 days apart," he added.

JoAnn Morgan, retired director of Kennedy Space Center's External Relations directorate, was an instrumentation controller and the only woman on console in the firing room during the Apollo 11 liftoff.

According to Morgan, summer launches were vulnerable to the storms, which could damage electronics on the Launch Umbilical Tower and the Pad Terminal Connection Room.

"We had learned on previous missions the importance of systems checks after lightning hits on the pad and what had to be retested," Morgan said.

As for the future of America's Vision for Space Exploration, lessons can be learned from the Apollo days, according to Bob Sieck, a retired Shuttle project manager. The same kind of effort that it took to get to the Moon in the 1960's is needed once again.

And above all, the return to the Moon must be a grassroots effort, with a dedicated workforce and support from the government and the country.

Time for U.S. to return to Moon and explore beyond

By Matthew Cavagnaro
Staff Writer

NASA's first trips to the Moon were set against the backdrop of the Cold War. It was a rivalry that led to the most incredible achievement in the history of mankind: We put a man on the Moon.

So why return?

The Moon is our first step to the cosmos. The equipment we use on our journeys into the universe will be critically important to our success. We need to make sure our systems are well-tested before we venture out into the unknown, and there's no better way to do that than by returning to Earth's lone satellite.

The Moon has a lot of Helium-3 just below its surface. This atom is a potentially valuable resource in creating nuclear power through fusion. Nuclear fusion promises to be a tremendous source of clean energy in the future.

Water ice, found on the lunar poles, is also promising for developing a manned presence on the Moon. And those are only some of the things we know about.

Just imagine the possibilities. The Moon's gravity is one-sixth that of Earth's. Launching from the lunar surface will use far less fuel than launching from Earth. Combine that with the possible fuel we can create by mining the Moon, and you've got an excellent case for a lunar space center.

Our first missions to the Moon are scheduled to begin in 2008 with a robotic orbiter. The probe will scout out the location of lunar resources, and help NASA determine the best place to start landing.

America's Vision for Space Exploration involves collaboration between robotic and human explorers. NASA will pave the way for manned landings by starting to land probes on the lunar surface no later than 2008.

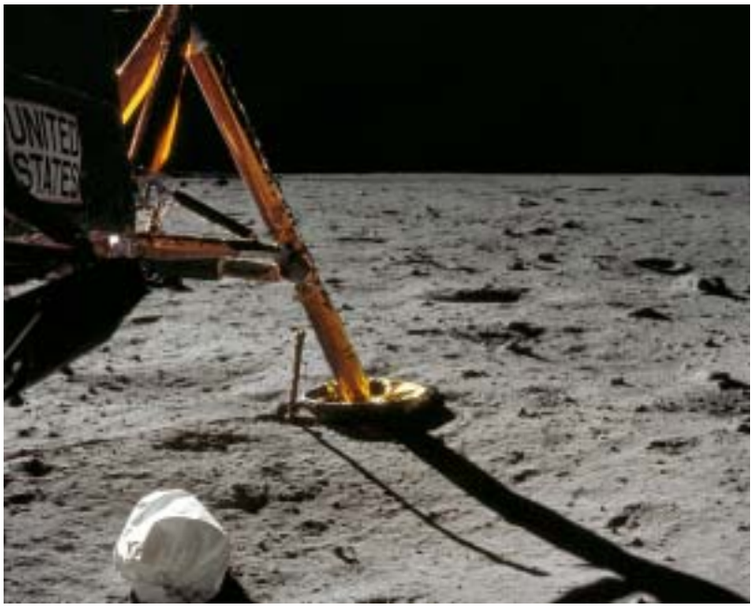
As early as 2015, "the Eagle" will land once again. NASA astronauts will return to the Moon and begin testing the hardware and skills needed to survive during missions to much more distant locations.

The Moon is an ideal place for this kind of "exploration testing," because it's a foreign world, but not too far from our home planet.

