National Aeronautics and Space Administration

MARSHALL STAR

Serving the Marshall Space Flight Center Community

July 1, 2010

Director's Corner

The work of generations

This year we're celebrating Marshall's 50th anniversary and the generations of men and women who have made Marshall what it is today. We are stewards of an incredible legacy that began with Dr. Wernher von Braun and his generation of engineers and scientists.

Within the pages of this issue, you will see many of the accomplishments we've achieved over the last 50 years in the areas of propulsion, space exploration and science.

It is very impressive how far we've come since the Jupiter-C rocket put America into the space race and Saturn V put twelve Apollo astronauts on the moon. Since the beginning of the space program, Marshall has been a leader in propulsion systems development and systems integration. Our Shuttle generation took the best from the Apollo program, and likewise, our Constellation team took the experience from both the previous programs to provide solid work on new launch vehicles. This experience will again, no doubt, be leveraged in the development of future heavy lift launch systems.

Marshall's initial capabilities in propulsion helped us springboard into other areas. From our experience with Skylab and Spacelab to the magnificent ISS, we have amassed a great deal of experience in learning how to live and operate in space. And we continue to improve on our ability to stay for longer periods in space and conduct key science experiments through our work with the Environmental Control and Life Support System (ECLSS) and the Materials Science Research Rack (MSRR), for example.

We also continue to see the benefits of generations of work through the great observatories of our world, including Hubble and Chandra which are now in their 20th and 10th years of operation, respectively. These telescopes continue to create awe for individuals and help scientists gain knowledge of our universe. Marshall continues the legacy and is now helping to develop the James Webb Space Telescope, which will be the largest telescope in the world – capable of seeing galaxies 13 billion light-years away.

Science also continues to be an integral part in helping Marshall fulfill our legacy of doing our part to improve life here on our own planet. Through earth science initiatives such as SERVIR, which was used to help Haiti following the massive earthquake earlier this year, to other key environmental efforts including weather forecasting and lightning research, Marshall's work has the ability to directly impact people's lives.

I am very proud of Marshall's contributions over the past 50 years. All of our great accomplishments have been built on the extraordinary work of previous generations. The men and women before us overcame many challenges in the pursuit of human and scientific exploration. But what made them great was not simply overcoming the challenges – it was, in the midst of all the obstacles – continually finding the opportunities that propelled Marshall forward.

And now, here at the center, we find ourselves again in a very challenging time. We are all affected by recent changes, especially our Constellation folks. I know the events we're facing now are disheartening and it makes it more difficult to focus on where we've been and how far we've come. But as certain as I am of the challenges ahead, I am equally certain there will be opportunities that will once again allow us to demonstrate the remarkable talent and dedication of our people and affirm the reasons why Marshall continues to be critical to our nation's space exploration pursuits. Our ability to persevere will honor the generations before us and embolden the generations that will come after us.

Robert Lightfoot
Marshall Center Director

50 years of NASA contributions

Wernher von Braun: First director of the Marshall Center

By Mike Wright

More than 40 years after his departure in 1970 as Marshall Space Flight Center's first director, Dr. Wernher von Braun still attracts public attention and scholarly discussion.

Von Braun, who passed away in 1977, never experienced the era of the operational space shuttle or the International Space Station. However, he is credited with generating original thoughts related to both programs. The origin of his technical expertise in rocketry dates back to World War II when he and his associates built the V-2 rocket for Germany. That foundation expanded after he and his associates were brought to the United States to work for the U.S. Army on rockets at White Sands, N.M., and then in Huntsville.

In 1960, von Braun transferred from the Army to NASA to become director of its new center in Huntsville. He was given responsibility for developing the Saturn V that took the first astronauts to the moon in 1969. Saturn, a national priority, soon became an all-consuming goal for von Braun and the Marshall Center. To get the job done, von Braun accepted the fact that other work Marshall had responsibility for – such as solar electric propulsion and the Centaur rocket – needed to be redistributed within NASA. "We have thrown our hat across the river," he once said, referring to Marshall's unending devotion to building the Saturn V.

Von Braun also faced other challenges. Work on Saturn rockets had been in progress before 1961 when President John F. Kennedy issued his goal of landing a human on the moon by the end of the decade. However, the pace and extent of the work on Saturn after President Kennedy's announcement involved moving more than boulders. It meant moving mountains.

Von Braun realized that the magnitude of meeting the lunar landing goal meant accepting a magnitude of changes in the way the Marshall Center had already been operating since it first opened its doors

Dr. Wernher von Braun

only months before. Above all, it meant that Marshall and all of NASA knew that Saturn's success called for participation from private industry at an almost wartime level. Von Braun accepted reality. However, as director of the Marshall Center, he absolutely insisted that the center's government work force retain the technical competence it needed to exercise vigilance over the final products

*See **von Braun** on page 4*

Series of events led to creation of Marshall in 1960

By Mike Wright

Reading a 50-year chronology of the Marshall Space Flight Center makes it easy to imagine that the successes and failures the center experienced over its 50-year history somehow unfolded like scenes written years before for a stage play.

Of course, the series of events that began transpiring at Marshall exactly 50 years ago today did not follow a pre-defined course. Some of the 4,670 Army employees who stood in the front yard of an Army building on Martin Road to become NASA employees had some ideas and hopes in their minds regarding what the next 50 years might bring.

However, no one in the crowd that returned to the same desk in the same Army building that day had Marshall's agenda for the future tucked in a bottom desk drawer. In fact, the events that brought about the Army/NASA transfer ceremony on July 1, 1960, were not pre-ordained the day that Wernher von Braun and his team of German rocket scientists had the utilities turned on in the apartments and houses they moved into in Huntsville beginning in April 1950.

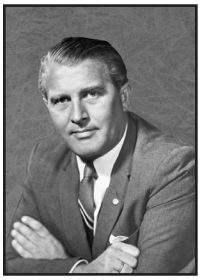
The decision to transfer Army employees, property and resources to NASA and establish a new field center in Huntsville was a long time coming. The fact that NASA was created in 1958 and that Marshall didn't come into existence for another two years begs the question. The answer is that it took two years of negotiations between the Eisenhower Administration, the Department of Defense and the new space agency.

