

# NEWS &NOTES

National Aeronautics and  
Space Administration



Volume 37, Number 4

Fourth Quarter 2020

## FROM THE ACTING CHIEF HISTORIAN

In many ways, 2020 has proven to be one of the most challenging years on record. The onset of the global COVID-19 pandemic resulted in most NASA Centers moving to telework status as the number of cases in our surrounding communities rose dramatically. Across the NASA History Program, our capable historians and archivists worked diligently to sustain ongoing projects, respond to reference requests, and communicate our Agency's incredible history to an interested public. The immense adversity presented by the crisis has not stopped the program's activities, nor has it stopped the Agency from pressing forward in its twin missions of scientific discovery and space exploration.

On 30 July, the aptly named Mars Perseverance Rover launched from Kennedy Space Center en route to an 18 February 2021 landing on Mars's Jezero Crater for a mission to look for signs of ancient life and collect samples for possible return to Earth. A remarkable first associated with the mission is the included experimental Mars Helicopter, Ingenuity—the first-ever test of powered flight in the thin Martian atmosphere. On 22 October, the Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer (OSIRIS-REx) mission team confirmed that the spacecraft had collected at least two ounces of material from the asteroid Bennu—material that would be returned to Earth with the goal of helping us investigate how planets formed and how life began. Just four days

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## MUSIC FOR MARS: THE SOJOURNER WAKE-UP LIST AND THE IMPORTANCE OF A COLLECTIVE DREAM

By Alejandro Pérez, Summer 2020 Intern

The first NASA wake-up song ever, or at least, the first one we know of, is “Hello Dolly,” sung by Jack Jones, sent to space during the Gemini VI mission in 1965. Since then, we have continued sending songs to space throughout the Gemini, Apollo, Skylab, and Space Shuttle missions. Wake-up songs were present on the Apollo 12, 15, and 17 missions to the Moon. They were also present on STS-7, in which Sally Ride became the first American woman in space, and on STS-31, in which the Hubble Space Telescope was sent on its way to explore our universe. Overall, these songs have been a part of almost every discovery, record, accomplishment, and “first” in our history. And they have not been reserved solely for crewed missions, as they have also become an essential component of the rover journeys to Mars. At first, if we look through a logical lens, we might believe that this makes no sense whatsoever. Clearly a rover—unlike an astronaut—is programmed to wake up on its own and has no need or desire to be woken up by music. Despite this, Mission Control made the decision to send wake-up songs to Mars as a joke, but also as a way to continue the long-standing tradition ingrained into the NASA identity.

*continued on page 4*

### IN THIS ISSUE:

- 1 From the Acting Chief Historian
- 1 Music for Mars: The Sojourner Wake-Up List and the Importance of a Collective Dream
- 5 News from Headquarters and the Centers
- 14 Stennis Space Center Test Complex Facilities Provide Critical Green Run Support
- 19 Other Aerospace History News
- 22 Upcoming Meetings
- 23 Moment in NASA History

NASA HISTORY PROGRAM OFFICE  
OFFICE OF COMMUNICATIONS



*From the Acting Chief Historian (continued)*



Captured on 20 October 2020 during the OSIRIS-REx mission's Touch-And-Go (TAG) sample collection event, this image shows the SamCam imager's field of view at the moment before the NASA spacecraft touched down on asteroid Bennu's surface. (Photo credits: NASA/Goddard/University of Arizona)

later, on 26 October, scientists working with NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) confirmed, for the first time, the presence of water on the sunlit surface of the Moon. These three missions are just a few examples of the incredible body of work accomplished by the men and women who continue to persevere in the face of incredible adversity.

In the area of human spaceflight, NASA's Commercial Crew Program has achieved two historic flights to the International Space Station with the SpaceX Demo-2 mission launch of NASA astronauts Robert Behnken and Douglas Hurley on 30 May and, most recently, the 15 November launch of Crew-1 aboard SpaceX's Crew Dragon spacecraft. Demo-2 marked the first launch of American astronauts from American soil since the close of the Space Shuttle Program in 2011, while the Expedition 64 mission aboard Crew-1 saw pilot Victor Glover become the first African American astronaut selected for a long-duration stay aboard the International Space Station.

Glover's historic milestone comes in a year of social conflict and racial protest taking place in the aftermath of the death of George Floyd on 25 May 2020. Earlier in the year, the NASA family was saddened by the 24 February passing of Katherine Johnson, whose trailblazing work in Langley Research Center's West Area Computing Section was portrayed in the film *Hidden Figures*. In June, NASA Administrator Jim Bridenstine announced that the Agency's Headquarters building in Washington, DC, would be named after Mary W. Jackson, the first African American female engineer at NASA. As part of that announcement, Bridenstine remarked that "NASA facilities across the country are named after people who dedicated their lives to push the frontiers of the aerospace industry. The nation is beginning to awaken to the greater need to honor the full diversity of people who helped pioneer our great nation." The following month, Bridenstine went a step further with the addition of "Inclusion" as a fifth NASA core value alongside Safety, Integrity, Teamwork, and Excellence.



**THESE THREE MISSIONS ARE JUST A FEW EXAMPLES OF THE INCREDIBLE BODY OF WORK ACCOMPLISHED BY THE MEN AND WOMEN WHO CONTINUE TO PERSEVERE IN THE FACE OF INCREDIBLE ADVERSITY.**



With the Agency firmly committed to ensuring that inclusion "remains a long-term focus...and becomes ingrained in the NASA family DNA,"<sup>1</sup> the History Program Office is dedicated to applying this principle to our own activities and encouraging historians working in the field of space history to redouble our efforts to eliminate the historical silences surrounding the

<sup>1</sup> James Bridenstine, "Message from the Administrator," 23 July 2020.



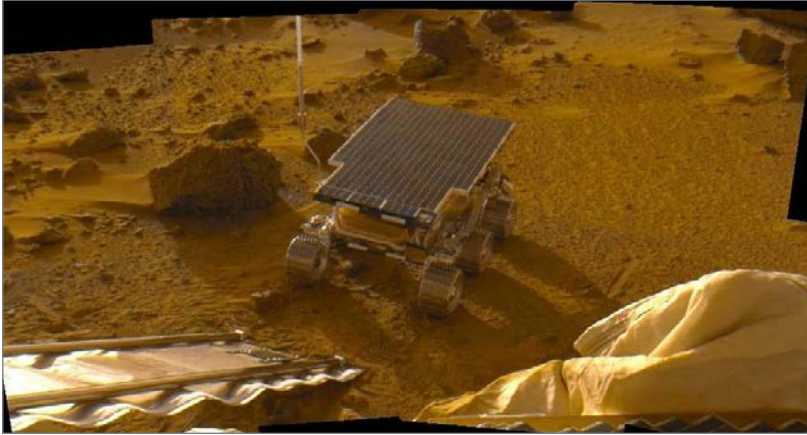
SpaceX Crew-1 pilot and Expedition 64 flight engineer Victor Glover of NASA sips on a water bag while familiarizing himself with systems and procedures during his first week aboard the International Space Station. (Photo credit: NASA)

efforts of African Americans, women, and other previously marginalized groups and their substantial contributions to NASA’s critical missions. Our efforts in this endeavor should include a wider reexamination of past accomplishments, from the early crucible of the Cold War to the International Space Station, through expanded archival collections and oral history projects. In doing so, we stand in solidarity with the Administrator’s hope that we can “continue to accomplish great things for all of humanity.” It is easy to forget that the epic achievements of the Apollo program took place during one of the most tumultuous periods of American history that included the civil rights revolution and the Vietnam War. Today, as then, NASA holds the potential to inspire the country and the world with its achievements in science, exploration, and humanitarianism.

