

National Aeronautics and
Space Administration



MARSHALL SPACE FLIGHT CENTER

Marshall Star



YEAR IN
REVIEW

2023

January 10, 2024

Marshall Continues Legacy of Space Exploration



This was a standout year for NASA and Marshall Space Flight Center, as we showed the world the ways we enable exploration, advance knowledge, inspire the next generation, and innovate big dreams. During 2023, our center continued to be a hub of technological advancement and engineering, continuing our legacy of pushing the boundaries of space exploration, enabled by strategic partnerships and deep, in-house technical capabilities. This is all thanks to the outstanding efforts of Marshall's talented and diverse workforce. Your tireless pursuit of NASA's core values of safety, integrity, teamwork, excellence, and inclusion helped us meet our mission commitments in 2023.

The successful launch of Artemis I continues to light the way for Marshall's and Michoud Assembly Facility's essential work for future Artemis missions. Highlights from this year include: the delivery of a transportation stand via the Pegasus barge, the installation of all four RS-25 engines onto the SLS (Space Launch System) rocket core stage for the Artemis II mission, applying the thermal protection system spray foam on the launch vehicle stage adapter for Artemis III, and rocket hardware that is under construction for Artemis III, IV, and V.

The HLS (Human Landing System) Program, led by Marshall, plays a critical role in helping achieve our goals on and around the Moon. HLS completed many milestones in 2023, namely, selecting Blue Origin as a second lunar lander provider. This year, SpaceX began running test flights for the Starship lander, providing us significant data that will inform future flights and continue progress in our partnership for Artemis III.

On the cover : From left, Artemis II astronauts Jeremy Hansen, Christina Koch, and Victor Glover listen as Commander Reid Wiseman talks during an employee event at NASA's Marshall Space Flight Center on Nov. 27. (NASA/Charles Beason)

At Marshall, we are continuously building on our propulsion expertise, and in 2023 we were excited NASA announced a new partnership with the Defense Advanced Research Projects Agency on a rocket engine that will utilize nuclear thermal propulsion. Additionally, we conducted a successful hot fire test of NASA's first full-scale rotating detonation rocket engine, an advanced rocket engine design that could significantly change how future propulsion systems are built. Marshall continued to advance designs critical for NASA's Mars Sample Return mission, especially for the Mars Ascent Vehicle, Marshall's contribution to the mission. MAV will launch rock and soil samples from the surface of Mars, making it the first rocket launched from another planet's surface.

We also made significant progress this year on habitation systems, which will enable a sustainable presence on the lunar surface. Our teams continued leading a partnership with the Italian Space Agency in formulating the Multi-Purpose Habitat, with the goal of completing a mission concept review in 2024. Marshall is also partnering with Sierra Space on their Large Integrated Flexible Environment module, and we recently completed a full-scale and sub-scale burst test, huge milestones for the program.

As we looked to the skies this past year, the Marshall-managed Chandra X-ray Observatory continued to thrive and produce valuable scientific data after 24 years of continuous operations. In November, by combining data from Chandra and James Webb Space Telescope, a team of researchers was able to identify the telltale signature of a growing black hole just 470 million years after the big bang. The Imaging X-ray Polarimetry Explorer, or IXPE, also utilized data from Chandra this year to build on our knowledge of the pulsar wind nebula MSH 15-52.

Throughout 2023, crew members on the International Space Station conducted science experiments that were supported around the clock by the Payload Operations Integration Center and Marshall's Payload & Mission Operations Division. This year, we assisted with investigations into monitoring and maintaining air quality, the impact of spaceflight on human brain ageing, and utilizing 3D-printing to create a human meniscus.

Our teams continued to inspire the next generation through increased community engagement and STEM events. The Student Launch initiative and the Human Exploration Rover Challenge brought hundreds of student teams to North Alabama to demonstrate innovation and teamwork in solving challenges for future exploration goals. We also increased our commitment to supporting the advancement of local educational institutions through classroom engagement and the first (of many) signed partnership with the Alabama School of Cyber Technology and Engineering.

This year, Marshall was fortunate to host a bevy of special guests, including the astronauts from Crew-5, Expedition 69/Crew-6, and the upcoming Artemis II mission. We also had NASA leadership at Marshall to discuss NASA 2040 and the Moon to Mars mission. In 2023, we bid farewell to our beloved center director, Jody Singer, as she embarked on her retirement journey. Additionally, we had several of our employees and senior leaders close out tremendous careers of service to Marshall and NASA and we are thankful for their contributions.

On a personal note, it has been an honor to work alongside all of you as the center's acting director, leading such an innovative and dedicated workforce — 266 of whom were brand-new hires in 2023. I am confident we are taking steps toward strengthening the fabric of Marshall and moving our center's strategy and culture into the future. I believe 2024 will be a year of reaching for the stars, and I look forward to seeing what you all accomplish together!

A handwritten signature in white ink, reading "Joseph Pelfrey". The signature is stylized with a large, looping "J" and a long, sweeping "P".