The Army had not sent von Braun to Huntsville to work on plans for a human space exploration program. As the Cold War got colder and war broke on the Korean peninsula in 1950, von Braun's assignment in Huntsville was clear – design and

*See **Marshall** on page 16*

50 years of NASA contributions

Marshall Space Flight Center directors



Wernher von Braun
July 1, 1960-
Jan. 27, 1970

Eberhard Rees
March 1, 1970-
Jan. 19, 1973

Rocco Petrone
Jan. 26, 1973-
March 15, 1974

William Lucas
June 15, 1974-
July 3, 1986

James R. Thompson
Sept. 29, 1986-
July 6, 1989

Thomas J. Lee
July 6, 1989-
Jan. 6, 1994

G.P. (Porter) Bridwell
Jan. 6, 1994-
Feb. 3, 1996

J. Wayne Littles
Feb. 3, 1996-
Jan. 1998

Carolyn Griner
Jan. 3, 1998-
Sept. 11, 1998
(acting)

Arthur G. Stephenson
September 11, 1998-
May 2003

David A. King
June 15, 2003-
April 2009

Robert M. Lightfoot
Aug. 24, 2009-
present

Von Braun *Continued from page 3*

that industry produced. In addition, von Braun's efforts to manage the Marshall Center by working with both industry and government partners also included responding to local, regional and national political interests, NASA Headquarters' requirements, and relationships with other NASA field centers.

Von Braun thrived at a time when public enthusiasm for space exploration was at its highest point. For von Braun, public support for the space program was far more than incidental. It was absolutely vital. As an ambassador for the space program, he shared his message about the benefits of exploration on an almost daily basis. His calendar shows him one night in Detroit, another in New Orleans, another in New York and then back to Huntsville to manage the activities here.

Von Braun developed a "persona" that seemed to be in demand everywhere at the same time. Photographs show him inspecting rocket hardware, meeting with members of Congress, walking with President Kennedy, deep-sea diving, sporting a beard from a land-based exploration expedition, interacting with a local youth baseball team, speaking at university graduations, conferring with his advisors and playing a banjo at an Apollo 11 celebration.

Von Braun's record of achievements, most notably as designer of the Saturn V moon rocket, started Marshall on a path that now encompasses 50 years of service to the American space program. Fifty years later, evidence still surfaces, however, that although von Braun was certainly aware of the scope of his responsibilities, he knew the difference between enthusiasm and ego. It is known, for example, that if his schedule demanded it, the Marshall Center would send a government car and driver to pick him up at home to ferry him to the airport. Von Braun utilized the service. However, one Marshall retiree also recalls how – in their eagerness to make sure that von Braun always got to the airport on time – someone over-reacted. He or she decided that it might be good to dispatch two cars to the house just in case there were mechanical difficulties with the first. And, according to the account, von Braun was not to know about the second car and driver standing by just around the block. Somehow, however, von Braun managed to spot the second car and was informed of the reasoning. And, while von Braun insisted on redundancy when it came to rocket components, he made it plain and clear that he thought it was ridiculous when it involved taxi service.

Wright is the Marshall Center historian.

50 years of NASA contributions

A historical chronology: 1960s

July 1, 1960: The Marshall Space Flight Center came into being as 4,670 Army civil servants became NASA personnel, and the U.S. Army Ballistic Missile Agency transferred 1,840 acres of arsenal land along with buildings, space projects and equipment.

Sept. 8, 1960: President Dwight Eisenhower visited the Marshall Center to dedicate the center in honor of Gen. George C. Marshall.

May 5, 1961: Alan Shepard rode into space aboard a Mercury-Redstone rocket designed by Marshall.

November 1961: The Saturn RL-10 engine, the first to burn the high-energy fuel hydrogen, passed its preliminary flight evaluation.

Oct. 27, 1961: The first Saturn vehicle flew a flawless, 215-mile ballistic trajectory from Cape Canaveral.

Sept. 7, 1961: NASA selected the Michoud Plant in New Orleans as the production site for Saturn rockets.

Oct. 25, 1961: NASA selected a 13,500-acre site known as the Mississippi Test Facility to conduct Saturn rocket tests.

During 1961: North American Aviation, Chrysler Corp., Boeing Co. and Douglas Aircraft Co. were selected as major Saturn hardware contractors.

April 25, 1962: The third Saturn I vehicle lifted Project Highwater, which ejected 30,000 gallons of ballast water in the upper atmosphere to test for the formation of ice crystals.

June 1962: Bids were requested for construction of a huge static test stand at Marshall to captive fire the Saturn V first stage booster.

Sept. 11, 1962: President John F. Kennedy and key members of government visited the Marshall Center for a first-hand look at the space effort.

June 1963: Some 1,200 Marshall employees moved into Building 4200, the center's new central laboratory and office building.

Nov. 27, 1963: Engineers conducted the first extended-duration firing test of the J-2 engine.

Dec. 3 and Dec. 5, 1963: Marshall conducted its first F-1 engine tests.

February 1964: Marshall completed assembly of the transporter for the huge Saturn V first stage.

March 24, 1964: Mrs. Lyndon B. Johnson made a one-day visit to Marshall.

July 21, 1964: NASA named its first large-scale scientific payload for the Saturn rocket, "Pegasus." Marshall managed the micrometeoroid measurement project.

Sept. 30, 1964: Major construction was completed on Marshall's Saturn V first stage test stand.

March 31, 1965: NASA awarded the contract for the Saturn instrument unit to IBM.

August 1965: All three stages of the 365-foot-tall Saturn V vehicle were captive tested for full durations in Marshall's Dynamic Test Facility.

1966: The Marshall Center was assigned responsibility for the Apollo Telescope Mount project that would eventually be part of the Skylab space station.

Nov. 9, 1967: The first Saturn V vehicle was launched from the Kennedy Space Center, Fla.

March 1968: Workmen completed Marshall's 75-foot-diameter Neutral Buoyancy Tank, an underwater testing facility that astronauts could use to simulate the weightless environment of space.

