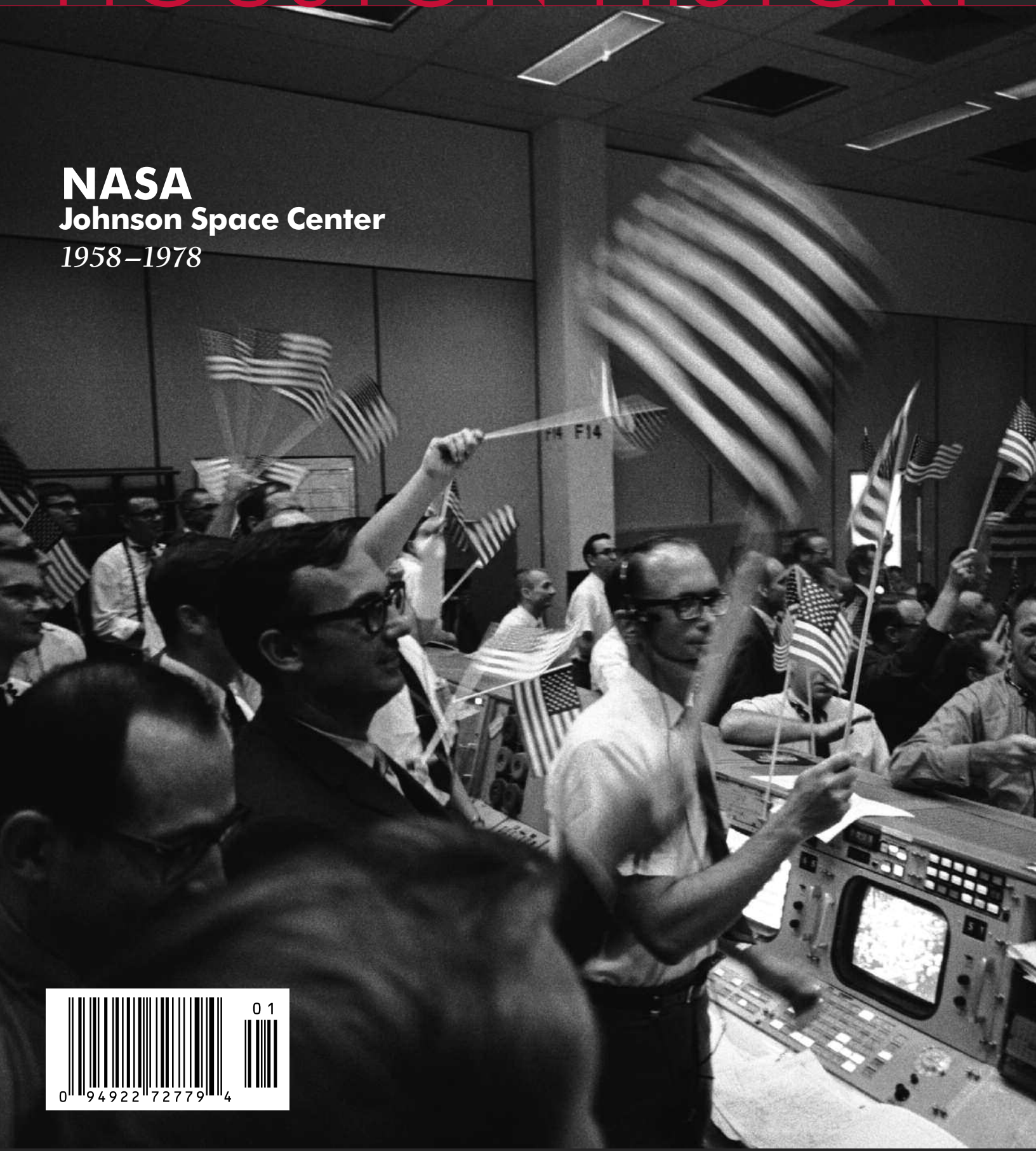
VOLUME 6 • NUMBER 1 • FALL 2008

HOUSTON HISTORY

NASA
Johnson Space Center
1958–1978



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VOLUME 6 • NUMBER 1 • FALL 2008

HOUSTON HISTORY

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Editorial Policy
Houston History is published three times a year by the Center for Public History at the University of Houston. We welcome manuscripts, interviews, and photographic essays on the history and culture of the Houston region, broadly defined. All correspondence should be sent to *Houston History*, University of Houston, Department of History, 524 Agnes Arnold Hall, Houston, TX 77204-3003 (713-743-3123). The Web site is *http://www.history.uh.edu/houstonhistory*. We also welcome ideas for topical issues; these can be sent to the above address or to *HoustonReview@uh.edu*.

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FROM THE EDITOR

To many of us old-timers the cover photograph brings back fond memories from the summer of 1969. What a moment it was to watch Apollo 11 land on the moon. On television screens around the world, citizens of planet Earth watched in awe as the drama unfolded. The Lunar Module made its way down to the moon's surface. After a safe landing came the magic words: "Houston... the *Eagle* has landed." Then came the stunning images of the "small steps" of the astronauts onto the moon. When the astronauts successfully returned to Earth, the scene shifted back to the Mission Control Center and those of us who lived in the region felt a special joy in the celebration of our fellow Houstonians.

Forty years later, we return to the joy of that moment and the excitement of the early years of the American space program. The Johnson Space Center (JSC) has been good to the Houston area, providing jobs, technical expertise, prestige, and a global identity as "Space City, USA." In celebrating fifty years in the history of NASA, this issue of *Houston History* focuses on the first twenty years of the space program, from the creation of NASA in 1958 to the naming in 1978 of a new group of astronauts who have flown many of the space shuttle missions. We also focus on the human side of JSC. The successes of the space program were, after all, shaped by our neighbors, not by supermen. Although a select few of these neighbors spent brief moments of their lives above us in space, for the most part, the astronauts and those who worked to put them on the moon lived among us while working and training for their missions.

The astronauts were, of course, the stars of the show. As a boy growing up in the early 1960s, near Houston, my world revolved around baseball and the space program. Mickey Mantle and Willie Mays were my heroes on the diamond, but they vied for my attention with Mercury astronauts Alan Shepard, Jr., and John Glenn. I began reading newspapers to follow the Yankees and the Cardinals, but I started to read the rest of the paper and watch the news on television to follow the "space race."

The astronauts seemed then, and now, to be "real American heroes." They looked as if they had come right out of central casting. I saw them as the equivalent of John Wayne and James Arness of *Gunsmoke* fame, but I was old enough to realize that the astronauts were not actors. They had to muster real courage to stand up to the real dangers they faced. They were the chosen few who had earned the enviable chance to be among the first humans to fly into space; yet, they seemed down-to-Earth in their enjoyment of the camaraderie of the "family" of astronauts and technical specialists at NASA.

Like most of my fellow Americans, I understood that they represented me and my nation in a struggle that transcended space. In an age of bomb shelters and "mutually assured destruction," the Cold War held the very real dangers of nuclear war for the U.S. and the world. The space programs of the U.S. and the Soviet Union became symbols of the strengths of the two competing systems. The space race obviously had far more than symbolic implications for the future of our country since it promised a new generation of technology with direct application in future wars. In this atmosphere, the early television accounts of the nation's first ventures into space were early versions of reality T.V. at its most riveting, most meaningful best.

The space program became even more exciting to me when it moved to Houston. From the announcement in September 1961 that our city had been chosen as the site of the Manned Spacecraft Center (later renamed Johnson Space Center),

Houston History *focused its Spring 2007 issue on a Texas icon—the San Jacinto Battleground—and held an event at the Monument for the release of that special volume. Rebecca Wright, JSC History Coordinator, attended and, upon arrival, was greeted by one of the organizers who expressed surprise that someone from NASA would find Texas history interesting. Her response: "But we (NASA)* ***are*** *Texas history."*

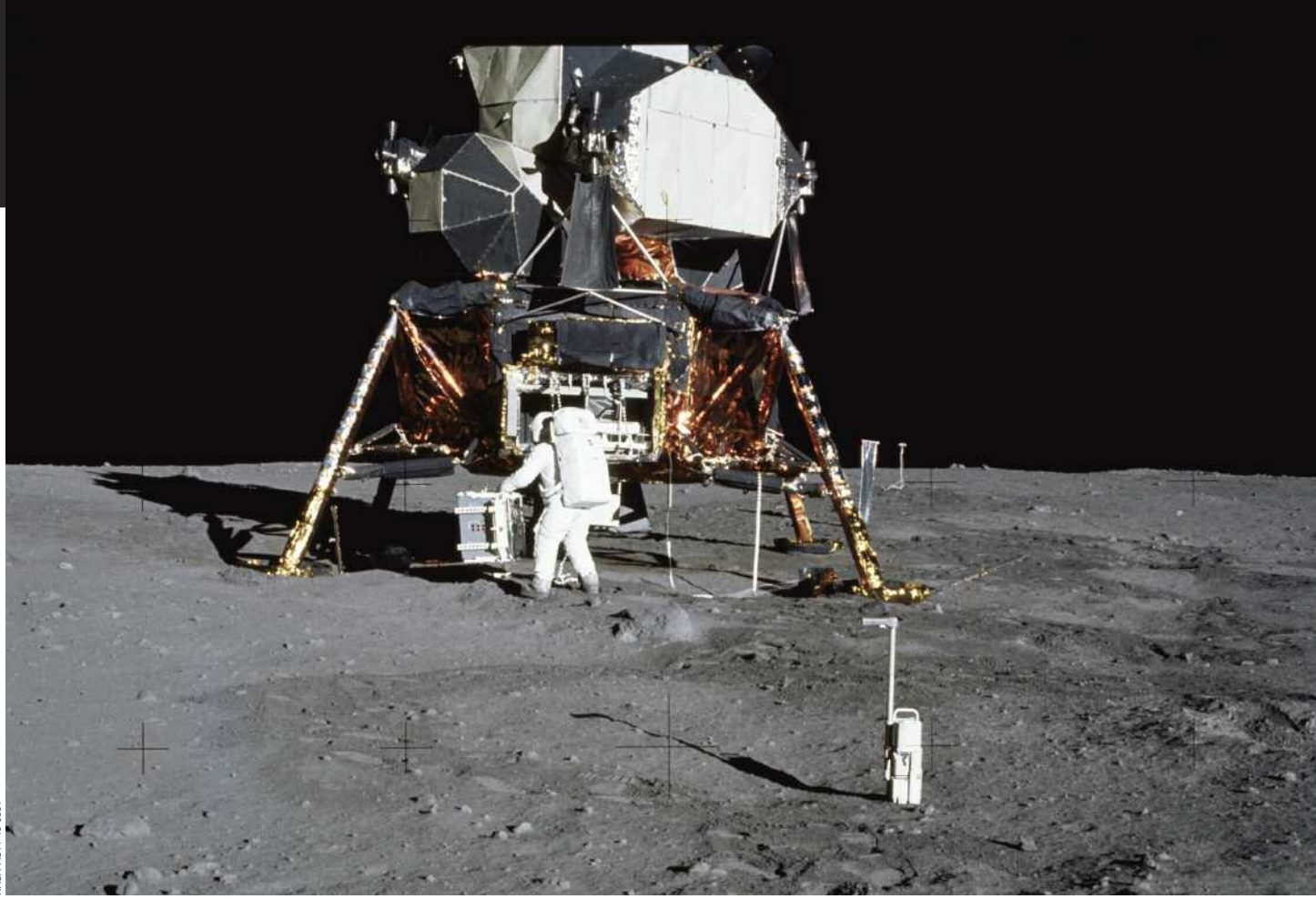
At that moment, Wright proposed the idea for an issue featuring the agency that brought "Space City" fame to Houston and would reflect on contributions from some of the Houstonians who helped create the avenue to the moon and the foundation for space history to follow.

To achieve this goal, Rebecca Wright served as the guest editor for this NASA issue. Contributing the NASA-related articles were Mike Coats, JSC Center Director; Christopher C. Kraft, former JSC Director; Sandra Johnson, Dr. Jennifer Ross-Nazzal, and Jessica Cannon from the JSC History Office; Shelly Henley Kelly and Dr. Deborah Griffin from the University of Houston – Clear Lake; Burton Chapman, independent writer from Pearland.

The photos selected show the dedication and commitment in meeting technological challenges, and assisting in identifying these images was Eliza Johnson from JSC Still Imagery Repository. Putting all of the materials together in its engaging design was Perry Jackson from JSC Graphics and working closely with him was editor Susan Breeden.

A special thanks is given to the management of the JSC Information Resources Directorate who supported the efforts for this publication in numerous ways; the management of the JSC JIMMS Contract; and Duane Ross, Senior Advisor to the JSC History Office.

Most importantly, many thanks go to the thousands of individuals who, at NASA, have inspired generations to look beyond today and explore for tomorrow.



NASA AS11-40-5931

Astronaut Buzz Aldrin unpacks experiments from the Apollo 11 lunar module,* Eagle*, July 20, 1969.

I joined most people in the region in welcoming the space program as a hometown endeavor. The astronauts quickly arrived here for training. Several years later, the newly completed Mission Control Center became a television soundstage of sorts, as mission after mission brought the familiar television image of this small room filled with experts in direct communication with the astronauts.

When I enrolled at Rice University in 1966, the campus bustled with space-related activities. I had never been to Clear Lake before starting college, but I remember the thrill of seeing the signs pointing the way to NASA from the Gulf Freeway on my first trip down to Galveston. In those years, students crowded into the television room in the dorm, at times, to watch reports on missions. Years later, seeing the giant Saturn rocket on display at JSC and touring the original Mission Operations Control Room was a special treat that reminded me of the excitement—and the audacity—of the Apollo Program.

JSC remains prominent in my life. In Friendswood, an old Quaker community near Clear Lake where I have lived for more than twenty years, the space program is everywhere. My wife has regularly taught the children of astronauts and engineers during her career as a fourth-grade teacher. My daughter's first soccer team, after we moved to the area, was named "Gemini" and was coached by a NASA engineer. The tragedy of the Space Shuttle *Columbia* directly affected many in the Clear Lake area who work for NASA. By happenstance, substantial debris from the orbiter came back to Earth and landed in the pine forest in front of my grandfather's home in Hemphill, Texas.

Of course, my experience is not unusual, since the size and importance of NASA in our region make it a significant part of the fabric of life in Houston. It has been an instrumental part of the growth and diversification of the regional economy. It gave us the name of our major league baseball team and of the Astrodome, while inspiring the design used on some of the ugliest baseball uniforms in the history of sports. It has also provided a symbol of the "can do" spirit that Americans, in general, and Houstonians, in particular, embrace as a central part of our character.

Houstonians should feel a special pride when the "spirit of the Apollo Program" is invoked as a symbol of the nation's capacity to meet other major challenges: "If we can put a man on the moon, surely we can muster the ingenuity and resources and sense of unified national purpose to solve our energy problems."

Time will tell, but looking into the past, we are reminded that our neighbors at NASA set the bar very high indeed.

Joseph A. Pratt, *Editor-in-Chief*

THE RIGHT PLACE

By Jennifer Ross-Nazzal

HOUSTON MAKES HISTORY

The Space Task Group

NASA Lyndon B. Johnson Space Center's roots were firmly planted in 1958—the same year that the National Aeronautics and Space Administration (NASA) was established—when the space agency created the Space Task Group (STG) headed by Robert R. Gilruth. Gilruth had been working as an engineer at the National Advisory Committee for Aeronautics (NACA) Langley Aeronautical Laboratory in Hampton, Virginia, since 1937. When the Soviets launched Sputnik 2 with a dog onboard in 1957, Gilruth recognized that the NACA needed to start pursuing a human spaceflight program.

"When I saw the dog go up, I said, 'My God, we better get going because it's going to be a legitimate program to put man in space.'"[1] He began working with people in Washington, D.C., to determine how the United States could do so. NACA continued to explore the possibility of manned spaceflight through 1958, when NACA became NASA. It seemed obvious to appoint Gilruth as head of the STG. After all, he had been heavily involved in these early efforts.

On November 3, 1958, Gilruth announced that thirty-six individuals (eight women and twenty-eight men) from the Langley Research Center would be transferred to the STG, which would be located at Langley but report to NASA Headquarters in Washington, D.C. Employees of the STG were charged with developing a manned satellite program, later known as Project Mercury.

Few senior members of the Center joined the group; most everyone was young. Some of Langley's older engineers discouraged recent college graduates from joining because spaceflight seemed like a passing fancy, nothing on which to build a career. Even before NASA was formed, the NACA Administrator Hugh L. Dryden likened a ballistic space project to a circus stunt—like shooting a lady from a cannon. Alan B. Kehlet, one of the original members of the group, remembers his boss telling him, "You know, this place is not going to make it. I think you ought to think more than once about whether or not you want to go, because when it does fail, there isn't any job for you back here."[2]

Members of the 1960 Flight Operations Division stand outside their temporary office at the Houston Petroleum Center.

NASA S64-26644

NASA S62-02704

The original Mercury astronauts are (standing, left to right) Alan B. Shepard Jr., Walter M. Schirra Jr., and John H. Glenn Jr.; (sitting, left to right) Virgil I. Grissom, M. Scott Carpenter, Donald K. Slayton, and L. Gordon Cooper Jr.

Over the next year, the STG's ranks increased as individuals from the Lewis Research Center in Cleveland, Ohio, joined the team and other Langley personnel began working on the project. However, staffing soon became a problem. Fortunately for Gilruth, a group of experienced aerospace engineers became available when the Canadian government scrapped the AVRO Arrow CF-105 fighter airplane in February 1959. NASA offered about fifty positions to the Canadians, with half accepting. Later, a few other former AVRO employees ended up accepting positions within the American space agency.

Project Mercury

On November 26, 1958, the manned satellite program officially became known as Project Mercury. The project had three major goals: one, to insert a spacecraft into Earth orbit with a human being onboard; two, to determine man's ability to function in microgravity; and three, to safely recover the passenger and capsule. These objectives required engineers to design a vehicle to protect the occupant from the vacuum of space and heat of landing. They designed a capsule that proved to be effective. Maxime A. Faget was the chief designer of the Mercury spacecraft and, along with six other members of the STG (Andre J. Meyer, Robert G. Chilton, William S. Blanchard, Alan B. Kehlet, Jerome B. Hammack, and Caldwell C. Johnson), held the patent for the bell-shaped capsule.

The astronauts, the heroes of the space program, were selected and assigned to the STG. Introduced to the American public in 1959, the Mercury 7, as they were affectionately called, included M. Scott Carpenter, L. Gordon Cooper Jr., John H. Glenn Jr., Virgil I. "Gus" Grissom, Walter M. Schirra Jr., Alan B. Shepard Jr., and Donald K. "Deke" Slayton. Six manned flights flew between 1961 and 1963. Shepard became the first American in space in May 1961, and Glenn was the first American to orbit the Earth in February 1962. (Slayton was the only member of his class who did not fly until much later because of a heart condition.)

When the Mercury Project ended, the space agency had learned a great deal. Mercury proved that humans could safely launch into orbit and land from space. And, astronauts could operate safely in microgravity.

Location, Location, Location

In 1958, the STG was located in Virginia but was to become part of the Goddard Space Flight Center being built outside of Washington, D.C., in Maryland. Once the Center opened in 1959, the STG was made a part of the Maryland Center, with Gilruth as assistant director. Harry J. Goett of Ames Research Center was appointed as director. NASA planned to keep the STG at Langley through the end of Project Mercury, when their staff would move north. But, the plan to include the STG at Goddard strained relations between Goddard and the STG and created a rift between Gilruth and Abe Silverstein, NASA's director of the Office of Space Flight Programs. The STG did not remain under Goddard for long; in January 1961, the group again reported to Headquarters and remained at Langley.

NASA began contemplating whether it should move the STG to a site separate from Langley, when, fortuitously,

Robert R. Gilruth, MSC Director, receives the Presidential Award for Distinguished Federal Civilian Service from President John F. Kennedy.

NASA S62-04852

NASA S62-03707

Astronaut Walter Schirra smiles at the crowds during the 1962 Fourth of July parade through downtown Houston in honor of the new NASA Center.

President John F. Kennedy committed the United States "to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the Earth" in a 1961 speech before Congress. The endorsement of a program to put a man on the moon shifted the nation's attention to NASA's manned spaceflight program and the STG. Human spaceflight was no longer a fad, and NASA intended to move the STG to its own location.

On September 19, 1961, NASA announced that the new spaceflight Center would be located in Houston, Texas. But why Houston?

NASA had criteria for the proposed site which included: transportation in ice-free water by barge, a mild climate, all-weather commercial jet service, a Department of Defense (DoD) air base that could handle military jet aircraft, a university nearby, at least 1,000 acres of land, and property that fell within certain cost parameters. Twenty-three sites were visited. Tampa, Florida, emerged as the winner because the Air Force planned to close down its Strategic Air Command Operations at MacDill Air Force Base. Houston originally came in second place, but became the top choice when the Air Force chose not to close MacDill.

Texan politicians probably had a hand in the establishment of a spaceflight laboratory in Houston. Lyndon B. Johnson, an enthusiastic supporter of the space program, served as vice president under President Kennedy. Other Texans served in various leadership positions within the Congress, like Sam Rayburn, who served as speaker of the house. Albert L. Thomas represented the area adjacent to Clear Lake and chaired the House Appropriations Committee. Olin E. Teague served on the House Committee on Science and Astronautics and headed the Subcommittee on Manned Space Flight.

Some of those working for the STG were not thrilled to hear that they would be leaving the shores of the Virginia coast for the prairies of Texas. Hurricane Carla had recently hit the Texas Gulf Coast and devastated the area south of Houston where the Center would be built. Public Affairs Officer Paul P. Haney flew over the area and remembers that water filled the site and a shrimp boat landed on the exact spot of the Center's future administration building, now known as Building 1. Jack A. Kinzler of the Technical Services Division remembers his visit as being "kind of scary." He and some of his fellow travelers recognized that their "wives might not be too happy to move into an area where there is the obvious possibility of extensive hurricane damage."[3]

Houston, Space City

Contrary to popular belief, Houston was a great place to live. Houstonians were thrilled that their city had been selected as the home of the new Manned Spacecraft Center (MSC).

(The STG was renamed MSC in the fall of 1961.) The city opened its arms to the 751 NASA employees who relocated to Houston and the 689 new hires. When they came, they were surprised by the response of the local community which had embraced the newcomers; Houston—the sixth largest city in the country—welcomed NASA.

Thousands of Houstonians came out to greet the MSC workers at a Fourth of July parade in 1962. Following the spectacle, MSC employees feasted on barbecue at the Sam Houston Coliseum, while local high school bands played "The Eyes of Texas" and "Dixie." George T. Morse, the Houston Chamber of Commerce president, told NASA employees, "We are deeply proud of the fact that the Manned Spacecraft Center has moved to our area," and Senator John Tower admitted, "We rejoice in your presence here; we like you and hope you'll like us."[4] After the presentations, the astronauts, Gilruth, Walter C. Williams, and John A. Powers received Texas-style hats and deputy sheriff badges, making each of the men members of the Reserve Deputy Sheriff's Posse.

The city became known as Space City and those associated with NASA were treated as VIPs. For example, William A. Parker, a procurement officer, recalled that people asked him for his autograph at a grammar school Halloween party. He explained, "It was a real embarrassing situation because, golly, we weren't astronauts or anything like that, yet we were being given this kind of treatment by the local people."[5]

Construction at the site began in April 1962. With no buildings yet erected in Clear Lake, MSC employees were spread out across the city. The Farnsworth-Chambers Building served as a temporary headquarters while a former Canada Dry Bottling Plant served as a machine shop. Ellington Air Force Base and other local buildings housed a number of employees.

Between February and April 1964, more than two thousand employees relocated from their interim offices and moved onsite. By June 30, 1964, the relocation was complete and MSC opened its doors to the public, but the Center was not finished. Construction continued on many of MSC's unique facilities, which were completed later that year or in 1965. The facilities included the Space Environment Simulation Laboratory, the Mission Control Center, the Flight Acceleration Facility, and the Vibration and Acoustic Test Facility.

The original seven Mercury astronauts, each wearing a cowboy hat, are on stage at the Sam Houston Coliseum during the welcome ceremonies and barbecue dinner.

NASA S62-03717

Gemini

If NASA were to successfully put a man on the moon by the end of the decade, MSC engineers, scientists, and medical doctors had to learn a great deal more about living and working in space. NASA created the Gemini Program as a follow-on to Mercury and announced the program in 1962. Gemini had to prove that astronauts could rendezvous and dock in space. This was necessary for the Apollo Program to be successful, since the Lunar Module that the astronauts would take to the moon would have to launch from the moon, rendezvous, and then dock with the Apollo Command/Service Module. Astronauts had to be able to conduct spacewalks. This ability was important for the Apollo Program when men would walk on the moon. Finally, the program had to demonstrate that humans could safely stay in space for long periods of time.

Nine new astronauts—called the New Nine—were selected in September 1962 and flew a total of ten Gemini missions along with the previous class of astronauts. (Compared to the Mercury spacecraft, the Gemini vehicle was larger and could hold two astronauts.) Members of this second class included Neil A. Armstrong, the first man to walk on the moon, and John W. Young, the commander of the maiden flight of the Space Shuttle *Columbia*.

Ellington Air Force Base served as a site for training astronauts including Gemini IV crew Jim McDivitt (left) and Ed White.

NASA S65-19283

NASA AS17-134-20384

Jack Schmitt stands next to the U.S. flag at the Taurus-Littrow landing site on the moon during the Apollo 17 mission. The Earth is visible in the distant background.

Gemini III, the first manned flight of the program, launched from Cape Canaveral in Florida in March 1965, and the new Mission Control Center in Houston backed up the flight. In June of that year, Gemini IV became the first mission managed by flight controllers in Houston; earlier flights had been controlled from the Cape. It was also a particularly notable flight as Edward H. White II conducted America's first extravehicular activity or spacewalk. This mission permanently established MSC as the home of the Mission Control Center for future human spaceflight programs. Since 1965, the Mission Control Center has controlled the agency's most memorable human spaceflights.

Apollo

Landing a man on the moon is considered one of the greatest accomplishments of the twentieth century, and MSC employees played a major role in achieving this victory. Astronaut Joseph P. Allen noted that the project built upon the "collective efforts of hundreds of thousands of people," from the engineers who calculated the trajectory to the seamstresses who stitched the spacesuits. "These bits and pieces of knowledge, processes, techniques, technologies, are across the entire spectrum of the human intellect, and they were all combined to accomplish Apollo."[6]

Eleven manned missions flew from 1968 through 1972. The first manned flight, Apollo 7 which launched in 1968, featured veteran astronaut Schirra with Donn F. Eisle and Walter Cunningham, both rookies. Apollo 8 was the first mission to fly around the moon. Apollo 11 was the first to land on the moon. For MSC employees, the success of the

lunar landing was a proud moment. Once the capsule splashed down in the Pacific Ocean and the astronauts were safely onboard the USS *Hornet*, flight controllers celebrated the conclusion of the first successful mission to the moon by waving American flags and lighting up cigars.