Joseph Pelfrey, Acting Director
Marshall Space Flight Center

JANUARY

NASA Barge Delivers Transportation Stand to Support Crewed Artemis Mission

Crews from NASA's Marshall Space Flight Center offloaded a transportation stand from NASA's Pegasus barge Jan. 7. The barge ferried the stand from NASA's Kennedy Space Center, where it was used to transport the launch vehicle stage adapter (LVSA) of the SLS (Space Launch System) rocket for Artemis I. It was returning for use on other LVSA's for the next Artemis missions. The nearly 28-foot-tall LVSA is a cone-shaped element that connects the rocket's core stage and the interim cryogenic propulsion stage (ICPS) and partially covers the in-space stage's single RL10 engine. It is fully produced and manufactured at Marshall by Teledyne Brown Engineering, the LVSA lead contractor.



Marshall Leaders Share Insights

Throughout 2023, Marshall managers shared their insights on leadership, inspiration, mentorship, and more, in the monthly Take 5 profile series. The Marshall Star interviewed leaders from the Partnerships & Formulation Office, NASA's Michoud Assembly Facility, Exploration Projects and Integration Office, HLS (Human Landing System) Program, Office of Strategic Analysis & Communications, Office of Diversity and Equal Opportunity, Planetary Missions Program Office, and the Cryo-Fluid Management Portfolio project at Marshall.

NASA Validates Revolutionary Propulsion Design for Deep Space Missions

As NASA takes its first steps toward establishing a long-term presence on the Moon's surface, a team of propulsion development engineers at NASA developed and tested NASA's first full-scale rotating detonation rocket engine, or RDRE, an advanced rocket engine design that could significantly change how future propulsion systems are built. The RDRE differs from a traditional rocket engine by generating thrust using a supersonic combustion phenomenon known as a detonation. Engineers at Marshall confirmed data from RDRE hot fire tests conducted at Marshall's East Test Area.



FEBRUARY

Chandra: Untangling a Knot of Galaxy Clusters

Astronomers have captured a spectacular, ongoing collision between at least three galaxy clusters, and a trio of radio telescopes is helping astronomers sort out what is happening in this jumbled scene. Collisions and mergers like this are the main way that galaxy clusters can grow into the gigantic cosmic edifices seen today. These also act as the largest particle accelerators in the universe. The giant galaxy cluster forming from the collision is Abell 2256, located 780 million light-years from Earth. Galaxy clusters are some of the biggest objects in the universe containing hundreds or even thousands of individual galaxies. Marshall manages the Chandra program. The Smithsonian Astrophysical Observatory's Chandra X-ray Center controls science operations from Cambridge, Massachusetts, and flight operations from Burlington, Massachusetts.



Marshall Leaders Discuss Center Strategy During All-Hands

On Feb. 1, Marshall Director Jody Singer, Associate Director, Technical, Larry Leopard, Deputy Director Joseph Pelfrey, and Center Strategy Lead Jeramie Broadway led an all-hands meeting that focused on future center strategy. They discussed the center's strategic goals and plans to assert its role into the evolving spaceflight environment. "We are implementing a new center strategy that will continue to leverage Marshall's unique offerings while enabling us to grow as a center, creating additional value for NASA, the community, and the nation's space exploration program," Singer said. Pelfrey highlighted the overarching goal of the agency to establish a blueprint for a sustained human presence and exploration throughout the solar system.

Mission Success is in Our Hands Series

The goal of the Mission Success is in Our Hands lecture series is to help team members make meaningful connections between their jobs and the safety and success of NASA and Marshall missions through shared experiences discussions, awards, and recognition. Guest speakers echoed that theme throughout the series in 2023. Those delivering presentations included Scott Hubbard, chair

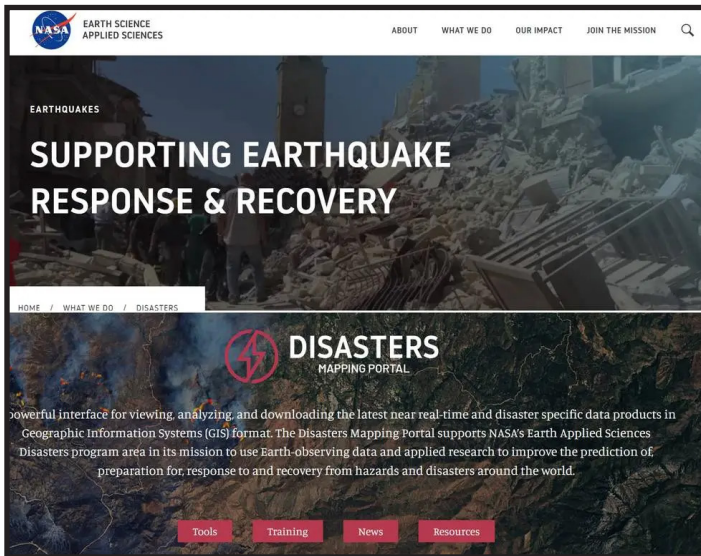
of the SpaceX Commercial Crew Safety Advisory Panel; Charlie Blackwell-Thompson, launch director for NASA's Exploration Ground Systems Program; and Garrett Harencak, Jacobs vice president and president of Mission Support and Test Services LLC. The series also includes a presentation of the Golden Eagle Award, which promotes awareness and appreciation for flight safety.