July 11, 1969: Marshall issued a request for proposal for the design, development, test and delivery of a manned lunar roving vehicle. Astronauts drove the lunar rover on the last three Apollo moon missions.

July 16, 1969: As its crowning achievement in the Apollo space program, a Saturn V rocket lifted the Apollo 11 spacecraft and three astronauts on their journey to the moon.

50 years of NASA contributions

A historical chronology: 1970s

1970: Engineers from Marshall and other NASA centers were already at work defining the requirements for the space shuttle main engine – the world's most sophisticated reusable rocket engine.

During the 1970s: As space shuttle development progressed, engineers reused many of the huge test structures originally designed as part of the Saturn launch vehicle program.

Jan. 5, 1972: President Richard M. Nixon announced plans for NASA to develop the space shuttle for routine access to space.

1972: Marshall was assigned responsibility for developing the propulsion elements for the space shuttle: the external tank, solid rocket boosters and the space shuttle main engines. Marshall also received responsibility for Spacelab, a versatile laboratory carried within the shuttle's cargo bay. Other center assignments included the upper stage boosters that would lift shuttle payloads into higher orbits.

1973: Saturn rockets launched Skylab, and Marshall had a vital role in providing the hardware and experiments. The Skylab space station was occupied in succession by three teams of three crew members. These crews spent 28, 59 and 84 days, respectively, orbiting the Earth and performing nearly 300 experiments.

July 15, 1975: NASA marked the final launch of a Saturn rocket. This time NASA launched a Saturn IB from the Kennedy Space Center. Earlier that day, a Russian Soyuz spacecraft lifted off its launch pad at a Soviet launch site carrying three cosmonauts. The joint mission was called the Apollo Soyuz Test Project. Rendezvous and docking of the two ships came on July 17, allowing astronauts and cosmonauts to conduct joint experiments and exchange national mementos.

1976: Marshall launched the Laser Geodynamics Satellite, or LAGEOS. Essentially a mirror in space, the 900-pound, 2-foot-diameter satellite was designed to precisely reflect laser beams from ground stations for extremely accurate ranging measurements. LAGEOS measured movements of the Earth's crust related to earthquakes, continental drift and other geophysical phenomena. The satellite was conceived and manufactured at Marshall.

April 1976: The first tests of the space shuttle main engines were conducted at the NASA-National Space Technology Laboratories at Bay St. Louis, Miss.

April 1976: An X-ray Test Facility, the only one of its size, was constructed at Marshall for verification testing and calibration of X-ray mirrors, telescope systems and instruments.

During 1976: Marshall managed several unmanned scientific payloads, including a Gravitational Redshift Probe. In addition, three Space Processing Applications Rocket missions were flown, and the Skylark X-ray telescope was launched from Australia.

July 18, 1977: The first firing of a solid rocket motor took place in Utah. The motor ran for about two minutes in what observers describe as a “near perfect” test. The motor was referred to as Development Motor-1.

Sept. 9, 1977: The first external tank rolled off the assembly line at Marshall's Michoud Assembly Facility in New Orleans.

1977-79: Marshall developed three High-Energy Astronomy Observatory (HEAO) spacecraft. NASA launched three of the unmanned scientific observatories into low Earth orbit. The missions focused on some of the most intriguing mysteries of the universe: pulsars, black holes, neutron stars and super nova.

March 18, 1978: The orbiter Enterprise arrived at Marshall for the Mated Vertical Ground Vibration Test series. Marshall engineers placed the Enterprise in the center's Dynamic Test Stand in order to critically evaluate the structural integrity of the vehicle.

1979: The Marshall Center sent to Kennedy Space Center the first external tank for the shuttle's first mission.

50 years of NASA contributions

A historical chronology: 1980s

1980: Marshall engineers participated in numerous tests related to plans to launch the first space shuttle. During these early tests and eventually prior to each shuttle launch, engineers in the Huntsville Operations Support Center monitored consoles in order to evaluate and help solve any problems at the Florida launch that might involve the shuttle main engines, external tank or solid rocket boosters.

During the 1980s: NASA examined ways to construct large structures in space. Two experiments were extremely important. One was known as Experimental Assembly of Structures in Extravehicular Activity, or EASE. The other was called Assembly Concept for Construction of Erectable Space Structure, or ACCESS. Both experiments were simulated in Marshall's Neutral Buoyancy Simulator prior to flight.

April 12, 1981: A new era in spaceflight began on April 12, 1981, when Marshall-developed propulsion systems lifted the first space shuttle off the launch pad in Florida and into space. Marshall's responsibilities for improving the shuttle propulsion systems have continued throughout the shuttle era.

1983: Spacelab 1, managed by the Marshall Center, flew aboard STS-9 as both a test flight of the Spacelab module and an ambitious research mission, with 73 experiments in seven science disciplines.

Jan. 25, 1984: President Ronald Reagan, during his State of the Union address, said the United States should explore the new frontier of space and directed NASA to build a permanent manned space station.

Dec. 1985: The first phase of the space station was well under way with the design concept for the crew compartments and laboratories. NASA astronauts, at the Marshall Center's Neutral Buoyancy Simulator, practiced construction techniques they later used to construct the space station after it was deployed.

Jan. 28, 1986: Only 74 seconds after liftoff, the space shuttle Challenger, flight STS 51-L, exploded about 10 miles above Earth, killing all seven crew members.

1986: As a result of the Challenger accident, the Marshall Center began redesigning and testing the shuttle's solid rocket motor. Marshall had management responsibility for space shuttle propulsion elements, including the solid rocket booster.

May 27, 1987: The first full-scale test of the redesigned space shuttle booster since the Challenger accident was a success.

1987: NASA announced that Marshall engineer Jan Davis had been selected as a NASA astronaut.

During July 1988: A team of NASA scientists from the Marshall Center, the Lockheed Company and the University of Alabama in Huntsville announced the discovery of a new high-temperature superconductor.