Five more missions landed on the moon, with the program ending in December 1972 with Apollo 17. This flight included astronaut Harrison H. Schmitt, the first scientist to fly a lunar mission. Three more scientist-astronauts would fly in the follow-on program to Apollo—Skylab.

MSC Becomes Johnson Space Center

As MSC busily worked on the Skylab and ASTP missions, one of NASA's biggest proponents passed away—former President Lyndon B. Johnson. U.S. Senator Lloyd Bentsen of Texas introduced a resolution to rename the Center in memory of Johnson, who had died on January 22, 1973. The Senate passed the resolution, and MSC became Johnson Space Center (JSC) on February 17, 1973. In August of that year, Lady Bird Johnson, wife of the late president, attended a formal dedication ceremony. Center Director Christopher C. Kraft, who led the ceremonies, said, "It's been just a few months since the legislation was enacted, designating this Center in honor of our late president. The new name is so appropriate, however, that it seems now that we've always been known as the Johnson Space Center." The Skylab 3 crew, in Earth orbit, admitted that "the work in which we are right now engaged in Skylab would not have been possible except for his [Johnson's] strong support and leadership in the Senate and in the presidency."[7]

Skylab

Skylab was America's first space station. The program had two basic objectives: to prove that human beings could live and work in a space laboratory for extended periods of time, and to learn more about the Earth, solar astronomy, and man's health in space. On May 14, 1973, NASA launched the unmanned laboratory, Skylab, from the Cape. (The mission, though unmanned, was called Skylab 1.) There were problems with the mission from the beginning. The meteoroid shield and sunshade tore off during launch. This damaged the solar cells designed to provide power to the workshop. Once in Earth orbit, the loss of the shade exposed the workshop to the sun, and temperatures inside the workshop rose quickly. Because of these problems, NASA delayed the launch of the Skylab 2 crew.

Numerous people at MSC and the Marshall Space Flight Center in Huntsville, Alabama, scrambled to save the ailing

NASA formally dedicated the Manned Spacecraft Center in honor of Lyndon B. Johnson on August 27, 1973, which would have been the former president's sixty-fifth birthday. On hand for the event was Lady Bird Johnson, pictured with Center Director Chris Kraft.

NASA S73-33323

workshop. MSC's own Jack Kinzler of the Technical Services Division is credited with saving the Skylab mission. He and his employees created a parasol that provided shade for the space laboratory and would be deployed by the crew of Skylab 2, which was commanded by moon-walker Charles C. "Pete" Conrad Jr. The crew successfully installed the parasol sunshade and remained in space twenty-eight days, where they conducted numerous scientific studies and medical experiments.

Two more manned missions flew between 1973 and 1974. Astronauts Alan L. Bean, Jack R. Lousma, and Owen K. Garriott flew on the second manned mission, which remained in space for fifty-nine days. The final crew broke all U.S. space records by living in space for a eighty-four days. No additional missions flew to the space station and, in 1979, the workshop tumbled back to Earth, with most of the laboratory burning up in the atmosphere. A few pieces survived and fell in Western Australia; in jest, one county council in the region fined NASA $400 for littering.

NASA S73-26047

MSC employees help a seamstress feed material through a sewing machine to create the three-layered sunshade for use as a parasol to protect the Skylab space station from excessive heat after it was damaged during launch.

Apollo-Soyuz Test Project

America's final Apollo flight was its first international mission. In 1970, MSC Center Director Gilruth, Glynn S. Lunney, Caldwell C. Johnson, and Marshall Space Flight Center's George B. Hardy traveled to the Soviet Union and were joined by Arnold W. Frutkin and State Department interpreter William Krimer. While there, they discussed how the U.S. and USSR might rendezvous and dock their two spacecraft in Earth orbit. A few months later, Lunney became NASA's project director for the Apollo-Soyuz Test Project (ASTP). Discussions with the Soviets and MSC engineers continued through 1972. Their labor paid off when President Richard M. Nixon and Soviet Premier Aleksey Kosygin signed an agreement to rendezvous and dock an Apollo Command/Service Module with a Soyuz vehicle in 1975. MSC's Lunney remained head of the project, seeing the goodwill flight to completion.

The Americans chose Thomas P. Stafford, Vance D. Brand, and Slayton to represent the U.S. in this one-of-a-kind flight. They received intensive training in the Russian language and studied the Soyuz spacecraft in Star City, Russia. Their counterparts, cosmonauts Alexei Leonov and Valeriy Kubasov, participated in simulations and in-flight training activities in Houston. They even visited Kennedy Space Center in Florida, where they toured the facilities and learned about operations at the Cape. As an added bonus, they toured Disney World in Orlando, Florida.

The crews launched on July 15, 1975, and rendezvoused and docked on July 17, 1975. Once linked, Stafford shook hands with Leonov. President Gerald R. Ford, then watching the mission from a TV feed in the Oval Office, noted the significance of the mission, saying it had "taken us many years to open this door to useful cooperation in space between our two countries."[8] Two days later, the spaceships undocked, marking the end of the first joint mission between the U.S. and the Soviet Union.

Space Shuttle

In addition to their work on the Mercury, Gemini, Apollo, and Skylab Programs, JSC employees have played an integral role in the design, development, and operation of America's workhorse, the Space Shuttle Orbiter. MSC engineers still remember the day that they were told to report to Building 36. It was April 1, 1969, and many thought it was an April Fool's prank, including Ivy F. Hooks, who was one of twenty called.

"In a few minutes, Dr. Max Faget walked in," Hooks recalled. "And he was carrying a balsa wood model of an airplane …

NASA S69-60341

Engineer Max Faget demonstrates his early concept of the space shuttle which, unlike the previous NASA spacecraft, would land like a plane.

and he strolled across the room, flew it across at us and said, 'We're going to build America's next spacecraft. And it's going to launch like a spacecraft; it's going to land like a plane.'"[9]

For the next few years, MSC engineers worked on the basic design and definition of the shuttle. They came up with the DC-3 design. The design changed many times, due in part to the political and economic climate of the early 1970s; the payload bay grew larger to accommodate DoD requirements and delta wings were added, not the straight-wings Faget and MSC engineers had envisioned.

In 1972, President Nixon approved the Space Shuttle Program, and MSC became the lead Center for the program. Development on the shuttle and its systems began soon after, with North American Rockwell receiving the contract to build the orbiter. Several subcontractors received contracts to build the orbiter's wings, the vertical tail section, and mid-fuselage. With the shuttle under development, no spaceflights flew until April 1981.

With so few spaceflights in the 1970s, many of the Gemini- and Apollo-era astronauts elected to retire, and their numbers began to dwindle. In 1976, NASA announced that the Agency would be selecting a new class of astronauts for the Space Shuttle Program. More than 8,000 individuals applied, but only a few made the cut. In 1978, NASA announced the first class of shuttle astronauts, known as the Thirty-Five New Guys. This group was the first to include women and minorities. Since then, such diversity has been included in every class.

These first twenty years, 1958–1978, laid the foundation for a new era of human spaceflight that would include long-duration flight, planetary satellite deployment, science studies, and a partnership of sixteen countries aboard the International Space Station. The dedication and commitment of individuals working together for a common cause in the first days remains evident in the workforce today as NASA prepares for its latest program, Constellation, that includes missions to the moon and on to Mars. ★

REMEMBERING APOLLO 8

By Christopher C. Kraft

Christopher C. Kraft *arrived at the Langley Aeronautical Laboratory just a few months after graduating from Virginia Polytechnic Institute. Those first steps through the gate in 1945 led him on a lifetime journey of looking beyond the boundaries of Earth. For the next thirty-seven years, Kraft used his engineering background and leadership skills to build and then strengthen America's human spaceflight program. Serving in management positions for more than two decades, Kraft guided operations in Mercury, Gemini, and Apollo missions, then led Johnson Space Center as its Director for more than ten years. After retiring in 1982, he provided his expertise to aerospace companies, began playing more golf, and wrote a book, titled* **Flight**, *reflecting on his experiences at NASA. Awarded numerous distinguished honors in his career, Chris Kraft continues to be recognized for his contributions in achieving the nation's greatest technological triumphs.*

Apollo 8 gave the world the first look at itself and set the nation on a nonstop path toward its goal of reaching the moon by the end of the decade. Some refer to the mission in December 1968 as the highlight in a year full of turbulence for the country; others still call it, even after forty years, the "most gutsy" decision NASA ever made. One of these people is Chris Kraft, famed pioneer flight director and former director of Johnson Space Center. He recently shared his thoughts during an interview with the JSC History Office and reflected on this historic journey that, for the first time, sent a manned spacecraft around the moon. He began by explaining how Apollo 8 cannot be appreciated unless "you know the situation we were facing in the summer of 1968."

As you recall, in January of '67 we had a fire; we killed three people. This was very traumatic for all of us, very tough on us. However, it was, without question, the turning point in the Apollo Program. Had we not had that event take place, it's a strong possibility we wouldn't have gotten to the moon in the '60s, and a strong possibility we wouldn't have gotten there at all.

At the time President John F. Kennedy said we're going to the moon, we had maybe 350 to 400 people working on the Apollo Program. There was a tremendous management challenge to build this monster program, and a tremendous number of unknowns—a tremendous difference between going from Alan Shepard's fifteen-minute flight (May 1961) to leaving Earth's gravity and landing on the moon. The magnitude of difference there was indescribable.

NASA S63_06268

President John F. Kennedy pins NASA's Distinguished Service Medal on Alan B. Shepard Jr. (left), honoring the astronaut for his flight in May 1961.

Not only was there not a large number of people in the Apollo Program Office, there was a whole group of new people—a lot of good, a lot of smart, a lot of very highly motivated people. But most of these people who came into the program were from unmanned programs; they were inexperienced in manned spaceflight and they were running too fast.

As a result, those of us working in Mercury and then Gemini, both in operations and engineering, had a darned hard time getting these people to recognize the implication of the human in the design of a space vehicle. Myself and a number of others were trying very, very hard to impress to the new people, particularly the upper management, that they were ignoring the lessons learned from previous programs. We could see the results of their labor and we could see the results of the contractors who, most of them, were also new to manned spaceflight.

In the late part of 1966, we were coming off of Gemini and able to put our best experienced people onto Apollo. The reports from Cape Canaveral, from the Thompson Committee which reviewed the Apollo 1 fire, described the quality of the hardware being delivered as a disaster waiting to happen. I could see it myself, because I'd been spending some time at the contractor's in California. John Bailey, who Bob Gilruth and I knew from the NACA (National Advisory Committee for Aeronautics) in the '40s and '50s, went to the Cape as our special representative down there in the '66 time period.

He kept writing these memorandums back to Gilruth, the Center Director, which were distributed among the top management, which said, "This hardware is not very good. The people are really not very good at checking this thing out. They're not very good at trying to maintain some semblance of the fact that a human being is going to be in this machine. I'm telling you, it's not good."

Now, on top of that, we had the management of the program bypassing the top management of the Manned Spacecraft Center (MSC), literally bypassing Gilruth. I spent a lot of time trying to convince the Apollo program manager, who was ignoring our inputs, that he needed to take advantage of the tremendous engineering experience and talent that we had at the Center.

That's the situation that we had in January of 1967. It was a tragedy, not only from the standpoint of loss of life, but from the standpoint of the program itself, because it was a situation that did not have to be that way. We were faced with a tough road technically, a tough road management wise, and a tough road politically because Congress, at that point, was not very happy with NASA. We had a lot to overcome.

Order out of Chaos

Fortunately, NASA had George Low. I can't emphasize how extremely important George Low was to the situation I just described, from every point of view: technical, management, and political—he had experience in all of those. George was the deputy director of the MSC; he had been in Washington from the beginning of manned spaceflight; he was very much involved in the decision-making process with John Kennedy to go to the moon. He was the ordained man to take the job. He knew what was wrong.

NASA S67-19770

Apollo 1 crew (left to right) Virgil I. Grissom, Edward H. White II, and Roger B. Chaffee died in a fire on the launch pad, January 1967.

NASA S70-27117

Chris Kraft (left) credits George Low (right) with advancing the space program.

The powerful 363-foot-tall Saturn V space vehicle launches early morning in November 1967 for the unmanned Apollo 4 mission.

NASA S67-50903

So, George Low becomes the Apollo program manager and brings order out of chaos. He immediately appointed a board, called a Configuration Control Board, and appointed all of the top managers at the MSC as board members. You could not send a representative to that meeting. You personally had to go. He had a meeting every Friday with that top management group. He had a meeting every day at noon to review the program.

Low then went to see the presidents of those companies building the Command/Service Module and Lunar Module, and had half of their top management removed. He began to get a hold of the program, solicited the advice of the top management of the Center, and brought the program to a place where it was obvious that it was healing.

Regarding the hardware, we had a meeting to list all of the things that everybody wanted done to fix the vehicles, to fix the management, to fix the rockets, to fix everything that had to be done. There were hundreds. There were 125 top ones. We listed their importance and then categorized them. We ended up, a year later, doing every one of them.

Operational Capabilities

The Marshall Space Flight Center under Wernher von Braun was building the Saturn V. They're rocket people. They know the rocket business. When we flew the first Saturn V, it looked like it was a great flight, but it wasn't. We had problems on the first, second, and third stage. They were not serious problems on that first flight because it made it. It did its job.

Well, the second flight was a disaster. I want to emphasize that. It was a disaster. The first stage had pogo (bounce). The second stage had pogo so badly that it shook a twelve-inch I-beam; it deflected a foot as it was flying in the second stage. The third stage ignited and then shut down, and it would not restart, which was a requirement to go to the moon. It also had some vibratory problems. Here's the Saturn rocket that everybody thinks is a wonderful piece of hardware but it almost busted itself into pieces in all three stages.

In July of 1968, the Command/Service Module had become a good-looking piece of hardware. That part of the program was really progressing well, and we all had a great deal of confidence that it would fly and fly well. But the Lunar Module was a mess. It was a mess because it had to be light and we were using these very delicate pieces of structure. Just everything was going wrong with it and it wasn't going to be ready for a while.

During those early Apollo planning meetings, we had set out various categories with objectives that we wanted to accomplish.

We wanted to prove to ourselves that the hardware was satisfactory and would accomplish the operational capabilities that we had set out in terms of rendezvous, docking, heat reentry capabilities, control, navigation and guidance, et cetera—all needed capabilities to reach the moon. We believed it probably would take more than one flight to accomplish the tasks we required; we thought to prove this, it would take us two or three flights.

Turned out, it took us one flight to do them all. That was a surprise to all of us.

A Change in Plans

In July of 1968, George Low could see that he was going to have trouble meeting the schedule. George was trying, in his mind, to come up with something that would advance the program but, at the same time, give him some time to get the Lunar Module corrected from both a structural and a management point of view and a checkout point of view.

So he called me into his office one day, and he said, "I'm thinking about trying to do something with the Command/Service Module (CSM) after the first manned Apollo flight, assuming that the first flight is very good if not perfect. I was thinking about a circumlunar flight."

I told him I would have to think about it a while. Asking us to go to the moon on the next flight after the first flight was quite a chore. Plus, that idea leapfrogged the program over these early orbital operations that we wanted. I thought we could probably hack that, if we worked our butts off. I didn't know about the Control Center, though, because we had a lot of problems in the Control Center with the magnitude of that hardware and the fact that we had a lot of new display systems.

Later, he called me into his office again and asked, "Well, what do you want to do?"

I said, "I think we ought to seriously consider it."

Then he said, "Let's go down to see Gilruth."

When we had some serious problems, we'd all have a bull session about it around Gilruth's table. We talked, just the three of us, for maybe a half an hour. We were talking about a circumlunar flight, just sending it up there, going around the moon. Gilruth liked the idea.

NASA S68-18733

Two pioneers of human spaceflight, Chris Kraft (left) and Robert R. Gilruth monitor the operations in the Mission Control Center, Building 30, during the Apollo 5 unmanned space mission launch (January 1968).

They both thought the achievement of this plan would give us a leg up on the Russians. I didn't know as much as they did about what the Russians were doing. Although I was asked to participate in all those secret briefings they were getting, I would not because I was with the press too much and was afraid of what I would say. Gilruth said, "We ought to call Deke in."

We got Deke Slayton, the director of flight crew operations, on the phone. He came in and we talked about it for another half an hour or so. We went out of that meeting with Deke going to see what he could do in terms of crew training and crew assignments, and how he'd have to shuffle crews because he had the astronauts all going in certain directions based on our originally laid out game plan.

Excited as Hell

I called in my top guys, and we sat around a table in my office, and God, they were excited as hell about it. I didn't expect that from them. I thought I'd hear all this doom and gloom, and I got nothing but, "God, that's a great idea."

We didn't want to let out as to what we were attempting to do here. In fact, we didn't know what we were attempting to do when I first got this group together. I was limited, as all of us were, in the people that we could talk to about it. We knew if this idea got out to the public, we'd be in deep serious trouble. It would spread like wildfire. We knew that it would mean a hell of a change to the press, it would be a hell of a change to the Russians, it would be a hell of a change to the politicians.

So, overnight, my guys went off and looked at this thing, and when I got to my office the next morning, they were there. They wanted to talk. They came in, excited, and they told me, "Yeah we think it's a great idea, we don't know whether we can do it or not, and we think we ought to do it." But then they said, "There's one thing we want to do which you haven't mentioned—we don't want to just *go* to the moon, we want to go in orbit *around* the moon."

Now frankly, that's an order of magnitude difference in risk right there. Of course my reaction to that was, "Why would you want to increase the risk?"

NASA S69-16417

Kraft (in jacket) stands with Apollo 8 Flight Director Glynn Lunney (left) during the historic mission that sent humans around the moon for the first time. Pictured also are Flight Directors Milton Windler (center) and Clifford Charlesworth (right).

NASA ISS010E18583

They said, "Well, we've been looking at the data from the tracking of the Ranger and the Lunar Orbiter around the moon, and we cannot do the orbital mechanics to determine the orbit in the first place, and then to predict where the spacecraft is going to be from the back side of the moon to the front side of the moon. Every time we do it with the gravitational models of the moon that we have, we miss by about two miles. We can't figure out why that's happening. But if we were to put the CSM in orbit *around* the moon, and measure it at the same orbit that we're going to fly to *land* on the moon, we could develop an empirical set of formulas which would allow us to do the right orbit prediction around the moon."

I don't remember exactly what my reaction to that was, as I didn't know whether that was a good idea or not. Frankly, I didn't know whether I could convince George Low to do that, because the service propulsion system engine had to work. You can go on a circumlunar flight without the engine. You can go at what we called a free-return trajectory. But you have to have that engine to put you into orbit *around* the moon, and you have to have the engine to get you *out* of orbit around the moon. So that really increased the risk probably an order of magnitude, if not two orders of magnitude, at that point in time.

Remember—we hadn't flown the Command/Service Module yet. We didn't know whether that hardware was good hardware or bad hardware. We thought it was good. All the engine tests were wonderful. But we didn't know. Anyway, I cogitated on that for about twelve hours or so, and then George called wanting to get together again to see what Deke and I had come up with.

Dead Silence in the Room

We met and started talking, then I threw this thing into the punch bowl and said, "Well look, if we're going to go, my people—and I think they're right—want to go in orbit around the moon."

There was dead silence in that room when I said that. They were shocked. But they listened. I did my best to convince them because I wasn't convinced totally 100 percent myself. I told them what we wanted to do, why we wanted to do it. George, just thinking about it a few minutes, said, "Well,"—and Deke, he didn't say much. He just reported what he would do.

As we discussed the possibility, we got pretty excited, and Gilruth said, "If we're going to do this, we got to get Wernher on board." He went right to his phone, picked up the phone, called the Marshall Space Flight Center and said he wanted to speak to Wernher.

The secretary said, "He's in a meeting. Can he call you back?"

Gilruth said, "No, I want to speak to him right now."

That shocked her on the other end. But after about five minutes, Wernher came to the phone. Gilruth told him that we'd been talking about a change in the program that would require his okay and his rocket. He didn't tell him what we were talking about, but said, "We'd like to come talk to you about it."

Wernher said, "I can probably see you tomorrow."

Gilruth said, "No, I want to see you right now. We'll fly over there right now and talk to you about it."

After we hung up the phone to von Braun, Low said, "I better call Sam Phillips (Low's boss). We can't go any further in this thing without getting Washington involved in this." It turned out Phillips was at a meeting at Cape Canaveral and said he'd join us.

We got on the airplane, flew to Huntsville (Alabama), and we all sat down in von Braun's office. Gilruth said we had a plan to fly to the moon on a flight after the Command/Service Module test in October. George explained the problems with the Lunar Module, what we thought about the CSM, what he thought the hardware could do, what he thought we could do. He said, "I haven't talked to Sam about it, but here's what we want to do." Then he looked at me and said, "You tell them what we want to do."

So I got up and described this mission. I could tell from the looks on the people's faces that they were surprised, but they began to become quite elated about it. Phillips responded immediately and thought it was a great idea. He recognized what a boost to the program it would be if we could pull it off.


NASA S68-56007

But he recognized the risks involved, the risks of getting ready to do it, the risks of being able to do it, the risks of having an almost perfect flight on the first flight of the CSM that would allow us to do it. Phillips said, "This is a pretty serious change, it's a serious risk, it's a serious thing in terms of convincing our own management and the politicians, so I don't want to talk about this outside of this room until we've thought about it, and see if there are any showstoppers, and we'll have a meeting two days from now."

Two days later we had a telephone conversation, and everybody reported, and everybody was going for it. Sam said okay, after we got through telling him what our problems were and what we thought we could do. He said, "I've got to expose this to Mueller and Webb."

NASA Administrator Jim Webb and George Mueller from the Office of Manned Spaceflight were in Austria attending an international space meeting. Sam talked to them and told us they were livid, saying how we were reshaping the whole program while they were out of the country for a few days. But Sam, a very competent human being, a great manager, and a great representative, said, "We're going to continue on because I think it's the right thing to do."

Then we brought Tom Paine, the Deputy Administrator, into the situation. Sam could tell that Paine liked it, but Paine wouldn't react. However, he did approve of going ahead with our plan, adding, "You've got to keep this secret."

Well, after a couple of days I went to see George, and I said, "We can't keep this thing a secret anymore. I've got to have at least seven or eight more guys to know the whole game plan here."

Deke had the same problem. "We've got to start laying this thing out if we're going to do it."

So they agreed that we could get a few more people involved. But they couldn't talk about it. We had to do it as if it were a general game plan.

When Mueller came back, we had meetings and meetings in Washington. He was still very cold to the program. He got recommendations from other people, and they were cold to it. He talked to Webb about it, and he was cold to it. But it turned out that Paine, who was Webb's deputy, thought very favorably about the idea. So we proceeded, convincing everybody that well, look, we're not saying we're going to do it. We've got to fly Apollo 7 first, that's number one, and it has to be practically perfect.

Webb said to continue to work on it and told us, "I'll have to announce that to the press, that we're doing this sort of thing, and I will couch it in the terms that it is a possibility being considered that we might do this for the various reasons that you guys have given me from the standpoint of the Lunar Module, et cetera." I don't know who else he talked to. I'm sure he must have talked to the heads of the committees in Congress. Probably talked to the White House. I'm not even sure he didn't talk to Lyndon Johnson about it, because he knew Johnson very well, as a personal friend.

George told us that all of that was going on, but I didn't pay too much attention. I had too many things to do.

High Risk

We had the flight of Apollo 7 (October 1968), and it was perfect. It was about as perfect as any spaceflight could be. As a matter of fact, for a first flight, it was uncanny. Nothing failed. Nothing. We've got the success we were looking for and now we've got to make a decision.

So we go to Washington. Gilruth, George, Deke, Bob and I—we're going back and forth to Washington like rubber balls to get this thing approved. Mueller tells us, "I'm going to talk with the presidents of all the companies and see what they have to say." I could tell he was getting a little warmer to the idea, but he had a lot of advisors telling him that there was too big a risk.

We had this meeting in Washington with the presidents of all the major companies—and I guess there were eleven or twelve of them—that were involved in Apollo. I was the major guy to make the presentations, along with George Low. He gave the management, the program management description, and I gave the description of what we wanted to do and why we wanted to do it from an operational point of view. George asked all these guys what they thought, and with one exception all of them thought it was a good idea.

They all admitted that it was a high risk. They thought, just like we did, that it was a tremendous step in the program, and that if we could pull it off it would really be a step function increase in both the morale and the confidence that we would have in doing the job.

and it has to be practically perfect."

Going to Change the World

Before we got too much further, Jim Webb left as NASA Administrator. Tom Paine was now the Acting Administrator and he was working through a checklist a mile long of people they had to consult with, because it was something that was going to change the world. Their checklist went all the way to President Lyndon Johnson.

Within twenty-four hours of NASA having made the decision that we were going, they said, "We've got to check with the outside world." So within forty-eight hours of having a go decision to do a lunar operation, we exposed the plan to the press. It was a headline in every technical paper and a headline in most newspapers that NASA is going to the moon on the next flight.

Once the news was out, we were met with total excitement and exhilaration from everybody at the Manned Spacecraft Center. They all recognized what a challenge that was, and what a shock to them, like the rest of us, that NASA was willing to do it. We were a very great organization, and able to do what we did technically, but we still were bureaucratic. The planning to do what we were doing had been in place for a couple of years. But now, we were suddenly faced with having to do it, and do it out of sequence from what we had planned to do.

From then on, it was: Get it done. Get the operation done, get the software done, get the people trained, define our goals, state our objectives, determine what tests we want to run to make sure while we're there we do this, that, and the other. Laid that out minute by minute. There were plenty of stopping points along the way, plenty of places along the operational mission where we could stop and regroup and reconsider.

