NEWS &NOTES

National Aeronautics and Space Administration

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CELEBRATING THE APOLLO 50TH

APOLLO 50 NEXT GIANT LEAP

NEWS FROM HEADQUARTERS AND THE CENTERS

PAINTING THE MOON FOR APOLLO

NASA–UNIVERSITY RELATIONS IN THE AGE OF APOLLO

Taken aboard Apollo 8 by Bill Anders, this iconic picture dubbed "Earthrise" shows Earth peeking out from beyond the lunar surface as the first crewed spacecraft circumnavigated the Moon.

NASA HISTORY DIVISION
OFFICE OF COMMUNICATIONS

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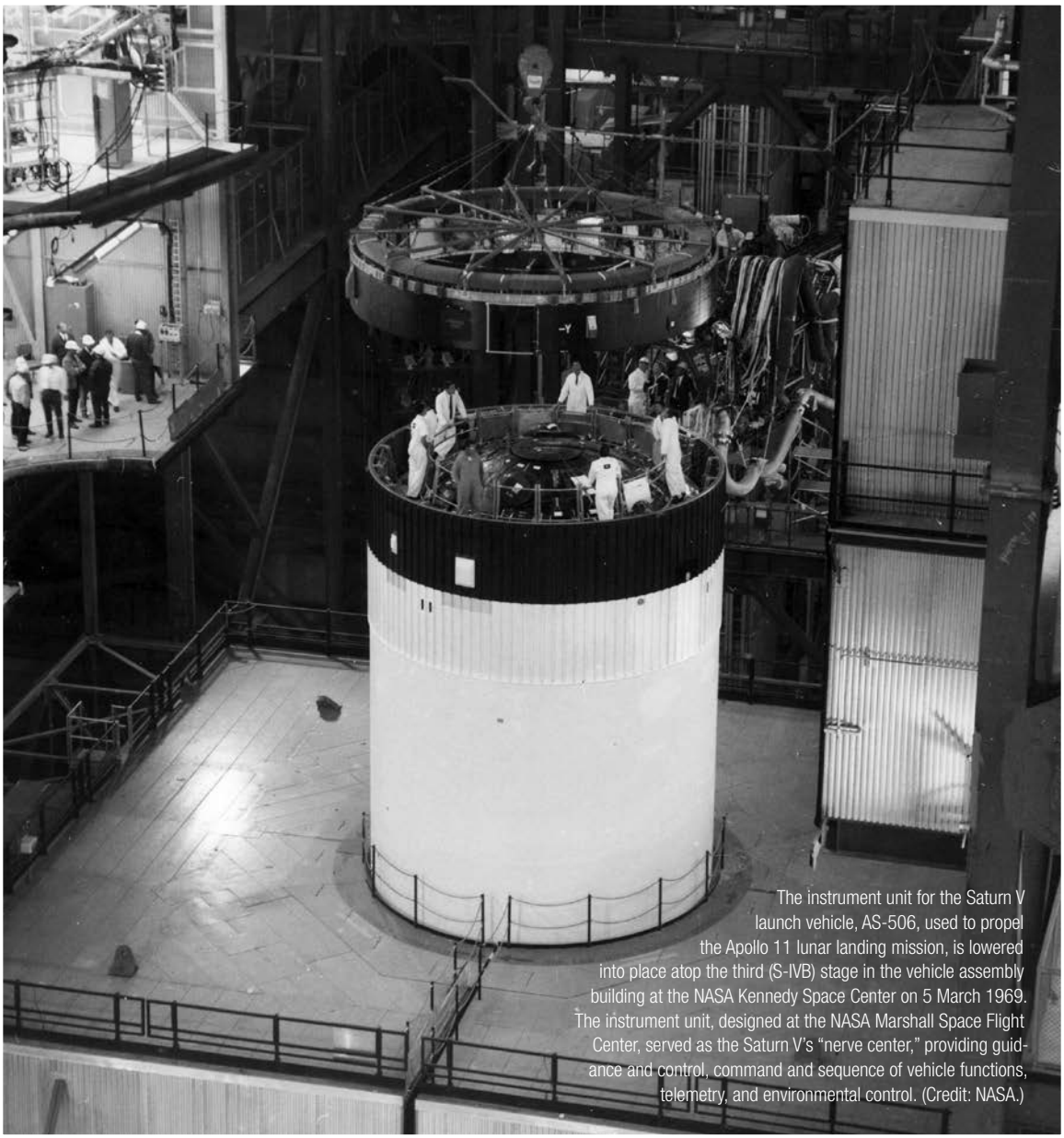