Aug. 18, 1988: NASA announced that TRW Inc. had been selected for final negotiations leading to the award of contracts for extended definition and development of the space-based Advanced X-ray Astrophysics Facility, later renamed Chandra.

1988: Thirty-two months after the Challenger accident in 1986, the space shuttle returned to flight on mission STS-26. The redesign effort directed by the Marshall Center had involved an extensive test program in order to verify that the shuttle's solid rocket boosters were safe.

April 2, 1989: A launch attempt of the space shuttle Atlantis was scrubbed 31 seconds before scheduled liftoff because of a power surge on a pump that recirculates liquid hydrogen fuel for one of the space shuttle main engines.

May 1989: The space shuttle Atlantis crew successfully deployed the Magellan spacecraft for its rendezvous with Venus. The deployment relied on a Marshall-managed Inertial Upper Stage that accompanied the STS-130 mission.

More chronological facts from the 1980s can be found on the Marshall 50th Anniversary Web page at http://mynasa.nasa.gov/centers/marshall/home/marshall50/index.html

50 years of NASA contributions

A historical chronology: 1990s

April 24, 1990: NASA launched the Hubble Space Telescope. Developed by Marshall, the telescope was designed to see deeper into space than ever before. It was the product of a partnership between NASA, the European Space Agency, industry partners and the international community of astronomers.

June 20, 1990: President George H. Bush toured the Marshall Center and addressed employees.

June 27, 1990: NASA said that the Hubble Space Telescope, which had been plagued with problems, was discovered to have a flawed mirror, causing the $1.5 billion instrument to be "near sighted."

1990s: Servicing missions continued on NASA's Hubble Space Telescope throughout the 1990s and after. Astronauts selected for these missions trained in the Marshall Center's Neutral Buoyancy Simulator. This facility provided the weightless environment encountered in space needed for testing and the practices of extravehicular activities, including those related to the Hubble Space Telescope.

June 29, 1990: A hydrogen leak similar to the one that scrubbed space shuttle Columbia's mission in late May was discovered in the space shuttle Atlantis as it was being readied on the launch pad.

July 2, 1990: Marshall awarded a $42.6 million contract to Rockwell International for continued space shuttle systems engineering and integration services.

July 13, 1990: Engineers located two leaks in the space shuttle's fuel line that they determined could be fixed and stated that flights would resume soon.

Aug. 13, 1990: NASA scientists released a photograph taken Aug. 3 by the Hubble Space Telescope that provided unexpected detail of a young star system determined to be 160,000 light years from Earth. After scientists corrected the flawed mirror problem with computer enhancement, the telescope revealed 60 of what were the youngest and heaviest stars known.

Dec. 2, 1990: Space shuttle Columbia on flight STS-35 was launched from Cape Canaveral, Fla., carrying the $150 million Astro-1 for a 10-day astronomy mission.

April 5, 1991: The Burst and Transient Source Experiment, aboard the Compton Gamma Ray Observatory, began a mission that would extend over the next nine years to study the phenomenon of gamma-ray bursts, although the detectors also recorded data from other exotic astrophysical objects.

1992: Astronauts onboard the space shuttle conducted microgravity experiments related to fluid physics, materials science, biotechnology, combustion science and commercial space processing.

Jan. 22, 1992: Managed by the Marshall Center, the International Microgravity Laboratory-1 went into space aboard the shuttle. The laboratory missions explored how life forms adapt to weightlessness and investigated how materials behave when processed in space.

1994: Scientists at Marshall funded a study related to urban heat islands in Huntsville and other metropolitan areas.

1995: NASA launched its second United States Microgravity Laboratory. USML-2 flew on STS-73. USML-2 activities were directed by NASA's Spacelab Mission Operations Control facility at the Marshall Center. Marshall's Fred W. Leslie served as payload specialist on the mission.

June 2, 1998: NASA launched its first Super Lightweight External Tank on STS-91.

Dec. 4, 1998: The U.S.-built Unity module was launched aboard the orbiter Endeavour. The International Space Station Node 1, or Unity, was designed as a connecting passageway to space station modules. It was manufactured by the Boeing Company at Marshall from 1994 to 1997.

July 23, 1999: NASA launched the Chandra X-ray Observatory developed by the Marshall Center. Chandra is the world's most powerful X-ray telescope.

More chronological facts from the 1990s can be found on the Marshall 50th Anniversary Web page at http://mynasa.nasa.gov/centers/marshall/home/marshall50/index.html

50 years of NASA contributions

A historical chronology: 2000s

Feb. 7, 2001: The International Space Station Destiny module was launched aboard space shuttle Atlantis on STS-98. It was built by the Boeing Company at Marshall under the direction of the Marshall Center.

2001: The Payload Operations Control Center at Marshall began round-the-clock operations in support of science aboard the International Space Station.

2002: The Marshall Center broke ground for a state-of-the-art Propulsion Research Laboratory, designed to serve as a leading national resource for advanced space propulsion research.

Jan. 22, 2003: The space shuttle main engines marked a significant milestone: the system surpassed one-million seconds of successful testing and launch firings during a successful flight acceptance test at NASA's Stennis Space Center near Bay St. Louis, Miss.

Feb. 1, 2003: The space shuttle Columbia accident occurred, claiming the lives of all seven crew members

April 2003: The National Space Science and Technology Center opened in Huntsville. The center would focus on space science, Earth sciences, information technology, optics and energy technology, biotechnology and material science.

2003: The Columbia Accident Investigation Board presented its final report on the causes of the space shuttle Columbia accident. The Marshall Center played a key role in ensuring space shuttle propulsion elements would perform safely in the future.

2004: NASA launched Gravity Probe-B, a relativity experiment developed at Stanford University to test two extraordinary predictions of Albert Einstein's general theory of relativity.

2005: NASA assigned the Marshall Center management responsibilities for the Ares I and Ares V launch vehicles.

Sept. 22, 2006: Solar-B, an international mission to study the sun, was launched from Japan. The Marshall Center managed development of the scientific instrumentation that NASA provided for the mission.