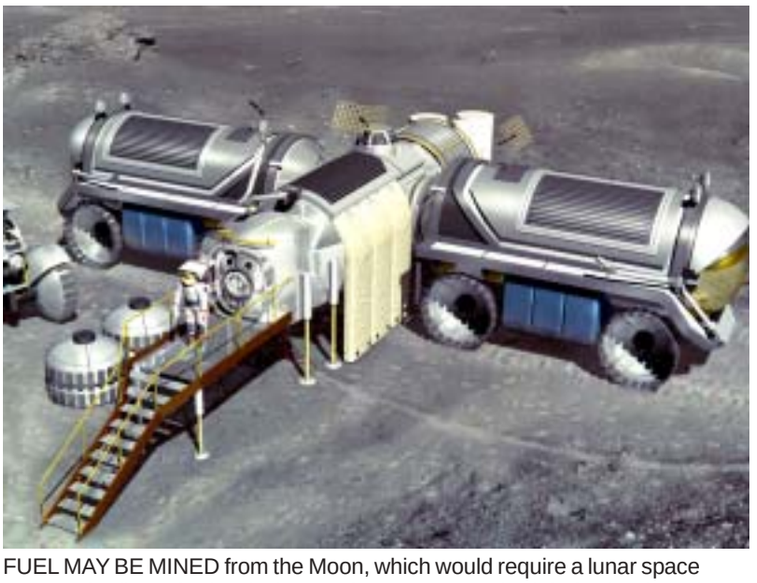
The lunar base we establish will be a model for what we do on Mars and beyond. What's the best way to use a planet's resources? How should we generate power? What kind of vehicles should we use? The Moon is a perfect place to answer those questions.

We don't yet know exactly what we'll do on the Moon. The picture of our future manned lunar base will begin to appear more clearly as robotic probes return data and give us a better understanding of what we can and can't do. The Vision for Space Exploration is a "living" concept: As the technology evolves, so will our plans for planetary exploration.

However, one thing is for certain: Once we establish ourselves with a permanent, manned presence on the Moon, the sky is no longer the limit.



APOLLO 11 astronaut Neil Armstrong's first photo after setting foot on the Moon. The Moon's gravity is one-sixth that of Earth's, meaning a launch from the lunar surface would require far less fuel.



FUEL MAY BE MINED from the Moon, which would require a lunar space center. The first robotic missions to the Moon are scheduled to begin no later than 2008, with manned mission to occur as early as 2015.

Next Moon-walkers will follow footsteps, create new path

By Corey Schubert
Copy Editor

MISSION SPECIALIST Winston Scott (left) conducted the second extravehicular activity on mission STS-87.

ABOVE, Scott (left) presents a NASA flag flown at the KSC Space Life Sciences Lab to NASA Administrator Sean O'Keefe. The flag was flown during construction through the dedication of the Lab.

Their hearts will pound with the same excitement. Their eyes will widen with the same wonder. Their footprints likely will even look the same on the Moon as those left by similar space boots.

But as tomorrow's astronauts take their own first steps on that cold, rocky planet, their goal will greatly differ from the historical touchdown on Earth's lone satellite 35 years ago.

The Apollo 11 mission taught the world that mankind can achieve moments of greatness, even when our reach appears to exceed our grasp. And while the historical trip of trailblazers Neil Armstrong and Edwin "Buzz" Aldrin Jr. was a short one, the next NASA astronauts who travel to the Moon are expected to stay awhile.

They'll start with lunar missions for increasingly extended periods as early as 2015, according to the nation's Vision for Space Exploration. Astronauts will develop new technologies on the Moon and use its resources for even more ambitious travels to Mars and exciting worlds beyond.

"When we return, we'll be establishing a true research capability on the Moon," said Capt. Winston Scott, executive director of the Florida Space Authority. Scott was a mission specialist on STS-72 Endeavor in 1996 and STS-87 Columbia in 1997.

The next Moon-walkers will focus on making those who come after them feel truly at home, and help man reach even farther into the heavens.

NASA's newest class of astronauts, the first focused from the start on fulfilling the nation's new vision, will play a pivotal role in laying the groundwork for this plan.

Unlike the nation's first space explorers who primarily needed to be excellent pilots, astronauts now must have skills in robotics, biology, medicine and other related fields to achieve new and important goals in space.

"We are no longer focused specifically on traveling from point A to point B and back again," Scott said. "Our missions now involve research, exploration and learning, along with the space travel."

His words were echoed by Dr. Sam Durrance, executive director of the Florida Space Research Institute.

"Apollo 11 was well designed and choreographed, but its goal was to land and come back," said Durrance, who served as an astronaut on STS-35 Columbia in 1990 and STS-67 Endeavor in 1995.

"We'll be going to the Moon this time to learn how to use the resources there," Durrance said. "It's more about developing exploration concepts, with a view toward Mars."