For the First Time

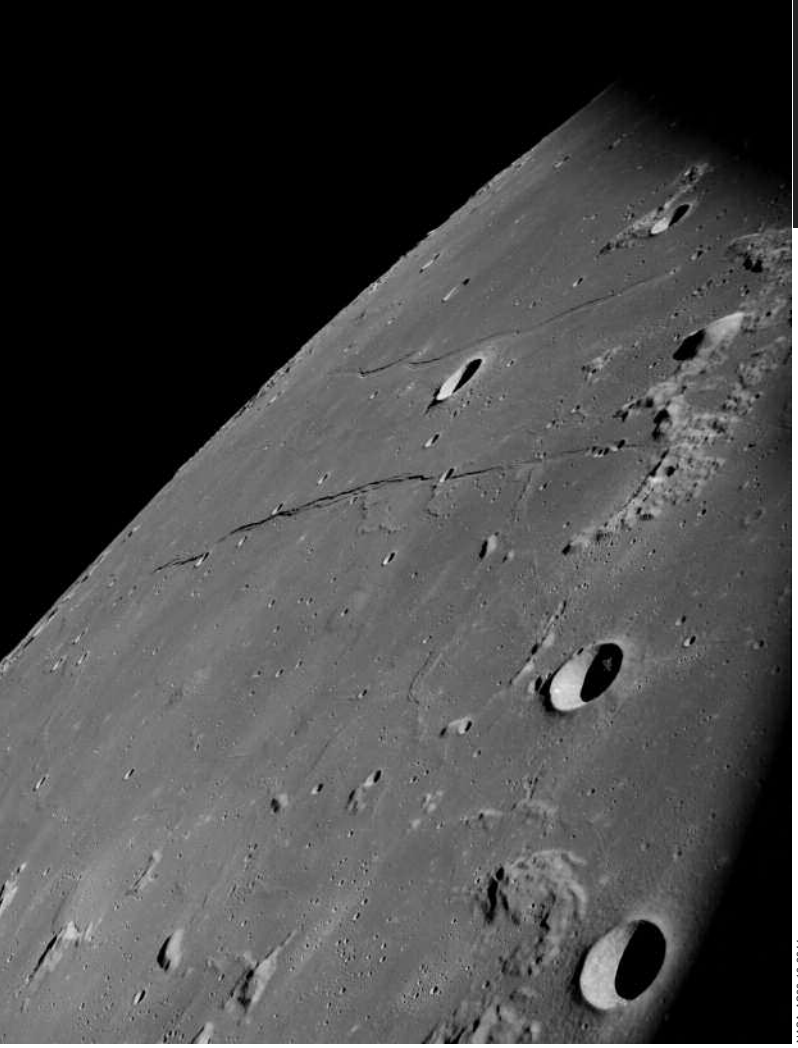
We told the scientists, okay, for the first time, we're going to have six eyeballs able to look at the moon from sixty miles away. Never been to the moon with anybody's eyeballs. We got them involved in telling us what they wanted to see, what they would do if they were inside that spacecraft, what would they look at, what they want to know about the moon, what we want to get out of it, what you want them to report. They began to think about that and said: Tell us the color, tell us the shadows, tell us the shape of things, tell us the crater size, tell us how many craters you see, what you think it looks like compared to Earth.

We had to rendezvous with the moon, and we had never done that before. We wanted to replicate the proposed lunar landing mission in terms of altitude above the moon and trajectory across the moon's face. We wanted to look at the gravitational model from that altitude. We were told, "You don't know that you're that accurate. You don't know that you can hit the moon within 60 miles as you are aiming at it from 270,000 miles away. You don't know that your radar is that good. You don't know that your tracking is that good." All correct.

But we had previous missions that we put up there, Ranger and Lunar Orbiter, and we'd done that very, very well.

The Apollo 7 crew returns from a perfect spaceflight, clearing the way for Apollo 8. Pictured (left to right) are astronauts Walter M. Schirra Jr., Donn F. Eisele, Walter Cunningham, and Dr. Donald E. Stullken, Recovery Team Leader, MSC Landing and Recovery Division.

NASA S68-52542



NASA AS08-13-2344

Apollo 8 captured this photograph looking into the Sea of Tranquility, the proposed landing site of the first lunar landing.

The tracking system, the deep space tracking network, had done that very well. They had told us what we were getting from Lunar Orbiter around the moon too. So we weren't dumb. The thing we were dumb about was that nobody had come up with mascons* yet. That's what screwed up the gravitational model. You may not believe that, but the things that had hit the moon and left these big core things of iron probably jammed into the face of the moon and had changed the gravitational effects, and that has a perturbation. Generally speaking, it doesn't change things, but when you're trying to get very accurate, it does perturbate the orbits.

We had to plan the whole recovery operation. It involves layers upon layers of people within the U.S. Navy and the Department of Defense; involves thousands. We would be recovering the crew in the Pacific for the first time, and we didn't have any people trained in the Pacific. They were all in the Atlantic. Got to train the frogmen, they need to know where the spacecraft might come down and what the dangers are, what they can do around the spacecraft. Teaching them that they can't touch this but if you do, you're going to get burned; this is how you open the hatch if you have to open the hatch, and here are the tools you can lift it up with, and then you got to crank this thing on board. The astronauts might be sick. This big bubble's on top, the balloons. All of that training has to be done.

Flight control team had to be ready. They're pretty resilient and they can do most anything. Their "what if" games during training are so broad you can't hardly ask them something they haven't thought about. We then laid out the flight plan and had the time planned down to the minute, to, from and while there. We had many groups, both operationally and in engineering, sitting down and saying, "These are all the things that we have to have ready, these are the things that we've got to make sure we have confidence will work, these are the tests we're going to run to prove it on the ground and then in flight."

That's where we realized that we couldn't leave this spacecraft sitting facing the sun. You can't just go to the moon and let one side face the sun and the other side face the moon. You're going to have to rotate it, and that affects the way you do guidance and navigation, as well as the stars you're going to look at and the rotational rates.

We had to know where the stars are at the time of day and the time of the season that we were going to fly, because we put thirty-five stars into the computer, and what you do is you look at this star and that star and that star, and you triangulate inside the computer, and you do it by hand, you do it on the ground, get these coordinates for what that says, and that'll tell you where you are. You have to be willing to say, "If the computer malfunctions, what is the crew manually going to be able to do?"

It was Dangerous. It was Risky.

It gets pretty broad as to what all we had to think about, and we had different groups that had that as a job anyway, except now we were going to have to do it for real.

I'm a guy who wants to know what's going on in everything. I want to make sure everybody's thinking right, that everybody is doing their planning, that they have their game plans made and could show me that they indeed did, both in the hardware and the software. But I didn't have to know the details of everything.

We had the best people in the world who were so extremely and highly motivated that, after you see them perform for a while, you know, well, they're going to do it and do it right and do it well. I never had the slightest doubt that any of the people that were in charge of that stuff couldn't do it. None.

* ***Mass concentration*** *can have different meanings in astronomy or chemistry. In astronomy or astrophysics* ***mass concentration*** *or* ***mascon*** *is a region of a planet or moon's crust that contains a large positive gravitational anomaly. In general, the word "mascon" can be used as a noun to describe an excess distribution of mass on or beneath the surface of a planet (with respect to some suitable average), such as Hawaii. However, this term is most often used as an adjective to describe a geologic structure that has a positive gravitational anomaly, such as the "mascon basins" on the moon.*

I had the same feeling about MIT. The MIT guys were a brilliant group of engineers.

Within the industry, we had people like that too. They had a bunch of great people involved and had put together a great team after the Apollo 1 fire with the help of George Low. By the time we got to Apollo 7, I don't remember having any doubts about anybody in terms of management or capability to penetrate the quality of what we were dealing with.

Now I don't mean to say that we didn't realize that we could get this thing pointed in the wrong direction off of the Saturn rocket, or that when we got to the moon we weren't at sixty miles altitude. Or that something could happen when we got on the back side of the moon, where we could not see what was happening from the Control Center and the crew was on its own.

It was dangerous. It was risky. Bill Tindall, as an example, gave me a presentation of all the things that could happen when you fire that engine on the back side of the moon. If the attitude control system did not work perfectly, when the engine stopped burning you could be going into the lunar surface. Or you could be going out into deep space and never see it again, if it cut off at the wrong time in the wrong attitude.

Tindall had it all figured out—what he was going to do about it in the computers, what the flight dynamics guys were going to do about it, when it showed up for first time and we saw it, or when it came back around the moon and it wasn't what we expected. We had thought about that in great detail and when we got to the moon, we had computed the exact second we would lose communications with the crew. It happened at exactly the right second and crew member Jim Lovell accused us of cutting the communications off saying, "You can't be that accurate." But we were.

The same thing is true about when it came back around the other side. We knew exactly the second. If the engine worked as it should, when the engine cut off and put it into orbit around the moon, we knew the exact second we should see that vehicle come out the other side of the moon on the deep space network.

Christmas Eve

While they were on the back of the moon, it was extremely tense for me. The worst time was after we'd been there for ten revolutions and were ready to come *out* of orbit. I was really tense about what might happen, what could happen, and waiting for it to happen. I wanted quiet inside the Mission Control Room for a while so I could pray or do whatever the heck I had to do to make sure that thing comes out the other end and the engine fires to put it back on a return trajectory to Earth. George Low and I were sitting there, looking at each other, next to each other waiting. That's when Lovell said, "There is a Santa Claus," and they were on the way home. But it sure was a relief in mental anguish when I knew they were on a return trajectory to the Earth and that engine had worked perfectly both times.

Until we decided we would be ready to go, and determined what the launch windows were, we had no idea that it was going to be on Christmas. We got accused of doing it purposely on Christmas, to be around the moon on Christmas Eve. That's untrue. It was happenstance. I didn't have any idea that it was going to be Christmas because we hadn't computed yet what the launch window was. We had only three hours to meet our criteria of getting to the moon at the right time and the right place with the sun at the right angle, and over the landing site that we had chosen for Apollo 11.

NASA S68-56533

Kraft and others in the Mission Operations Control Room heard the voice of crew member Jim Lovell say, "there is a Santa Claus," as the Apollo 8 spacecraft came around the moon for its last time and they were headed back to Earth.

William Anders:

"For all the people on Earth the crew of Apollo 8 has a message we would like to send you."

"In the beginning God created the heaven and the earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters. And God said, Let there be light: and there was light. And God saw the light, that it was good: and God divided the light from the darkness."

Jim Lovell:

"And God called the light Day, and the darkness he called Night. And the evening and the morning were the first day. And God said, Let there be a firmament in the midst of the waters, and let it divide the waters from the waters. And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: and it was so. And God called the firmament Heaven. And the evening and the morning were the second day."

Frank Borman:

"And God said, Let the waters under the heavens be gathered together unto one place, and let the dry land appear: and it was so. And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good."

Borman then added, ***"And from the crew of Apollo 8, we close with good night, good luck, a Merry Christmas, and God bless all of you—all of you on the good Earth."***

The Apollo 8 crew entered lunar orbit on December 24, 1968, and via a live television broadcast shared with listeners the above message. That day the crew captured this Earthrise photo, giving humans their first look at their home planet. Traveling only sixty miles from the moon, the crew photographed numerous views of the lunar surface including the photo far right.

NASA AS08-14-2383

That Christmas Eve, they read from the Bible—that was very impressive that they chose to do that. Both Commander Frank Borman and I are lay readers in the Episcopal Church, so we had read that passage from the book of Genesis several times in our life. I got a little teary-eyed, I guess you would say.

Earthrise and Earthshine

The crew will tell you that when they saw the sight of a full-color Earth over the craters of the moon it was one of the most impressive sights they've ever seen. It was the first time we had seen the Earth. It had been unimaginable until that moment. The Earthrise picture taken (December 24, 1968) was probably the greatest picture ever obtained in space. That series of photos is really something.

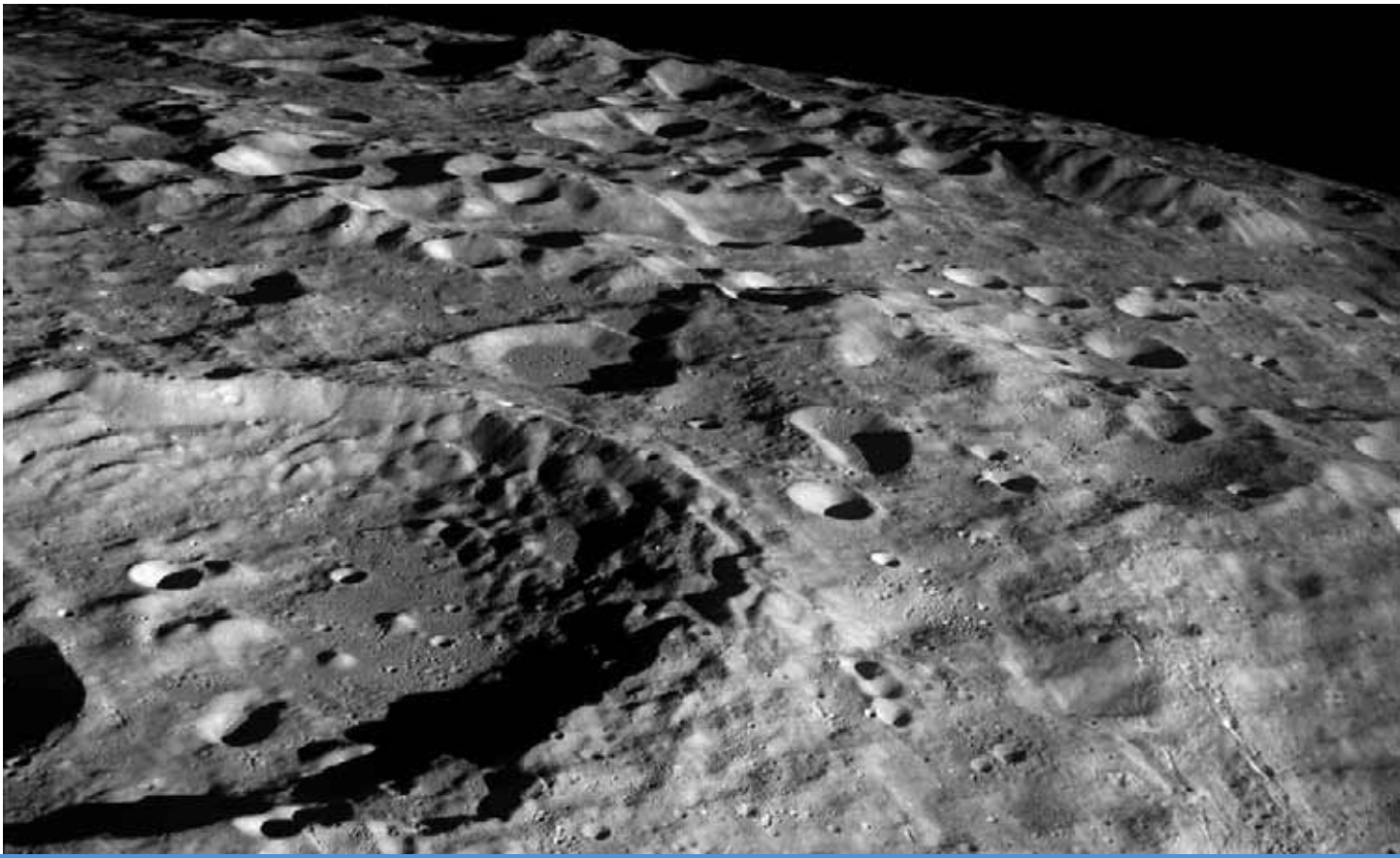
Before the photos were taken, crew member Bill Anders had been telling us that he found Earthshine was about as expected. Earthshine at the moon is about ten times as strong and you have no reference for what you see on the moon. Depending on what altitude you're at, you see craters, and that was particularly important in planning for the landing on the moon because, as you approach the moon, all you do see is more craters.

From some altitude, you see all these craters, but they are all big craters. When you get closer, you see more craters, but you don't know what their size is. Then you get down here, you see more craters and don't know whether you're seeing a big rock or a little rock because you have no reference. There aren't any automobiles, there aren't any trees, there aren't any buildings, there aren't any streams, the mountains you see, you don't know how tall they are, relatively speaking.

The one thing we do know is shadow length as you approach; from a crater, you can see the shadow. To give the pilots depth perception, we landed with the sun at their back at a seven to twelve degree angle. That's one of the major criteria in setting the launch time and the launch window in going to the moon. We wanted the sun at that angle at the point we were going to land. We wanted to land in the Pacific back on the Earth. When you put all that together, you had a three-hour launch window three days out of the month, and if you wanted to do it very well, one day out of the month.

Giving 110 Percent

George Low, myself, Bob Gilruth, Max Faget, and Deke Slayton—we were going to do everything within our power to do it and do it right. All felt that it was our duty. It was something that was required of us, and we were representing the country. I don't believe that it would have been anywhere



NASA AS08-13-2244

NASA S68-50265

Mankind had been looking at the moon ever since they could see, but these three men were the first to see it from only sixty miles away. Left to right are James A. Lovell Jr., William A. Anders, and Frank F. Borman II of Apollo 8.

near possible to do it, had we in the management lacked the commitment, because it was too damned hard.

The people who were working on the program—by the thousands—were giving us 110 percent of their capability every day. I don't think we could have done it without that kind of dedication to the program. We got *all* from the recesses of everybody's mind that worked on the program. If they had some talent buried back in those places, it came out.

Now that's what was so wonderful about working on it, that I think most of us—I guarantee you not all of us, but most of the people working on the space program felt that way. Maybe at least ninety percent. There would probably be ten percent that say we were nuts, and ask why are you doing this, or say I don't feel so good about it.

But, my God, the perfection we did it with, the tests run on the hardware, the success couldn't have been done without that kind of commitment right down to the working level of the guy on the machine in the machine shop, or the women that put the wires together in the spacecraft. They had that commitment.

The Apollo Program had 400,000 people involved. Somebody had to manage that effort, and managing 400,000 people in all walks of life was no simple task. That's not braggadocios. That's fact, because we couldn't have done it without that kind of commitment. I don't know whether we can ever do that again.

Most Significant Mission Ever

Although a lot has been accomplished, Apollo 8 probably remains the most significant mission ever flown. The first flight of the shuttle from a technical point of view was equivalent. But not from the total aspect, not from an emotional or the significant effect on the country and on the world that Apollo 8 had.

Mankind had been looking at the moon ever since they could see and wondering about it, thinking about it, looking at it from a religious point of view, from an astrological point of view, from a farmer's point of view, then later from a scientific point of view. Putting ourselves in the position of having a man leave the Earth for the first time, being able to look back at the Earth for the first time, realizing the environmental aspects of that—you can just go on and on.

The firsts involved in Apollo 8 almost were unlimited, if you stop to think about it, from an educational point of view, a theological point of view, an esthetic point of view, an art point of view, from culture, scientifically, philosophically, engineering wise, management wise, scope of capability wise. Outside of a war, we have never done anything like that in this country.

That event was a milestone in history, which in my mind, unless we land someplace else where there are human beings, I don't think anyone can match it.

It was an opportunity for those of us who were allowed to do it that doesn't present itself very often in any human being's life. We were extremely fortunate that all the conjunction of the stars and the politics and the money and the technology all came together in the '60s, in '68. That was a very extremely unique period in man's history from all those points of view.

In the '60s, even though people might not like you, even though they seemed to be hard to get along with, even though you thought they were going off in the wrong direction, you knew you all had the same thought in mind, you knew everybody was trying to get to land men on the moon. We were given an opportunity to do it, and we did it. But that's a characteristic of the American human being. That's what makes us great. ★

To read the entire transcript, log on to:
http://www.jsc.nasa.gov/history/oral_histories/KraftCC/kraftcc.pdf.

Houston's Treasure Houses — Bayou Bend and Rienzi
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American Collections

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German Porcelain

Chinese Export Porcelain

American Porcelain

English Porcelain

Sterling Silver

Sterling Silver

Joseph Badger, ***Portrait of John Gerry****, 1745, oil on canvas, Gift of Miss Ima Hogg, B.53.13*

William Ellis Tucker, ***Vase****, 1827–38, porcelain, Gift of Miss Ima Hogg, B.72.118.1*

Attributed to John Weesop, ***Portrait of Esmé Stuart, 5th Duke of Lennox and 2nd Duke of Richmond****, c. 1651, oil on canvas, The Rienzi Society and Mr. and Mrs. Harris Masterson III, by exchange, 2003.49*

Worcester Porcelain Manufactory, ***Plate from the Stowe Service****, c. 1813, soft-paste porcelain, Gift of Mr. and Mrs. Harris Masterson III, 96.1146*

Meissen Porcelain Factory, ***Plate from the "Mollendorff" Service****, c. 1761, hard-paste porcelain, Bequest of Caroline Wiess Law, 2004.1370.20*

Paul Storr, ***Wine Cooler****, 1812, sterling silver, Bequest of Caroline Wiess Law, 2004.1359.1.*

Hot Water Dish*, c. 1810–20, porcelain, gift in honor of Ann Lacy Crain by her daughter Lacy Crain, B.2007.1.*

Manufactory of Andrew Ellicott Warner, ***Soup Tureen****, sterling silver, 1817, Gift of the Theta Charity Antiques Show in honor of Betty Black Hatchett, B.80.6*

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THE FIRST DAYS IN HOUSTON

By Burton Chapman

During his visit to Houston in 1962, President John F. Kennedy (center) toured the Rich Building, located on the corner of Telephone Road and Westover, that served as the temporary spacecraft research and development facility. Also pictured is Manned Spacecraft Center Director Bob Gilruth (left) and Vice President Lyndon B. Johnson.

NASA S62-03984

CURRENT PHOTO BY BURTON CHAPMAN

The East End State Bank building at 4200 Leeland became home to the NASA personnel offices and NASA credit union. Today, it is the City of Houston Utility Customer Service.

It may seem hard to believe today, but at least a dozen of the sturdy, conventional, old buildings that are scattered throughout southeast Houston have an amazing and momentous history. They were once used as the space age laboratories and offices of some of the most brilliant NASA astronauts and scientists in the race to put a man on the moon. One of these buildings on Telephone Road was even visited by President John F. Kennedy on his tour of the nation's space facilities. In September 1961, the federal government named Houston as the location for the National Aeronautics and Space Administration's Manned Spacecraft Center, previously housed at Langley Research Center in Hampton, Virginia. While permanent NASA facilities were being constructed in the Clear Lake City area, a variety of buildings were leased throughout southeast Houston. These buildings became the first home to NASA in Houston.

Time was of the essence when President Kennedy and space program officials set their sights on being the first nation to land a man on the moon and return him safely to Earth. In the late 1950s and early 1960s, there was an urgency to bring the United States space program up to the level of the Soviet Union. The Soviets launched the first satellite into orbit in 1957. The Soviets were the first to put a man into orbit in April 1961. There was a concern among the American government and citizens that the Soviets may have been gaining an edge in technology and military capability. This concern led to many government meetings over the following month to consider what should be the next step in the U.S. space program. In a speech on May 25, 1961, President Kennedy announced that "this nation should commit itself to achieving the goal, before the decade is out, of landing a man on the Moon and returning him safely to Earth."[1] Once Houston was named as the Manned Spacecraft Center (MSC), there was no time to waste. Work had to begin in Houston immediately while the Center was being constructed. At least a dozen buildings throughout southeast Houston and Ellington Air Force Base were leased by NASA. Surprisingly, most of the buildings are still around and in use today, over forty-five years after NASA moved to its permanent home near Clear Lake on a road now known as NASA Parkway.

One of these interim NASA buildings with an especially fascinating history is the Phil Rich Fan Company Building, constructed at the corner of Telephone Road and Westover for the company's own use in 1961. The Rich Fan Company was beginning to move into the new building when the company was contacted by members of the Houston Chamber of Commerce and the federal government regarding use of the building. Government officials said that President Kennedy was planning to put a man on the moon and they needed the building for use in the manned space program. The government and the Rich Fan Company agreed to a price for leasing the building for two years with two one-year options. The company put in several hundred thousand dollars of improvements requested by NASA. Work then began in the building as the Space Flight Office.[2]

Keeping a travel schedule typical of presidents today, President Kennedy made a whirlwind two-day tour, in September 1962, of four of the nation's space facilities located in four different states. The day before coming to Houston, Kennedy toured NASA facilities in Huntsville, Alabama, and Cape Canaveral, Florida. After touring Houston facilities in the morning of the second day of the tour, he flew to St. Louis to visit a McDonnell Aircraft Corporation plant responsible for spacecraft manufacturing.[3] It is of historical significance that Kennedy made such an effort to champion the space program in nearly the peak of Cold War tensions. At the time of Kennedy's Houston visit, the Cuban Missile Crisis was about a month away. The success of the space program went hand in hand with the idea of beating the Soviets and winning the Cold War.

NASA S62-03939

The interim headquarters for the Manned Spacecraft Center was in the Farnsworth-Chambers Building, at the intersection of South Wayside and Wheeler.

CURRENT PHOTO BY BURTON CHAPMAN

Roberts Carpet location at 4750 Gulf Freeway at Canada Dry Street housed the machine shop for the Technical Services Division.

NASA S62-00518

The Life Sciences Division was housed in the Lane-Wells Building, 2002 Wayside.

PHOTO COURTESY KUHT CHANNEL 8-PBS.

A television studio building at 4513 Cullen became NASA's Computer and Data Receiving Division. After NASA moved out, KUHT Channel 8 moved in.

NASA S62-04739

Before operations were completely housed at its newly constructed location, some 1,500 personnel worked at Ellington Air Force Base in renovated World War II barrack structures.

During the Houston visit, President Kennedy delivered a speech to forty thousand people in Rice University Stadium. He was very instrumental in promoting the importance of the nation's manned space program. He reiterated his support in his speech with statements like, "the exploration of space … is one of the great adventures of all time, and no nation which expects to be the leader of other nations can expect to stay behind in this race for space."[4] After delivering the speech at Rice Stadium, his motorcade went to Telephone Road. Approximately forty thousand people lined the streets between Rice Stadium and the NASA facility to see Kennedy. Upon arrival, Kennedy had a one-hour classified briefing by NASA officials. He then toured the model of the Apollo lunar landing vehicle at the site. The vehicle was nicknamed the "Lunar Bug" because of its massive body supported by fifteen-foot legs. Kennedy had his questions answered by astronaut Alan Shepard and other NASA officials. The president was presented with a small desk model of the Apollo Command Module. In a short speech before the "Lunar Bug," he said that attempts to place the manned vehicle on the moon may come "within the next five or six years." This was the most definite date announced publicly so far by American officials. Kennedy departed from the Rich Building for Houston International Airport (now William P. Hobby Airport) by way of Telephone Road. He flew to St. Louis to tour the McDonnell plant and then back to the White House that evening.[5]

"the exploration of space …

Permanent facilities in Clear Lake were eventually opened and the final move from leased facilities like the Rich Building began on June 24, 1964.[6] The Rich Fan Company never occupied the building after NASA moved out. They had since built a plant in another location in west Houston. The Rich Fan Company operated for many more years before being sold to Sunbeam in 1981. Phil Rich's son Hershel was president of the company through these years. According to Hershel Rich, the leasing of the building to NASA was not the great windfall that some may have expected. He states that the company basically broke even financially from the leasing of the building for twenty-seven months to NASA. Taxes had to be paid on the improvements that NASA requested. Rich states that NASA left in the middle of the lease, leaving the building vacant for about one year before the Ambox Corporation bought it. However, Rich reasons that the excitement of seeing the space landing mock-ups and getting to talk with some of the first people to work for NASA made the experience worth it.[7] The building is in use today by the Ambox Corporation in the metal works services industry.