July 4, 2006: Space shuttle mission STS-121 marked a significant historical milestone in the shuttle's return to flight following the Columbia accident in 2003. As part of the mission, the STS-121 crew carried out testing of shuttle inspection and repair hardware and evaluated operational techniques and concepts for conducting on-orbit inspection and repair of the International Space Station.

2006: The J-2X engine was designed to power the upper stages of a new Ares I Crew Launch Vehicle and the Ares V cargo segment. The engine was designed as a stepped-up version of the hydrogen/oxygen-fueled Apollo-era J-2 engine.

2006: Marshall saw the shipment and launch of the oxygen generation system to the International Space Station, where the system will use water to generate breathable oxygen for crew members.

2008: The world's largest known welding machine of its type – capable of building major components of NASA's Ares I and Ares V rockets – was installed at Marshall. The friction stir welder offers rocket builders a modern welding technique by using forging pressure and frictional heating to produce high-strength bonds virtually free of defects.

2009: NASA's Ares I-X test rocket lifted off in 2009 from Kennedy Space Center for a two-minute powered flight. The test flight lasted about six minutes from its launch from the newly modified Launch Complex 39B until splash down of the rocket's booster stage nearly 150 miles down range.

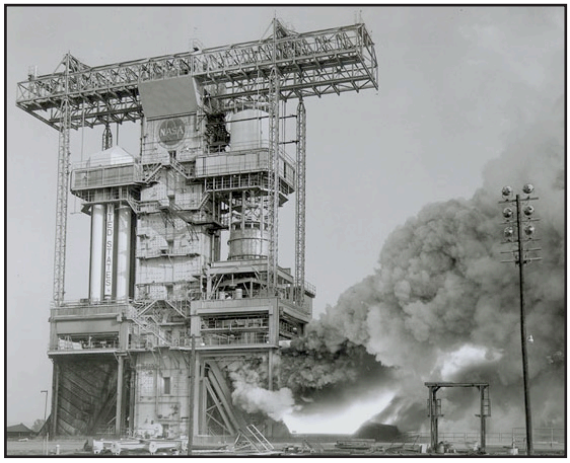
2010: Mirror testing was under way at Marshall on the James Webb Space Telescope. The Webb telescope mirror will be the largest primary mirror ever assembled in space. The telescope will give scientists clues about the evolution of our own solar system, from the first light after the Big Bang to the formation of the universe.

50 years of NASA contributions

President Dwight D. Eisenhower dedicates the Marshall Center in 1960 with Mrs. George C. Marshall

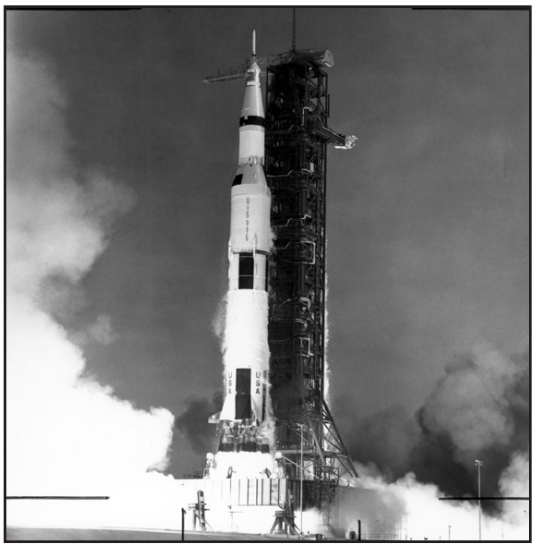
A Marshall-managed Redstone Rocket launches Alan Shepard in 1961

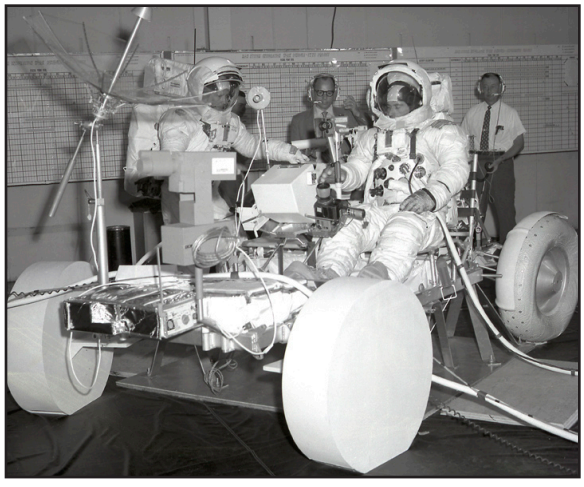
President John F. Kennedy with Dr. Wernher von Braun at Marshall in 1962



Saturn F-1 Engine is tested at Marshall in 1964

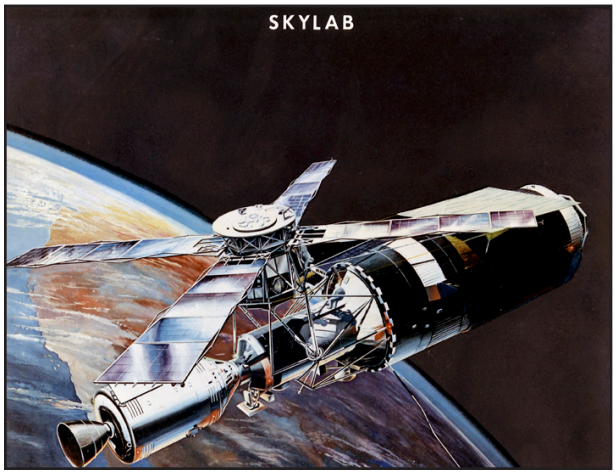
Marshall-managed Saturn V launches Apollo astronauts to the moon in 1969