Stay safe,

Brian C. Odom  
Acting Chief Historian



*Music for Mars: The Sojourner Wake-Up List and the Importance of a Collective Dream (continued)*

Eight-image mosaic of the Sojourner rover acquired during day 2 of the Pathfinder mission. (Photo credit: NASA)

The first Martian wake-up songs were played for the Sojourner Rover as part of the Pathfinder mission that landed on Mars in 1997, which provided scientists with groundbreaking insights about the Red Planet, as well as substantial evidence that it was once warm, wet, and possibly habitable. When we first take a look at the list of songs played for the rover, it may seem as if they were chosen at random. After all, it is filled with reggae, samba, opera, jazz, rock, and every genre imaginable. However, when we take a closer look at the list as a whole, we realize that two themes prevail: the importance of teamwork and the importance of dreams.

Some songs that celebrate teamwork are “You’ve Got a Friend” by Randy Newman and “I’ll Be There for You” by The Rembrandts—the latter perhaps more commonly known as the theme song from the television sitcom *Friends*. In “You’ve Got a Friend,” Newman sings, “There isn’t anything I wouldn’t do for you / We stick together and can see it through.” The entire song feels like an ode to self-sacrifice and to the notion that any hurdle can be surpassed with a little bit of support. The Rembrandts provide us with a similar message in “I’ll Be There for You,” singing, “I’ll be there for you / when the rain starts to pour.” These lyrics suggest that there is some kind of joy, or at least some kind

of comfort, to be found in the fact that we can hold another person’s world together when they feel like it is falling apart. Ultimately, the songs on the Sojourner wake-up list remind us that there is beauty in helping and being able to count on others for help.

The list also provides us with encouragement to dream with songs such as “Obscured by Clouds” by Pink Floyd and “Dreams” by Van Halen. Pink Floyd tells us, “Ancient bonds

are breaking...dreaming of a new day,” and with these words, he suggests that we should always have something to look forward to and that we can create the future we desire. Meanwhile, Van Halen sings, “[I]n the end on dreams we will depend,” and with these words, he tells us that dreams are like food or water or any form of sustenance—that without them, it is impossible to face any obstacle or reach any height.

If we look at the list of songs played for the Sojourner rover—and more broadly, at all the songs ever played in space—they clearly tell us to work as a team and to dream, but they also tell us more than that. They remind us of the importance of being a part of a collective dream that goes beyond the individual struggle. They tell us that if we dream together and work together, we can accomplish things that nobody would ever think possible. Ultimately, the songs that have been played in space may have been played for fun, but they also represent the ideology and spirit of an entire institution.

A chronological list of wake-up calls compiled by former NASA archivist Colin Fries can be found at <https://history.nasa.gov/wakeup%20calls.pdf>.

## NEWS FROM HEADQUARTERS AND THE CENTERS

### NASA HEADQUARTERS

Washington, DC

By Brian Odom

To say the History Program has experienced a lot of changes lately is quite the understatement. Bill Barry's retirement from the position of Chief Historian in July was followed by Chief Archivist Robyn Rodgers's move from NASA to Veterans Affairs. Luckily, we were able to bring in Holly McIntyre from NASA's Goddard Space Flight Center archives to continue the excellent work started by Robyn during her tenure with the program. No one is better equipped to step up to the challenge than Holly, who, beyond her years of service with the National Archives, has built the Goddard archives from the ground up since 2016. Her efforts in the realm of digital archives will prove critical to the History Program Office's goal of putting more of our archival collections into the hands of our researchers and space historians. For myself, I look forward to hearing from as many of you as possible during my term as acting Chief Historian.



Goddard archivist Holly McIntyre becomes the Chief Archivist for NASA Headquarters.

For those of you familiar with the Mission Support Future Architecture Program (MAP) activities at NASA (see "From the Chief Historian," *News & Notes*, vol. 37, no. 2), the History Program Office continues its efforts to overcome shrinking budgets, inconsistent staffing, and fragmented structure and implement a new approach that realigns historical and archival resources into a thematic-based model capable of providing a baseline function to researchers and internal stakeholders. Our expectation is that this redistribution of resources will lead to better coordination across the Agency to fill gaps in our history and place ourselves in a better position to capture new history moving forward. The goal is to begin implementing this approach during the early part of next year.

As many of you have experienced by now, the COVID-19 environment has caused much shifting of planned in-person events to online platforms. This has been the case with our own upcoming symposium scheduled for 18–19 March 2021, "NASA and the Rise of Commercial Space." While originally scheduled to take place at the University of Alabama in Huntsville, the event will now take place via virtual platform. The deadline for the call for papers has been extended to 1 January 2021. If you are interested in submitting a proposal for the event or are interested in "attending," more information is located on the website <https://www.nasa.gov/centers/marshall/history/nasa-and-the-rise-of-commercial-space-symposium.html>.

Speaking of online resources, it was recently announced that the web page for *To Boldly Preserve* is now up and running here: <http://www.toboldlypreserve.space/>. This effort stems from an initial National Science Foundation–sponsored March 2018 conference developed with the goal of "encouraging domestic and international space actors to collect and preserve aerospace history by formulating pragmatic historical and policy justifications as well as archiving best practices, models, and support networks aimed at the preservation of this unique experience." Anyone

interested in understanding the challenges historians and archivists face documenting contemporary history and eliminating profound silences in the archival and historical records is encouraged to visit the site.

The History Program Office’s monthly “brown bag” talks continued to bring new space history research to a growing audience over the past three months. The program for this past quarter included several stimulating talks from across the discipline. On 16 August, historian Bill Causey gave a presentation on his recent book, *John Houbolt: The Unsung Hero of the Apollo Moon Landings*, tracing how NASA’s Langley Research Center’s John C. Houbolt developed “lunar orbit rendezvous,” or LOR—a plan Houbolt viewed as being a safer, cheaper, more reliable, and faster alternative to previous ideas. Despite being ignored, then criticized, and finally dismissed by many senior NASA managers, Houbolt persisted, risking his career in the face of overwhelming opposition.



**DESPITE BEING IGNORED, THEN CRITICIZED, AND FINALLY DISMISSED BY MANY SENIOR NASA MANAGERS, HOUBOLT PERSISTED, RISKING HIS CAREER IN THE FACE OF OVERWHELMING OPPOSITION.**



Lisa Ruth Rand, a Haas Postdoctoral Fellow at the Science History Institute in Philadelphia, followed in September with her talk, “A Limited Natural Resource: Environmental Sovereignty in GEO.” Rand explored how the first satellite to reach geostationary orbit (GEO) shrank the planet in space and time, facilitating instantaneous, uninterrupted broadcasts across unprecedented distances. Twelve years later, a coalition of equatorial nations claimed sovereignty

over GEO. The Bogotá Declaration of 1976 aimed to redefine the spatial boundaries of Earthliness and, in doing so, formalized ongoing criticism among representatives of developing nations that characterized the Outer Space Treaty as a tool of hegemony drafted by and for the benefit of wealthy, industrialized nations.

In her talk on 16 September, “Through Astronaut Eyes: Photography from Early Human Spaceflight,” National Air and Space Museum curator Jennifer Levasseur presented the story of how human daring, along with technological ingenuity, allowed people to see Earth and the stars as they never had before. She noted how photographs from the Mercury, Gemini, and Apollo programs tell powerful and compelling stories that continue to have cultural resonance to this day, not just for what they revealed about the spaceflight experience, but also as products of a larger visual rhetoric of exploration. The photographs tell us as much about space and the astronauts who took them as their reception to an American culture undergoing radical change throughout the turbulent 1960s.

On 14 October, retired astronaut Kathryn D. Sullivan recounted her experience as part of the team that launched, rescued, repaired, and maintained the Hubble Space Telescope, detailed in her recent book *Handprints on Hubble: An Astronaut’s Story of Invention*. Sullivan explored how the Hubble Space Telescope has revolutionized our understanding of the universe by revealing thousands of galaxies in what seemed to be empty patches of sky, transforming our knowledge of black holes, locating dwarf planets with moons orbiting other stars, and measuring precisely how fast the universe is expanding. Sullivan described her work on the NASA team that made all this possible. Sullivan, the first American woman to walk in space, recounted how she and other astronauts, engineers, and scientists launched, rescued, repaired, and maintained Hubble, the most productive observatory ever built.