Another interim NASA facility that has had an intriguing history is the Farnsworth-Chambers building at the intersection of Wheeler and South Wayside. The building was designed by an admirer of Frank Lloyd Wright's architectural style. It includes lots of long horizontal lines and a broad, rambling layout. The building was used for the MSC headquarters in the early 1960s. After NASA moved out, it was leased by various companies from the mid-1960s to the mid-1970s. Since 1976, the building has been owned by the City of Houston. It is still a "headquarters," but this time for the Houston Parks and Recreation Department. The City of Houston is currently renovating the building while retaining the structure's unique charm.[8]

NASA S62-03172

The Canada Dry Bottling Plant at 4750 Gulf Freeway would become the NASA Technical Services Division.

PHOTO BY BURTON CHAPMAN

Ambox Corporation owns what was formerly the Rich Building at 6040 Telephone Road.

NASA S62-00800

The Minneapolis-Honeywell Building at 5440 Gulf Freeway was once home to the Public Affairs Office.

NASA S62-06240

NASA occupied fifteen different temporary locations, including the former Veteran's Administration Building, 2320 La Branch.

The Lane-Wells building on the east side of the Gulf Freeway on South Wayside was home to Dr. Stan White's Life Sciences Division. The two-story, red-bricked building is in excellent condition today and is known as the St. Austin Center. It is a community center that is used for a variety of purposes such as a meeting place for the Idylwood Civic Club, a home of the Christus Community Health Ministry, and offices for some of the nuns from the neighboring Villa de Matel Convent.

An old Canada Dry Bottling Plant at 4750 Gulf Freeway was turned into NASA's Technical Services Division. The building was then used by Simmons Carpet for several decades after NASA moved out. Today, the building is a warehouse for Roberts Carpet. Most of the original building's walls and foundation are intact, but newly constructed walls are built around them. Three of the original walls are visible only from the inside of the warehouse. The fourth original wall that faced the freeway had to be demolished to widen the Gulf Freeway and its service roads.[9]

A television studio building at 4513 Cullen on the University of Houston (UH) campus became the NASA Computer and Data Receiving Division. It had been used by KNUZ-Channel 39 and KTRK-Channel 13 through 1960. After NASA moved out, KUHT-Channel 8-PBS moved into the building.[10] The Quonset hut-shaped building is still on the UH campus. It is surrounded by satellites at the south end of the large parking lot across Wheeler from Oberholtzer Hall.

Once you know which buildings to look for, you will encounter former interim NASA buildings virtually everywhere you turn in southeast Houston. It is obvious what a presence NASA had on the southeast side in the early 1960s. These buildings were vital in providing space on short notice for the men and women who were working under pressure to reach the goal of landing a man on the moon. Be mindful of the unique history and importance of these buildings the next time you drive through southeast Houston. ★

NASA S62-03842

The Stahl and Myers Building provided temporary offices for Project Mercury, Gemini, Apollo, and Flight Operations Division.

NASA S63-00893

NASA used four of the six apartment buildings for office space in the Franklin Development Complex on Beatty Street.

Testing of the Gemini spacesuit was conducted in the Lane-Wells building until facilities were built on the permanent site of the Manned Spacecraft Center.

NASA S62-00573

OWLS IN SPACE:

RICE UNIVERSITY'S CONNECTIONS TO NASA JOHNSON SPACE CENTER

By Jessica A. Cannon

On September 12, 1962, President John F. Kennedy gave a speech from a stage in the middle of Rice Stadium restating America's commitment to send a man to the moon by the end of the decade. Yet, beyond this historic moment for the city of Houston, other Rice University associations with the space program are less well known.

In fact, Rice worked closely with leadership in the National Aeronautics and Space Administration (NASA) beginning in 1961 with the selection of Houston as the site for the new Manned Spacecraft Center. This involvement was even acknowledged by Kennedy toward the end of his speech:

NASA S63-22847

A Gemini spacecraft model garners attention at Rice University, December 1963.

"I am delighted that this university is playing a part in putting a man on the moon as part of a great national effort of the United States of America."[1]

The connections between NASA and Rice, especially through the Lyndon B. Johnson Space Center (JSC), over the last half-century, have helped sustain scientific research at these institutions individually, but they have also contributed on a larger scale to making Houston world-renowned as Space City, U.S.A.

Rice's link to what would become JSC began in early 1961 as Humble Oil and Refining Company Chairman Morgan Davis, Texas Congressman Albert Thomas, and Rice officials tried to convince NASA to build its sixty-million-dollar facility to support manned spaceflight in Houston. Thomas, who graduated from Rice in 1920, had tried unsuccessfully throughout the late 1950s to convince the Atomic Energy Commission to create a laboratory and research program at his alma mater. In August and September of 1961, he succeeded in convincing NASA Administrator James Webb and a site selection committee of the virtues of a Houston facility—access to Ellington Air Force Base, a climate that allows for year-round training and flights, and proximity to a major city with established communications and computer resources, industry, and educational institutions. Thomas had assistance from his friend and fellow Rice alumnus George R. Brown, then chairman of the Rice Board of Trustees, and Rice officials President Kenneth S. Pitzer and Chancellor Carey Croneis, as well as the Houston Chamber of Commerce and other leaders in the city. In fact, Davis transferred 1,000 acres of land to Rice University from Humble Oil's holdings near Clear Lake, and Rice in turn gave the land for the new NASA Manned Spacecraft Center (MSC) to be constructed. Soon thereafter in early 1962, NASA purchased another 600 acres from Rice (also deeded to the university from Humble Oil) for $1.4 million.[2]

NASA announced the site of the new MSC on September 19, 1961, to the elation of many people in Houston.[3] The availability of the land from Rice for the NASA site demonstrates the work that went on locally to win this coveted government installation, but it did not end there. On September 22, NASA officials from the Space Task Group—including Walt Williams, Robert Gilruth, and Martin Byrnes—arrived in Houston to tour the site and the relevant city facilities. They were treated to a warm welcome by

members of the Houston Chamber of Commerce. After touring the Clear Lake site, NASA officials sat in the president's box before a crowd of seventy-three thousand to see Rice defeat LSU 16-3 in football. That evening they attended a party at Rice Dean of Engineering Franz Brotzen's home with city officials, members of the Rice and University of Houston administration, and Rice faculty.[4] Meetings and letters between NASA Administrator James Webb and Rice officials Kenneth Pitzer, George Brown, Carey Croneis, and others on both sides continued throughout the fall of 1961 and well into 1962 as plans were finalized and both sides outlined their goals for cooperative efforts.[5]

NASA officials were particularly interested in seeing Rice continue its program of materials research and its strong engineering programs. "It is clear that the Manned Spacecraft Center will want to look to Rice for advanced training of the Center personnel," wrote Homer Newell, director of NASA's Office of Space Sciences, but also "we will wish to go further than this…to develop a relationship between elements of the Manned Spacecraft Center and Rice similar to those that now exist between Jastrow's Institute for Space Studies and the universities in the New York area."[6] President Pitzer and Rice officials had similarly high aspirations. In a speech before the Houston Chamber of Commerce on December 7, 1961, Pitzer illustrated how Rice fit into the larger goal for space exploration: "Rice is participating effectively in this sort of [theoretical and practical] research activity and we anticipate expanding our activities with the aim of contributing further knowledge and providing trained manpower for the space program." Specifically, Rice could offer the MSC "great enthusiasm for the project" and "complete cooperation" of a "supporting academic and scientific environment." Additionally, Rice's "traditional emphasis on excellence" would complement "an effort such as Apollo, where the failure of even a minor valve or control circuit can mean the failure of an entire mission and can endanger the life of the astronaut." One final contribution was "the willingness of Rice University to expand its activities to meet space age needs and the ability of the community to support such expansion."[7]

Although Pitzer only vaguely mentioned "new programs" in his December 1961 speech, he quickly set about creating graduate courses of study and organizing a program around space studies during 1962. Pitzer briefly considered adding these courses to the current Physics Department but instead won approval from the Committee of Faculty, Students, and Alumni to start a new Department of Space Science. On January 4, 1963, the "first Department of Space Science in any college or university in America" was announced, with Alexander J. Dessler from the Graduate Research Center of the Southwest in Dallas named as head of the department. The department offered a graduate course of study leading to the Masters and Doctor of Philosophy degrees, with "a well-balanced program…in the most important fields that constitute Space Science and will develop scientists who are proficient in most areas of Space Science and expert in at least one."[8] With the department established and numerous students applying to study at Rice, there was a need to find laboratory space for the new program. Funding for a Space Science Building to be built on the Rice campus was provided by NASA and by the university, and ground-breaking ceremonies were held in February 1965. It was completed in 1966.[9]

Rice University Alumni Astronauts

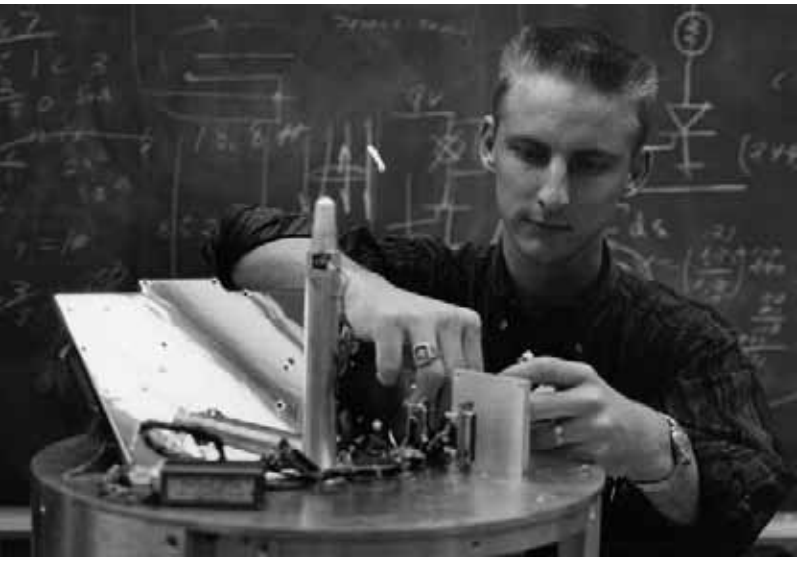
John S. Bull	BA, BS	'57	Mechanical Engineering
Takao Doi	PhD	'04	Astrophysics
Jeffery Hoffman	MA	'88	Engineering-Materials Science
Tamara E. Jerrigan	PhD	'89	Space Physics and Astronomy
James H. Newman	MA PhD	'82 '84	Physics
John D. "Danny" Olivas	PhD	'96	Mechanical Engineering and Materials Science
Peggy Whitson	PhD	'86	Biochemistry
Shannon Walker	BA MA PhD	'87 '92 '93	Space Physics

Other Noteworthy Alumni and Friends

N. Wayne Hale, Jr. *Deputy Associate Administrator of Strategic Partnerships* *Former Program Manager, Space Shuttle Program*	BS	'76	Mechanical Engineering
Janice Voss *Astronaut*	Graduate work in Space Physics at Rice 1977–78		
Curt Michel *Scientist-Astronaut from 1965 – 69*	Professor of Astrophysics at Rice		

In June 1963, also immediately following the creation of the Space Science Department, the university established a Satellite Techniques Laboratory to serve as the basis "for the design, construction, check-out and environmental testing of individual instruments and complete payloads" at Rice. The lab housed a telemetry management and command station and the necessary equipment to analyze data received from satellites in addition to design and fabrication equipment. Curtis D. Laughlin was brought in to head the new lab, as were Brian J. O'Brien, newly appointed Professor of Space Science at Rice, and Ray Trachta. These three men had designed and built the Injun 1, 2, and 3 satellites at the University of Iowa (funded by the U.S. Navy).[10]

One of the lab's first projects was a contract with NASA to design and build six rocket payloads to be launched atop Nike-Cajun rockets. The payloads were named in honor of Rice's mascot Sammy the Owl, making them Sammy 1, 2, 3, and so on. Sammy 1 was launched from Wallops Island, Virginia, on January 14, 1964, to the cheers of a number of alumni who flew to Virginia to see Rice's first space traveler (albeit a mechanical one). The rocket reached an altitude of 90 km, and Sammy 1 functioned according to plan, sending back data to waiting Rice graduate students on the ground. The remaining Sammies (2 through 6), with more complex equipment to study the auroras, were launched successfully that winter and the next from Fort Churchill in Canada. A report on the flight of Sammy 5 dated March 23, 1964, recorded "a complete success" with "three beautiful flights into auroral conditions which were very satisfactory." The Sammy payloads made pioneering studies of the auroras, and they provided valuable design and launch experience for the students, some of whom earned their degrees based upon these projects and went on to contribute to the study of space during their careers through research and teaching.[11]



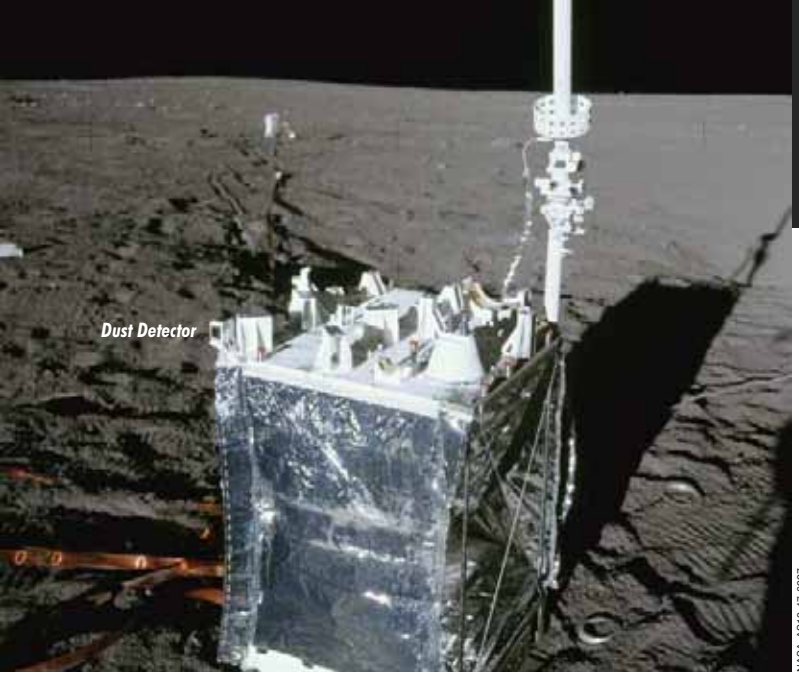
WOODSON RESEARCH CENTER, RICE UNIVERSITY

Rice graduate student works on an Owl satellite in 1966.

In addition, the Rice Space Science program won the honor of building the first satellites in NASA's University Explorer Program. This program allowed universities to design and build complete satellites, instead of their instruments being simply added to other NASA satellites. Rice faculty and students designed a two satellite system that studied the auroras in both hemispheres, and the types of particles that caused them. The satellites, code-named Owl 1 and Owl 2, were initially set to be launched in 1967 from the Vandenberg Air Force Base in California, although they were delayed by budget issues and development problems.[12] They were never launched, but several instruments developed for the Owls, including a low-level auroral TV camera, were later flown on manned spacecraft.[13]

Other scientific instruments and satellites were developed during the 1960s at Rice. The Biosatellite Research Program in the Department of Biology, a NASA-sponsored program, developed two satellites—Biosatellite–A and –B—that were launched from Cape Kennedy in December 1966 and September 1967, respectively. These satellites used vinegar flies to test the effects of radiation and weightlessness on living organisms. The first satellite was never recovered, but the second was recovered near Hawaii after a forty-five hour flight.[14] Back in the Satellite Techniques Lab, Brian O'Brien and the Space Science students built a Navy-funded satellite to conduct further research on the auroras and the Earth's magnetosphere. Called Aurora 1, the satellite was put into orbit in June 1967.[15]

NASA's Apollo missions to the moon (11, 12, and 14 through 17) included scientific equipment designed to be left on the moon by the astronauts. The Space Science faculty and students designed three different instruments that were included in these Apollo payloads. John Freeman's Suprathermal Ion Detector Experiment (SIDE) was set-up on the moon by Apollo 12 and Apollo 14 astronauts. The Charged-Particle Lunar Environment Experiment (CPLEE) developed by Brian J. O'Brien was on the Apollo Lunar Surface Experiments Package (ALSEP) payload for Apollo 13, and was deployed on the moon by Alan Shepard on the Apollo 14 mission. The CPLEE was, in fact, an electronic ancestor to equipment developed for the Aurora 1



NASA AS12-47-6927

The Dust Detector Experiment was one of only two experiments placed on the moon during Apollo 11, and included on three other missions. The matchbox-size detector is shown (left) as part of the ALSEP, placed on the lunar surface by Apollo 12, November 1969.

satellite. The Dust Detector Experiment (DDE), also developed by O'Brien, was perhaps the most noteworthy experiment of the three. The matchbox-size detector weighed just 270 grams, and was one of only two experiments placed on the moon during the historic landing of Apollo 11 (the other was a seismology monitoring device). The DDE was also deployed on Apollo missions 12, 14, and 15. Data sent back to scientists on Earth showed dust accretion was a significant problem on the moon's surface—research that is still important today as NASA plans new missions to the moon. Transmissions from the DDE ended only when NASA turned off all the ALSEP equipment in December 1977, although these small pieces of Rice remain on the moon today, much like the footprints of twelve men who also made the long journey from Houston.[16]

There have been other connections between JSC and Rice since the 1960s. Although the focus at JSC rapidly became design and applied engineering (on items like spacesuits, capsules, and later the space shuttle), Rice University was able to maintain some research relationships with JSC and to capitalize upon its strong engineering program in training several past and present astronauts. Members of the Rice faculty lectured to astronauts on various scientific topics, and Brian O'Brien specifically was asked to serve on a NASA commission to discuss radiation dangers to the astronauts.[17] Collaborations with the MSC continued with the creation of the Lunar Science Institute to handle materials brought back from the moon. Rice owned the West Mansion (as part of the lands initially give to the institution from Humble Oil in 1961), so when NASA began seeking a facility for a Lunar Receiving Laboratory to house the lunar samples and research, the adjacent lands of the West Mansion near JSC made sense. Rice, along with grants from NASA and the National Academy of Sciences, created the Lunar Science Institute, renamed in 1978 the Lunar and Planetary Institute. It was operated at this location by Rice and the Academy until 1990, when it relocated to another site in the Clear Lake area.[18]

Additionally, Rice's Fondren Library staff cooperated with the new MSC library in obtaining needed technical books through a book sharing agreement, and Fondren Library became "an official repository for general purpose educational-information materials from NASA," as opposed to the purely technical reports.[19] In the 1980s, Professor Alexander Dessler studied data received from Voyager 1 (which passed by Jupiter and Saturn) and Voyager 2 (that went past Neptune and the planet's moon Triton).[20] From 1982 until 2000, the Woodson Research Center, by agreement with NASA, housed the Johnson Space Center History Collection, making the records of the Mercury, Gemini, Apollo, and Apollo-Soyuz Test Project Programs available to the public.[21] Even today, there are ongoing collaborations between JSC and Rice's Center for Nanoscale Science and Technology.[22]

While the connections today between Rice and JSC may be on a seemingly smaller scale compared to such institutions as Cal Tech and the Jet Propulsion Laboratory, there is a great deal of history between these two Houston icons. Rice University officials and alumni—including Congressman Albert Thomas, class of 1920—were very influential in bringing NASA to Houston. The university also seized the opportunity to develop a stronger graduate program in the sciences with the creation of the Department of Space Science to further facilitate the relationship with the MSC and, later, JSC. Three satellites were launched out of the Rice program, including Aurora 1, which may still be in orbit. And three different pieces of equipment designed at Rice were deployed on the moon through the Apollo ALSEP program, and they remain there today.

These links between the two institutions continue today and are reinforced by the numerous people who were trained at Rice over the last fifty years. Astronauts who have earned degrees from Rice, including Peggy Whitson (PhD '86)—who recently broke the U.S. record for longest cumulative time in space and was the first female commander of the International Space Station—and other alumni like former Space Shuttle Program Director Wayne Hale (BS '76) contribute in obvious ways to space exploration, but other Rice graduates participate behind the scenes through their valuable ongoing research that helps to make space travel possible.[23] ★

MUTUALLY BENEFICIAL:

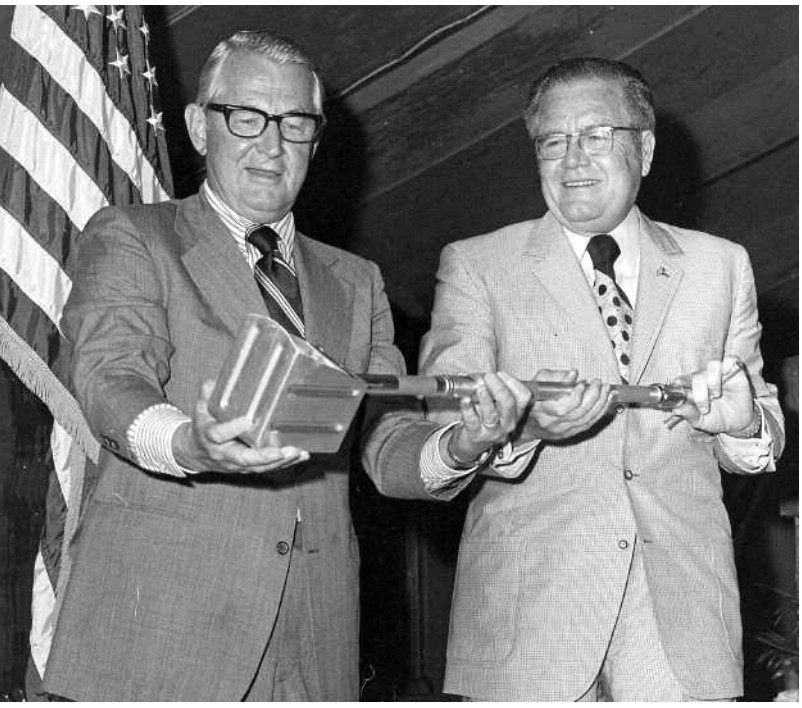
UNIVERSITY OF HOUSTON – CLEAR LAKE AND NASA JOHNSON SPACE CENTER

By Shelly Henley Kelly

On September 19, 1961, NASA announced that the Manned Spaceflight Center (MSC) would be located in Harris County (Houston) just off the shores of Clear Lake. As the Clear Lake City community around MSC evolved and the University of Houston at Clear Lake City (UH/CLC) was created, a symbiotic relationship between the university and Johnson Space Center (JSC) formed in two distinct periods, under two different visions.

Early in the MSC development, a demand for graduate work grew within NASA and the nearby space-related industries. MSC Director Dr. Robert Gilruth recognized the need for continuing education, knowing that offering graduate education would serve as an inducement in recruiting. As NASA's primary contact between MSC and the educational community, Paul Purser achieved an academic first, persuading Rice University, the University of Houston, the University of Texas at Austin, and Texas A&M University to accept graduate credits from each other's programs, as well as credits MSC employees had earned earlier at Virginia universities.[1]

UH Chancellor Dr. Philip Hoffman (left) and Texas Governor Dolph Briscoe use a moonscoop for the university's groundbreaking, May 1, 1974.



UHCL ARCHIVES

The University of Houston began offering selected graduate courses at MSC in the fall of 1964; the MSC sponsored employees whose classes were needed to substantially improve job performance.[2] In the first year, more than five hundred MSC employees enrolled in graduate and undergraduate courses at UH. Faculty taught physics, math, and various engineering courses in MSC conference facilities though these rooms were not suitable for permanent use and were urgently needed for engineering office space. On September 10, 1965, MSC Director Robert Gilruth formally requested "that the University of Houston give immediate consideration to the establishment of a permanent graduate and undergraduate educational facility in the Clear Lake area." Gilruth recognized that, "The availability of the best educational opportunities for our employees is vital to the accomplishment of our Center's mission objectives."[3]

UH Chancellor, Dr. Philip Hoffman, replied that "…it would be difficult for us to be unresponsive to vital needs of the MSC and its staff," but indicated that "the acquisition of appropriate land in the Clear Lake City area would be of crucial importance to this project."[4] Plans were already in motion, as their correspondence was copied to Dr. Charles Jones, president of Humble Oil & Refining Company, and M.W. Hankinson, president of Friendswood Development Company. Dr. Jones wrote that he was "pleased to inform [Dr. Hoffman] that Humble Oil & Refining Company is prepared to donate fifty acres of land in Clear Lake City to the University of Houston for the establishment of a permanent undergraduate and graduate facility…contingent upon the University's willingness to construct and operate a substantial educational facility on the property." A total of 487 acres would be donated from the Friendswood Development Corporation to become The University of Houston at Clear Lake City.[5]

With the original fifty acre donation, the University of Houston pursued approval from the Coordinating Board and Texas Legislature to construct the Clear Lake Graduate Center (CLGC), which opened for classes in January 1973. By that time

UHCL ARCHIVES

Dr. Alfred R. Neumann (left) served as the first Chancellor at UHCL. He was appointed by UH Chancellor Dr. Phillip Hoffman (right).

however, plans were already underway to develop a second, separate and independent, UH campus adjacent to the CLGC. In 1968, the Coordinating Board, Texas College and University Systems (now the Texas Higher Education Coordinating Board) had called for the creation of a new campus in Clear Lake to offer upper-division and graduate-level programs. Four years later, the 62nd Texas Legislature passed House Bill 199, establishing in Harris County "…a coeducational institution of higher education to be known as the University of Houston at Clear Lake City."[6]

Dr. Hoffman appointed his Dean of Arts and Sciences, Dr. Alfred R. Neumann, as the founding chancellor of the new institution. Although the birth of UH/CLC came from the need for graduate engineering programs at UH, the primary focus for academic programs at UH/CLC would be more community-based: business and management, education, public affairs, literature, human sciences, and the humanities. As founding chancellor of UH/CLC, Dr. Neumann strove to provide the new institution with its own sense of identity, to be separate and to fulfill a need in the area without stepping on the toes or interfering with the plans of the central campus. He firmly believed in the upper-level and graduate institution's charge "to extend the educational opportunities of students who have completed two or more years of college; to provide non-traditional curricula in response to the needs of contemporary society; and to meet the continuing and often specialized educational needs of the unique population of the Bay Area." Excellent teaching was his paramount focus.[7]

Charter faculty and future Dean of Sciences and Computer Engineering Charles McKay years later reminisced, "Dr. Neumann believed that a major role of our university was to humanize the high-tech Neanderthals who roamed the corridors of Clear Lake…he was very interested in bringing improved opportunities in the humanities, in the fine arts, and other things to the community."[8]

Because Dr. Neumann focused on teaching and the humanities—developing programs for the community of Clear Lake, rather than the engineering needs of MSC—his involvement with NASA has largely been overlooked or forgotten. The very cultured chancellor, a former professor of German literature and an accomplished musician, preferred to leave the details of developing programs with the newly renamed Johnson Space Center (JSC) to his provost and school deans. Correspondence from his office reflect a more reserved, formal connection with JSC Director Christopher Kraft (1972-1982) while UH/CLC Provost Dr. Lou Rodriguez communicated with JSC Director of Administration and Program Support Philip Whitbeck.