Astronauts inspect Lunar Roving Vehicle in 1970

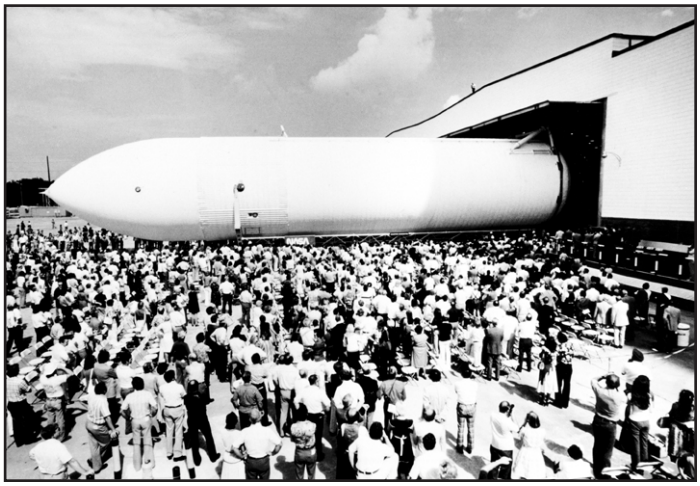
50 years of NASA contributions



Artist's rendering of the Skylab Space Station in 1973

Saturn rocket launches Apollo capsule for Apollo-Soyuz Mission in 1975

Laser Geodynamics Satellite was developed by the Marshall Center and launched May 4, 1976, from Vandenberg Air Force Base, Calif.

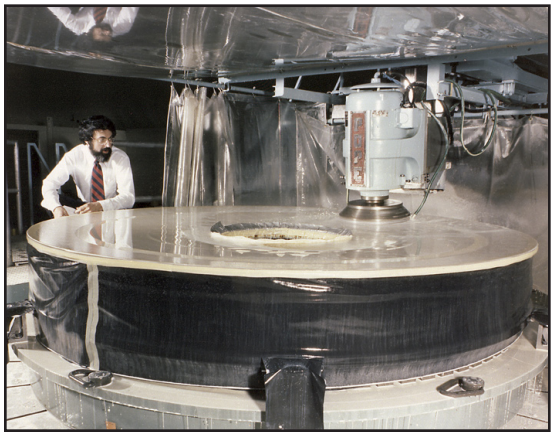


Marshall-managed first space shuttle external tank rolls off assembly line Sept. 9, 1977, at Michoud Assembly Facility in New Orleans

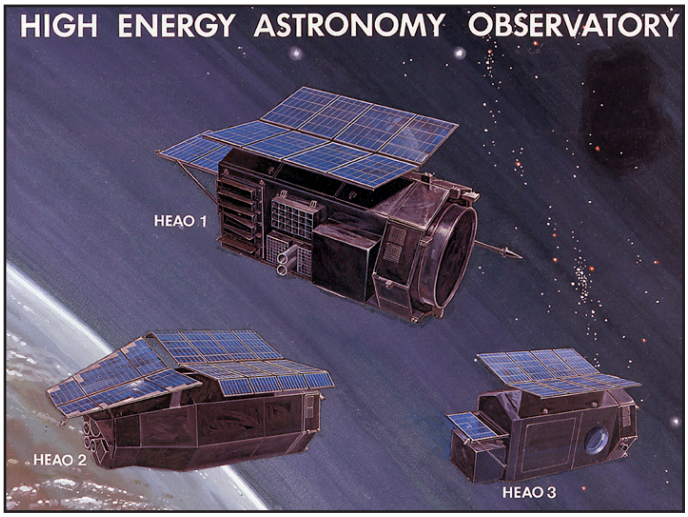
Marshall-designed solid rocket booster segments undergo stacking operations in Building 4707

Orbiter Enterprise arrives at Marshall for testing in 1978

50 years of NASA contributions



Marshall-managed Hubble Space Telescope's primary mirror is ground at the Perkin-Elmer Corp.'s large optics fabrication facility in the late 1970s



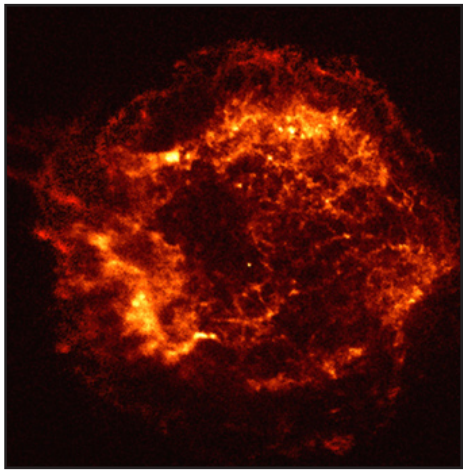
Artist's rendering of High Energy Astronomy Observatories in the late 1970s

First space shuttle launch in 1981

Marshall Center was NASA's lead center for monitoring the development of Spacelab and managing the program

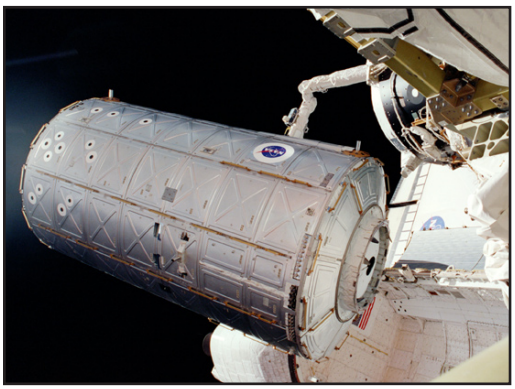
Marshall's Jan Davis working on Spacelab in 1992

Space station work at Marshall in 1999



First star formation image captured by Marshall-managed Chandra X-ray Observatory in 1999

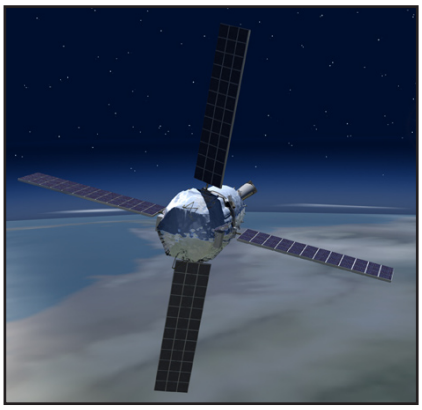
50 years of NASA contributions



Marshall-managed Destiny module launches to the International Space Station on STS-98 mission in 2001