MARCH

President's Fiscal Year 2024 Budget Strengthens NASA, Space Economy

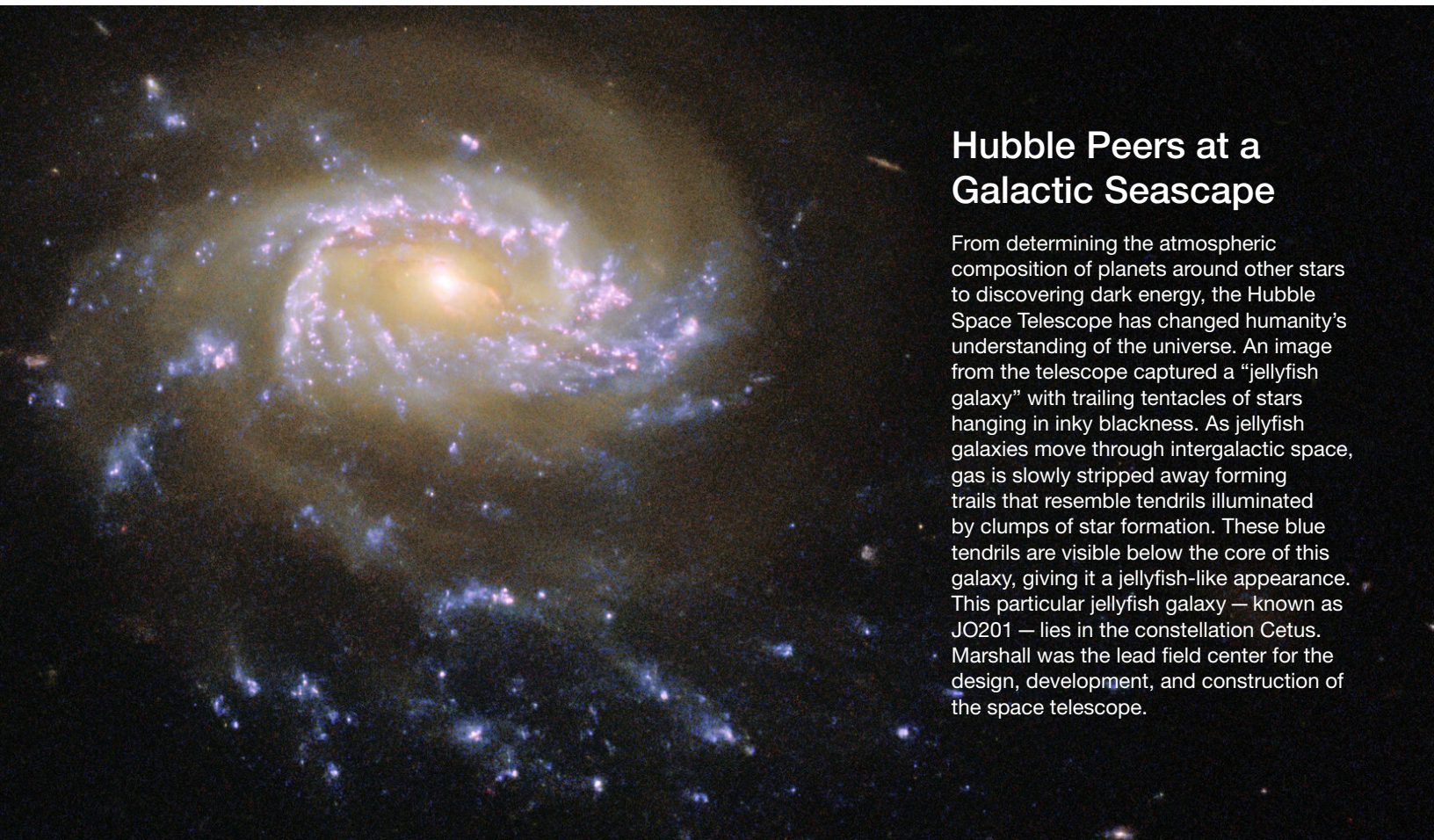
The Biden-Harris Administration released the President's Budget for Fiscal Year 2024 on March 9, and it will allow NASA to continue exploring the secrets of the universe for the benefit of all through Artemis, the Mars Sample Return mission, and other efforts. "The budget details a blueprint to grow the economy from the bottom up and middle out," said NASA Administrator Bill Nelson. "At NASA,

we support good-paying American jobs, stir imaginations, and excite the world to gaze up at the heavens and reflect on our place in the universe." The budget allows NASA to monitor and protect the planet, advance sustainable aviation, better support orbital debris management, develop innovative new technologies, and inspire the Artemis Generation.