During the formative years, UH/CLC and JSC reached out to one another to find a mutually beneficial relationship. In late 1975, Dr. Neumann assigned a faculty committee to explore the possibility of establishing an Institute on Educational Applications of Space Research, to find ways in which the new knowledge generated by NASA could be applied in the educational process at all levels. The committee, chaired by Dr. Christopher Dede, prepared a report detailing methods to reach three major types of clients: educators, local industries (non-engineering sectors), and specialized meetings in Houston (conventions, conferences). They envisioned workshops, courses, briefs, and supplemental curriculum to promote the social benefits of aerospace research. The committee only lasted a few years before disbanding in October 1977 due to a lack of funding.[9]

Through a series of NASA Cooperative Agreements, UH/CLC set up a Laboratory Preceptorship Program (internships) and received over $613,000 of specialized equipment loaned or donated by JSC. In 1979, a Graduate Internship Program Memorandum of Understanding replaced the earlier Laboratory Preceptorship Program

agreement to better facilitate a university graduate internship program, allowing university graduate students the opportunity to use JSC facilities. A separate Cooperative Education Program allowed students to work at the center for one semester and attend the university on a full-time basis the next. There were normally two or three students per semester enrolled in this program.[10]

The most successful early program with JSC was the Management Development Program, a management training and education program specifically directed at mid-level, high-potential employees. In May 1974, NASA contacted UH formally requesting two management courses per semester for three years, with onsite registration and coursework, for trainees to receive a Masters in Public Administration degree. UH forwarded the request to UH/CLC and Dr. Rodriguez visited JSC to explore a "number of complementary endeavors that I hope will develop between NASA and the University of Houston at Clear Lake City." In addition to speaking to over one hundred interested students about business and industry, public affairs, and business administration programs, he was also looking to attract potential faculty.[11]

Dr. Rosemary Pledger, Dean of Professional Studies, worked out the details with Phil Whitbeck, offering four courses each semester in areas such as organizational behavior, organization theory, and theory and management of systems. At least one class was taught at JSC each semester, and in the summer one faculty would conduct research on a mutually acceptable topic at JSC.

In July 1980, Dean Pledger expressed her concern about the lack of women participating in the program. JSC Personnel Officer Jack Lister shared her frustration and requested any suggestions from her for increasing participation that despite informal contacts made with "eligible, highly qualified" women to encourage their application, only three had applied for the program since its inception. Over one hundred employees were graduated from this special two-year program before it was cancelled in 1981 by mutual agreement because nearly all of the employees who met the criteria had participated.[12]

Rodriguez later commented that JSC "really needed our management program more than probably anything else." Business degrees were in high demand among JSC employees who came to UH/CLC, though JSC students grilled the faculty over credentials, demanding to know where they had studied, what they had published, and how many years of teaching experience they had.[13]

Dr. Neumann enjoyed the cordial relationship with JSC, and noted "…that a large number of NASA employees have returned to school here on a part-time basis to upgrade their skills in

Chancellor Alfred R. Neumann serves as master of ceremonies at the dedication of the Clear Lake Area Bicentennial Time Capsule at UH/CLC on July 20, 1976. Providing contents for the capsule were area government agencies, organizations, businesses, and the Johnson Space Center.

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Houston Mayor Kathryn J. Whitmire along with NASA JSC Director Gerald D. Griffin (left) and UHCL Chancellor Dr. Thomas Stauffer at the world premiere of "The Artist and the Space Shuttle," held at the UHCL campus in October 1983.

management, public affairs, business or just general liberal arts."[14] Records from the fall of 1978 to the spring of 1982 indicate that NASA and contractor sponsored students made up about four percent of the enrollment, though there are no statistics showing the number of students who were NASA employees not receiving tuition reimbursement.

Neumann's emphasis on strong business and humanities programs for the "community university" helped to develop a relationship with NASA and that relationship, in turn, would later help UHCL recruit future faculty. By 1982, UHCL had attracted seven faculty in business, science & technologies, and public affairs from NASA or contractors, including Phil Whitbeck, who retired from NASA in 1981.

NASA even became involved in physical campus development. In 1977, UH/CLC announced plans for a new prototype solar-powered building to be built next to the former CLGC, now known as the Arbor Building. The Developmental Arts Building would contain multipurpose areas for dance classes, recreation, a gym, racquetball courts, classrooms, and physical fitness labs. A grant from the Department of Energy (DOE) and NASA provided the cutting-edge solar energy heating and cooling system. A series of 616 solar collectors in three heights were installed over 18,000 square feet of the roof. Solar heated water could be stored in a 21,000 gallon tank, while cooling would be provided by a specially designed Carrier 75-ton solar operated absorption chiller. The grant specified that DOE/NASA would furnish and install the complete air and water heating systems and would provide monitoring and maintenance for a two-year period.

Unfortunately, the experimental project never worked properly. The solar panels lining the roof were removed and replaced by another NASA energy-efficient project, a modified roof comprised of a UV light protective coated foam. However, it soon became evident that this material trapped moisture in the roofing system and pervaded the building's structure. In 1995, the building was renovated and reopened as the Delta Building.[15]

In August 1982, JSC Director Christopher C. Kraft and UH/CLC Chancellor Dr. Alfred R. Neumann both retired from their respective agencies. Their replacements would enjoy a more casual, personal friendship.

Dr. Thomas Stauffer, UH/CLC's second chancellor, a young, self-confident, energetic man of limited teaching experience, had worked for the American Council on Education as vice president/director of External Affairs. The proximity of NASA's JSC was an immediate attraction to him, and he wasted no time in contacting the new JSC Director Gerry Griffin to develop a friendship and shared vision. Stauffer remembers that when he came to UH/CLC the university "was oriented more toward the humanities and social sciences," and he deliberately set out to develop a particular expertise in technology and information science. As a sign of the coming changes, the university name was shortened to University of Houston – Clear Lake (UHCL).[16]

Griffin invited the new chancellor to the launch, landing, and welcome home of STS-6, the first flight of the Space Shuttle *Challenger* in April 1983. Dr. Stauffer thanked him profusely, adding, "although it was not why I was chosen for my current post, the fact is that I have been a wildly enthusiastic 'space fan' for the past quarter century or so. If you ever need a chancellor to inspect the needs for higher education in Earth orbit, I would certainly be the logical candidate."[17]

About the same time, the two men agreed to honor NASA's twenty-fifth anniversary in October 1983 with the world premier of "The Artist and the Space Shuttle," a Smithsonian Institution traveling exhibit on tour from the National Air & Space Museum. The exhibit highlighted seventy works by thirty-five artists commissioned by NASA over the past twenty years to render their impressions of the development of the Space Transportation System (STS) or Shuttle Program. The reception on October 14 was attended by such notables as Houston Mayor Kathy Whitmire, JSC and contractor senior staff, university faculty, astronauts, artists, and the recently widowed Selma Neumann.[18]

UHCL ARCHIVES

UHCL Chancellor Dr. Thomas Stauffer (left) and Dr. Charles McKay promote the Ada partnership.

The April launch activities also gave Dr. Stauffer and Griffin an opportunity to discuss their desire to establish mutually beneficial ties between UHCL and JSC. After meeting with faculty and administrators, Dr. Stauffer outlined four operational principles toward future collaboration with JSC: that UHCL's academic programming and research must be sensitive to JSC priorities and mission requirements; that the campus atmosphere must be welcoming to JSC employees and contractors; that the academic integrity and mission of UHCL must be protected in its relationships with all other agencies; and that the university and JSC must only engage in those collaborative activities that can be done well. Stauffer envisioned a regular communication of data, experience, and concepts leading to in-depth studies.[19]

Perhaps the most significant development with JSC during Dr. Stauffer's era was the selection of UHCL as the first beta test site for the Ada Programming Support Environment (ASPE) and Ada Language System. In 1979, the Department of Defense adopted a set of requirements to establish a single, high-level, language intended primarily for systems programming applications that could be used for mission and safety-critical computer applications. That same year, JSC released a two-volume report analyzing the concept of a shuttle serviced, permanent, manned facility in low-Earth orbit called the Space Operations Center, now known as the Space Station Program.

UHCL, the first public university to teach Ada as a regularly scheduled course, opened its High Technologies Laboratory in September 1982 to conduct cooperative research and problem-solving services focusing on the Space Operations Center, ASPE, and Electro-Optical communications, guidance, and control. It brought together numerous researchers from multiple aerospace and electronics corporations across the country, including NASA, and it brought in grant funding.

In 1983, UHCL became the first campus worldwide named an APSE Beta Test Site to establish a set of standards and policies covering the design, development, and management of future flight data systems, including the Space Station. Part of NASA's justification statement for the Memorandum of Understanding with UHCL stated that, "University staff and students …are recognized experts in the Ada arena, especially associated with the design and development of distributed data systems and networks. The University has been chosen by commercial firms with a vested interest in application," and "JSC requires outside technical expertise to integrate with the flight systems expertise within the center."[20]

The joint NASA/JSC and UHCL APSE Beta Test Site earned and received accolades and recognition from the international community of participants and spectators. UHCL emerged as a recognized leader in software engineering.

Dr. McKay recalled another step in the partnership. "NASA looked down the road…and said, 'You know, this is an example of a really good thing. This is an example of a community working in close collaboration with a university on projects that matter to NASA. Let's broaden it beyond a finite project, and let's

open up a whole spectrum of programs ... that would be helpful for our university, and other universities, and other people from industry to collaborate on, that would benefit NASA.'"[21]

The Research Institute for Computing and Information Systems (RICIS) opened in May 1986 to allow faculty and students to work for and with JSC on advanced data processing systems and to help with technical and management information systems needed for future missions. RICIS conducted, coordinated, and disseminated research in computer information systems, serving as a focal point for joint programs. NASA management, scientists, and engineers worked directly with the university in five areas: computer systems and software engineering, information management, mathematical and statistical analysis, artificial intelligence and expert systems, and education and training.[22]

On February 19, 1987, representatives of UHCL and JSC announced the establishment of the NASA funded Software Engineering Research Center (SERC), the first publicly supported software engineering facility for non-military research in the nation. SERC researchers would identify and verify software engineering advancements and work to integrate and transition them into practice. UHCL and JSC continued to offer joint meetings and symposium, and these collaborations eventually led to the development of several new programs at UHCL, including degrees in computer systems engineering and biotechnology.[23]

In 1986, Dr. Stauffer, the self-proclaimed 'space fan' who witnessed the inaugural launch of the orbiter *Challenger*, found himself in a unique position to give back to the NASA community. In the days following the January 1986 *Challenger* explosion, Dr. June Scobee, a UHCL faculty member with the School of Education and widow of the *Challenger* commander Dick Scobee, contacted President Stauffer to ask him to meet with the other widows and family members. Stauffer had known all of the *Challenger* crew except one.

"We met on the floor; I remember it was a shag-carpet floor in her living room. This was just a few days after the accident, and tears were flowing all over the place. I was wondering what I was doing there. The whole topic was on what we should do to memorialize the *Challenger* crew," he recalled. During those early months, Dr. Stauffer freely supplied the families with university office space and equipment. After the families created the founding board of directors for what would become known as the Challenger Center for Space Science Education, they invited Dr. Stauffer to serve on the board of directors, where he held the office of secretary, and later succeeded June Scobee as chairman of the board.[24]

In the years since Dr. Stauffer and Gerry Griffin departed the university and the space center, the leaders that followed continued to build on the solid foundation formed between the two institutions. After a relatively formal beginning, UHCL and JSC discovered mutually beneficial collaborations, not only between themselves, but also in the economic growth and development of their community. ★

The University of Houston–Clear Lake (UHCL) continues to service the space community and NASA Johnson Space Center (JSC) by providing care and access to the JSC History Collection at the UHCL Archives and by offering library services through the Alfred R. Neumann Library.

By law, inactive federal records determined to have enduring historical value are retired and transferred to the National Archives and Records Administration (NARA) along with all legal custody. In February 2001, NASA, NARA, and UHCL signed a ten-year renewable Memorandum of Understanding to house over 2,500 linear feet of historical documents at the UHCL Archives. This memorandum allows the early flight program records to be readily available for use in current and future project planning, while also permitting the records to be accessible to the general public.

The JSC History Collection consists of approximately 1.5 million documents collected by the NASA JSC History Office as they worked on chronologies and histories of each manned spaceflight program. The large collection amassed for their "historian source files" covers the Apollo, Apollo-Soyuz Test Project, Skylab, Shuttle, and the Space Station Programs. In addition, the collection includes a General Reference Series and [Johnson Space] Center Series. Another major component of the Collection is the Oral History Series, consisting of over 1,000 interviews and other audio and/or transcribed data collected under the Oral History Project.

The JSC History Collection arrived at UHCL in several installments throughout Fall 2001 and Spring 2002. Since opening to the public, UHCL has assisted over 800 patrons in person and answered over 1,200 e-mail requests from all over the world.

In 2002, JSC negotiated a contract for the Alfred R. Neumann Library to provide library services, including reference and interlibrary loan, to JSC personnel and contractors. Throughout 2003, books and journals were transferred from JSC to UHCL and processed into the Neumann Library collection. Services have been expanded to provide JSC onsite book and document delivery via the JSC Scientific and Technical Information Center, and to allow JSC patrons to request books from other UH-System libraries. Over 4,000 requests have been handled since June 2002, predominantly interlibrary loan and article delivery.

THE MOON ROCKET

By Jennifer Ross-Nazzal

I still remember the first time I saw a Saturn rocket. It was the summer of 2000, and I had just accepted an internship with the Johnson Space Center (JSC) Oral History Project. My husband and I had been on the road for four days, coming from eastern Washington. In our 1993 purple Cavalier, we drove down NASA Road 1 toward the Center. As we inched closer to Saturn Lane, I saw the rockets on display within the Center's gates. I was in awe of the Saturn's immense size and had a hard time taking photos of the entire thirty-story vehicle.

NASA JSC2003E46913

JSC's Rocket Park features a single F-1 rocket engine (on the left), the five F-1 engines, and the first stage of an actual Apollo Saturn V launch vehicle.

NASA JSC2003E56795

The Saturn V, near the main entrance of JSC, impressed thousands of approaching visitors for almost twenty years (aerial view, 2003).

NASA JSC2003E46904

Due to the area's environmental elements, the 363-foot Moon Rocket experienced deterioration.

NASA JSC2004E33613

The National Air and Space Museum began an extensive repair and restoration project, March 2004.

NASA JSC2004E37838

The structure framing the building to house the rocket goes up in 2004.

NASA S77-28429

Later that summer, a friend from college came to visit. By then I had bought a camera that could take panoramic photos. Since then, it has become a tradition to visit Rocket Park and take snapshots in front of the Saturn rocket when visitors come to Houston.

Eight years later, the scene at the park has changed. The Saturn V, which was once part of an open-air exhibit, is now enclosed in a temporary building to protect the newly preserved launch vehicle. The doors to this facility opened on July 20, 2007, the thirty-eighth anniversary of the Apollo 11 mission, when the restored vehicle was unveiled to the public for the first time.

The rocket arrived in Houston in the fall of 1977, after a year of negotiations between NASA Headquarters and JSC. More than 750,000 visitors had traveled to Houston to see the exhibits and to learn more about the human spaceflight program, prior to this time. Since they had a particularly "intense interest" in the Apollo and Skylab missions, Center Director Chris Kraft came to believe that visitors could not fully understand the historical significance of these two programs without seeing the launch vehicle, in person. He asked that a Saturn V be transferred to JSC for public display.[1] In May 1977, the NASA Artifacts Committee approved JSC's request and, just a few months later, the Saturn V arrived in Houston.[2]

Parts came from all across the country to form a complete Saturn V rocket. The Michoud Assembly Facility (LA) held the first stage, while the Kennedy Space Center housed the second and third stages as well as the Spacecraft Lunar Adapter. The Command/Service Module (CSM) was in California.[3] The first stage to arrive came by barge from Louisiana to Galveston Bay and reached Clear Lake on September 19. Transferring the first stage to its current location, near the JSC visitor parking lot, proved to be particularly difficult. NASA Road 1 had to be closed off, and the rocket had to be moved in the wee hours of the morning, around 1:30 a.m. The generators for the transporters worked sporadically or, in some cases, failed. Eight hours later, the transportation team secured the 33 x 138 foot stage in its new location.[4] In October, the rest of the rocket was shipped by barge to JSC. The CSM arrived in November.

Since then, the Saturn has been part of the permanent exhibit at JSC, serving as a symbol of America's technological accomplishments. Even though the view from Saturn Lane has changed, as I drive over the bridge on Saturn and gaze upon Rocket Park, I am still awed by, and proud of, NASA's achievements so many moons ago. ★

NASA S77-28425

Onlookers watch and wait as the S-1C booster of the Saturn V launch vehicle is transported in 1977 for display at JSC.

NASA JSC2005E37628

Multiple layers of the rocket's exterior paint were removed using ultra-high pressure water jets.

NASA JSC2006E05153

For more than two years, the rocket was out of view while the work continued.

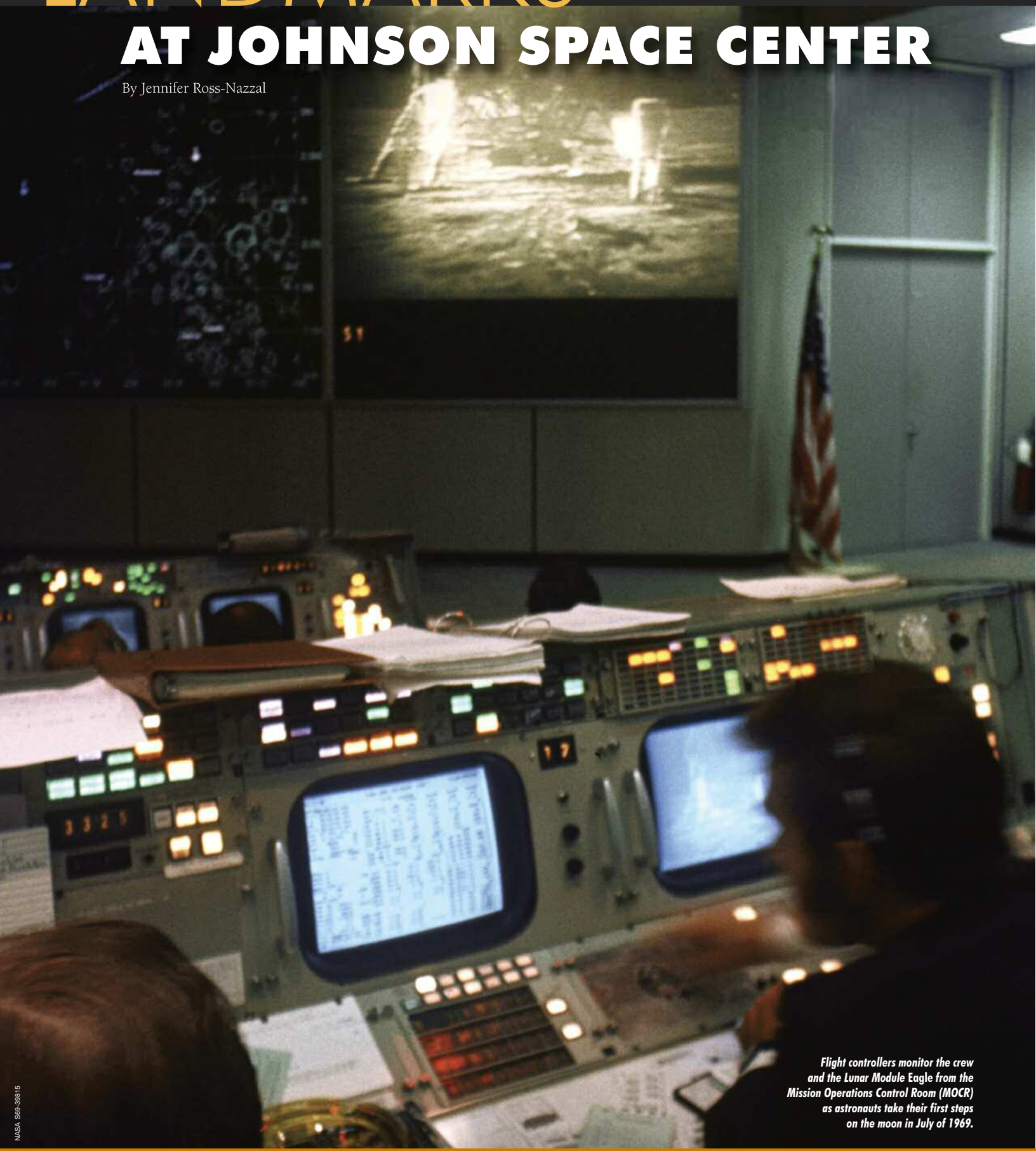
NASA JSC2007E036083

With restoration complete, the rocket appears as it did the day it arrived at the Center.

LANDMARKS

AT JOHNSON SPACE CENTER

By Jennifer Ross-Nazzal



Flight controllers monitor the crew and the Lunar Module Eagle *from the Mission Operations Control Room (MOCR) as astronauts take their first steps on the moon in July of 1969.*

NASA S69-39815

NASA S81-30386

The MOCR, the cathedral of human spaceflight, and her flight controllers quietly await a transmission from the crew of STS-1, the first flight of the Space Shuttle Program.

Perhaps unbeknownst to many Houstonians, four National Historic Landmarks (NHLs) are in their backyard: the San Jacinto Battlefield and the USS *Texas* in La Porte, and the Mission Operations Control Room, and Chambers A and B of the Space Environment Simulation Laboratory (SESL) at the Johnson Space Center (JSC).

Less than 2,500 historic properties—out of more than 80,000 sites on the National Register of Historic Places, including the Saturn V at JSC's Rocket Park—have been designated landmarks by the Secretary of the Interior.

Named NHLs in October of 1985, both facilities serve as symbols of America's achievements in the Apollo era.

Mission Operations Control Room

Construction on the Mission Control Center (MCC) began in 1963. Its purpose was to house the areas to monitor the upcoming Gemini and Apollo spaceflights. Employees of the Flight Operations Directorate moved from their cramped offsite locations (the Stahl and Myers building and the Houston Petroleum Center) into the three-story Building 30 in June 1964. Space was allocated for key NASA engineering and scientific personnel along with representatives of the major contractors to support each mission. Their increased presence strengthened the problem-solving capabilities of the MCC team.

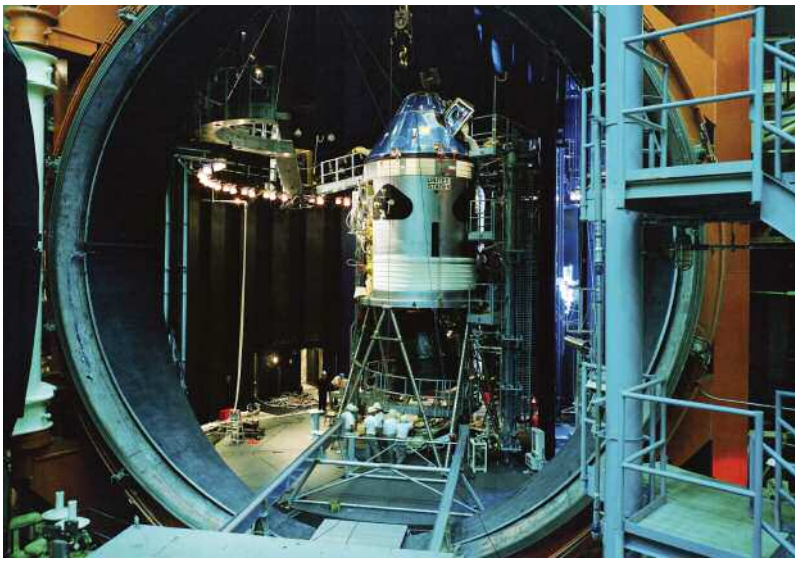
Within the MCC was the Mission Operations Control Room or MOCR. For the first two Gemini flights, the Mercury Control Center at Cape Canaveral directed the missions because the computers and hardware in the MOCR had yet to be tested and installed. In June 1965, the MOCR contolled the historic Gemini IV mission, which featured America's first spacewalk, and established Houston as the nerve center for the United States' manned spaceflight program.

Throughout the Gemini and Apollo Programs, Americans came to identify the MOCR with the spectacular missions flown between 1965 and 1972. The first words spoken on the moon rang out in the control room, "Houston, Tranquility Base here. The *Eagle* has landed." Television and newspaper reporters filed reports from the space center and frequently used images of the MOCR and flight controllers to convey the excitement of the flights. One of the most popular images was taken after the Apollo 11 crew safely returned home and features flight controllers celebrating the conclusion of the first successful mission to the moon. Since that time, flight controllers working in the Mission Operations Control Room have monitored multiple moon landings, the flights of Skylab (America's first space station), the Apollo-Soyuz Test Project (the first international spaceflight), and the early space shuttle flights.

By the 1990s, the technology supporting MCC operations was outdated and needed replacing. A state-of-the-art MCC became operational in July 1995 and the Apollo MCC was set aside as a national historic facility.

Space Environment Simulation Laboratory

JSC's second landmark, the SESL, was less well known, though the laboratory and its test subjects occasionally appeared in a few newspaper articles. The lab was built to test hardware for the Apollo Program, by simulating the conditions the systems would face in space, and consisted of two man-rated chambers: Chambers A and B. The Apollo Command/Service Module, which would ferry the crews to the moon and back home, could be tested in the chamber along with a crew of three. At the time, the size of the chamber was much larger than any that had been built by aerospace corporations, the Jet Propulsion Laboratory, or the Goddard Space Flight Center. "So when we undertook to build a chamber that was going to be 120 feet tall and 65 feet in diameter to be able to give these kinds of conditions, it was really one tremendous step, much beyond what the technology could support at that time," Aleck C. Bond, one of the designers and developers of this facility, later recalled.[1]



NASA S68-34803

Chamber A houses the Apollo spacecraft 2TV-1, which is mounted on a rotating platform to expose the Command/Service Module to the temperature extremes found in space. Three astronauts participated in the testing of the 2TV-1 spacecraft in 1968 and spent a week in the chamber to check for any anomalies with the vehicle.