The National Space Science and Technology Center in Huntsville, founded in 2002

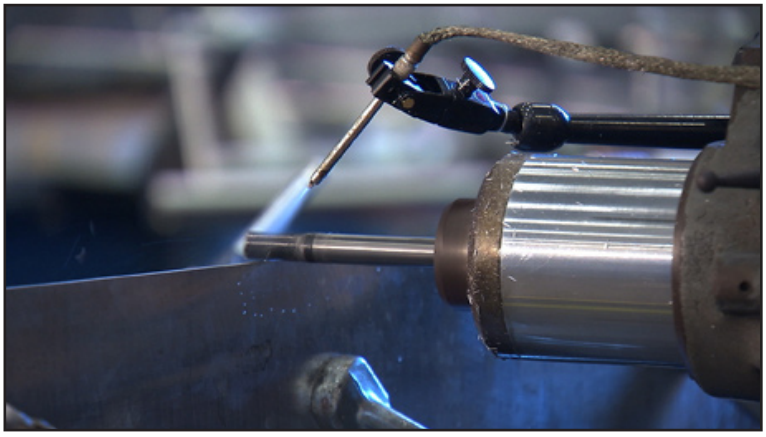
Marshall-managed space shuttle main engine undergoes test firing at the National Space Technology Laboratories, now the Stennis Space Center in Mississippi



Gravity Probe B launched in 2004

J-2X engine underwent a series of hot fire tests performed on sub scale main injector hardware in Test Stand 116 at Marshall

Marshall-managed Environmental Control and Life Support System's Oxygen Generation System rack delivered to the International Space Station



Friction Stir Welding installed at Marshall

50 years of Marshall: 'It's a part of who we are'

By Jessica Wallace Eagan

Six trips to the moon, 132 space shuttle flights, 50 years later, and two Marshall Space Flight Center employees – who had a hand in them all – continue to support the center's mission today.

When Marshall officially opened for operation July 1, 1960, Ann McNair and John Key were here on these 1,841 acres that makeup the center inside the gates of Redstone Arsenal.

Ann McNair, in foreground at left, and other Marshall Center engineers work in Building 4663 in the 1960s to receive Doppler data via teletype machines to help determine the orbit of satellites. This building would later become the Huntsville Operations Support Center. Today McNair is director of Marshall's Office of Center Operations.

McNair is now director of the Office of Center Operations, and Key is a technical manager for the External Tank Project in Marshall's Resident Office at Kennedy Space Center, Fla.

They both jump started their NASA careers as students working for the U.S. Army Ballistic Missile Agency before their leader, Dr. Wernher von Braun, and his rocket team of 4,670 were transferred to Marshall in 1960. With the transfer, von Braun became Marshall's first director.

McNair remembers a friend in Huntsville calling her in 1957, when she was a junior at the University of Alabama in Tuscaloosa. "My friend said there was something exciting going on and that I must come work here," said McNair.

That summer she came to Redstone, accepting a job to evaluate the orbit location of America's first successful satellite, Explorer I. She also helped develop a model of the decay characteristics of a satellite.

"I met my future husband during that time," said McNair. "He had just finished his master's degree at the University of Georgia in Athens, and was at Redstone working as an engineer. Because of this, there was an attraction for me to come back once I finished school."

And that's just what she did. Graduating in 1958 with a bachelor's degree in mathematics and physics, she returned to the arsenal. A few years later, she was part of the group that helped establish the Marshall Space Flight Center.

In the same year McNair graduated from college and came back to work with von Braun's team, John Key – enrolled at Evansville College in Indiana – was an industrial and mechanical engineer student trainee in the Cooperative Education Program with the Army at Redstone Arsenal.

"In May 1960, I got a letter saying that I would be transferred to the Marshall Center," said Key. "Although I wasn't given an option of staying with the Army, I would have chosen to go to Marshall because I wanted to work on space exploration."

In 1962, Key earned his bachelor's degree in mechanical engineering and came back to Huntsville to his first job at Marshall as a structural analyst for the Saturn I booster's liquid oxygen propellant feed lines.

Most memorable Marshall memories

McNair and Key share a Marshall memory that stands out in both of their minds: playing a part in America going to the moon.

"For me, it was when we reignited in Earth orbit the Marshall-developed S-IVB stage of the Saturn V vehicle and put the Command/Service Module and its flight crew on a journey to circumnavigate the moon for the very first time on Nov. 9, 1967, from the Kennedy Space Center," said McNair. "That was my 'awe moment.' Everyone needs a moment like that."

*See **50 years** on page 15*

The Saturn V had three stages: S-IC, S-II and S-IVB, McNair explained. The S-IVB ignited to get the vehicle in orbit, and then reignited to put the space capsule in transit to the moon. To track the data retrieved from the S-IVB, they used planes called Apollo Range Instrumentation Aircraft, known as ARIA. McNair was the Marshall lead for the aircraft.

"When that S-IVB reignited for the first time, all my heart went up into my throat," said McNair. "I thought, 'Oh my gosh, we're headed to the moon. This can't be real. I know we said we're going to, but we are actually on our way.'"

And on our way we were, recalls Key as he remembers watching the TV in Huntsville as the Apollo 11 crew launch July 16, 1969, from Kennedy – a mission that landed the first humans on the moon. "As I watched astronaut Neil Armstrong make the first footprint, I thought, 'I helped make this happen. I worked with the team at Marshall that designed the Saturn V, and here we are, witnessing our work in action … out of this world!'"

That pride carried to the launch of STS-1 on April 12, 1981, marking the beginning of the Space Shuttle Program. "I was an engineering specialist when space shuttle Columbia made its debut into space," said Key. "I worked on the solid rocket booster and motor. When the shuttle went up for the first time, I will never forget it. I was amazed that such a complicated machine worked as well as it did."

McNair remembers the first time she saw Columbia, landing from its journey April 14, 1981. "When I saw that shuttle land like an airplane, I thought, 'Hey, that is really neat!'"

Marshall 50 years from now

Long gone are the days of the slide ruler, computers the size of rooms, and Monday-through-Saturday workweeks that McNair and Key once knew. To them, so much has changed in the past 50 years … for the good.