Bill Ayrey, a historian and former employee of ILC Dover, spoke to our virtual audience on 28 October. In his talk, “Lunar Outfitters: Making the Apollo





Space Suit,” Ayrey remembered how President John. F. Kennedy’s proposal that this country land a man on the Moon and return him safely challenged NASA and industry since many of the advanced technologies had yet to be invented. This challenge included developing the space suits we would need to operate in the vacuum of space and walk on the Moon. Two well-respected aerospace organizations had experience making high-altitude pressure suits, but only a couple of engineers from a relatively unknown company had set their sights on developing a true spacesuit with high mobility. This situation constantly challenged NASA and the team at ILC Industries who were developing the new suit.

Finally, Roland Miller presented his and International Space Station (ISS) astronaut Paolo Nespoli’s photography that forms the core of their work *Interior Space: Preserving the History and Culture of the International Space Station Through Photographic Interpretation*.

Miller noted that while there are countless photographs of Earth from the ISS, there is a dearth of images that intentionally document and interpret the interior of the ISS itself. As in any environment, life aboard the ISS affects astronauts socially, physically, and mentally. There is a need to examine the cultural, social, historical, and even aesthetic aspects of the ISS environment. Investigating this environment through photography and from artistic and sociological perspectives is critical to this goal.

Last, but certainly not least, lots of projects are at various stages of development at the moment. One example of work just getting started is a history of the Explorers Program, NASA’s long-running program designed to “provide frequent flight opportunities for world-class scientific investigations from space utilizing innovative, streamlined and efficient management approaches within the heliophysics and astrophysics science areas.” Opportunities have ranged



A view of clouds and ocean through the windows of the Cupola on the International Space Station in 2017. (Photo credit: Paolo Nespoli and Roland Miller; image courtesy of NASA)

from the first launch of Explorer 1 on 1 January 1958 to the upcoming launch of the Imaging X-ray Polarimetry Explorer (IXPE) scheduled to launch on 21 October 2021.

In more forthcoming news, Chris Gainor's *Not Yet Imagined: A Study of Hubble Space Telescope Operations* is scheduled to arrive at the printer any day now! *Not Yet Imagined* documents the history of Hubble from its launch through its first 30 years of operation in space. It focuses on the interactions among the general public, astronomers, engineers, government officials, and members of Congress during that time. The decision-making behind the changes in Hubble's instrument packages on servicing missions that made it a model of supranational cooperation amongst scientists is chronicled, along with Hubble's contributions to our knowledge about our solar system, our galaxy, and our universe. The book also covers the impact of Hubble and the images it produces on the public's appreciation of the universe, as well as how Hubble has changed the ways astronomy is done. Congratulations to Chris and the editorial staff for bringing this excellent book to the finish line.

#### Headquarters Intern Update

The NASA History Headquarters interns this fall have had a slightly different internship than their predecessors. Since their internship is funded through the Office of the Chief Scientist (OCS), each intern is responsible for a specific historical research project that is supervised by OCS. Here is a description of each of their projects in their own words:

#### Jade Fischer—Massachusetts Institute of Technology (MIT)

I'm researching historical mission costs and the mission proposal evaluation process for the Discovery and New Frontiers programs. Each mission has a stated cost cap in its Announcement of Opportunity (AO), but this cap includes different aspects across missions. For example, in some missions, the stated cost cap covers the expendable launch vehicle (ELV) while in others it does not. Therefore, to reach cost caps that can be compared across missions, I'm



**THE NASA HISTORY HEADQUARTERS INTERNS THIS FALL HAVE HAD A SLIGHTLY DIFFERENT INTERNSHIP THAN THEIR PREDECESSORS. SINCE THEIR INTERNSHIP IS FUNDED THROUGH THE OFFICE OF THE CHIEF SCIENTIST (OCS), EACH INTERN IS RESPONSIBLE FOR A SPECIFIC HISTORICAL RESEARCH PROJECT THAT IS SUPERVISED BY OCS.**



accounting for these differences and for inflation. I'm further researching how the mission proposal evaluation process has changed over time. This involves tracking the quantity and topics of the strengths and weaknesses noted in proposal evaluation documents for each mission. My research will inform future budget decisions and the proposal evaluation process moving forward.

#### Felicia Ragucci—Dartmouth College

My research topic is a NASA facility with a rich history and role in the American space program. The Neutral Buoyancy Simulator (NBS), located at Marshall Space Flight Center, was in operation from 1968 to 1997 and is a National Historic Landmark. This 75-foot[-] wide, 40-foot[-] deep pool once held 1.3 million gallons of water, where neutrally buoyant pressure-suited subjects found themselves in conditions mimicking those of low-gravity space. Among its many contributions, the NBS was used to develop procedures to save Skylab and evaluate on-orbit maintenance of the Hubble Space Telescope. From a historical perspective, my research aims to understand, document, and analyze the NBS as a NASA facility. Why are facilities important? How are they utilized? What lessons





can they teach us? I am working with Chief Scientist Dr. Jim Green—who dove in the tank as a safety diver in the 1980s—on an eBook that will explore these questions. During the first part of my internship, I immersed myself in the history of the NBS by tracking its activities for the nearly three decades it was in operation. Using the *Marshall Star* archive and other sources, I created a 50-page timeline of events. More recently, I transcribed a couple [of] existing interviews about the NBS and have been working on an interview strategy to capture the varied perspectives of engineers, astronauts, technicians, and divers. Going forward, I am excited to conduct interviews and also explore the online archive of visual material associated with the NBS.

#### Loren Stephens—Smith College

I'm a senior at Smith College studying astronomy and museum studies (and taking a semester off while working with the History Office). This fall, along with posting to History Office social media, I'm working on a new research project with the Office of the Chief Scientist. The project covers the telescopes known as the Great Observatories—Hubble, Chandra X-Ray [Observatory], Compton Gamma-Ray Observatory, and Spitzer Infrared Telescope—and focuses on the sociopolitical dimensions of how they came to be. These four telescopes have contributed an immense amount of data and knowledge to our image of the universe, and have [ ] much to teach us about how science happens on a political and interpersonal level and maybe also about how we want to make it happen in the future.

Because there's just an incredible amount of information to cover and I'm the first intern on the project, my main job this fall is collecting information, including interviewing some of the many people who had a hand in creating the observatories. Even though I'm only with the project for a relatively short time, I'm excited about what the project (which likely will end up as a book, but even that is up in the air) can say, the foundation I can build for it, and all the stories I can hear along the way.