Testing of Apollo hardware began in 1966. Since that time, every major human spaceflight program has tested hardware in

the SESL, and both chambers remain active, ready to test NASA's hardware for the Space Shuttle and Space Station Programs, and NASA's newest exploration program, Constellation. Even though the SESL is listed as an NHL, the Center has been given permission to make modifications to the facility to enable testing of the James Webb Space Telescope, scheduled for launch in 2013.

Ongoing Preservation

Preservation is an ongoing effort at JSC. Last year, the Center's Planning and Integration Office surveyed and evaluated JSC's facilities in Houston, the White Sands Test Facility in New Mexico, and Air Force Plant 42 in Palmdale, California, to determine whether any of the Center's facilities were eligible to be listed on the National Register of Historic Places. Properties that supported the Space Shuttle Program were considered. Eventually, seven JSC facilities in Houston were determined to be eligible: Buildings 5, 7, 9, 16, 30, 44, and 222. Also included are the White Sands Space Harbor, or landing strip for the shuttle in New Mexico, and two buildings in Palmdale: the Orbiter Lifting Frame and B150.

Building 5, known as the Jake Garn Mission Simulator and Training Facility, is a crew training facility that contains simulators to train the space shuttle crews. Some of the

Chamber A's forty-foot door towers over two technicians.

NASA S74-32122

NASA S68-16063

George E. Mueller, NASA's Associate Administrator for the Office of Manned Space Flight, is briefed during a visit to the SESL Vacuum Chamber and Control Room.

Center's major test facilities—vacuum chambers and advanced environmental system control laboratories—are housed in the Crew Systems Laboratory or Building 7. Building 9 houses, among other things, a Crew Compartment Trainer and Full Fuselage Trainer (mockups of the space shuttle orbiter) to help to prepare space shuttle crews for flight. Building 16 houses the Shuttle Avionics and Integration Laboratory, used to provide software verification. Building 30 is the Mission Control Center, which includes the Shuttle Flight Control Room, and 44, the Communications and Tracking Development Laboratory, tests space shuttle radio frequency communication systems. The shuttle's Thermal Protection System (or tiles) have been rigorously tested in Building 222, the Atmospheric Reentry Materials and Structures Evaluation Facility.

Currently JSC's Historic Preservation Officer, Abdul Hanif, is working with the National Park Service on the recordation of these buildings to determine how the Center can mitigate any adverse effects on these seven properties as the agency begins to close out the Space Shuttle Program and begins ramping up for the Constellation Program. As an active space laboratory working on the cutting edge of technology, the configuration of JSC's facilities were never meant to be permanent. They were built to change over time, not to remain fixed in time as technology and programs changed.

The National Park Service will help the Center determine how JSC's facilities can be modified and what needs to remain to preserve the history of the Space Shuttle Program. Many of the facilities may simply be documented with large format photographs, drawings, and written documentation. While the idea may seem contrary to those who favor preserving JSC's historical facilities, this is an acceptable option for preservation. Following the survey, JSC will begin the process of nominating these buildings for listing on the register. ★

A HOME FOR HEROES

By Rebecca Wright

When Timber Cove was established in 1958, its developers had no idea that an announcement made three years later by the federal government would impact the heart and soul of the neighborhood.

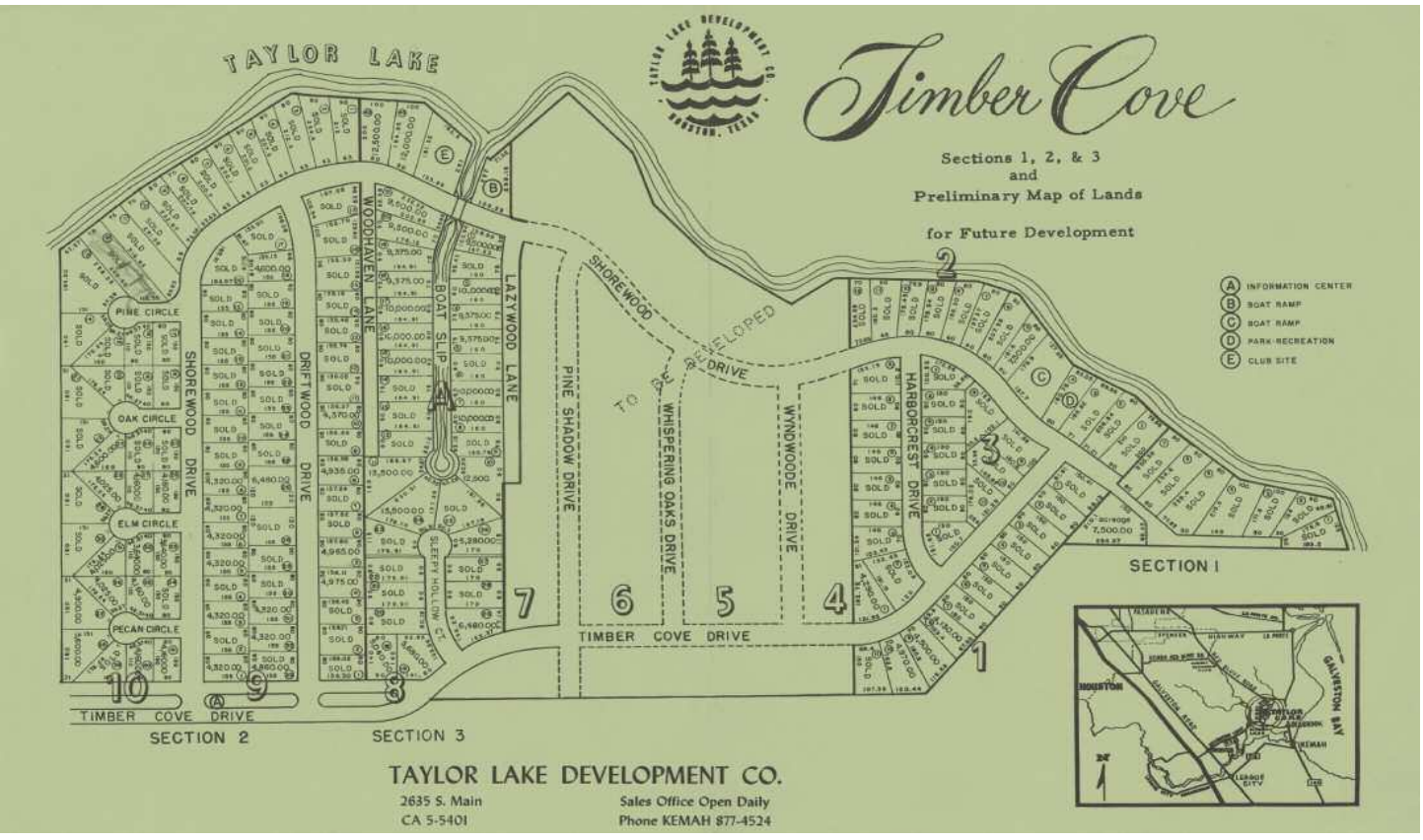
Just days after NASA named Houston as its home for the Manned Spacecraft Center, a small group from Virginia traveled to see the place where they would be a part of sending a man to the moon and returning him safely to Earth. Jack Kinzler was among those visitors from the space agency and, knowing he would be relocating, Jack scouted for prospective homesites.

He found little housing available in the mostly undeveloped land near the proposed Center. In every direction, Jack saw devastation left by the recent occurrence of Hurricane Carla. But in his search, he located the single entrance to Timber Cove.

Tucked away in the midst of wooded acreage down Old Kirby Road was property that had recently belonged to a longtime family of the Seabrook area. A road had been built on each side of two long rows of majestic oak trees, providing an appealing pathway to the spacious lots. Convinced he had found the perfect place, Jack walked into the contractor's office and left a deposit. That was in September 1961. Less than two years later, he and his wife Sylvia moved in. They are still there, and they are not alone.

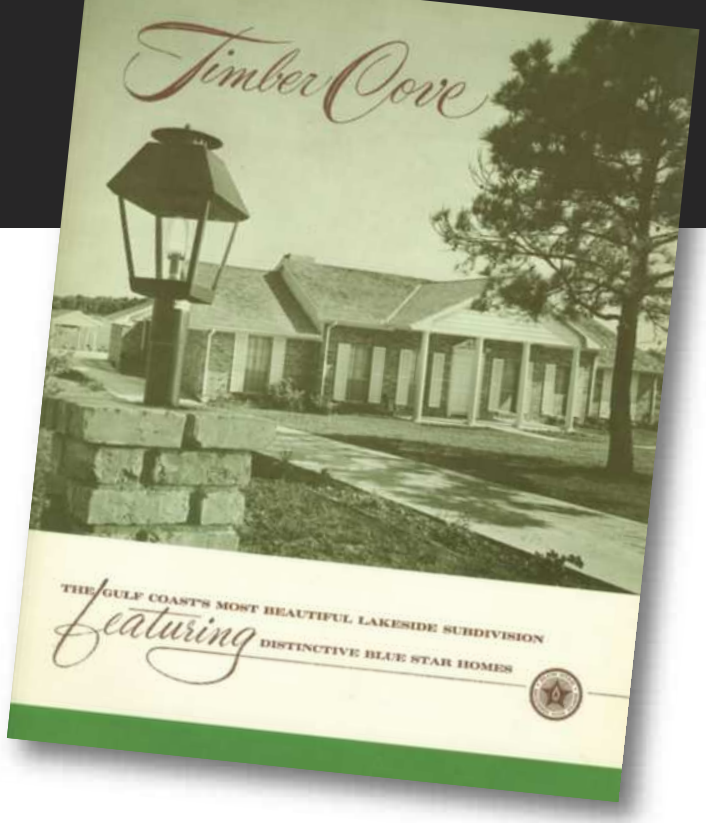
Along with the Kinzlers, other NASA employees moved into the neighborhood, including rocket scientists, engineers, spacecraft designers, and four of the original Mercury 7 astronauts. More followed and, collectively, they transformed their neighborhood. Sharing a common goal at work, the neighbors became friends; friends became extended family; and the subdivision evolved into a close-knit community.

Today, Timber Cove continues to host a number of those who purchased original lots and then spent the next forty-plus years enjoying their homes. Sprinkled in with these long-timers are about a dozen or so of those fondly referred to as the "second generation"—children who grew up in Timber Cove in the 1960s and 1970s and have returned, purchased homes, and are raising their families near their former backyards.



COURTESY UHCL ARCHIVES, TIMBER COVE COLLECTION

In the brochure released in 1958, Timber Cove developers invite potential home buyers to "live where the fun is." A number of families moving to Texas to work at the new space center moved in and still enjoy their homes today.



Why? Well, most will say they choose Timber Cove because the neighborhood reflects and retains a character instilled by the first residents who set a foundation of fellowship and trust in the midst of two hundred families. They want to preserve this connection that began when many of the neighbors shared a common goal with their jobs, a casserole on weekends, and the everyday burdens of raising children in an ever-changing world.

Although noting its fiftieth year of existence, residents still find reminders of the time when this community spirit began—like the civic club that facilitates the maintenance of the subdivision, the garden club, and the Timber Cove phone book published annually—all continuing since 1962.

And then there's the neighborhood swimming pool constructed in the unique shape of a Mercury space capsule. According to Jack Kinzler, the idea came from Art Garrison, "one of our neighbors who worked at NASA."

"When asked how we would do that, he answered, 'Oh easy. We just put a pair of steps on the east end that come down. Those steps would represent the two retro rockets, and then we'll taper the pool sides to the exact matching contour of the Mercury capsule,'" said Jack.[1]

Completed in 1963, the nose of the capsule serves as the deep end, allowing for one- and three-meter diving boards and a competitive diving team. The blunt-end reentry shape hosts the shallow end.[2] Once fully operational, the pool definitely became "the center of societal activity," said James Kinzler, son of Jack and Sylvia Kinzler.

"Summers meant the swim team was going on, so that meant, get up in the morning early and get past dragonflies and other scary-looking bugs that were out there, to get to the pool and do swim practice," said James, who describes his childhood community as a destination neighborhood. "You'd hang out at the pool as much as possible when you weren't riding your bicycle or playing football or a little bit of tennis."

"We never ran out of things to do," said Doug Shows, one of the second-generation residents, who added that there was no better place to be than Timber Cove when he was a kid. He remembers those days when the subdivision was still under construction.

"Everything you needed was here," said Doug. Everything, including friends. "We came in from all different directions of the country. Activity-wise, the parents had to get someone on the moon, so the kids were left on their own. And that was good, because we did get creative doing things—unsupervised."

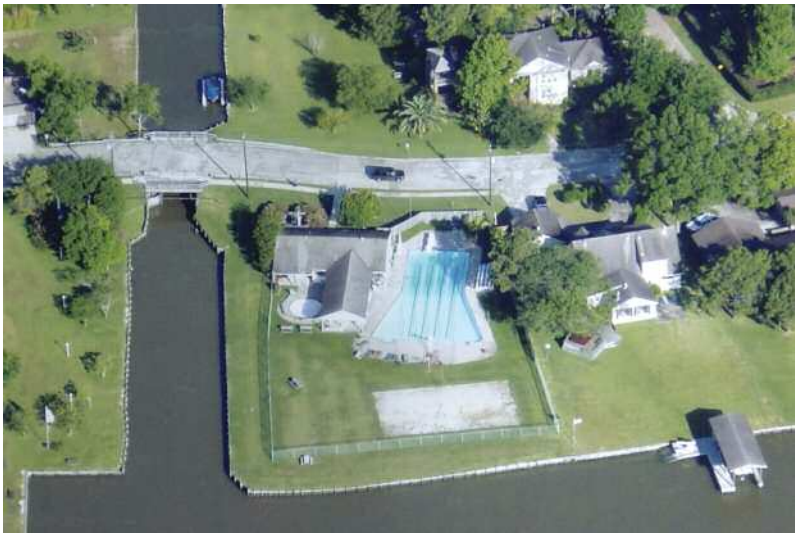


PHOTO BY DOUG SHOWS 2004

A NASA neighbor designed the community pool in the shape of the Mercury capsule, as seen in these aerial views. (1963 and 2004)

NASA S66-51581

Timber Cove resident Gus Grissom (center) practices water egress procedures with Apollo 1 crewmates Ed White (foreground) and Roger Chaffee at Ellington AFB.

The boys made good use of nearby Taylor Lake, which was adjacent to the western shore of Timber Cove and accessible almost year-round. They recalled building a dock that reached an estimated 150 feet out into the lake. "When you have a neighborhood that's building a lot of houses, there's lumber. We continued to build the dock out far enough that the Coast Guard came in and wanted to know what was going on here. The kids scattered," he said. "We were ordered to tear it down."

"Because of the nature of Timber Cove, as opposed to being a part of a big city, our parents thought of us as being in a very, very safe place," said James. "You went out and I'm not sure I even told anybody where I was going. I was just out running around and playing a lot of baseball in the street, or around the corner playing touch football or tackle football, a lot of dodge ball. We had a lot of johnboats and small sailboats."

They also recall how all the adults knew each other (James said that even he knew the last name of everybody in Timber Cove, minus a few); and when not at their jobs, how the adults spent time socializing together, but still working.

"They would have parties after work, and they would design," said Doug. "Half the designs would be on cocktail napkins. They never stopped working. They were having a blast. It was the best time of their life, and they really enjoyed it. They all [did]—everybody in the neighborhood. You had the astronauts. You had the engineers. Everybody worked together. It was a really fun time, and the kids had a good time."[3]

The time together in the evenings provided an occasion for recreation and entertainment since there were few restaurants in the local area. The "nightlife" in the cities of Houston and Galveston was thirty miles away, so neighbors looked to each other to supply the society they were accustomed to but could not easily find in their new locale. They welcomed each other to their homes. Many residents today continue to identify a home by its original owner's name, can provide its history, and say whether the house had been owned by one of the nation's first astronauts.

In the 1960s, Gus Grissom and Wally Schirra lived on Pine Shadows; on the next street, Lazywood, was Jim Lovell. At the end of Sleepy Hollow Court were the homes of John Glenn and Scott Carpenter, and next door to the Kinzlers, Pete Conrad and his family. As America's first space explorers, these men were seen as heroes, and the national attention cast upon them also impacted their neighbors in Timber Cove. Residents would often see tour buses driving past their houses.

"At first, it was a real novelty. People would stop and look and want to know about the neighborhood," said Aleck Bond, a

COURTESY UHCL ARCHIVES, TIMBER COVE COLLECTION

A home on Lazywood Lane sits nestled in one of the many tree-filled lots.

NASA employee who, with his wife Tassie, also moved from Virginia in the early 1960s to Timber Cove. "But after a while, and I don't think it took too long, it got to be just old hat."[4]

Others remember that, originally, Timber Cove residents moved into the neighborhood and planted their mailboxes in a row at the entrance to the subdivision, much like rural mail patrons still do today. When the word got out that astronauts lived in the community, visitors would come and look through the mailboxes to find astronauts' home addresses. Then, these visitors would roam the neighborhood until they found the houses. No one can document that the U.S. Postal Service accommodated the astronauts' privacy by providing door-to-door service, but the change in mail delivery did occur early in the 1960s.[5]

When the astronauts were on missions in space, the neighborhood would endure the arrival of the national and local news media.

"In the early days of spaceflight, they didn't have the remote facilities, sophisticated like they do now. They had to come out and build a tower so they'd have a line-of-sight transmission to somewhere where they could pick it up," said Aleck.

"You could hear the trucks coming along, and all the kids would get on their bicycles and follow them," said Tassie. "That was the fun part."[6]

"They'd build these huge towers so they could put the antennas on top. Being kids, we liked to climb things, and we'd climb those towers to the top, and not knowing exactly what we were doing, half the time, we unplugged the antennas, and pulled the cables out," said Doug. "We'd scamper down and watch the news media, the technicians, go up and connect them back up. We thought that was fun."[7]

While the community endured the intrusions by the outsiders, they became more protective of their astronaut neighbors and their families. Sometimes when inquiring strangers arrived seeking directions, the Timber Cove residents provided incorrect information or refused to answer. And, being the close extended family they were, they mourned greatly the loss of their friends when they died during their preparations for spaceflight: Elliott See, 38, who died in February 1966 when his T-38 trainer plane crashed in St. Louis, Missouri, and Gus Grissom, who perished with two crewmates during a fire on the launch pad in January 1967.

In 1971, the community felt the threat of another loss when a malfunction occurred during the mission of Apollo 13, placing Jim Lovell and his crew in danger of not returning safely to Earth. Jack Kinzler remembers the quiet greeting given to the astronaut on his arrival back home to Timber Cove.

"The community had prepared to meet him down at the entrance," he said. "In the most humbling situation I've ever seen—everyone had torch lights and flashlights and what have you, and everybody that met him at the entrance put their hand on that car and walked the car to his house. He hardly said anything except, 'I'm glad to be back.'"[8]

This very caring community may have started fifty years ago, but the essence that characterizes Timber Cove only strengthened through the years that followed and helped the community deal, once more, with the death of another astronaut neighbor and friend. In January 1986, Mike Smith was the pilot onboard the Space Shuttle *Challenger* when an explosion occurred seventy-three seconds into the flight, destroying the spacecraft. A tree planted in his memory grows in a park near the pool.

As expected after a half-century, some aspects of Timber Cove are not the same as in 1958. No longer is it in the midst of wooded acreage, but rather it is surrounded on both sides by housing additions. Fewer lots are empty and some lots near the lake now support new expansive houses. Other changes have occurred, with families moving away and new ones arriving. Although some of the first buyers are beginning to fade away, the momentum started by those original dwellers remains embedded deep within the neighborhood. According to Cindy Evans, the evidence of their spirit continues on.

Cindy, who currently works at the NASA Johnson Space

PHOTO BY SANDRA L. JOHNSON

The bridge on Shorewood Drive hosts the community's Christmas Eve caroling.

PHOTO BY SANDRA L. JOHNSON

Adjacent to Taylor Lake is the park in Timber Cove.

Center, said that soon after her family had moved to Timber Cove, they traveled to the East Coast during the Christmas holidays. While there, the Texas Gulf Coast experienced a rare winter storm with temperatures cold enough to freeze the water in the house, causing the pipes to burst.

"Somehow, our neighbors found where we were staying in Buffalo, NY, and called us to tell us that they saw water flowing from under our front door. Then, they told us how they broke into the house, turned off the water, pulled out the wet carpet, and scheduled the plumbers to come in and make the repairs," she said.[9]

In the twenty years since Cindy personally experienced this unexpected and overwhelming assistance from her neighborhood, she has witnessed plenty of other occurrences since then where neighbors have shown their concern for each other and their interest in building community relationships.

One example is a regularly scheduled, "old-fashioned," casual evening of neighborly visiting. Every month, an e-mail with details arrives in electronic mailboxes; then, a few days later, approximately one hundred residents walk, bike, or drive to the designated home, carrying an appetizer or dessert along with their choice of beverage. This event started a couple of years ago and resembles a time in the 1960s when parties of some type were happening somewhere almost every weekend in Timber Cove. In fact, some of those attending this Friday Night Bash are the same ones who attended the first progressive dinner started around 1965 along Shorewood Drive. This well-received holiday event featuring food and friendship was enjoyed every year until the mid 1970s. Back then, the telephone—not e-mail—was the modern mode of planning, but the exchange among friends is still genuine, rewarding, and anticipated, say those who participated then and now.

PHOTO BY SANDRA L. JOHNSON

This backyard scene reflects the terrain of the neighborhood.

Progressive dinners continue to be one of Timber Cove's holiday traditions, but the illumination of the entire neighborhood on Christmas Eve possibly reigns as the most anticipated occasion on the calendar. The inaugural lighting occurred on December 24, 1968, to honor the crew of Apollo 8, who aboard their spacecraft became the first humans to see the far side of the moon as they journeyed around the celestial body that night. Included onboard was neighbor Jim Lovell.

Since then, luminaries (paper bags with candles in sand) line the front lawns throughout the neighborhood on Christmas Eve. If needed, younger families help some of the longtime residents in preparing their yards by loading up children's wagons with the materials and setting the luminaries in their proper places. Even if residents are planning to be away, arrangements are made to have the candles lighted at the appropriate time, resulting in almost 100 percent participation.

"After lighting our luminaries, we all gather at the bridge to sing Christmas carols and have some hot cider," said Deborah Griffin, a Timber Cove resident for almost twenty years. "It's heart-warming to see how many families are there to exchange holiday greetings."[10]

Deborah repeatedly has seen the closeness of the neighborhood, not just on holidays, and has learned that volunteerism has been a fact of life carried on from the early days. She shared an example, of a time long ago, which serves as a reminder of the sharing of duties among a few that supported and assisted the community, as a whole.

"I've been told that, originally, the city of Taylor Lake Village consisted largely of Timber Cove and not much else. Until our community was built, there wasn't a need for a police force. But, once the flood of new residents began in the 1960s, a local constabulary was required. Timber Cove volunteers were deputized and took turns on evening and weekend shifts serving the public as peace officers. They even shared the City's one police car," she said. "Most of the calls to which they responded were non-violent disagreements or kids who were

PHOTO BY SANDRA L. JOHNSON

The oak tree-lined drive leads travelers past the entrance to Timber Cove homes.

having too much fun decorating the neighbor's house with toilet paper. After all, in the flatlands around NASA, Timber Cove's trees were just too tempting to pass up!"[11]

Cindy and Deborah are just two of the "newcomers" living in Timber Cove who have embraced the legacy of the neighborhood and continue to learn more about the history of their community. They, along with others, are busy preparing for a homecoming event scheduled for October 11 (see sidebar).

When Timber Cove residents look back on fifty years, they will see a rich history of individuals and families who are leaving a standard for the next generations. They will find swim teams still using a pool designed by NASA employees as the space program was just beginning, and astronauts who recently traveled in space with international partners once considered adversaries of the U.S. They will also learn how the current residents who work at the Space Center are planning to send explorers once again to the moon, and then on to Mars.

As they move forward into the next fifty years, they will probably continue to identify the homes by who lived there before, while assisting the latest arrivals with moving in. They will keep finding kids being creative in activities on streets where neighbors know each other and help guard the safety of the children. And they will definitely carry on their treasured traditions, while seeking new ones to further strengthen the relationships within the neighborhood.

But most likely during the next fifty years, Timber Cove residents will enjoy preserving the aura that is distinctly theirs, while sitting in the shadow of the Space Center where history continues to be made. ★

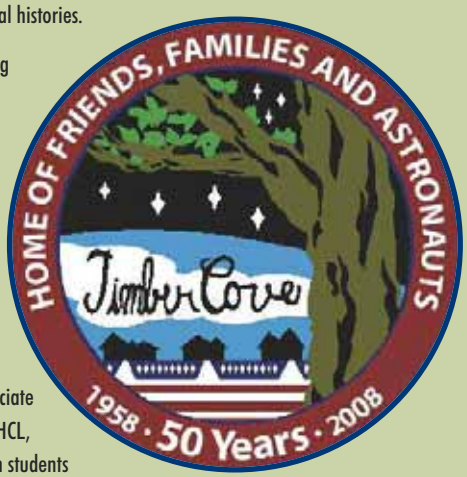
Timber Cove Celebrates Fifty Years

By Deborah Griffin

IN 2007, a small group of Timber Cove residents met to consider ways to celebrate the neighborhood's fiftieth anniversary. They did not realize it at the time, but their efforts would soon blossom into more than a simple homecoming party at the pool. In the spirit of volunteerism that defines Timber Cove's existence, this group of planners—Cindy Evans, Ava Galt, Deborah Griffin, Walt Jaescke, and Kay Ann Jorgenson—rallied their neighbors in support of a weekend of events that will celebrate the community's unique history as home to families building our nation's space program. The celebration will also kick off a focused effort to capture and preserve Timber Cove's story for future generations.

On Saturday, October 11, 2008, Timber Cove will open the doors of some of its most famous homes to the public. The Tour of Homes will feature the former residences of Mercury, Gemini, and Apollo astronauts. Together with a peek at Timber Cove's famous Mercury capsule-shaped swimming pool, visitors will have the chance to experience NASA's space history from a unique perspective.