NASA Disasters Program Aids Relief Efforts Following Turkey, Syria Quakes

Following a deadly earthquake that struck Turkey and Syria, NASA's Disaster's Program helped pinpoint areas most direly in need of quick response, identify access routes, and detect challenges associated with the quake and its aftermath. Part of the agency's Earth Science Applied Sciences Program, Earth science researchers and satellite observation teams coordinated with local and regional governments, delivering near real-time information to aid response teams and to provide tools that could help safeguard lives and resources in the future. Lori Schultz, a physical research scientist specializing in satellite applications research at Marshall, coordinated NASA's disaster response efforts for Syria and Turkey.



Hubble Peers at a Galactic Seascape

From determining the atmospheric composition of planets around other stars to discovering dark energy, the Hubble Space Telescope has changed humanity's understanding of the universe. An image from the telescope captured a "jellyfish galaxy" with trailing tentacles of stars hanging in inky blackness. As jellyfish galaxies move through intergalactic space, gas is slowly stripped away forming trails that resemble tendrils illuminated by clumps of star formation. These blue tendrils are visible below the core of this galaxy, giving it a jellyfish-like appearance. This particular jellyfish galaxy — known as JO201 — lies in the constellation Cetus. Marshall was the lead field center for the design, development, and construction of the space telescope.

NASA Names Astronauts to Next Moon Mission, First Crew Under Artemis

NASA and the Canadian Space Agency announced the four astronauts who will venture around the Moon on Artemis II, the first crewed mission on NASA's path to establishing a long-term presence at the Moon for science and exploration through Artemis. The crew assignments are as follows: Commander Reid Wiseman, Pilot Victor Glover, Mission Specialist 1 Christina Hammock Koch, and Mission Specialist 2 Jeremy Hansen. The approximately 10-day Artemis II flight test will launch on the agency's powerful SLS rocket, prove the Orion spacecraft's life-support systems, and validate the capabilities and techniques needed for humans to live and work in deep space.



NASA Welcomes Return of Human Exploration Rover Challenge

For the first time since 2019, NASA's HERC (Human Exploration Rover Challenge) returned to in-person competition at the Aviation Challenge camp of the U.S. Space & Rocket Center. More than 500 students from around the world participated in the 29th anniversary of the competition, attempting to pilot human-powered rovers across a half-mile-long obstacle course designed to simulate the geographical terrain of the Moon, Mars, and other distant bodies. Escambia High School in Pensacola, Florida, won first place in the high school division, and the University of Alabama in Huntsville captured the college and university title. HERC is managed by NASA's Southeast Regional Office of STEM Engagement at Marshall.



Rockets Soar During NASA Student Launch Competition

More than 40 high-powered amateur rockets successfully launched April 15 in North Alabama, each carrying a scientific payload nearly one-mile-high above ground level, as part of a NASA student competition. The launches were the culminating event of NASA's Student Launch, a competition tasking students to design, build, and launch rockets in support of NASA research. The University of Alabama in Huntsville was the overall winner of the 2023 challenge. Marshall hosts the Student Launch challenge with management support provided by NASA's Office of STEM Engagement — Southeast Region. More than 800 students from across the U.S. and Puerto Rico participated.

MAY



NASA Selects Blue Origin as Second Artemis Lunar Lander Provider

NASA selected Blue Origin of Kent, Washington, to develop a human landing system for the agency's Artemis V mission to the Moon. Blue Origin will design, develop, test, and verify its Blue Moon lander to meet NASA's human landing system requirements for recurring astronaut expeditions to the lunar surface, including docking with Gateway, a space station where crew transfer in lunar orbit. In addition to design and development work, the contract includes one uncrewed demonstration mission to the lunar surface before a crewed demo on the Artemis V mission in 2029. The total award value of the firm-fixed price contract is \$3.4 billion.

NASA Selects Winners, Announces Final Phase of Space Food Challenge

NASA announced eight winning teams and awarded \$750,000 in prizes in the second phase of the agency's Deep Space Food Challenge. The winning teams moved on to compete in the third and final phase of the challenge. As NASA prepares to send astronauts farther into the solar system than ever before, the agency needs food systems that can fortify future crews in deep space for years at a time. The Deep Space Food Challenge calls on solvers from around the world to create technologies to help feed astronauts on future long-term space missions. The

Deep Space Food Challenge is one of NASA's Centennial Challenges, which is managed by Marshall.



Crew-5 Astronauts Meet with Workforce, Share Mission Experiences

Marshall hosted the agency's SpaceX Crew-5 mission astronauts May 1 during a standing-room-only employee event of more than 400 people at Activities Building 4316, where the crew members discussed their mission to the International Space Station and met team members. This was the first time NASA astronauts engaged with the center workforce to share mission highlights since 2018, and the first employee event featuring commercial crew astronauts. NASA astronauts Nicole Mann, Josh Cassada, and JAXA (Japan Aerospace Exploration Agency) astronaut Koichi Wakata, were part of the agency's fifth commercial crew mission to the space station, which launched in October 2022 on NASA's SpaceX Crew-5 flight.