"One thing has remained the same, though," said McNair: "The Marshall team has always stepped to the plate to meet great challenges. And 50 years later, we continue to accomplish a lot – every day. It's just amazing."

"And in the next 50 years, I hope Marshall continues to do all that we can to further space exploration," said Key. "In the 1950s, you would hear, 'Man can't go to the moon.' That expression stopped after 1969. You know what I say? I say we went to the moon, we can do it again. We must continue to develop spacecrafts that get us there. This is NASA. This is what we do."

"In my time here, I have learned the importance of establishing relationships," said McNair. "Understanding and appreciating the contributions that everyone makes leads to success. If we keep up this attitude, I believe we can keep on achieving for years to come."

And for those new Marshall team members coming aboard now and in the future, McNair and Key give the same advice: "Continue to be the best. It's a part of who we are."

Eagan, an AI Signal Research Inc. employee and the Marshall Star editor, supports the Office of Strategic Analysis & Communications.

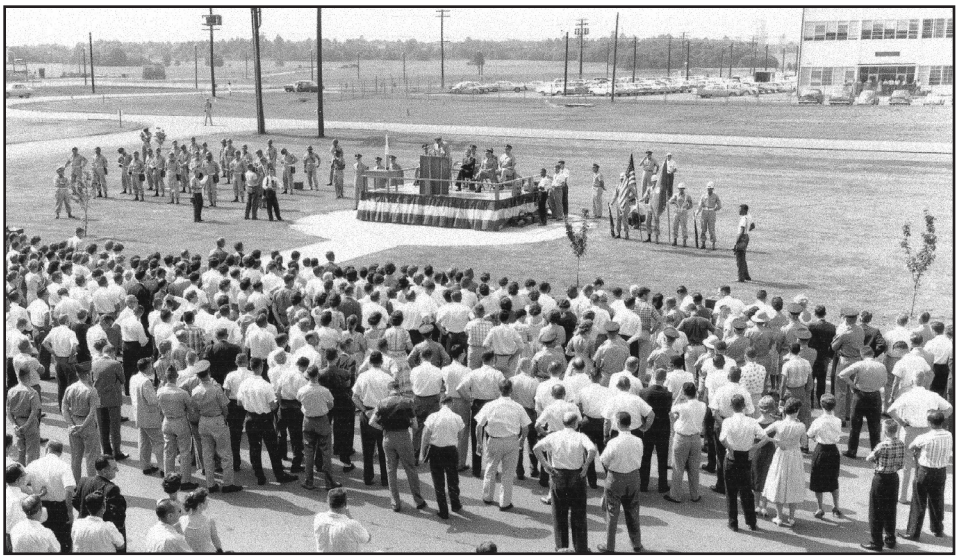
John Key – now a technical manager for the External Tank Project in Marshall's Resident Office at the Kennedy Space Center – shows where the tank attaches to the space shuttle during hardware integration at Kennedy's Vehicle Assembly Building.

Marshall *Continued from page 3*

build missiles to defend the United States. Von Braun had long dreamed of human spaceflight certainly as far back as the early 1940s, when he and his team were building V-2 rockets during World War II. In fact, one account claims that Adolf Hitler had von Braun spend a few days in jail when it was learned that he really would like to build rockets that humans could use to explore space. Like Paul Newman in the chain-gang classic film, "Cool-Hand Luke," von Braun got some time "in the box" to get his "mind right."

Five years later, von Braun and his team were under contract to build and test rockets for the U.S. Army. Outside of von Braun's mind and the gates at White Sands, N.M., however, human spaceflight was a story told most often in Saturday afternoon movie matinees. Flash Gordon and Buck Rogers portrayed straight-jawed space explorers wearing helmets on their heads that looked like goldfish bowls and chasing aliens with ray-guns that today look more like hand-held blow dryers.

It took von Braun preaching the possibility of human spaceflight on television quiz shows and Walt Disney films to make the public believe it could happen. It took the shock from learning that the Russians had orbited the first man-made satellite in 1957 to jolt American leadership into believing that the age of space exploration was at hand. As a result, von Braun's Army team from Huntsville launched an American satellite in January 1958, and the idea that the United States needed a civilian space agency came to fruition when NASA was created in 1958.



More than 4,000 Army employees participated in the ceremony transferring them to the new Marshall Center on July 1, 1960. The ceremony took place across the street from what is now the Payload Operations Center.

Ironically, the people who knew most about building space launch vehicles for peaceful purposes were the same people who had been building rockets for national defense in Huntsville. As noted before, however, it took another two years for the American leadership to make the firm decision that the center of American rocket expertise would come into existence on July 1, 1960.

On July 1, 1960, American leadership created the George C. Marshall Space Flight Center with a mandate for human space exploration. Certainly there were plans and ideas that were circulating at the time. However, the next 50 years would all be tough ones when it came to turning ideas into reality at Marshall. In fact, only a few years before Marshall was created, Hugh Dryden – who would serve as NASA's first deputy administrator – had wondered publicly if von Braun's idea related to human spaceflight was "a circus stunt." Of course, Dryden was wrong. But on July 1, 1960, no one knew that for sure or what history might have in store for the Marshall Center. Certainty and the future don't always travel the same road.

Wright is the Marshall Center historian.

MARSHALL STAR

Vol. 50/No. 40

Marshall Space Flight Center, Alabama 35812
256-544-0030
http://www.nasa.gov/centers/marshall

The Marshall Star is published every Thursday by the Public and Employee Communications Office at the George C. Marshall Space Flight Center, National Aeronautics and Space Administration. Classified ads must be submitted no later than 4:30 p.m. Thursday to the Marshall Public and Employee Communications Office (CS20), Bldg. 4200, Room 102. Submissions should be written legibly and include the originator's name. Send e-mail submissions to: intercom@msfc.nasa.gov
The Star does not publish commercial advertising of any kind.

Manager of Public and Employee Communications: Dom Amatore
Editor: Jessica Wallace Eagan

U.S. Government Printing Office 2010-623-044-00055

www.nasa.gov