In addition to celebrating past heroes and events, Timber Cove residents are establishing a local history collection that will preserve the community's history for future use. Many longtime residents have special stories that capture both the daily rhythm of life in the neighborhood and behind-the-scenes reflections about the excitement and can-do spirit of the early days of NASA. Working with Shelly Kelly, archivist for the University of Houston–Clear Lake's (UHCL's) Neumann Library, organizers are collecting oral histories and archival documents that will become a valuable resource for social historians and American and Women's Studies scholars. In conjunction with the Tour of Homes, *Tales of Timber Cove* will give current and former residents the chance to tell their stories of life in this community and of the ways NASA's history has intersected their own, personal histories.



Besides touring homes and telling tales, Timber Cove residents are celebrating fifty years with a commemorative patch. Reminiscent of the crew patches NASA astronauts have long designed and worn to celebrate their missions, Timber Cove's anniversary patch will serve as a lasting reminder of the event. Working with Stuart Larson, Associate Professor of Graphic Design at UHCL, organizers offered graphic design students the opportunity to participate in a patch design contest. The winning design, featured here, was created by Communication major Richard Willis.

In his artist's statement, Richard wrote: "When considering the original seven astronauts, immense concern was given in trying to differentiate, without separating, the four of the seven original astronauts who lived in Timber Cove. This was configured successfully through an illustration of one of the neighborhood's protective oak trees. The oak branch overhangs four of the seven stars as to purposely connect them to the community they are a part of while the other three remain above, yet not too far away."

Other UHCL students are also involved in the anniversary event. Assistant Professor of Communication Leo Chan, and his student Web site designers Laurie Perez and Homie Rowe, have created and launched the event Web site. Be sure to visit *www.timbercove50.com* to view their work and to learn all the details of Timber Cove's Tour of Homes.

"ONE GIANT LEAP"

THOUGHTS ON APOLLO 11

On July 20, 1969, Flight Director Gene Kranz ***reports for work and walks down the hall in Mission Control not thinking of the lunar landing but with a feeling that he and his team, from the time that they were born, were "meant for this day." When he enters the Mission Operations Control Room, he "can feel the atmosphere immediately. Everything is pretty much ops-normal. This room is bathed in this blue-gray light that you get from the screen, so it's sort of almost like you see in the movies.***

"Then the rest of the room's atmosphere, it's the smell of the room, and you can tell people have been in there for a long period of time. There's enough stale pizza hanging around and stale sandwiches and the wastebaskets are full. You can smell the coffee that's been burned into the hot plate in there. But you also get this feeling that this is a place something's going to happen at. I mean, this is a place sort of like the docks where Columbus left, you know, when he sailed off to America or on the beaches when he came on landing.

"It's a place where you know something is going to happen. You feel the energy of the room, because, as you walk in, you pass little groups where there's little buzzes of conversation. You don't waste too many words in Mission Control. You speak in funny syllables, in acronyms and short, brief sentences, and sometimes you use call signs, other times you use first names. It depends upon what the mood of the room is.

"I went up to the console. I sort of eat my way through a shift. Then talk to the Spacecraft Analysis Room where we've got the engineering representatives from our contractors, and this is another good place to get the pulse of the room. There are things going right. My controllers are in the other half of the room, and these people don't seem particularly uptight. It's really amazing. You get the feel that, gee whiz, this is just almost a normal day in Mission Control.

"I go back to the console and find out it's been more normal than you'd ever expect, because I read the log, and talk with [departing flight director] Glynn Lunney during the handover. So, it still doesn't sink in that today's real time, this is really it.

"Then I put on my vest, my landing vest. The vest tradition started with the white team that goes all the way back to Gemini. The reason it's always got white is because I lead the white team. Red, white, and blue are the colors of the first three flight directors. For this landing, my wife Marta had made me a silver and white brocade vest, very fine silver thread running through it. I carried it in a plastic bag, turned inside out because the vest is always a surprise for the controllers. This is sort of a way to get the team loose, to get them a bit relaxed, because you don't want people who are trigger-happy in this business.

"We go through the first couple of orbits and things are really percolating along, no anomalies. It's almost like a simulation. There's many times during this day when the thought would come to mind, it's like a simulation. Finally we get down to the point now where it is time to finish. We're in our final orbit around the moon, which is two hours, and roughly for about an hour-twenty, we see the crew, and then forty minutes they're out of sight for us. We're into the final orbit. The crew goes behind the moon.

"There are certain things in Mission Control, and there are two of them [that] happened, one now and then one later on, that really indicated that this was not a normal day, or not a normal simulation day. The first one—and this was one of the triggering events—the spacecraft is now behind the moon, and the control team, the adrenaline, just really was—no matter how you tried to hide it, the fact is that you were really starting to pump. There isn't the normal banter, no jokes, etc. I mean, the level of preoccupation in these people—and these are kids. The average age of my team was twenty-six years old. I'm the oldest guy on this entire team. I'm thirty-six; I'm ten years older. This team, this day, is either going to land, abort, or crash. Those are the only three alternatives. It's really starting to sink in, and I have this feeling I've got to talk to my people.

NASA S69-44080

Gene Kranz, 36, leads the White Team during the Apollo 11 historic lunar landing.

"So I told my team, 'Okay, all flight controllers, listen up.' And although the people in the viewing room are used to hearing all these people talking, all of a sudden there's nobody talking anymore. But I had to tell these kids how proud I was of the work that they had done. That from this day, from the time that they were born, they were destined to be here and they're destined to do this job, and it's the best team that has ever been assembled. And today, without a doubt, we are going to write the history books and we're going to be the team that takes an American to the moon, and that whatever happens on this day, whatever decisions they make, whatever decisions as a team we make, I will always be standing with them, no one's ever going to second-guess us. So that's it.

"I finished the discussion and tell the controllers to return to business. I have the doors of Mission Control locked—we do this for all critical mission phases. This was the final thing that sunk in in the controllers that, hey, this is again something different from training, these doors are locked, we've got a job to do. …

"Everybody in the room is deathly silent except for what is on the voice loops, and we're only listening to Bob Carlton's call. The last call was 'sixty seconds,' and the next call was going to be 'thirty seconds.' So I advised controllers no more calls, because we're now operating in what we call negative reporting. We're not saying a word to the crew, because they're just busier than hell right now, and the only reason for us to abort is fuel.

"Now Carlton hits thirty seconds. Now we're thirty seconds off the surface of the moon, and very—I mean, incredibly rapidly I go through the decision process. No matter what happens, I'm not going to call an abort. The crew is close enough to the surface I'm going to let them give it their best shot.

"At the same time, the crew identifies they're kicking up some dust, so we know we're close, but we don't know how close because we don't know at what altitude they'd start kicking up the dust, and then we're to the point where we're mentally starting, waiting for the fifteen-second call, and Carlton was just ready to say, 'Fifteen seconds,' and then we hear the crew saying, 'Contact.'

NASA S70-27128

Flight controllers review procedures before the first moon landing.

"There's nothing in training that ever prepares you for that second, because the viewing room behind me starts cheering. Our instructors, which are over in the Sim Sup area (on the right) they start cheering, but we've got to be cool because we have to now go through all of the shutdown activity. We have to go through a series of what we call 'stay/no stay' decisions, because forty seconds after we've touched down on the moon, we have to be ready to lift back off again.

"I had to get going on the stay/no stay. I just rapped my arm down on the console there, just absolutely frustrated. I broke my pencil, the pencil flies up in the air. I got back on track and started, 'Go. Okay. All flight controllers stand by for T-one stay/no stay.' Then, as soon as we finished that, we had another; I think it was ten or twelve minutes later, and these were opportunities for liftoff and go back up, and immediate rendezvous. Once we went beyond T-two, then we had to go through a T-three.

"While we're doing all this stuff, Charlie Duke's still talking to the crew, saying, '*Eagle*, you know, you've got a bunch of controllers down here about ready to turn blue.' Well, the fact is, I don't think any of us breathed for that last sixty seconds."

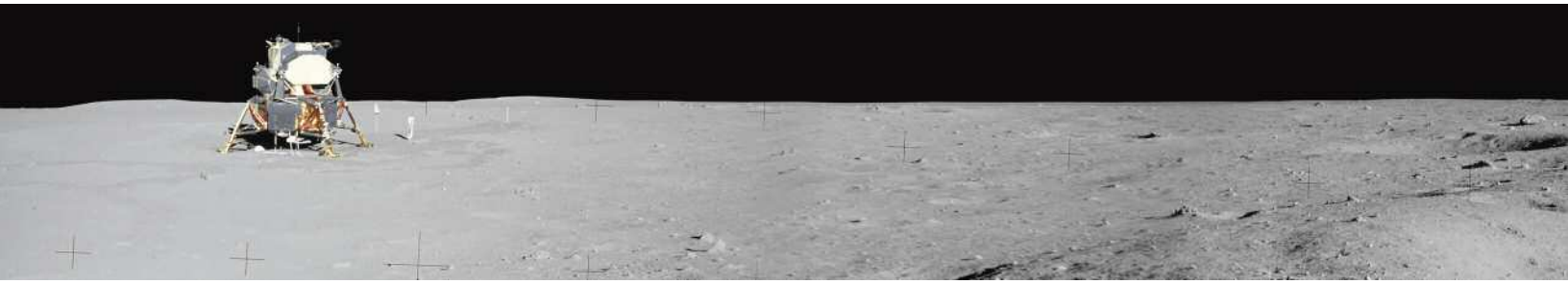
Neil Armstrong: "Each of the components of our hardware were designed to certain reliability specifications, and far the majority, to my recollection, had a reliability requirement of 0.99996, which means that you have four failures in 100,000 operations. I've been told that if every component met its reliability specifications precisely, that a typical Apollo flight would have about 1,000 separate identifiable failures. In fact, we had more like 150 failures per flight, substantially better than statistical methods would tell you that you might have.

"I can only attribute that to the fact that every guy in the project, every guy at the bench building something, every assembler, every inspector, every guy that's setting up the tests, cranking the torque wrench, and so on, is saying, man or woman, 'If anything goes wrong here, it's not going to be my fault, because my part is going to be better than I have to make it.' And when you have hundreds of thousands of people all doing their job a little better than they have to, you get an improvement in performance. And that's the only reason we could have pulled this whole thing off. …

"When I was working at the Manned Spacecraft Center, you could stand across the street and you could not tell when quitting time was, because people didn't leave at quitting time in those days. People just worked, and they worked until whatever their job was done, and if they had to be there until five o'clock or seven o'clock or nine-thirty or whatever it was, they were just there. They did it, and then they went home."

Jerry Bostick: "It was not until after the mission was over and for the first time in my career, I took like a week off, [because] we've done what we came to do, we want to do it a bunch more times, but we have proved it can be done. We met the President's goal. We beat the Russians."

Mel Brooks: "Apollo 11, what an adventure. I was with a group of guys who were just about as fortunate as you can possibly be. We were in the right place at the right time when the President decided we were going to go to the moon and put plenty of money in the budget. We set out to do it, and it's probably, I still think, the greatest achievement in mankind's history, what we did on the moon."



Gene Cernan: "The Apollo 11 epitaph was written before they left—a testimonial to what we can do if we really want to do something badly enough and do it well. We made a few mistakes along the way; there was a period of time in two years where I wore my uniform eight times when we buried people at Arlington National Cemetery. The other side of that coin is we had our tickertape parades and trips around the world. So it's a two-way street. We can do it if we want to do it badly enough.

"We had no guarantees. Nobody had any guarantees. We had a challenge. We had a challenge from the President of the United States to do at that point in time, which most people thought couldn't be done. Going to the moon when we had those sixteen minutes of spaceflight experience, I mean, was Kennedy a visionary? Was he a dreamer? Was he politically astute? I expect he was all three. So that's the lesson that we have to pass on from Apollo. That's what we have to tell our kids and our grandkids. That's the lesson that I think history somewhere sometime will record."

Larry Davis: "I was proud that I got to be on the shift where they were going to land on the moon. I've never seen so many people in the Control Center. I believe they were afraid about structural support and the floor, because it was just everybody who you'd ever seen and people you hadn't seen. There were more people than there were headsets that could be plugged in. It was a full house. They talk about people holding their breath; I think everybody literally was. It was really unbelievable. It did not seem real. It was just amazing.

"I remember we had a display in the Control Center that moves along the trajectory. When the Lunar Module landed, the display didn't move, because that's the first time we'd ever had a vehicle that wasn't moving—it's sitting on the moon. That was part of the trajectory; it was very strange to [see] it always sitting there."

Ed Fendell: "When it started getting down close, I don't think I was touching my chair. I actually believe I was levitating. It was so intense that I don't think most people really fully realized what we did. I know I didn't. [Afterwards] we did a shift change, and I went home to sleep for a few hours, got cleaned up, and stopped to eat some breakfast on the way back to work at one of these little coffee shops with the round stools. I sat down up at the counter, and I'm sitting there reading the paper when two guys walk in and sit down on the two stools next to me. They are from the gas station down at the corner, and they're in their gas station uniforms, grease under the fingernails, and so on. They were older [than me]. They get their coffee and while waiting for their breakfast, they start talking. One of them says to the other one, 'You know, I went all through World War II. I landed at Normandy on D-Day. It was an incredible day, an incredible life, and I went all the way through Paris and on into Berlin.' [Then] he said, 'But yesterday was the day that I felt the proudest to be an American.'

"Well, when he said that, I lost it. It all of a sudden hit me as to what we had done. And I just threw my money down, grabbed my paper, and walked out and got in the car and started to cry. I realized what we had done and what had happened—but I hadn't until that moment. It hadn't hit me. It wasn't like sitting in the control center. That was great, a tremendous experience and relief they were alive, and we had made it but it was just a complete different feeling. I had now joined up with the rest of the world as to what had happened."

Ed Gibson: "When you're in the midst of it, you don't step back and be too philosophical about it. I was in mission control in the viewing room when Apollo 11 landed, and Wernher von Braun, Chris Kraft, and Bob Gilruth were there. I looked at their faces, and von Braun just had tears in his eyes. Here was a guy that I had grown up to admire from his contributions he had made to rocketry. Then it hit me. This is really monumental, what has happened."

Bob Heselmeyer: "While they were on the moon and even after the flight, I kept trying to get in touch with the reality. It was, for me, mind-bending in terms of connecting with it really happened. They really got there, really got back. I concluded

NASA S70-27092

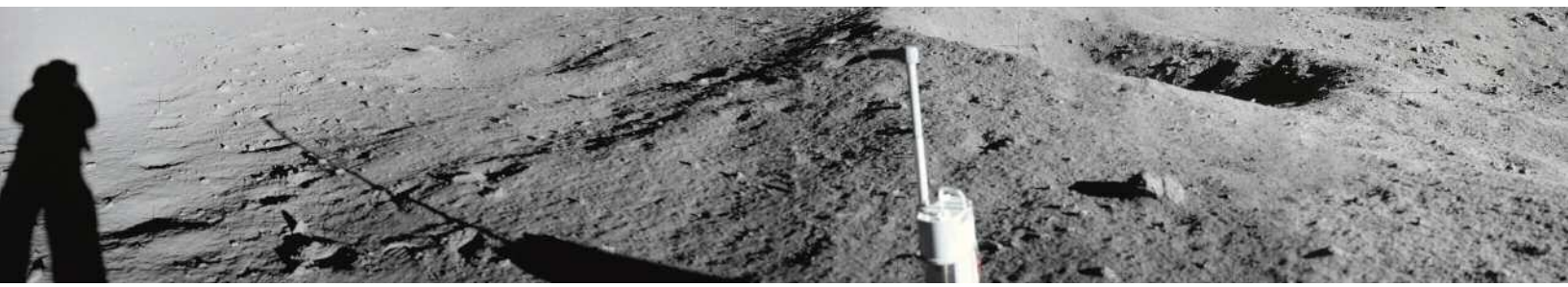
Post-Apollo 11 celebration in the Mission Operations Control Room.

that it was probably going to be some time before that really sunk in, and it was. Still is. Still think about that. Of course, it's been some time now, but I think about that and think, 'Man, amazing.' And done on the fast track, in terms of the vehicles; in terms of the limited, by today's standard, computing capacity; the ability of the whole organization to make hard decisions without having to convince Congress that it was the right thing to do at the time and have it debated back and forth, but to get on with doing something pretty amazing in an efficient way, and as safely as we all knew how to do it."

Jack Lousma: "Very few times in history do you ever get to the point where everybody in the whole world wants to have the same thing happen or is concerned about the same issue or has the same hope and vision for its success, but this particular one was one in which that happened. Probably Apollo 11 in the space program was the first time that everybody around the world was glued to the news and glued to their television sets watching this happen. It didn't matter what country one lived in or what the culture was or the language or the religion or anything. The astronauts were people who represented all of mankind, so to speak, and they wanted them to be successful. It didn't matter who it was, as long as someone or humans like them were involved in this."

Dave Whittle: "[After the landing,] we handed over to the team that was going to be there while we were on the ground. I stuck around for a while. I walked outside the Control Center and looked up, saw the moon, and thought, 'You know, I am part of history. This is incredible. Here I am looking at the moon, knowing that there's somebody there looking back.' I reflected on that, really and truly, the thought that this is something that's going down in history books, something that I've had a part of, that I've been involved with, that I've helped make happen. I was very proud of that, and awestruck, really. I purposely walked outside of the Control Center and stood there and looked up at the moon. It was something else." ★

These excerpts are from interviews conducted for the NASA Johnson Space Center Oral History Project. For the complete transcripts and for more transcripts, go to www.jsc.nasa.gov/history



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is proud to play a unique part in the future of the **nation's space program.**

As a system, we take pride in:

Having six alumni – astronauts John "Danny" Olivas, Rex Walheim, Bonnie Dunbar, Michael Fincke, Bernard A. Harris Jr., and Akihiko Hoshide – who have gone to space, and numerous others who have worked with and for NASA throughout the years.

Offering the world's only Master of Science in Space Architecture, as well as a proposed Master of Science in Human Space Exploration Sciences.

Formally establishing a working relationship with NASA through the Space Act Agreement, signed in 2004.

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The University of Houston System joins in celebrating

50 years

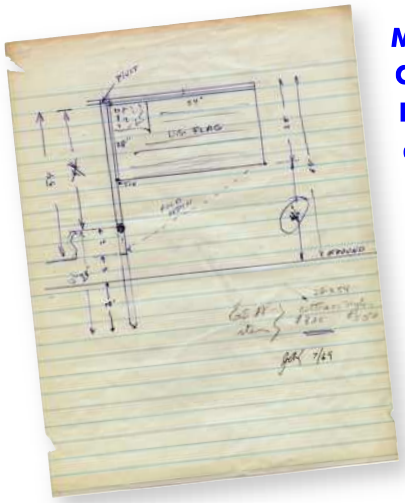
of NASA

THE UNIVERSITY OF HOUSTON SYSTEM

RED, WHITE, & BLUE

U.S. FLAG AT HOME ON THE MOON

By Sandra L. Johnson



Manned Spacecraft Center (MSC) Director Robert R. Gilruth placed a call to Jack Kinzler less than four months before the Apollo 11 launch. Gilruth needed him to attend a meeting with a high-level group of individuals from both MSC and NASA Headquarters to discuss ideas for celebrating the first lunar landing. Kinzler, in his capacity as the chief of the Technical Services Division, arrived ready to present his concept for taking an American flag along with a commemorative plaque to the moon. However, this was not the first time Kinzler had received such a call from Gilruth asking him for his input.[1]

Ten years earlier, Gilruth, then director of the Space Task Group at Langley Research Center in Hampton, Virginia, asked Kinzler to consider joining him in a new venture to put man in space. As Kinzler recalls, "I had been reading books about spaceflight and listened to some of the lectures that were available at the time, and I was primed, ready to jump onboard whenever he asked me."[2]

Kinzler began his career at Langley in 1941 as an aircraft model maker. After completing an apprenticeship program, he learned machining and eventually advanced to assistant supervisor of the machine shop. Kinzler also gained significant experience as "supervisor of the initial installation and shakedown phase of most of the major facilities at Langley."[3] By 1959, the space race was on and as Gilruth's new technical services assistant, Kinzler bet that the race would be won by the home team.

After first traveling to Houston with the Space Task Group in 1961, Kinzler established the Technical Services Division, a group of approximately 180 highly skilled and experienced technicians specializing in machining and sheet metal work, welding, electronics, modeling, plastics, and electroplating, along with a field test branch. He quickly settled into a new life in the Clear Lake area and led his creative group in actively supporting the Mercury, Gemini, and first Apollo flights.[4]

So, when the call came from Gilruth to join the planning meeting for the first lunar landing, Kinzler went prepared with two ideas—a plaque and a flag. Both suggestions received approval and he was told to go forward with his plans. "So I got an action item out of the committee saying, 'It's up to you. You go do it.' That was all I had, 'Go do it.'"

Kinzler turned to his assistant chief, David McCraw, and together they came up with a prototype for a plaque to be installed on the Lunar Module (LM) descent stage ladder. The finalized stainless steel plaque contained the signatures of all three Apollo 11 astronauts, Neil A. Armstrong, Edwin E. Aldrin, Jr. and Michael Collins, along with the signature of

NASA S69-38765

NASA S69-38767

NASA S69-38770

NASA S69-38773

Jack Kinzler, David McCraw, and the MSC Technical Services team, along with representatives from the Center's Engineering Division and the Reliability and Quality Assurance Office, work together in Building 9 to pack the first American flag to be deployed on the moon by Neil Armstrong and Buzz Aldrin.

President Richard M. Nixon. The top of the plaque depicted the Eastern and Western Hemisphere and the inscription, *"Here Men from the Planet Earth first set foot upon the moon. July 1969 AD. We came in peace for all mankind."*[5]

Kinzler believed that the people of the United States would also want to see an American flag to commemorate the enormous achievement of landing a man on the surface of the moon. The original LM design had an American flag painted on the side of the descent stage, but he thought, "That's not a very effective way to celebrate with an American flag."[6] Again with the help of McCraw, Kinzler sketched his idea of a freestanding full-size flag on a telescoping flagpole. The entire flag unit fit into a three-foot protective heat shroud attached to the LM ladder, making it accessible to the astronauts on the lunar surface, but not taking up any precious space inside the LM itself.[7]

They went to the warehouse and retrieved a standard-issue three-by-five-foot nylon flag. Kinzler proposed the idea of hemming the top of the flag and inserting a telescoping curtain rod so that once unfolded, the rod or crossbar, could be extended to allow the flag to appear to "fly." He credits this idea to his memory of watching his mother making curtains years before. A hinged latch connected the crossbar to the pole and allowed the crossbar to be held perpendicular to the pole once the latch was locked into position. A loop of material connected the bottom of the flag to the pole. The pole itself was gold anodized aluminum tubing about one inch in diameter and telescoped out to about six feet. The upper portion of the pole then fit into a base tube consisting of a hardened steel ring fitting and tip; this allowed the astronauts to use their geological hammers to drive the assembled pole into the lunar surface to a

PHOTO BY SANDRA L. JOHNSON

Jack Kinzler stands with the prototype of the full-size telescoping flagpole built from his sketch (shown on previous page).

NASA S69-38777

NASA S69-38781

NASA S69-38784

NASA S69-38790

PHOTO BY SANDRA L. JOHNSON

Installed on the lunar module, the plaque includes words of peace for all mankind.

minimum depth of approximately ten inches. This depth had been marked on the pole with a red ring. A second red ring painted at about eighteen inches indicated the maximum depth to prevent the flag from being too low next to the astronauts. The flag assembly was a relatively low-cost endeavor—$5.50 for the flag and about $75 for the aluminum tubing.[8]

After the development of the protective heat shroud, Kinzler created step-by-step procedures for packing the flag, installing it on the LM and deploying it on the moon. He then trained Armstrong and Aldrin on the deployment procedures and supervised the assembly and packing of the flag. With the Apollo 11 launch date fast approaching, a chartered Lear jet flew the plaque and flag, along with Kinzler; George Low, manager of the Apollo Program; and Low's secretary to Kennedy Space Center in Florida. Under Kinzler's supervision, the installation of the plaque and flag assembly took place just hours before launch as the LM sat on top of the Saturn V rocket.[9]

On July 20, 1969, as the world watched in awe, humans landed on another celestial body for the first time. They carried with them these two items for all future generations—a simple stainless steel plaque and an inexpensive American flag. Along with those items was a straightforward message—"We came in peace for all mankind." But the design of those two items demonstrated something else—a can-do spirit and a willingness to create something out of nothing with little or no direction.

As Kinzler described the attitude at the time, "We, as a group of people, didn't worry about everything being just exactly according to Hoyle. Just *improvise* is the word we used many, many times."[10] And with that improvisational spirit, Kinzler and his Technical Services Division continued to support NASA's human spaceflight programs, culminating in his award of the highest achievement in NASA, the Distinguished Service Medal, for his role as the man who saved America's first space station, Skylab. But then, that's another story… ★

NASA S69-38754

NASA S69-38755

NASA S69-38756

NASA S69-38757

On a mock-up of the Lunar Module, David McCraw demonstrates the deployment sequence of the flag, following step-by-step procedures created for the astronauts. The entire flag unit fit into a three-foot protective heat shroud, stored on the side of the descent stage ladder.

PHOTO BY SANDRA L. JOHNSON

A simple stainless steel plaque and inexpensive American flag, like the ones shown above, flew onboard with the Apollo 11 crew, leaving a message for future generations.

NASA S69-38758

NASA S69-38759

NASA S69-38760

NASA S69-38763

LEGACY OF THE

By Jennifer Ross-Nazzal

35 NEW GUYS

Guion S. "Guy" Bluford, Jr.
Philadelphia, Pennsylvania

Daniel C. Brandenstein
Watertown, Wisconsin

James F. Buchli
Fargo, North Dakota

Michael L. Coats
Riverside, California

Richard O. Covey
Fort Walton Beach, Florida

John O. Creighton
Seattle, Washington

John M. Fabian
Pullman, Washington

Anna L. Fisher
San Pedro, California

Dale A. Gardner
Clinton, Iowa

Robert L. "Hoot" Gibson
Lakewood, California

Frederick D. Gregory
Washington, D.C.

S. David Griggs
Portland, Oregon

Terry J. Hart
Pittsburgh, Pennsylvania

Frederick H. Hauck
Long Beach, California

Steven A. Hawley
Salina, Kansas

Jeffrey A. Hoffman
Scarsdale, New York

Shannon W. Lucid
Bethany, Oklahoma

Jon A. McBride
Beckley, West Virginia

Ronald E. McNair
Lake City, South Carolina

Richard M. Mullane
Albuquerque, New Mexico

Steven R. Nagel
Canton, Illinois

George D. "Pinky" Nelson
Willmar, Minnesota

Ellison S. Onizuka
Kealakekua, Kona, Hawaii

Judith A. Resnik
Akron, Ohio

Sally K. Ride
Los Angeles, California

Francis R. Scobee
Cle Elum, Washington

Margaret R. Seddon
Murfreesboro, Tennessee

Brewster H. Shaw, Jr.
Cass City, Michigan

Loren J. Shriver
Paton, Iowa

Robert L. Stewart
Washington, D.C.