JUNE

Crews Spray Foam Insulation on Artemis III Rocket Hardware

Teams at Marshall completed applying a spray-on foam insulation to the LVSA for the Artemis III mission. The LVSA is a cone-shaped piece of hardware that connects the SLS rocket's upper and lower stages and partially encloses the engine of the interim cryogenic propulsion stage. The spray-on foam insulation is a type of thermal

protection system that is used to protect the Moon rocket's hardware from the extreme temperatures, forces, and sounds it'll experience during launch and ascent. Unlike other parts of the mega rocket, the thermal protection system for the LVSA is applied entirely by hand using a tool similar to a spray gun.



Marshall Recognized as World Leader for Lightning Instrumentation, Research

Dating back to 1979, Marshall has been a world leader in building cutting-edge instruments to study the science of lightning and improve safety. Today, Marshall continues to use ground, airborne, and space-based lightning sensors to advance lightning research and develop lightning safety products the public can use. Patrick Gatlin, a research meteorologist with the lightning team at Marshall, received program funding from NASA Headquarters to investigate a satellite measurement concept that uses a constellation of small satellites with new lightning instruments being designed at Marshall and the Los Alamos National Laboratory to obtain three-dimensional maps of lightning on a global scale.

NASA Enters Stretch in Critical Moon Rocket Engine Test Series

NASA entered the stretch run of a key RS-25 certification engine test series with a successful hot fire June 1, continuing to set the stage for future SLS flights and Artemis missions to the Moon. The hot fire on the Fred Haise Test Stand at NASA's Stennis Space Center marked the ninth in a critical 12 test series. The series is designed to certify production of new RS-25 engines by lead contractor Aerojet Rocketdyne for SLS flights, beginning with Artemis V. Operators powered the RS-25 engine for more than eight minutes (500 seconds), the same amount of time needed to help launch the SLS rocket, carrying astronauts aboard the Orion spacecraft, into orbit.



JULY

Webb Celebrates First Year of Science with Close-up on Birth of Sun-like Stars

From our cosmic backyard in the solar system to distant galaxies near the dawn of time, NASA's James Webb Space Telescope has delivered on its promise of revealing the universe like never before in its first year of science operations. To celebrate the completion of a successful first year, NASA released Webb's image of a small star-forming region in the Rho Ophiuchi cloud complex. The new Webb image released July 12 features the nearest star-forming region to us. Its proximity at 390 light-years allows for a highly detailed close-up, with no foreground stars in the intervening space.

Marshall Director Retires After 38 Years of Service

Marshall Director Jody Singer announced her intent to retire after more than 38 years of federal service that includes multiple key leadership roles at the agency. Her retirement was effective July 29 with Marshall's current deputy center director, Joseph Pelfrey, serving as the interim acting director until her successor is identified through a nationwide search and open competition. As center director, Singer managed one of NASA's largest field installations, with nearly 7,000 civil service and contractor employees and an annual budget of approximately \$5 billion. Among many firsts in her career, Singer was appointed as the first female center director at Marshall in 2018.

15 Years of Radio Data Reveals Evidence of Space-Time 'Murmur'

Scientists have found evidence of a universal background of gravitational waves, or ripples in the fabric of space-time – and a research astrophysicist at Marshall is contributing to the work. The motion of black holes and other massive objects through space can create gravitational waves, or ripples in the fabric of the universe. Scientists announced the first evidence of a background of long-wavelength gravitational waves that fill the cosmos. These waves are thought to have been created over eons by supermassive black holes, up to billions of times the mass of our Sun, circling each other before they merge. Detecting the gravitational wave background is like tuning in to “the murmuring of the universe,” said Marshall astrophysicist Tyson Littenberg.



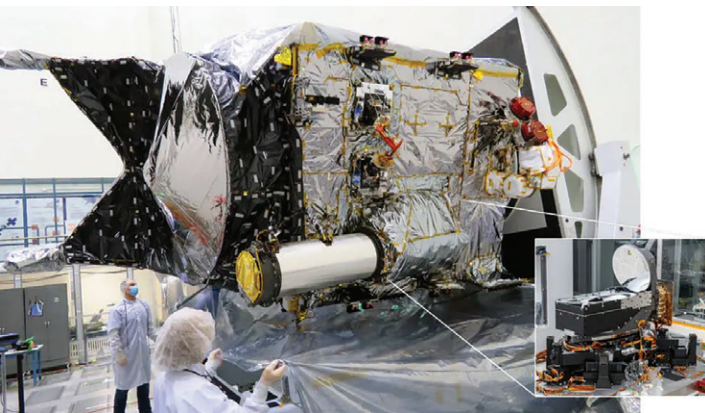
AUGUST



Science in Space/Payload Operations Integration Center

Monitoring and maintaining the quality of the air inside the International Space Station is essential to ensure crew health and comfort and proper functioning of equipment. These activities become more important as mission duration increases. During August, crew members collected samples for ANITA-2, an investigation from ESA (European Space Agency) that uses

a compact gas analyzer to automatically monitor 33 trace contaminants in the station's ambient air. The device also can detect unknown substances that can be analyzed later on the ground. The Payload Operations Integration Center at Marshall operates, plans, and coordinates the science experiments onboard the space station 365 days a year, 24 hours a day.