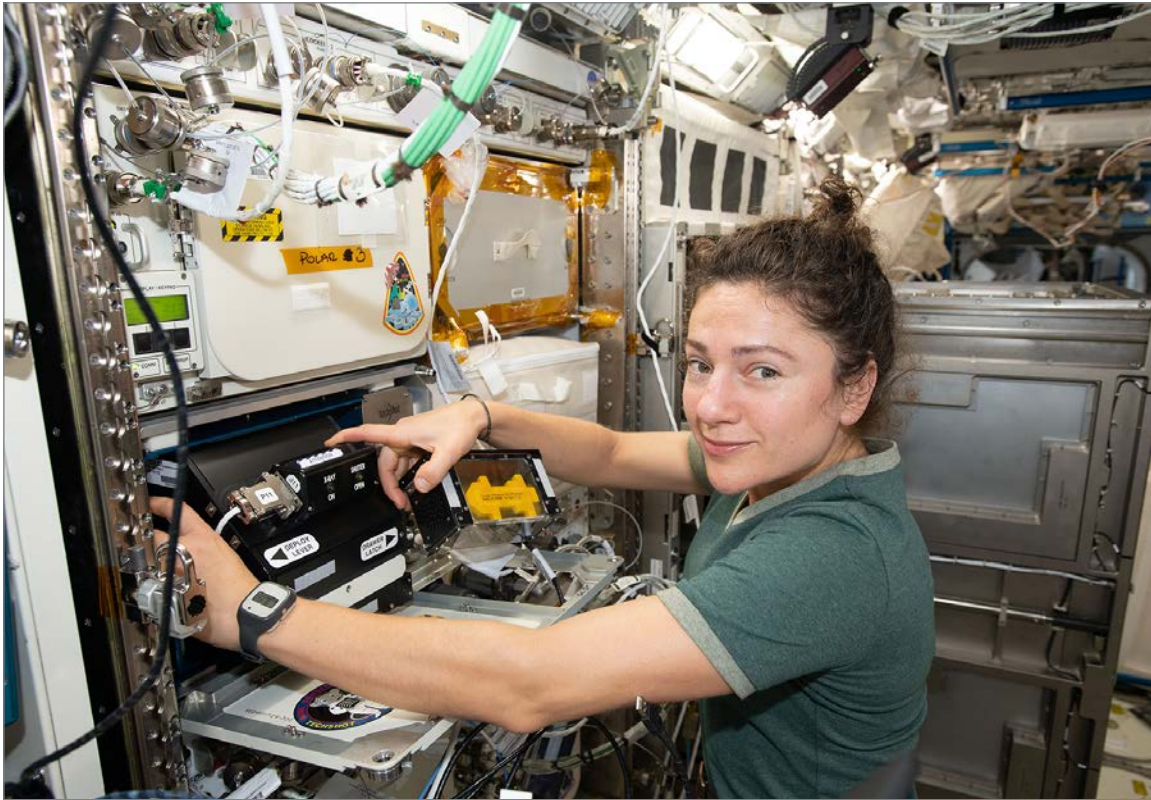
## AMES RESEARCH CENTER (ARC)

### Moffett Field, California

By April Gage and James Anderson

As NASA celebrates two decades of continuous human presence on the International Space Station (ISS) this year, it seems fitting to highlight the Ames Life Sciences Data Archive (ALSDA). The repository is primarily used by the science community but also offers a treasure trove of information for the adventurous historical researcher willing to think outside the proverbial box. ALSDA holds numerous collections relating to more than 900 life-science experiments, starting with the Gemini program and extending to work conducted aboard the ISS over the past 20 years. It also holds the world's largest repository of non-human space biology samples from NASA-supported research studies dating back to 1979. Most samples originated from experiments carried out on the Space Shuttle and the ISS, but ALSDA also contains samples from cooperative United States–Soviet Union (now Russian) investigations aboard Russian biosatellites. While the actual nuts and bolts of the hard science data may not be of primary significance to the typical historical researcher, the documentation contextualizing these data is of broader interest in providing authoritative information about missions, personnel, hardware, science objectives, and results. On the public-facing platform (<https://lsda.jsc.nasa.gov/>), one can perform a broad keyword search for information in the database or a complex query across multiple search criteria within any of eight modules. In addition, there is a mechanism for users to request assistance with their research inquiries from the repository team. NASA encourages the use of this vast accumulation of information, which has supported research efforts worldwide that advance efforts toward enabling long-duration spaceflight while solving biomedical problems on Earth. For example, the investigative gains toward mitigating bone loss in microgravity can also translate into treating conditions such as osteoporosis. Beyond science applications, the wealth of information has been mined and used in historical research and, believe it or not, even science-themed art projects.





NASA astronaut Jessica Meir installs bone densitometer hardware on the International Space Station to support a Rodent Research 19 experiment designed to investigate two proteins that may prevent muscle and bone loss in space. (Photo credit: NASA)

ALSDA is but one node of NASA's Life Sciences Data Archive (LSDA), which is headquartered at Johnson Space Center. As a whole, LSDA repositories hold nearly 60 years of research data and information for spaceflight and associated ground-control investigations involving human, microbial, cellular, plant, and animal subjects. These data are collected from investigations funded by the Agency's Space Biology and Human Research Programs. The LSDA archives are allied with related repositories, such as NASA's GeneLab at Ames, which collects genomic, transcriptomic, proteomic, and metabolomic data from a variety of model organisms.

In addition to managing the Ames History Archives, archivists Danielle K. Lopez and April Gage are on the team of archivists, scientists, and engineers supporting the ALSDA.

In other news, Center Historian James Anderson designed an oral history project called *Voices of Ames*, which was proposed at the Ames Innovation Fair at the end of August and named one of the seven awardees. The Ames Innovation Fair is held through the Ames Office of the Chief Scientist and aims to identify and provide resources to innovative projects that advance NASA's goals. The theme of the project is to capture the present ongoing historic moment from the point of view of the Ames workforce, documenting in their voices how their work and lives have adapted and changed in 2020 since the onset of the COVID-19 pandemic. This effort also intends to expand the representation of the Ames workforce in our archives and, by extension, our Center's future histories.

## ARMSTRONG FLIGHT RESEARCH CENTER (AFRC)

Edwards Air Force Base, California

By Christian Gelzer

Christian Gelzer published “Steam to the Rescue: The NACA, NASA, and RCS” in *Quest*, vol. 27, no. 4, 2020. The article looks at the development of reaction control systems (RCS) by the National Advisory Committee for Aeronautics (NACA) starting in 1954. The system was developed for the X-15’s exo-atmospheric flights, relying on 80–90 percent hydrogen peroxide by solution. So successful was the RCS that NASA employed it in its entirety on Mercury capsules. Later RCS on Gemini and Apollo was a propellant with a higher specific impulse ( $I_{sp}$ ).

Christian taught five different classes (one per day) at a grade school in Lancaster (remotely, of course), focusing on the life, work, and conditions of NACA and NASA research pilots and astronauts.

## JOHNSON SPACE CENTER (JSC)

Houston, Texas

By John Uri

The Johnson Space Center History Office continues to operate largely in a teleworking mode. At the outset of the pandemic, on 14 March 2020, JSC entered Stage 2 of NASA’s response framework, highly encouraging those employees whose job responsibilities allowed them to telework to do so. Three days later, as cases in the JSC area surged, the Center transitioned to Stage 3, mandating telework except for mission-critical and mission-essential personnel. The Center remained at Stage 3 through the spring and summer, but as the number of COVID-19 cases in the area declined in the early fall, JSC met the criteria to return to Stage 2 on 19 October 2020. An additional 900 employees were eligible to return to the Center, if they were comfortable doing so. John Uri was included in that group and divides his time between on-site and remote work. A transition to Stage 1, a fully open Center, is not expected in the foreseeable future. Because of the

continuing high number of COVID-19 cases in their area, JSC’s White Sands Test Facility in Las Cruces, New Mexico, remains at Stage 3. Impacts to the JSC History Office from the COVID-19 pandemic and the continued remote work environment preclude our ability to sponsor interns, as the Center is hiring interns only for virtual projects and our activities require an on-site presence.

Following the temporary suspension of face-to-face interviews for the Oral History Project due to the pandemic, Jennifer Ross-Nazzal and Sandra Johnson have resumed conducting interviews both in person, with appropriate safety protocols in place, and in the Microsoft (MS) Teams environment. Recent interviewees included former astronaut Robert L. “Hoot” Gibson and Kent Slayton, son of Mercury 7 and Apollo-Soyuz Test Project astronaut Donald K. “Deke” Slayton. Jennifer and Sandra continue to process transcripts from already-completed interviews to be able to add them to the JSC History Portal as soon as the interviewees approve them for release. During this time, the team is also taking advantage of



Former NASA astronaut Robert L. “Hoot” Gibson recently participated in JSC’s Oral History Project . (Photo credit: NASA)



opportunities to attend virtual conferences, webinars, and other training and enrichment events.