Kathryn D. Sullivan
Woodland Hills, California

Norman E. Thagard
Jacksonville, Florida

James D. A. "Ox" van Hoften
Burlingame, California

David M. Walker
Columbus, Georgia

Donald E. Williams
Lafayette, Indiana

George W. S. Abbey, Director of Flight Operations for NASA Johnson Space Center (JSC), pulled into the Center early on Monday morning, January 16, 1978, having recently chaired the board for the selection of the first class of space shuttle astronauts. He took the elevator to his office on the eighth floor of Building 1. After settling in, he began calling the men and women selected for the 1978 class, trying to reach everyone before NASA Administrator Robert Frosch released the thirty-five names that afternoon at 1 p.m.

This was quite a task, since everyone was spread out across the globe. Steve Hawley, an astronomer, was working on a post-doc in Chile; Kathy Sullivan was completing her PhD at Dalhousie University in Halifax, Nova Scotia; and Dave Walker, who could not be reached by phone, was on an aircraft carrier in the Mediterranean.[1] Others were scattered across the United States, from California to Florida. The conversations were brief. Abbey asked each candidate if he or she was still interested in working as an astronaut, offered jobs to those he called, and then asked everyone to withhold sharing the good news until the release had been issued.

Everyone was thrilled. Dick Covey, then working at Eglin Air Force Base in Florida, jumped on his desk after hearing the news; and when his secretary asked if he had been picked, he replied, "I can't tell you."[2] When Sally Ride answered the phone, she wondered if it was all a dream.[3]

That afternoon, the press learned the names of the thirty-five men and women NASA had chosen.[4] The media had been waiting more than a decade for the selection of another astronaut class; the last time NASA named astronauts was in 1967, when it selected eleven scientist-astronauts, who called themselves the XS (pronounced excess)-11 and coincidentally did not fly until the space shuttle became operational in 1982. In 1969, the agency transferred seven pilots to NASA's Astronaut Corps when the Air Force cancelled their Manned Orbiting Laboratory Program.

The selection of the first class of space shuttle astronauts was historic because, for the first time, the group included women and minorities. They represented the new face of NASA astronauts, and the press was eager to meet them.

Ride, then a PhD student at Stanford University in California, was immediately thrust into the limelight, with the university arranging a press conference for the twenty-six-year-old physics major on the same day NASA released the announcement. To Ride, the event seemed surreal. As she explained, "I mean, my gosh, I was a PhD physics student. Press conferences were not a normal part of my day."[5] *People*

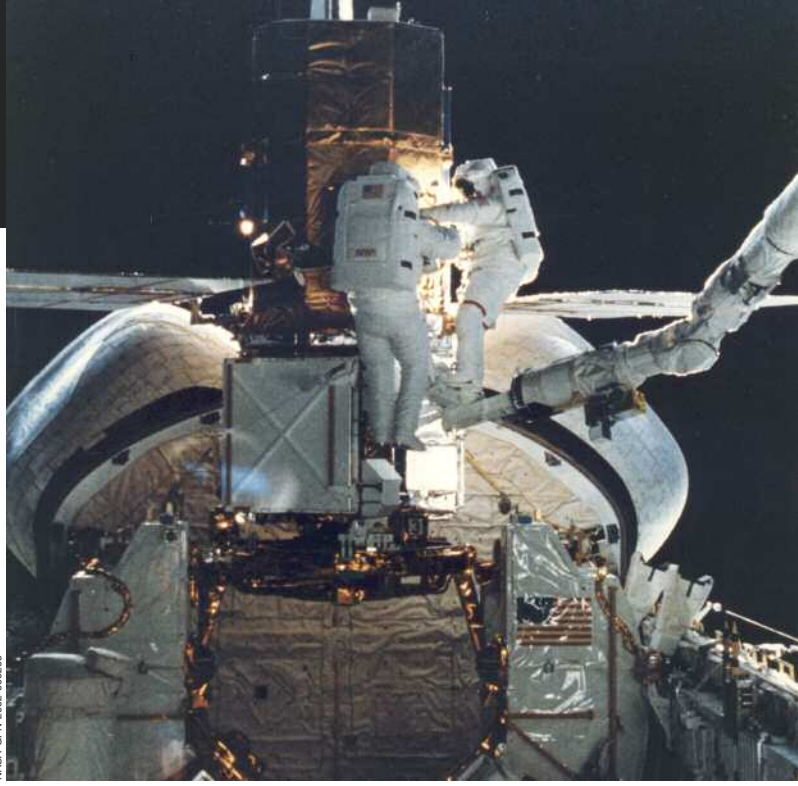
NASA S79-30342

Astronauts Rhea Seddon and Ronald McNair experience the thrill of zero-gravity in NASA's KC-135 airplane.

Magazine traveled across the country and even to Canada, to speak with all of the female astronauts for an article that ran in the first week of February.[6]

On January 31, two weeks after NASA had announced the selection of thirty-five astronaut candidates, JSC Center Director Christopher C. Kraft welcomed the astronaut candidates, who had traveled to Houston for a three-day briefing and orientation period.[7] Public Affairs introduced the thirty-five pilots and mission specialists to JSC employees and the press. One member of the group, Mike Mullane, an Air Force flight test engineer, remembered how anxious he was, sitting on the stage in the Teague Auditorium in Building 2. Bewildered, he expected the Public Affairs officer to announce that there had been a mistake and that "two burly security guards" would drag him off the stage and drop him at the front gate.[8] But, that did not happen.

Few in the audience knew the men and women then on the roster, but certain members of the class had been friends for several years. Covey and Ellison Onizuka had attended test pilot school and were in the same flight test engineering course, and Steve Nagel and Covey had flown A-7s together.[9] Both Rick Hauck and Dan Brandenstein worked at the Naval Air Station



NASA GPN-2002-000205

STS 41-C astronauts Ox van Hoften and Pinky Nelson repair the captured Solar Max satellite in the shuttle's payload bay.

in Whidbey Island, Washington, and some in the group had met during their week-long interview and physical examinations.[10]

Immediately following their introduction, the press had a chance to speak with the candidates. The press members were most interested in interviewing the atypical astronaut candidates—the women and minorities: Ride, Sullivan, Onizuka, Shannon Lucid, Anna Fisher, Judy Resnik, Rhea Seddon, Guy Bluford, Ron McNair, and Fred Gregory.

Sullivan recalled that Carolyn Huntoon, a member of the astronaut selection board and mentor, talked with the first American women astronauts about what to expect when they were introduced to the press and encouraged them to think about how much personal information they would share with the media. Would they discuss whether or not they might wear makeup on the shuttle or who they were dating? Recognizing that they were now in the public eye, they understood that their professional work would be open to analysis, but they wanted to keep their personal lives as private as possible. After each interview, the women met up and exchanged information about the interviewer, his questions, and how each of them had responded. As day wore into night, the women of the class developed a group approach about how public their private lives would be.[11]

The next day, articles about the ten women and men peppered the country's newspapers. The *Houston Post* highlighted a reversal of roles, of sorts. The husbands of Fisher, an emergency room physician, and Lucid, a research chemist, intended to leave their prestigious and professional jobs in California and Oklahoma to come to Houston with their wives, who had just accepted positions as astronaut candidates. The names of the other women, who were single, were not mentioned.[12]

NASA GPN-2002-000214

Five of the first female astronauts take a break during water survival training at Homestead Air Force Base, Florida.

When the class reported for duty in July, they were welcomed warmly by the Gemini- and Apollo-era astronauts. The Thirty-Five New Guys (TFNGs), as they came to be called, more than doubled the size of the office then headed by veteran John Young, who commanded the Apollo 16 moon flight and was slated to fly the first shuttle mission. The size of the office had dwindled over the years, and the corps needed some new hands to jump in and help. The "real astronauts," as Hauck called them, "couldn't have been better to us," he recalled. They realized that they didn't have enough people to do everything that had to be completed before the first shuttle flight, and they wanted to integrate the new class as quickly as possible into the program.[13]

Soon after arriving in Houston, the astronaut candidates dove into training and NASA orientation with astronaut Al Bean, the Apollo 12 Lunar Module pilot and commander of the Skylab 3 mission who was head of the astronaut candidate (AsCan) training program. Their class was much larger than any of the previous selections, so the office split the class into two groups: the red and blue teams, headed by Hauck and John Fabian (affectionately called "Father John" by the younger AsCans). The oldest and most senior men in their class, they addressed any problems that were identified or encountered with the class and its training.[14]

The new class members traveled to the various NASA Centers scattered across the United States to familiarize themselves with NASA functions and its various organizations. Their curriculum also included lectures on space shuttle systems, geology, space physics, physiology, biology, orbital

mechanics, and astronomy. A few of the candidates even participated in water survival training. At times, the curriculum seemed overwhelming, and Brandenstein equated AsCan training with "drinking water out of a fire hose; it just kept coming and kept coming and kept coming."[15] After a thirteen-month candidacy period, they graduated and officially became astronauts in August 1979.

From that point on, everyone in the class followed the progress of the orbiter's subsystems, a highly complex machine that had not yet flown. Terry Hart, a mechanical and electrical engineer, monitored the Space Shuttle Main Engines for the office, traveling regularly to Huntsville, Alabama, and Bay St. Louis, Mississippi. "Failures on the test stand" at that point were "too frequent," and he had the unfortunate task of delivering the bad news to the corps at the Monday morning meetings.[16] Others verified software in the Shuttle Avionics and Integration Laboratory at JSC or the Flight Systems Laboratory in Downey, California. Some traveled to Toronto, Canada, where they helped to develop the procedures and user's input for the Shuttle Remote Manipulator System (or arm). Others were tasked to monitor extravehicular issues, which included the Shuttle Extravehicular Mobility Unit (or spacesuit).

Dr. Norm Thagard performs a medical experiment during STS-7 to learn more about space sickness.

NASA S83-35770

Though they had been selected in 1978, members of the TFNGs continued to attract media attention throughout the 1980s and well into the 1990s. Like the Mercury 7 (the first class of space flyers), the first class of shuttle astronauts were celebrities of sorts, partly because the 1978 class had a multitude of firsts—the first American woman in space, the first African American in space, and so on. In 1980, for instance, the Fishers made history when Bill—Anna's husband—was selected as an astronaut candidate, and they became the first married couple in the office. Known as Mr. and Mrs. Astronaut, they passed that title on to Seddon and Hoot Gibson, who married in May of 1981. The news of their engagement intrigued the media, who hoped to cover the wedding of two astronauts. Upon hearing that the couple was engaged, *Bride's Magazine* contacted the office, hoping to secure an interview with Gibson, and classmates teased him, calling him Mr. Seddon.[17] The couple remained in the public eye well into 1982, when Seddon became the first pregnant astronaut.

NASA 51A-46-0057

Riding the Manned Maneuvering Unit during STS 51-A, Dale Gardner prepares to capture the faulty Westar satellite so that it can be returned to Earth.

When the shuttle was finally ready to fly for the first time in April of 1981, every one of the TFNGs, with the exception of Fabian, supported the flight in some capacity.[18] Bluford and Sullivan—the new face of the agency—provided technical commentary during the launch and landing of *Columbia* for ABC News. Loren Shriver helped to secure Commander Young and Pilot Bob Crippen into the shuttle. In the Mission Operations Control Room, where flight controllers had manned the flights of Gemini, Apollo, and Skylab, others worked as Capsule Communicators (CapComs). NASA paired several classmates and assigned them the task of literally chasing the orbiter when she landed. As this was the first flight of the space shuttle, the agency planned for a host of contingencies—possible aborts and landings at several sites. With so many astronauts then in the corps, the TFNGs worked at Cape Canaveral, Edwards Air Force Base, and El Paso (close to the Northrup Strip landing site in New Mexico).

The launch of the orbiter on April 12, 1981, was a success, and the crew returned safely two days later. Though the flight had gone well, there were three other test flights scheduled, and no one from the 1978 class would fly until

Judy Resnik completes her T-38 jet training with pilot Richard Laidley.

NASA S78-29250

1983, even though President Ronald Reagan declared the program operational—or ready for regularly scheduled flights—after the landing of STS-4.

On April 19, 1982, nearly three weeks after the landing of STS-3 at Northrup Strip in New Mexico, NASA announced the crews of STS-7, -8, and -9. Seven members of the class received assignments. Fabian, Hauck, and Ride would fly onboard *Challenger* with Crippen as part of STS-7; Norm Thagard, a medical doctor, would later be added to the crew. The next shuttle flight included Bluford, Brandenstein, and Dale Gardner, with Brewster Shaw named to the first flight of the Spacelab (a reusable laboratory that fit in the payload bay of the orbiter, which allowed researchers to conduct scientific studies in space) or STS-9.[19]

NASA recognized that Ride might be unnecessarily burdened by all the media attention. Before the space agency released the names of the seventh, eight, and ninth crews, she met privately with Abbey, who told her that she had been selected for a flight, and then with Kraft, who promised her that the Center would provide whatever assistance she needed. "It was a very reassuring message, coming from the head of the space center," she later recalled.[20]

In fact, NASA protected her from much of the media frenzy by holding a press conference right after the announcement and then holding all requests until the preflight press conference, which fell about one month prior to liftoff. Following the press conference, an entire day was dedicated to interviews with the crew. Hauck, the pilot for the flight, and Crippen, commander of the mission, often sat in with Ride, shielding her from the media. After she landed, Ride recalled that the "protective shield was gone. I came face-to-face with a flurry of media activity. There was a lot more attention on us than there was on previous crews."[21]

Bluford followed Ride's historic flight, becoming the first African American in space in August of 1983. Recalling the interest in his first mission, he believed he was fortunate, having followed Ride's flight. Bluford witnessed firsthand how the crew of the seventh shuttle flight dealt with training and media events, and he saw how America's first female in space worked with the Center and NASA Public Affairs. "I gained some insight into what I would face as I was preparing to fly on STS-8. So in some cases, that worked in my favor," he later explained.[22]

Between 1983 and 1986, the TFNGs flew on every mission, with the exception of STS 51-F. They flew some of the most exciting and interesting missions of the program, which included several satellite repair and retrieval missions: STS 41-C, STS 51-A, and STS 51-I. All members of the 41-C crew, with the exception of Commander Crippen, were members of the first class of space shuttle astronauts. They rendezvoused with the ailing Solar Max satellite and then with assistance of two spacewalkers, Ox van Hoften and Pinky Nelson, repaired and released the satellite. STS 51-A deployed two satellites and then recovered Palapa B-2 and Westar VI, two malfunctioning satellites, and brought them back to Earth. Except for Joe Allen, all of the 51-A astronauts had been selected in 1978. The five-man crew of STS 51-I, which included Covey (the last pilot in his class to fly), repaired and redeployed a Syncom IV-3 satellite in Earth orbit.

Others deployed numerous satellites into orbit, while some in the class flew on classified Department of Defense flights. Several classmates flew Spacelab flights.

Though Ride and Bluford made history as the first American woman and African American in space, other notable firsts were bestowed upon other members of the TFNGs. In 1984, Sullivan became the first American woman to walk in space, and when the crew of STS 51-A circled the Earth, Fisher became the first mother in space. STS 51-C featured the first Asian American in space, Onizuka.

He and three other classmates, Dick Scobee, Resnik, and McNair, were members of the ill-fated *Challenger* flight, which lifted off the pad on January 28, 1986. They and three other crew members perished when the *Challenger* was torn apart by aerodynamic and inertial forces.

President Ronald Reagan, a staunch supporter of the space program who, just two years earlier, had directed NASA to build a space station within a decade, appointed a commission

Ellison Onizuka enjoys his first flight in space while Loren Shriver sleeps on the middeck of* Discovery *during STS 51-C.

NASA 51C-08-0035

NASA S79-25694

Guy Bluford sits in a rescue ball, which was designed to safely transport crew members from one orbiter to another in the case of an emergency, but was never used.

to investigate the accident. William P. Rogers headed the commission along with former astronaut Neil Armstrong, Brigadier General Chuck Yeager, and Nobel laureate Richard Feynman and many other distinguished scientists and engineers, including astronaut and physicist Ride. Two other members of her class, Fabian and Shaw, joined her in the investigation, serving as members of the support staff.

All shuttle flights had been halted after the accident, and during the first year of inactivity several members of the 1978 class of astronauts decided to leave the agency. Gardner, a veteran of two spaceflights, returned to the U.S. Navy and began working at the U.S. Space Command in Colorado Springs. A promotion encouraged Robert L. Stewart to return to the U.S. Army as a Brigadier General. Van Hoften, who realized that it would take at least two years to begin flying again, joined Bechtel Corporation. Most, however, remained in Houston and hoped for a quick return to flight.[23]

As early as 1986, NASA began planning the return to flight effort. Richard Truly, NASA's Associate Administrator for Space Flight, and Abbey met privately with Hauck, to tell him that he would command the mission, but prohibited him from sharing the news with anyone. Two other members of his class would fly: Covey and Nelson. Mike Lounge and David Hilmers from the 1980 class would round out the crew that flew in 1988.[24]

Sullivan served as the planning shift CapCom for the flight and selected wake-up music for the crew. Thrilled that the shuttle would finally be flying again and recognizing the importance of the mission, she wanted the music and wake-up calls to reflect her enthusiasm. Remembering the exuberant opening shout of the radio announcer in the movie *Good Morning, Vietnam*, she set about contacting Robin Williams. Eventually the comedian agreed to record several variations of "Gooood Morning, *Discovery*!" for her to use.[25]

Discovery and her all-veteran crew finally lifted off the pad on September 29, 1988, thirty-two months after the *Challenger* accident. Twice, the crew woke up to Williams' greeting. During their short flight, the crew deployed a Tracking and Data Relay Satellite and paid homage to the fallen *Challenger* crew. Following the flight of *Discovery*, Nelson and Hauck retired from NASA. Though fewer in number, the TFNGs continued to fly many of the agency's high-profile missions.

They helped to deploy many of NASA's Great Observatories: the Hubble Space Telescope, the Gamma Ray Observatory, and the Chandra X-Ray Observatory. Several in the class flew on servicing missions to the Hubble Space Telescope and participated in the first phase of the International Space Station Program, known as the Shuttle-Mir Program. In 1996, Lucid broke all U.S. space records when she resided for six months onboard the Russian Space Station, *Mir*. The flights of the TFNGs ended in 1999, when Hawley flew onboard STS-93, more than twenty years after their class had been announced.

NASA GPN-2000-001036

Dale Gardner proudly displays a "For Sale" sign after he and Joe Allen successfully captured and stowed two ailing satellites during STS 51-A. Allen can be seen in the visor of Gardner's helmet.

Today, only a handful of class members remain at JSC: Lucid, Fisher, Nagel, and Mike Coats, who returned to the agency in 2005 to head the Center. Many still remain in the Clear Lake area and actively support the program as contractors. Covey is president and CEO of the United Space Alliance, which handles a variety of space shuttle operations—mission design and planning, crew training, and flight operations to name a few, and his second in command is Brandenstein. Shaw serves as vice president and general manager of the Boeing's NASA Systems business unit.

NASA S79-28218

Rick Hauck proudly displays his class T-shirt on the KC-135.

Others have scattered across the country, with many of the PhD scientists now working for universities as faculty members or in other capacities. In the fall of 2008, Hawley returned to his home state of Kansas to teach astronomy and promote education in science and mathematics. America's first female spacewalker currently serves as director of the new Battelle Center for Mathematics and Science Education Policy at Ohio State University. Located in the John Glenn School of Public Affairs, the center's initial work is focused on generative leadership and the mechanism of innovation in science education. Jeff Hoffman teaches at the Massachusetts Institute of Technology, and Ride works for the University of California at San Diego.

Though many worked only a short time for the space agency, the importance of the class of 1978 cannot be overlooked. They literally reshaped America's image of the astronaut. Like those who came before them, they had the "Right Stuff," but they were more than test pilots. The TFNGs represented the diversity present in American society, and they helped pave the path for future classes of space shuttle astronauts, which now include female pilots and commanders.

Aside from this legacy, the first shuttle astronauts also had a tremendous impact upon the Space Shuttle Program itself. When they came onboard, a great deal of work had to be completed before the first flight of *Columbia*. In some way, everyone in the first class of shuttle astronauts helped to get the orbiter off the pad and into Earth orbit. Much later, as they began leaving the Astronaut Office, some continued to influence the Program as they moved into senior management positions within the agency and as contractors. Their impact can still be felt today. ★

Sally Ride looks out the windows of* Challenger*'s flight deck during her first flight, STS-7.

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THE FUTURE IS NOW

AT JOHNSON SPACE CENTER

By Mike Coats, *Center Director, NASA Johnson Space Center*

NASA JSC2006E017826

Spacesuit engineer Dustin Gohmert simulates work in a crater in Johnson Space Center's Lunar Yard, while his ride, NASA's new lunar truck prototype, stands ready in the background. The rover has the ability to lower its platform all the way to the ground, making climbing on and off easy—even in a bulky spacesuit.

NASA has continued to explore and discover space for fifty years, and since its establishment in 1961, the Lyndon B. Johnson Space Center (JSC) has been a major contributor to the agency's success.

Originally called the Manned Spacecraft Center, this federal institution was born out of the early space program's need for a location to house the Space Task Group at the beginning of the Apollo Program. After President John F. Kennedy announced that the U.S. would put a man on the moon by the end of the decade, the site in Houston was selected to provide test facilities and research laboratories suitable to mount an expedition to the moon.

Since then, the Center has continued to make history in space exploration, highlighted by scientific and technological advancements as well as engineering triumphs. This rich tradition continues each and every day, and here is a summary of how it is reflected.

From JSC's inception, it was to be the primary center for U.S. space missions involving astronauts; however, through the years JSC has expanded its role in a number of aspects in space exploration. These include serving as the lead NASA center for the International Space Station (ISS)—a sixteen-nation, U.S.-led collaborative effort that is constructing and supporting the largest, most powerful, complex human facility to ever operate in space.

Home to NASA's astronaut corps, JSC trains space explorers from the U.S. and our space station partner nations, preparing these individuals as crew members for space shuttle missions and long-duration Expedition missions on the ISS. At the Center's famed Mission Control Center, all activity onboard the space station and during all space shuttle missions is directed. This control center has been the operational hub of every American human space mission since Gemini IV.

Nearby, Ellington Field hosts the Center's flight operations. The training aircraft housed there include a C-9 jet used to produce space-like weightlessness, twin-engine Gulf Stream jets modified to simulate a shuttle orbiter landing, and T-38 jets trainers flown by astronauts to maintain their pilot proficiency.

As part of the Center's longstanding tradition of achievement, flight-related scientific and medical research efforts developed here make revolutionary discoveries and advances to benefit all humankind. Technologies developed originally for spaceflight have found a wide range of applications in medicine, energy,

NASA JSC2006E18535

A new era of spacecraft are being developed as part of the 2004 Vision for Space Exploration that directs NASA to return to the moon and prepare to go beyond.

transportation, agriculture, communications, and electronics. Additionally, the Center manages the development, testing, production, and delivery of hardware supporting spacecraft functions including life-support systems and all human spacecraft-related functions. The latter include life-support systems, power systems, crew equipment, electrical power generation and distribution, navigation and control, cooling systems, structures, flight software, robotics, and spacesuits and spacewalking equipment.

The Center also takes a direct approach to maintain its earthbound assets and incorporate significant environmental stewardship on many levels. The child care center is a model of renewable energy through the use of solar panels and wind turbines which completely power the facility. Construction is underway for a new 83,000-square-foot building that will use Leadership in Energy and Environmental Design standards. Those same standards will be applied to a research and human adaptation facility to be constructed that will provide rehabilitation for crew members following long-duration spaceflight duty.

In addition to new buildings, many are under refurbishment, such as a vintage centrifuge building that we are transforming into a new avionics laboratory for the Orion spacecraft. Also, the Center's central campus is undergoing a revitalization and beautification program with many roofs being repaired and replaced, streets and parking lots being repaved, and a new perimeter fence constructed. More than nine thousand members utilize the recently upgraded employee fitness center.

Supporting all of these efforts at the Center is a budget of nearly $5 billion annually and the more than sixteen thousand people employed by the aerospace industry in the Houston area.

Looking to the next years, JSC's future is bright. During 2009-2010, the remaining eight shuttle missions will continue to service the construction of the ISS and provide an expansion to a crew of six aboard the station, thereby allowing scientific research to significantly increase.

As we prepare to retire the orbiters and close out the Space Shuttle Program after thirty years, we begin to pave the way back to the moon to establish lunar habitats with our newest program, Constellation. Contracts have been awarded for the next generation of spacecraft—Orion and Ares—and, within the next year, the Ares 1-X unmanned test rocket will be tested, marking a major milestone and providing important data for future flights. The experiences we are building will eventually take us on to Mars and beyond.

Our future success is dependent on today's students, and NASA is recognized for its ability to engage and excite students through the wonders of space exploration. JSC logs more than 625,000 contact hours with students annually, encouraging their interest in science, technology, engineering, and mathematics subjects. Through the Texas Aerospace Scholars Program, high school students from across the state spend a week during the summer at JSC learning about career opportunities and projects. This unique exposure reminds them they are the future scientists, engineers, astronauts, and technicians needed to fulfill the goals of NASA.

JSC partners with the University of Texas Medical Branch, Baylor College of Medicine, the University of Houston, University of Houston – Clear Lake, and Rice University. Recently, we announced that we will be working with engineering teams from the University of Texas and Texas A&M to design and launch very small satellites called picosats to be launched onboard STS-127. These picosats will demonstrate autonomous rendezvous and docking in low-Earth orbit—something that has never been demonstrated before.

Locally, our community partnerships include our Longhorn Project with the Clear Creek Independent School District and the Houston Livestock Show and Rodeo. In 1996, JSC initiated this agreement that allows the students to raise longhorn cattle on a sixty-acre tract of land located on the Center, where thirty-five longhorn show animals and four trophy-winning steers are housed. We also partner with the State of Texas and the Texas Emerging Technology Fund to leverage the availability of NASA to spinout and commercialize new technologies.

Our history at JSC has been interesting and intriguing, but the next fifty years promise to be even more exciting. As the premier human spaceflight center in the world, we will continue to take a leadership role in space exploration that will propel us beyond low-Earth orbit to the discovery and understanding of planets beyond our own. ★

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To reference the endnotes for the articles contributed by these writers, go to *http://www.jsc.nasa.gov/history/HouHistory/endnotes.pdf*

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