NASA's Deep Space Communications to Get a Laser Boost

NASA's DSOC (Deep Space Optical Communications) project will test how lasers could speed up data transmission far beyond the capacity of current radio frequency systems used in space. What's known as a technology demonstration, DSOC may pave the way for broadband communications that will help support humanity's next giant leap: when NASA sends astronauts to Mars. The DSOC near-infrared laser transceiver hitched "piggyback" on NASA's Psyche mission when it launched later in 2023. During the first two years of the journey, the transceiver will communicate with two ground stations in Southern California, testing highly sensitive detectors, powerful laser transmitters, and novel methods to decode signals the transceiver sends from deep space.

Center Leadership Discusses Future Strategy, Culture During All-Hands

Marshall leaders discussed the center's future strategy, culture, and on-site work during an all-hands meeting Aug. 15. The hybrid meeting at Activities Building 4316 was the first all-hands since Jody Singer announced her retirement as center director last month. Acting Center Director Joseph Pelfrey opened the event

by welcoming team members and discussing the leadership transition. Pelfrey said he will work with the center's leadership team to make the best decisions for Marshall and the agency. He said the center's pursuit of new business opportunities "will ensure we have a bright future."

SEPTEMBER

Agency Leadership Talks NASA 2040, Artemis, Budget at Marshall Town Hall

From funding to historic achievements to the future of NASA, there was no shortage of topics for discussion during a Marshall Town Hall on Sept. 18. Marshall team members joined in person and online as Acting Marshall Center Director Joseph Pelfrey, NASA Administrator Bill Nelson, Deputy Administrator Pam Melroy, Associate Administrator Bob Cabana, and Deputy Associate Administrator Casey Swails shared their goals for Marshall and

the agency's future and answered questions from the audience. Nelson called Marshall team members "wizards who make the impossible possible." The leaders also discussed NASA 2040, a strategic agency initiative aimed at driving meaningful changes that will allow the agency to realize its long-term vision for what leaders want the agency to be in 2040.



NASA Documentary Screening Shares Journey of Black Astronauts

There's space for everyone as NASA continues to explore the secrets of the universe for the benefit of humanity. That was one of many key messages shared with students and others attending a special screening of NASA's *The Color of Space* documentary film on Sept. 8 at Alabama A&M in Huntsville. As NASA prepares to land the first person of color on the surface of the Moon through its Artemis missions, the documentary explores the many contributions Black Americans have made to the space program. Retired NASA astronaut Leland Melvin, who is featured in the documentary, attended and joined in a panel discussion.

NASA's First Asteroid Sample Has Landed (OSIRIS-REx)

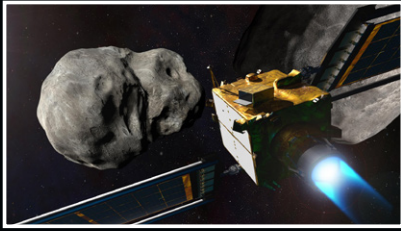
After years of anticipation and hard work by NASA's OSIRIS-REx (Origins, Spectral Interpretation, Resource Identification and Security — Regolith Explorer) team, a capsule of rocks and dust collected from asteroid Bennu finally returned to Earth. It landed at 9:52 a.m. CDT on Sept. 24, in a targeted area of the Department of Defense's Utah Test and Training Range. The delivery of an asteroid sample — a first for the U.S. — went according to plan thanks to the massive effort of hundreds of people who remotely directed the spacecraft's journey since it launched on Sept. 8, 2016. OSIRIS-REx is the third mission in NASA's New Frontiers Program, managed by Marshall.



OCTOBER

Marshall Managers Win Top Federal Award for DART Asteroid Deflection Mission

Brian Key and Scott Bellamy of NASA's Marshall Space Flight Center accepted the Samuel J. Heyman Service to America Medals, presented by Partnership for Public Service Oct. 17 during a ceremony at the John F. Kennedy Center for Performing Arts in Washington. Key and Bellamy led NASA's DART (Double Asteroid Redirection Test) team, which successfully altered the orbit of an asteroid in September 2022, providing the first-ever planetary defense test capable of protecting Earth from celestial threats. As part of the PMPO (Planetary Missions Program Office) at Marshall, Key and Bellamy served as program manager and mission manager, respectively, for DART.