The JSC History Office continues to work to prepare Jennifer's book *Making Space for Women* for publication by the Texas A&M University Press. Using the oral history narratives of 21 women, this pathbreaking work looks at women's challenges and opportunities at JSC over the past 50 years. We eagerly anticipate the publication of this unique and important volume that will make a significant contribution to the field of women and spaceflight.

The JSC History Office continues to respond to numerous research requests from a variety of sources as the need for historical research appears unaffected by the pandemic. The team responded to requests from within NASA, such as the NASA Headquarters History Office, NASA's Freedom of Information Act (FOIA) Office, and JSC's Safety and Mission Assurance Directorate and External Relations Office (ERO), as well as those from outside the Agency, such as universities, academies, and museums. Sandra provided audio clips from oral histories to several requestors.

We are nearing the rollout of the JSC COVID Oral History Project website. Sandra continues to spearhead this effort to gather information in real time from the JSC community about the impacts from the coronavirus pandemic. The web-based system will capture personal experiences, stories, and multimedia submissions provided by employees on the internal JSC Knowledge Management website. The JSC History Office will archive the information for future research and use it as the first step for a follow-up oral history project to capture how this unprecedented event affected people, processes, and procedures across the Center.

Sandra and John met on MS Teams with the National Oceanic and Atmospheric Administration's (NOAA's) oral historian and her manager at their request to discuss possible collaboration. In her original e-mail to us, the NOAA oral historian stated, "I recently came across the JSC oral history project and was so

impressed with the collection's breadth and scope.... Your interviews would be a valuable and important addition to the collection. Most of the database comes from outside institutions looking to expand the access and use of their oral history interviews to scholars, students, and the general public." They provided an overview of the NOAA's Voices Oral History Archives project (<https://voices.nmfs.noaa.gov/>); we described the JSC Oral History Project; and we jointly discussed the challenges of conducting oral histories in the federal government. We directed them to the four interviews with former NASA astronaut and NOAA Administrator Kathryn D. Sullivan, as well as the Earth System Science interviews. The sharing of the two agencies' oral history projects' contents will be of mutual benefit to both organizations.

The JSC History Office actively participated in an effort led by JSC's ERO to commemorate key moments culminating with the 20th anniversary of permanent occupancy of the International Space Station (ISS) on 2 November 2020. Recent articles contributed features about food on the ISS and assembly missions to prepare the ISS for crew occupancy, and they described the preparations of the first ISS expedition crew for its historic launch to the ISS.

We continue to work with the JSC ERO to publish a series of articles commemorating other significant historical milestones, such as the 50th anniversaries of Apollo 14 and follow-on Moon landing missions, as well as the 40th anniversary of STS-1 in April 2021. The content appears on the [www.nasa.gov](http://www.nasa.gov) website and JSC's Facebook and Twitter accounts. Select articles appear as features on JSC's *Roundup Reads*, and abstracts of the articles appear in *Roundup Today*, JSC's online daily newsletter. The features often highlight the anniversaries of less heralded events and people that were nevertheless important in the various spaceflight endeavors. We would like to thank history and archive personnel at other NASA Centers for their valued help and contributions to many of these products. In early August, we reached a significant milestone with the publication of the 300th article since the series began in August 2017.



## MARSHALL SPACE FLIGHT CENTER (MSFC)

Huntsville, Alabama

By Brian Odom

While the History Office continues to perform our operations off-site due to the continuation of the COVID-19 pandemic, lots of important work continues. One important project is a collaborative attempt to develop a comprehensive list of all the employees, civil servant and contractor, who have contributed to the incredible work accomplished at the Center. As part of this project, the Marshall Space Flight Center Retirees Association is seeking biographical information of past and present Center employees for a memorial it is planning that will honor those who made more than six decades of U.S. space exploration possible.

The memorial will contain engraved names of all Marshall civil servants since the Center opened in 1960. The names of Marshall-associated companies and representations of some of the Center's best-known rockets and spacecraft will also be engraved on the memorial.

Retiree association members, along with representatives from Marshall and the University of Alabama in Huntsville, have created an online database that contains the names of 22,000 current and former employees. Memorial organizers request that past and present Marshall civil servants verify their names and add biographical information to the database by visiting <https://www.marshallretirees.org>.

Accessible beside the memorial, the online database will display the names of the civil servants and the companies, along with the location of the names on the memorial. Additionally, the names of all known employees from Marshall-associated companies will also be listed in the online database. Memorial organizers are working with the contractor community to identify their relevant employees. Later phases of the memorial will add dynamic water fountains showing



An illustration of the proposed Space Exploration Memorial at the U.S. Space & Rocket Center. The memorial would honor past and present Marshall employees and companies. (Image credit: Fuqua & Partners Architects)

the power of rockets conceived in Huntsville—including the Redstone, Saturn I, Saturn V, Space Shuttle rockets, and Space Launch System (SLS).

Former Marshall Acting Director Gene Goldman is among the retiree association members leading this memorial project. He noted the Center's role in vital programs, missions, and technology for NASA, including Apollo, the Lunar Roving Vehicle, Skylab, the Space Shuttle, Spacelab, the International Space Station, and the world's most powerful space telescopes. "Marshall and the Huntsville community have made an invaluable contribution to our nation's leadership in space exploration," Goldman said. "A lasting memorial will be a most appropriate way to honor that legacy, as well as to teach and inspire future generations of explorers."<sup>1</sup>

1 Adapted from a 22 April 2020 *Marshall Star* story: <https://www.nasa.gov/centers/marshall/about/star/star200422.html>.

## STENNIS SPACE CENTER TEST COMPLEX FACILITIES PROVIDE CRITICAL GREEN RUN SUPPORT

By C. Lacy Thompson

### PART I

**I**t is tempting to say that it takes a village to conduct a large propulsion test. However, “it takes a city” would be closer to the truth. When the core stage of NASA’s new Space Launch System (SLS) rocket—with its four RS-25 engines—is test-fired at Stennis Space Center, test complex support facilities will be called on to supply city-level supplies of electricity, water, high-pressure gases, and propellants. All must work in careful concert.

The four-engine hot fire will conclude a series of Green Run core stage tests and mark the biggest milestone yet in the march to the next great era of human space exploration. NASA will use the SLS to launch Artemis program missions to return humans, including the first woman, to the Moon and to prepare for eventual missions to Mars.

Two Stennis support facilities will play essential roles: the High-Pressure Industrial Water (HPIW) Facility and the High Pressure Gas Facility (HPGF).

The Stennis HPIW facility fills two critical propulsion test needs, most notably water. Rocket engines and stages are tested in the same way they are fired during a launch. During a test, the engine or stage is anchored into place on a large stand, with exhaust directed outward by an L-shaped steel flame deflector. The exhaust can reach 6,000 degrees Fahrenheit, hot enough to melt the steel. NASA uses water to keep that from happening.

A single rocket engine test requires more than 200,000 gallons of water per minute, piped to the stand and sprayed through thousands of small holes into the flame deflector to protect it. When the pressurized water hits the exhaust, it turns to a cloud of steam. Some water also is held in reserve in case of a fire or mishap.

**“IT IS TEMPTING TO SAY THAT IT TAKES A VILLAGE TO CONDUCT A LARGE PRO-PULSION TEST. HOWEVER, ‘IT TAKES A CITY’ WOULD BE CLOSER TO THE TRUTH.”**

For the Green Run hot fire, more than 300,000 gallons of water per minute will be needed. In addition to protecting the flame deflector and providing fire protection, some water will be sprayed around the core stage to dampen the noise and vibrations that accompany a test. The noise and vibrations are loud and intense enough to damage a stage. A curtain of

water will help prevent that.