The instrument unit for the Saturn V launch vehicle, AS-506, used to propel the Apollo 11 lunar landing mission, is lowered into place atop the third (S-IVB) stage in the vehicle assembly building at the NASA Kennedy Space Center on 5 March 1969. The instrument unit, designed at the NASA Marshall Space Flight Center, served as the Saturn V's "nerve center," providing guidance and control, command and sequence of vehicle functions, telemetry, and environmental control. (Credit: NASA.)

FROM THE FIRST CHIEF HISTORIAN

For this Apollo 50th Anniversary special edition, we thought we'd share the thoughts of NASA's first chief historian, Dr. Eugene Emme. The unedited note below is from his introduction to the history newsletter written at the end of 1969.

NASA HISTORICAL NEWSLETTER

Historical Division (EH)
National Aeronautics and Space Administration
Washington, D. C. 20546

Gene Emme, NASA Chief Historian

Portrait of Eugene M. "Gene" Emme, NASA's first chief historian, who served from 1958–1978. (Credit: NASA)

January 1, 1970 Number 11

July 20, 1969, may come to be regarded as the day of the greatest single human event of the twentieth century, the day when man first set foot upon an extraterrestrial body. While the impact of man's first landing upon the surface of the Moon may also be of high interest to historians after the year 2001, the voyage of Apollo 11 was at least the most visible and vicarious event to date in world history. Over a half-billion people around the world were estimated to have witnessed the lunar walk of astronauts Armstrong and Aldrin live via television. Americans who did not witness this event as it happened now appear reluctant even to admit it. The full consequences of this instant historical experience remain in the domain of prophets and posterity.

This moment in NASA's twelfth year offers a challenging perspective from which to view the contemporary history of science, technology, and public policy. The dynamic and detailed story of the recent past deserves in-depth attention to seminal documentation, timely interviews of the key people, and dispassionate scholarship. Disciplined attention to this important chapter in the full history of mankind must proceed, be it noted during a challenging era of great problems as well as of visions of unlimited future prospects. Many of these visions are notable consequences of the swift and wholesale impact of space exploration and exploitation. Ready explanations of limited depth and breadth have quickly appeared; the flood of beautifully illustrated publications with caption-style chronology has just started. Spokesmen of thought and action rooted in traditional assumptions regarding science, technology, and all echelons of political and social affairs have been critically vocal. The aerospace-minded community in our pluralistic society, preoccupied with the next decades of technological opportunities, is yet assessing the scientific harvest and utilitarian payoffs of the past decade. It appears even more clear that there are but few workers in the historical vineyard of the history of astronautics and aeronautics.

Without dwelling upon the intellectual discipline of history as it is challenged by man's first step beyond his planetary homeland I by the concept of "spaceship Earth," of the "global village," this newsletter offers recent notes upon what has so far been done under the aegis of NASA. It covers items not covered in previous newsletters.

NEWS FROM HEADQUARTERS AND THE CENTERS

NASA HEADQUARTERS

Washington, DC

By Bill Barry

As noted in the September edition of *News and Notes*, we expected fall 2018 to be busy—and it certainly has been! We were taxed by anniversary work, pushing our new history directive through the system, planning a workshop, doing interviews, speaking requests, tons of questions from the media and the public, and getting books into print. In the midst of all of this, tragedy struck our team.

On the morning of Sunday, 14 October, Chief Archivist Robyn Rodgers' 21-year-old daughter Beth passed away unexpectedly. This was a heavy blow. I was, however, heartened to see the outpouring of support from the history and archival team across the Agency and our colleagues here in the Headquarters Office of Communications. On behalf of Robyn, let me pass along her thanks for your continuing help and concern.

In more mundane matters, the good news on the anniversaries is that the 60th anniversary of NASA events are done and that we can concentrate now on Apollo 50th anniversary activities. Unfortunately, the extra help—both personnel and funding—that we had been expecting last summer has failed (so far) to materialize. So, anniversary work has been a matter of dashing from one crisis to the next. Fortunately, much of the NASA anniversary activity has been online or based on partnerships. NASA's tremendous digital teams (especially the folks at NASA.gov and NASA TV) have done a great job of leveraging limited resources.