Scott said the nation's cultural attitudes have grown since the Apollo 11 flight.

Women are now well-represented among astronaut classes, along with people of all races and ages. The Agency also has advanced by teaming with international space agencies to share scientific and technological resources that help everyone on Earth.

"I suspect when we go to the Moon, our international partners will play a part in that," Scott said.

Regardless of their mission, the characteristics that fuel the minds of astronauts throughout the ages won't change, he said. NASA will continue to rely on people who love and respect space exploration to accomplish the nation's goals.

And when astronauts step onto the Moon's surface again, they'll be inspired knowing they walk in the footsteps of the space travelers who cleared their way.

CURRENT EXECUTIVE director of the Florida Space Research Institute Dr. Sam Durrance shares stories of his experiences as a Shuttle astronaut with enthralled students in a classroom at Oscar Patterson Elementary Magnet School in Panama City. Durrance joined Center Director Jim Kennedy in a visit to the Florida NASA Explorer School to share America's new Vision for Space Exploration with the next generation of explorers.

Scientists make it easier to flourish in space

By Anita Barrett
Staff Writer

RAY WHEELER, a plant physiologist, checks the growth of radishes in a plant growth chamber at the Space Life Sciences Laboratory. These radishes, plus onions and Bibb lettuce, are being grown using hydroponic techniques.

As early as 1947, rocket engineer Werner von Braun proposed sending a fleet of 10 ships to Mars to explore and return a year and a half later. His vision didn't die, but it did change over the next 20 years.

In 1969 he made a presentation to President Richard Nixon about a Mars mission, utilizing nuclear shuttles. Now NASA again looks to Mars as it adopts America's space vision of returning to the Moon and launching to Mars and beyond in the decades ahead. While von Braun and others have focused on the hardware and technology – still major components – more mundane realities remain equally as important.

How and what do space travelers eat and drink? How will they live on other planets? How will they heat, cool and light their dwellings?

Kennedy Space Center's Space Life Sciences Lab is working to answer some of those questions.

"Our research has always been focused on the future of space travel and landings on the Moon and Mars," said Ray Wheeler, a plant physiologist at the SLS Lab.

Wheeler and his colleagues are researching growing plants to provide food, clean water and oxygen in space. The lab is currently testing plant growth under different types of light, such as LEDs, different CO_2 concentrations, and temperatures.

Most of the plants are grown using hydroponic techniques, but other tests study plant growth on recycled wastewater and nutrients. The development of a "Mars greenhouse" is a project originally begun by Wheeler.

It is now under the auspices of the University of Florida in Gainesville, which established a new Center for Space Agriculture and Biotechnology Research and Education (SABRE) within its Institute of Food and Agricultural Sciences. Researchers are working on greenhouses that operate at reduced pressures and allow plants to be grown on the martian surface.

Researchers face many challenges in understanding the reliability of food production systems: Can the plants perform reliably for a three-year mission? How are plants affected by high radiation? Do they grow in predictable ways? What kind of lighting is needed? Will it be tied to a wastewater system? What materials will withstand the martian environment ?

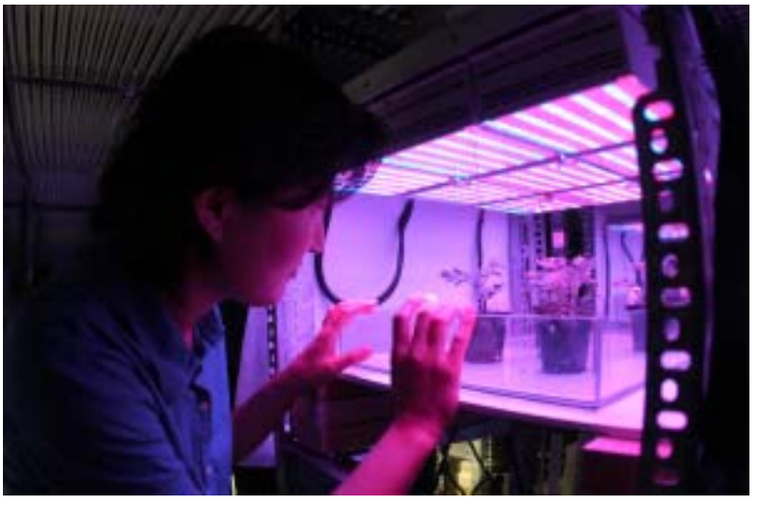
Wheeler emphasized the protocol needed for such research. "For a three-year mission, for example, we would need to conduct a three-year study [in growing and using plants], plus time to repeat the test," he said.