The water will be drawn from a 66-million-gallon reservoir and piped through 96-inch pipes from the HPIW facility, using 10 large diesel pumps from the 1960s and 1 new electric pump. Each diesel pump provides more than 10 times the horsepower of a typical pickup truck. The water is pumped at about 300 psi, compared to the 60 psi most city water pipes use. That pressure has to be constant—and monitored carefully. Otherwise, serious piping and stand damage can occur.

In addition to water, the HPIW facility will provide the electricity needed to conduct the core stage hot fire. A propulsion test is a precise operation; any deviation in process can be costly. This is very true when it comes to power. Relying on the commercial power







The massive core stage for NASA's Space Launch System (SLS) rocket is in the B-2 Test Stand at NASA's Stennis Space Center near Bay St. Louis, Mississippi, for the core stage Green Run test series. NASA and Boeing, the core stage lead contractor, installed the stage into the test stand in January 2020. The core stage Green Run test series is an important step toward safely launching SLS and NASA's Orion spacecraft beyond Earth's orbit to the Moon for the Agency's Artemis program. The 212-foot-tall rocket stage—the largest stage the Agency has ever produced—contains the cryogenic liquid hydrogen and liquid oxygen tanks that will feed four RS-25 rocket engines, along with the vehicle's avionics and flight computers. The comprehensive test campaign will validate the core stage design and ensure that it is ready for the first and future Artemis missions to the Moon. (Photo credit: NASA)

grid puts a test at the risk of a blackout, brownout, or power glitch when a bird perhaps hits a transformer. Even a small interruption in power supply—a mere second or less—can disrupt or scuttle a test and prove very costly.

Stennis avoids the risk by shifting test complex power from the commercial grid to four generators housed in the HPIW facility. Each of the four generators can produce up to 1.5 kilowatts of power. They are original equipment from the 1960s, but their control systems and switches have been upgraded through the years. Facility teams also have incorporated procedures to ensure that they are operating efficiently. The generators are connected to the test complexes through underground cables, offering another level of protection from disruption.

The HPGF is responsible for providing the gaseous nitrogen, helium, and hydrogen, as well as the missile-grade air, needed for pressurizing test complexes, purging lines and systems, operating valves, and pushing propellant to barges and test stands. Its network includes miles of piping needed to maintain systems and support test activity.

The HPGF has not ceased operations since the 1960s. Propulsion test systems cannot be turned on and off like a piece of lawn equipment but must maintain constant pressures and ongoing flows to ensure system integrity.

System depressurization could contaminate countless pipes and components. Recovery could cost millions.

The HPGF ensures that the gases needed to maintain the systems are available. The facility receives helium in gaseous form, but hydrogen and nitrogen arrive in liquid form, are pumped to high pressure, then are vaporized and distributed through the piping network. Air is collected from the atmosphere, then scrubbed and cleaned through compressors to the missile-grade purity needed.

Core stage testing poses a particular challenge for the HPGF, which underwent several modifications to provide the high volume of high-pressure nitrogen needed. The modifications have been completed and tested to ensure that they are ready to support core stage operations. For core stage hot fire, the HPGF will provide the following:

**Gaseous nitrogen.** Core stage testing will use considerably more gaseous nitrogen than during a typical large engine test—about 12 and a half times more on test day and 4 to 5 times more for post-test activities. Some gas will be used to pressurize propellant tanks, maintain a clean system before and after testing, and actuate valves. For core stage testing, the bulk of the gaseous nitrogen will travel from the HPGF to the B-2 Test Stand through a 1.5-mile-long pipeline, then through five heaters, with heating capacity equivalent to the energy needed to light 6,000 New Orleans streetlights. The heated gas will be piped into core stage sections to help keep the compartments and their sensitive electronics warm and dry from the chill and moisture of the super-cold propellants used for testing. Following testing, gaseous nitrogen also will be used to dry the core stage's four RS-25 engines.

**Gaseous helium.** Core stage testing will use about 25 times more gaseous helium than usual, primarily because the core stage and its propellant tanks use helium, instead of gaseous hydrogen or nitrogen, for pressurization. Helium is also used to make the hydrogen tank inert post-test.

**High-pressure air.** Core stage testing will require more high-pressure air than usual, primarily to purge electrical boxes and the 100 or so cameras on the stand. Air

also is used by B-2 stand systems and can be used as part of the engine-drying sequence in lieu of nitrogen.

**Gaseous hydrogen.** A small amount of gaseous hydrogen will be needed to warm vent lines and push fluid in propellant transfer lines back to the barges.

## PART II

When it comes to rocket propulsion testing, a variety of test complex facilities and personnel are involved. For instance, the on-site High Pressure Gas Facility and High Pressure Industrial Water Facility supply megaloads of gases and water that are critical for any propulsion test.

For the Green Run hot fire of the first flight core stage of NASA's new Space Launch System (SLS) rocket, two other Stennis facilities also will deliver key support—the E Test Complex and the Cryogenic Storage Facility. The E Test Complex will help deliver gaseous nitrogen for the test. The cryogenic area will supply liquid oxygen and liquid hydrogen to fuel the test.

The four-engine hot fire will conclude a series of Green Run core stage tests and mark the biggest milestone yet in the march to the next great era of human space exploration. NASA will use SLS to launch Artemis program missions to return humans, including the first woman, to the Moon and to prepare for eventual missions to Mars.

### E Test Complex

The E Test Complex at Stennis was constructed to support propulsion development programs in the late 1980s and early 1990s. The versatile, three-stand complex includes seven test cells capable of testing that involves ultra-high-pressure gases and cryogenic fluids. While the High Pressure Gas Facility supplies the bulk of gases needed for propulsion system testing at Stennis, some E-1 Test Stand projects require gaseous nitrogen at higher pressures than the facility can provide. For that reason, the E complex has a built-in capability that allows it to pump and store gaseous nitrogen at the higher pressures.



The Green Run hot fire will require copious amounts of gaseous nitrogen throughout a 24-hour period. To help meet that demand, the E complex will use its built-in capability to provide additional nitrogen to the site system to keep up with the pressure and flow rate demands from the core stage. The nitrogen will be stored in bottles at the E-1 stand prior to test day. On test day, a team of E complex personnel will configure the system to allow the stored gas to flow through pressure-reducing stations and back into the site system as needed.

In addition to the nitrogen, the E complex will provide supplemental gaseous helium to the sitewide system for hot-fire support. A pair of helium compressors mounted on mobile trailers are being installed and activated at the E-3 Test Stand to provide this capability. The equipment is expected to be installed by the end of the month and will be activated prior to the wet dress rehearsal test that precedes the actual Green Run hot fire.

E complex personnel have participated in several dry-run stress-test scenarios to make sure that teams and

equipment are all set. The tests helped identify equipment that needed to be replaced or improved, as well as critical spare equipment needed on hand for test day. On test day, about 16 to 20 people will provide the 24-hour support needed prior to, during, and after the hot-fire test.

“The team has done a great job identifying and correcting any issues found during the stress tests to ensure the E complex systems are ready to support,” said Stephen Rawls, NASA E-3 Test Stand director. “It’s hard to put into words the feelings I have to be part of such an amazing team at Stennis and to be part of making history. The Green Run test will be the culmination of countless hours of hard work put in by a diverse group of Stennis team members to make it a success. No challenge is too big for us when we work as a team.”

#### Cryogenic Storage Facility

Four RS-25 engines will power the SLS rocket at launch. While these RS-25 engines will help power the Space Launch System, the Cryogenic Storage Facility at Stennis helps power the engines during Green Run



At Launch Pad 39B at NASA's Kennedy Space Center, liquid hydrogen tanks that supported Space Shuttle launches for 30 years have been sandblasted, repaired, and repainted. Along with the liquid oxygen storage vessel, the two tanks are designed to store super-cold propellants. They were refurbished to support NASA's Space Launch System rocket and other launch vehicles. (Photo credit: NASA)



hot fire. The area is responsible for storing, handling, transporting, and delivering the liquid oxygen and liquid hydrogen used as the RS-25 engine propellant.