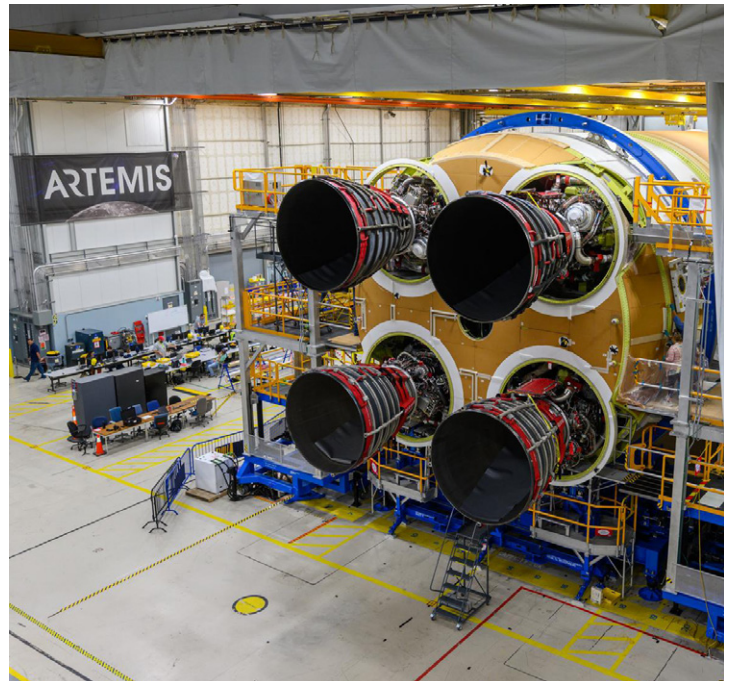


NASA Prepares Artemis II Moon Rocket Core Stage for Final Assembly Phase

NASA and its partners fully secured the four RS-25 engines onto the core stage of the agency's SLS rocket for the Artemis II flight test. The core stage and its engines make up the backbone of the SLS mega rocket that will power the flight test, the first crewed mission to the Moon under Artemis. Engineers started final integration testing at NASA's Michoud Assembly Facility, in preparation for acceptance ahead of shipment of the stage to Kennedy Space Center in the coming months. Also, the 10 booster motor segments for the SLS rocket that will help propel the Artemis II astronauts on a trip around the Moon arrived at Kennedy on Sept. 25.

Psyche Launches, Headed Toward Metal-rich Asteroid

NASA's Psyche launched aboard a SpaceX Falcon Heavy from the agency's Kennedy Space Center on Oct. 13. Psyche is on its way to a metal-rich asteroid of the same name. The mission could teach us more about how rocky planets like Earth formed. Managed by the Planetary Missions Program Office at Marshall, Psyche is the 14th planetary exploration mission in NASA's Discovery program, which is also managed for the agency by Marshall. Read more about Marshall's role in Psyche. NASA's Jet Propulsion Laboratory is responsible for the mission's overall management.



NOVEMBER

Artemis II Crew Enjoys Visit with Marshall Team Members

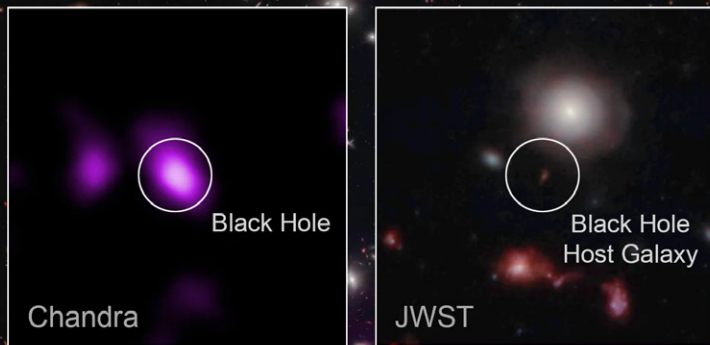
From talking about continuing the legacy of Marshall in space exploration to describing their roles in an upcoming historic mission, Artemis II astronauts enjoyed visiting with center team members Nov. 27. The crew will be the first to ride aboard NASA's SLS rocket and Orion spacecraft. They will launch atop the rocket to venture around the Moon on Artemis II, the first crewed flight for Artemis. The four-member crew answered questions from a standing-room only crowd inside Activities Building 4316 before taking photos with Marshall team members. The crew consists of NASA astronauts Reid Wiseman, Victor Glover, and Christina Koch, and Canadian Space Agency astronaut Jeremy Hansen.



Commercial Crew Program's Plaque Hanging Tradition Continues

Marshall participated again in a tradition to honor engineers for their exceptional efforts on CCP (Commercial Crew Program) missions to the International Space Station with a third plaque hanging Nov. 13 at the HOSC (Huntsville Operations Support Center). Team members are nominated at Marshall, Johnson Space Center, and Kennedy Space Center – centers that support CCP – to hang the