UF's SABRE team is also proposing testing plant growth directly on Mars. Researchers plan to send seeds from the *Arabidopsis* plant to the Red Planet in an automated greenhouse the size of a toaster aboard a Mars lander. Once on the surface, the lander would scoop up Martian soil and place it in the greenhouse, where the seeds can take root.

The SABRE researchers are also considering what is needed to build larger greenhouses for manned bases on the Moon and Mars. For more details about this topic, visit the Web site **http://science.nasa.gov/headlines/y2004/25feb_greenhouses.htm**.

Other research projects at the SLS Lab include wastewater purification and solid waste bioconversion. Dick Strayer, a microbiologist, uses a rotating composter to study denitrification and waste degradation, in which organisms use nitrate instead of oxygen to break down the waste and produce nitrogen as a byproduct.

America's vision for space has not altered the direction of research at the SLS Lab. "It offers the opportunity to do unique research," said Wheeler, "and generates enthusiasm we haven't seen before."



IN THE KSC Space Life Sciences Lab, Dr. Hyeon-Hye Kim checks plants in a plant growth chamber being tested under various light conditions. Other plant research includes different CO_2 concentrations and temperatures.

Apollo astronaut Gene Cernan's wish will come true

By Jeff Stuckey
Editor

When Apollo 17 astronaut Gene Cernan stated, "I don't want to be the last man on the Moon," it was a challenge to the Nation that went untested until last January when President George W. Bush unveiled a new path of exploration for the country. Now, as the Agency moves forward with the Vision for Space Exploration, Cernan is proud of his prophetic statement.

"When we came back to KSC in January of 1973, the media continually asked me what it felt like to be the 'tail end of the dog,' and other comments I did not care for about the space program," he said. "I told them that Apollo 17 was not the end, it is the beginning of a whole new era in the history of mankind.

"At the time, I told them not only are we going back to the Moon, we'll be on our way to Mars by the turn of the century."

Cernan is excited the president wants NASA to continue its path of exploration.

"I've been a Moon and Mars advocate for 25 years, so my glass has been half full, quite frankly, until the president articulated his new vision of going back to the Moon and on to Mars," he said. "It's not the destination that counts as much as it is the direction.

"I think the time is now for NASA to redirect its resources technically, financially and intellectually in a direction that makes us a space-faring nation. NASA is the spearhead into the exploration of space."

Craig Steidle, NASA's associate administrator for Exploration Systems, already laid this Center's foundation when he visited KSC in May and confidently stated, "This is certainly the operations center of the future. It is also the Center around which we will develop those technologies for life-cycle support of our systems and our infrastructures in the future."

KSC Director Jim Kennedy was a 19-year-old college student working as a summer intern at the Center during the Apollo 11 mission. One of his responsibilities was to drive various dignitaries from airports in Orlando, Melbourne and Daytona to KSC for the launch.

"I remember being a part of that group of co-ops in Daytona, and management decided that one of us had to stay behind on launch day in case there was a late arrival," Kennedy said. "I drew the short straw, so I watched the Apollo 11 launch from Daytona.

"I then remember watching the Moon landing on television and celebrating with the rest of the world, because as a co-op student it was exciting to be a small part of a big deal."

Kennedy is also thrilled about what the future holds for KSC. He understands there will be concerns as our role evolves.

"We will focus on the ability to execute the numerous activities that will be going on as we find ourselves stepping into the new world order of space exploration," he said. "If we stick to the current plan and use the Shuttle to finish the International Space Station in the 2010 time frame, there may be a slight gap in space flight activity. A couple of years later we could be flying people to the Moon.

"We will also be flying something in the 2008 time frame to demonstrate the flight readiness of the Crew Exploration Vehicle," Kennedy said. "The bottom line is we're already being factored in as part of the future vision equation.

"As was the case with the Mercury, Gemini, Apollo, Space Shuttle and other NASA programs, I'm confident our workforce can successfully achieve the challenges ahead."

DURING AN ANNIVERSARY banquet at KSC's Apollo/Saturn V Center honoring the people who made the entire Apollo program possible, former astronauts Neil Armstrong (left) and Gene Cernan talk about their experiences.

APOLLO 11 launches from Kennedy Space Center on July 16, 1969.

John F. Kennedy Space Center

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