Liquid hydrogen is the actual fuel. The element with the lowest molecular weight, it burns with extreme intensity. Combined with an oxidizer (liquid oxygen), liquid hydrogen is the most efficient propellant available, providing more thrust per pound of fuel than any other option.

Testing a single RS-25 engine requires more than 100,000 gallons of combined propellant. That demand is multiplied for the Green Run hot fire, which will consume 610,000 gallons of liquid hydrogen and 270,000 gallons of liquid oxygen. The wet dress rehearsal test prior to hot fire will require even more—about 900,000 combined gallons—as operators simulate at least a 2-hour hold, which will require extended propellant flow.

On test day, the Cryogenic Storage Facility will use three liquid hydrogen barges, each loaded to 115 percent capacity (260,000 gallons each) and five liquid oxygen barges, each loaded with 98,000 gallons. The volumes differ due to the respective atomic weights of the propellants. However, each barge essentially holds about 24 tractor-trailer loads of its particular cryogenic.

Handling the cryogenics is a careful process. Both are stored at extremely low temperatures: -297 degrees Fahrenheit for liquid oxygen and -423 degrees

Fahrenheit for liquid hydrogen. Each step of loading and unloading a barge with cryogenics must be performed with great care.

It normally takes three to four days to load each barge to capacity; that process will be completed prior to test day. All maintenance and checkouts also will be completed. The barges will be moved from the storage area to the B-2 Test Stand prior to test day, transported by a single tug boat on the Stennis canal waterway. It takes 2 or 3 hours to disconnect and move a single barge.

Once in place, the barges will be connected to stand piping and used to help fill the large core stage propellant tanks and replenish the 28,000-gallon ground-based storage tank at the stand. There will be

little propellant to spare, less than 10 percent. Teams must address any issues quickly to avoid running out of propellant. The transfer procedure must be precisely timed and carefully controlled to provide the specific flow rate needed during different phases of the loading process.

“The biggest challenge in supporting the Green Run hot fire is making sure our barges are ready to support the test without any problems,” said Billy Davis, assistant operation manager at the Cryogenic Storage Facility and High Pressure Gas Facility. “We only have three liquid hydrogen barges so we can’t afford to have one go down.”



**TESTING A SINGLE RS-25 ENGINE REQUIRES MORE THAN 100,000 GALLONS OF COMBINED PROPELLANT. THAT DEMAND IS MULTIPLIED FOR THE GREEN RUN HOT FIRE, WHICH WILL CONSUME 610,000 GALLONS OF LIQUID HYDROGEN AND 270,000 GALLONS OF LIQUID OXYGEN.**



## OTHER AEROSPACE HISTORY NEWS

### AMERICAN ASTRONAUTICAL SOCIETY (AAS) HISTORY COMMITTEE

By Michael Ciancone

#### 2019 Emme Award for Astronautical Literature

The Emme Award, named for NASA's first Chief Historian, recognizes outstanding books that advance public understanding of astronautics based on originality, scholarship, and readability. The Emme Award Panel, chaired by Dr. Don Elder, is in the process of reviewing submitted titles. Other members of the Panel are Dr. Rick Sturdevant, Dr. Jennifer Levasseur, and Dr. De Witt Kilgore.

AAS has announced the 2019 winners of the Emme Award as follows:



Brian C. Odom and Stephen R. Waring have been selected as recipients of the Emme Award for editing *NASA and the Long Civil Rights Movement* (University Press of Florida, 2019).



Jonathan Fetter-Vorm has been selected as the recipient of the Eugene E. Emme Junior Award for Astronautical Literature for writing and illustrating *Moonbound: Apollo 11 and the Dream of Spaceflight* (Hill and Wang, 2019).

#### International Academy of Astronautics (IAA) History Series

The series editor, Dr. Rick Sturdevant, reports the following status:

- Univelt has published the history proceedings for International Astronautical Congress (IAC) 2017 (Adelaide, volume editor: Michael Ciancone).
- The edited papers from IAC 2018 (Bremen, volume editor: Hannes Mayer) are en route to the series and copy editors.
- The series editor has completed work on the papers from IAC 2019 (DC, volume editor: Otfried Liepack) and will forward them to Univelt. Univelt will await publication of IAC 2019 until after they publish IAC 2018.
- The papers that were virtually presented at IAC 2020 will be combined with the papers from IAC 2021 into a new volume, which will likely fall to the new publisher selected by AAS.

#### 2020 Ordway Award for Sustained Excellence in Spaceflight History

The Ordway Award is named in memory of Frederick I. Ordway III (1927–2014), human spaceflight advocate and chronicler of the history of rocketry and space travel. The award recognizes exceptional, sustained efforts to inform and educate on spaceflight and its history through one or more media, such as 1) writing, editing, or publishing; 2) preparation and/or presentation of exhibits; or 3) production for distribution through film, television, art, or other nonprint media. The award is managed by the Ordway Panel of the AAS History Committee. Members of the Panel are Michael Ciancone (Chair), Robert Godwin, Dr. Valerie Neal, Ron Miller, Dr. John Logsdon (2019 recipient) and John Noble Wolford (2019 recipient).

AAS has announced the 2020 recipients of the Ordway Award, as follows:

- Roger Launius—for sustained excellence as a prolific scholar, author, and advocate of space history.
- Bill Ingalls—for sustained excellence in memorializing milestones in U.S. space programs and policy through his artistically crafted photographic images.
- University of Nebraska Press: Outward Odyssey Series—for its Odyssey Series (A Personal History of Spaceflight) documenting key topics in the history of spaceflight.

- Viking Mars Missions Education and Preservation Project (VMMEPP)—for the preservation of archives and artifacts associated with the Viking missions to Mars and educational outreach using the Viking missions as a science, technology, engineering, and mathematics (STEM) catalyst.

## CALL FOR PAPERS: NASA AND THE RISE OF COMMERCIAL SPACE SYMPOSIUM, 18–19 MARCH 2021

NASA’s Marshall Space Flight Center History Office and the University of Alabama in Huntsville (UAH) History Department are pleased to invite paper proposals for a two-day symposium exploring the history of commercial space to the present day. Today, the commercial space industry is taking on an increased leadership role and position of innovator in both space access and exploration. This growth of commercial space over the past decades offers the potential for a new paradigm for space exploration—one in which

industry transitions from supplier to partner. Still, many questions remain. These questions span from the most seemingly consequential “How will humanity explore the Moon and Mars?” to the most basic, “What is commercial space?”

To develop further the historical context of commercial space—and thereby better inform decision-making at NASA going forward—the organizers of this symposium invite proposals on a broad range of topics related to the history of commercial space operations, including but not limited to the following:

**Contextualizing “commercial space”:** How has the concept of “commercial space” evolved in different fields and disciplines? Submissions can address topics of interest in the fields of policy, law, environment, political science, economics, or organizational studies.

- Evolution of United States and international commercial space policy



A SpaceX Falcon 9 rocket carrying the company’s Crew Dragon spacecraft launched from Launch Complex 39A on NASA’s SpaceX Demo-2 mission to the International Space Station with NASA astronauts Robert Behnken and Douglas Hurley aboard on Saturday, 30 May 2020, at NASA’s Kennedy Space Center in Florida. (Photo credit: NASA)



- Pre-NASA conceptions of commercial space activities
- Environmental impacts of commercial space
- Social history of commercial space
- Historical impact of innovative technologies

#### Exploring the history of nongovernmental activities:

What have been the major events and milestones in the emergence and evolution of commercial space activities in the U.S. and internationally?