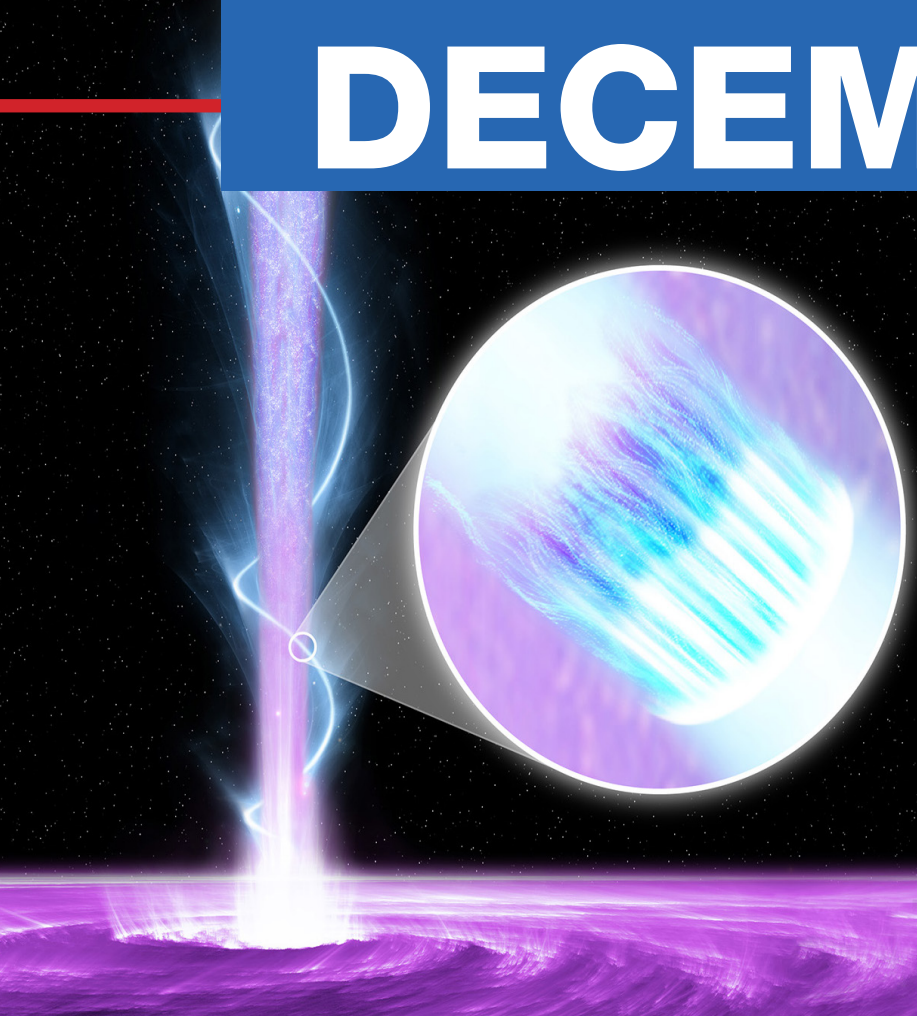
plaque of the mission they supported. David Gwaltney, LVSO (Launch Vehicle Systems Office) technical assistant, was selected to hang the plaque for Crew-5, and Jonathan Carman, deputy SpaceX Falcon 9 lead engineer, was selected to hang the plaque for Crew-6. The Crew-5 mission launched in October of 2022. Crew-6 launched earlier this year in March.



NASA Telescopes Discover Record-breaking Black Hole

Astronomers have discovered the most distant black hole yet seen in X-rays, using NASA telescopes. The black hole is at an early stage of growth that had never been witnessed before, where its mass is similar to that of its host galaxy. This result may explain how some of the first supermassive black holes in the universe formed. By combining data from NASA's Chandra X-ray Observatory and NASA's James Webb Space Telescope, a team of researchers was able to find the telltale signature of a growing black hole just 470 million years after the big bang. This discovery is important for understanding how some supermassive black holes can reach colossal masses soon after the big bang.

DECEMBER



IXPE Marks 2 Years of Groundbreaking X-ray Astronomy

Findings throughout 2023 by NASA's Imaging X-ray Polarimetry Explorer are shedding new light on the origins and geometry of the brightest phenomena in the universe — neutron stars, magnetars, active galactic nuclei, and supernova remnants — and the relationship between magnetic fields and the flow of high-energy particles from these powerful sources. Launched on Dec. 9, 2021, the joint NASA-Italian Space Agency mission, supported by a dozen countries around the globe, orbits Earth some 340 miles up to observe X-ray emissions from powerful cosmic phenomena hundreds or thousands of light-years from Earth. In 2023, IXPE's subjects of study included blazars such as Markarian 501 and Markarian 421, supernova remnants including Tycho and SN 1006, and the supermassive black hole at the center of our own galaxy. Marshall leads the IXPE mission.

Crew-6 Connects with Marshall Team Members During Visit

One week after the 25th anniversary of the International Space Station, NASA's SpaceX Crew-6 visited Marshall to share their experience during Expedition 69. While aboard the space station, the crew studied the behavior of flames in microgravity, grew cardiac tissue using 3D culturing, and researched the impact of weightlessness on astronauts' health. NASA astronauts Frank Rubio (flight engineer), Stephen Bowen (flight engineer), Warren "Woody" Hoburg (flight engineer), and UAE (United Arab Emirates) astronaut Sultan Alneyadi (flight engineer) answered questions from Marshall team members after viewing a short film summarizing the research done on Expedition 69.

New Course from NASA Helps Build Open, Inclusive Science Community

NASA released its free Open Science 101 curriculum Dec. 6 to empower researchers, early career scientists, and underrepresented communities with the knowledge and tools necessary to embrace open science practices. The curriculum's initial goal is to train 20,000 scientists and researchers over the next five years, enabling them to embrace open science practices and maximize the impact of their work. The TOPS (Transform to Open Science) Project Office is located at Marshall. The team at Marshall supports the TOPS project by providing project coordination, digital resources, and communications support for the duration of the project.



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