- Commercial space in United States and international law/property rights/space mining
- Commercial analogs for space exploration and exploitation
- Development of commercial efforts in space tourism, colonization, and exploration
- Commercial activities in low-Earth/geosynchronous orbit
- Public perception of space tourism (suborbital vs. orbital, lunar, Mars)
- Advancement of the philosophy, economics, and politics of commercial space

#### Examining relevant government activities past and present:

How has the U.S. government assisted or impeded the emergence and evolution of commercial space activities?

- Origins of programs such as Commercial Crew
- Comparison of commercial space industry to Apollo/Space Shuttle procurement models
- Comparative experiences in commercialization from governmental and private industries
- Applicable experiences of national security and civil space programs
- Development of public-private partnerships at NASA

The format of the symposium will be a combination of panel discussions, keynote talks, and group discussions. The intended outcome is a deeper understanding of

the relationship between NASA and commercial space as well as an improved definition of commercial space. As part of this goal, each presenter must also propose a definition of “commercial space” and develop that definition as it relates to their chosen topic. The intention is to publish an anthology of selected papers.



**AS PART OF THE EFFORT TO OFFER INSIGHT TO BROAD CONSTITUENCIES, THE ORGANIZERS ENVISION A RANGE OF PRODUCTS EMERGING FROM THIS SYMPOSIUM.**



As part of the effort to offer insight to broad constituencies, the organizers envision a range of products emerging from this symposium. The possibility of online blogs and other means of communication are being considered. So is a fully referenced edited collection of essays on the origins and development of commercial space activities. Participants are invited to make their presentations available in written form for dissemination.

#### Submission Procedures

If you wish to present a paper, please send an abstract of no more than 400 words and a short biography or curriculum vitae, including affiliation, by 1 January 2021 to Dr. Brian C. Odom at [brian.c.odom@nasa.gov](mailto:brian.c.odom@nasa.gov) or Dr. Stephen P. Waring at [warings@uah.edu](mailto:warings@uah.edu).

Decisions about acceptance will be made by 15 January 2021. For more information, contact Brian Odom at [brian.c.odom@nasa.gov](mailto:brian.c.odom@nasa.gov).



## UPCOMING MEETINGS

The 2021 American Institute of Aeronautics and Astronautics (AIAA) SciTech Forum will be held virtually **11–15 and 19–21 January 2021**. Visit <https://scitech.aiaa.org> for details.

The annual meeting of the National Council on Public History will be held virtually **8–27 March 2021**. Visit <https://www.ncph.org> for more details.

NASA’s Marshall Space Flight Center History Office and the University of Alabama in Huntsville (UAH) History Department’s “NASA and the Rise of Commercial Space Symposium” will be held virtually **18–19 March 2021**. Visit <https://www.nasa.gov/centers/marshall/history/nasa-and-the-rise-of-commercial-space-symposium.html> for details.

The annual Spring Meetings of the International Astronautical Federation will be held virtually **23–25 March 2021**. Visit <http://www.iafastro.org> for more details.

The annual meeting of the Organization of American Historians will be held virtually **15–28 April 2021**. Visit <https://www.oah.org> for more details.

The American Astronautical Society’s annual Goddard Memorial Symposium will be held virtually **4–6 May 2021**. Visit <https://astronautical.org/events/goddard> for more details.



A look back at the IAA History Committee Meeting on 11 October 1972 in Vienna. Front row (left to right): Lise Blosset, A. Mikhailov, E. Cambi, Å. Ingemar Skoog, Frank J. Malina, and Rudolf Pesek. Back row (left to right): Frederick C. Durant III and Eugene M. Emme. (Photo credit: Å. Ingemar Skoog Archives)

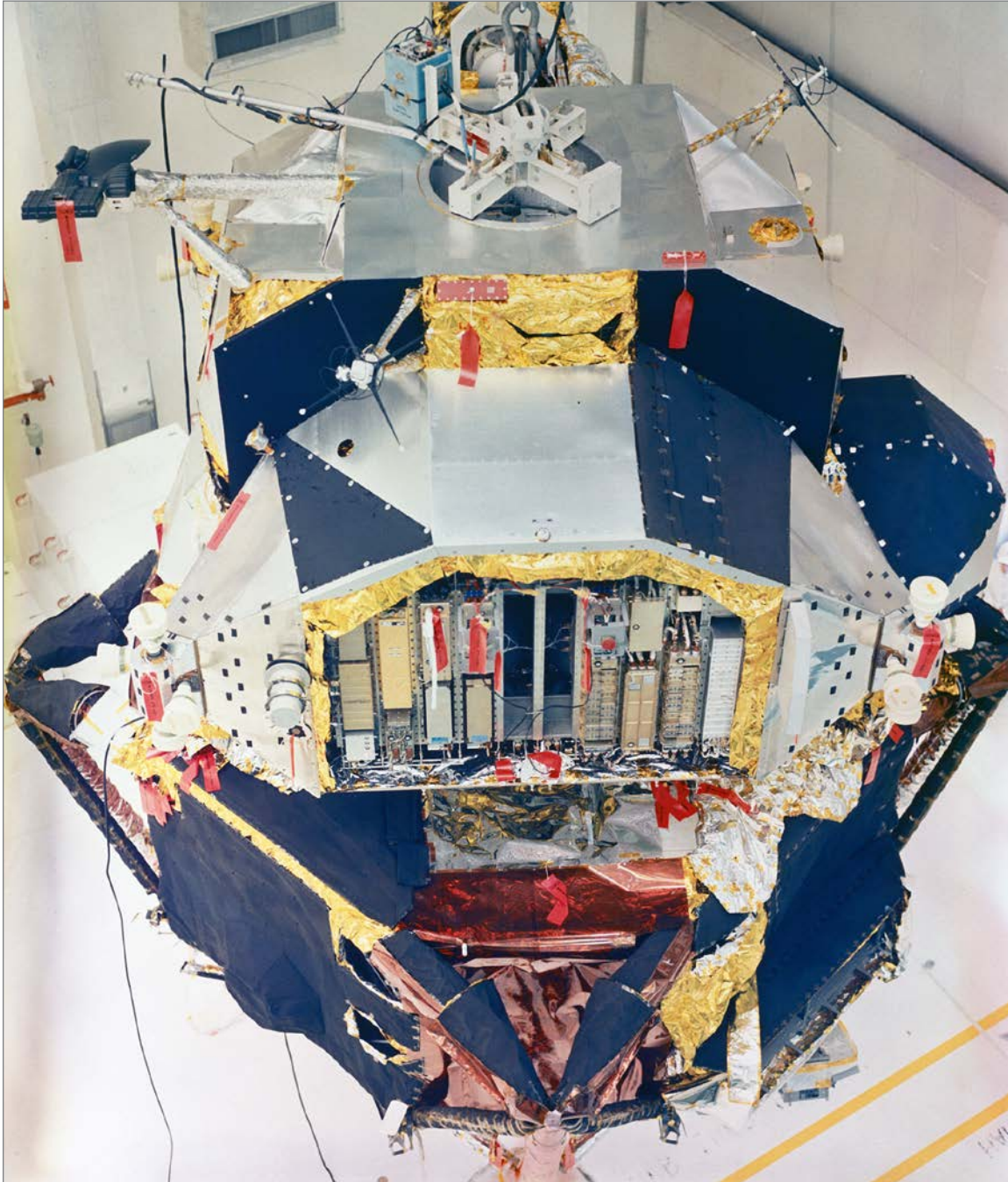
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## MOMENT IN NASA HISTORY



Originally, LM-3 was intended for flight on Apollo 8, but after two months of testing, NASA determined that it was not ready for the projected launch in December 1968. The Lunar Module (LM) got its time to shine on Apollo 9 in March 1969. The crew of Apollo 9 used LM-3, nicknamed "Spider," to perform the first crewed test of the "lunar ferry" that would eventually put astronauts on the Moon. Here LM-3 is photographed in the Manned Spacecraft Operations Building (MSOB) at Kennedy Space Center. (Photo credit: NASA)



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