We also have some really great partners, most notably our colleagues at the Smithsonian National Air and Space Museum, who have carried the anniversary ball for us. The marking of the Apollo 8 anniversary is a good case in point. The museum initiated the "Spirit of Apollo" event at Washington National Cathedral on 11 December and invited NASA to join in. We broadcast that event live both on NASA TV and online. NASA's Apollo 8 story was also told at the annual American Geophysical Union (AGU) Fall Meeting in Washington, D.C., that same week (10–14 December), largely through the efforts and funding of our colleagues in NASA's Science Mission Directorate. Unless there is a dramatic change in support, I expect that this is the model we will follow throughout 2019 for the other Apollo mission anniversaries.

A particular bright point in the anniversary effort has been planning for the "Apollo Dialogues Workshop: New Perspectives on Spaceflight in Society," held on 7 December at the Smithsonian Institution's Ripley Center here in Washington, D.C. We expected that we might get as many as 100 applicants for the 80 or so slots that we thought we could accommodate. Instead, we were flooded with 30 percent more than we expected! This made for some very tough choices, but we think that the combination of established scholars in aerospace history, plus an interesting mix of those from other historical disciplines, as well as interested people from outside the historical community will make for some very fertile conversations. The workshop was not planned as a conference, but as a place to foster assessment and discussion of Apollo history and the future directions of inquiry in this field. We have great hopes that this event will serve as an incubator that will kick off further work—from conferences to publications—on that amazing Apollo decade in the middle of the 20th century.

This fall we also finished the review of a new NASA Policy Directive (NPD) for the history program. In the late 1990s, the Headquarters policy guidance document for the history program (as well as a number of others) was abolished in a whirlwind of deregulation. In lieu of stated policies, the program continued much as before. But, after two decades and much

change, there was clearly a need to re-establish history policy guidance for the Agency. Fortunately, the draft NPD prompted few critiques during the review cycle, and we are dispositioning those as I write this. You should soon see *NPD 2700 – The NASA History Program* published.

With the combination of the NASA 60th anniversary and the Apollo 50th anniversary, the Headquarters history program has been swamped with questions from the press and public. From kids working on National History Day projects on the space program, to documentary filmmakers, to those with questions about the feature film *First Man*, the team here has been busy every day. I have been spending a lot of time giving talks on the anniversaries and talking with the press about Neil Armstrong. While I get far more time in front of a microphone or camera than I would like, it is important to note that I would not be able to do that sort of work effectively without the awesome support of the history team here at Headquarters and across the Agency. My thanks to everyone for making us all look so smart.

"WHILE ANNIVERSARIES ONLY ROLL AROUND EVERY FEW YEARS, ONE OF THE CONSTANTS OF HISTORY PROGRAM LIFE IS THE PRODUCTION OF QUALITY NASA HISTORIES. I'M PARTICULARLY PROUD OF OUR LATEST RELEASE: *BEYOND EARTH: A CHRONICLE OF DEEP SPACE EXPLORATION, 1958–2016* BY ASIF SIDDIQI."

While anniversaries only roll around every few years, one of the constants of history program life is the production of quality NASA histories. I'm particularly proud of our latest release: *Beyond Earth: A Chronicle of Deep Space Exploration, 1958–2016* by Asif Siddiqi. This is an update of the essential reference document *Deep Space Chronicle*. Much has happened in planetary exploration since Dr. Siddiqi wrote *Deep Space Chronicle* in 2001. This new book not only fills in the missions over the last decade-and-a-half, but also updates and corrects the entries from the original work. Much of what you see on the Internet about planetary missions was directly lifted from *Deep Space Chronicle* and I fully expect that *Beyond Earth* will become the new essential reference source for planetary missions. Not only is it a great resource, but the cover design, donated by artist Ariel Waldman, is unique and exciting. We could only afford to print 1,000 copies, so if you feel the need for flipping pages when finding data let us know soon. Those of you who like the convenience of computer searching, the PDF and two e-Book versions are available for download—free—on the NASA e-Books site at ***http://www.nasa.gov/ebooks***. I know that you will find *Beyond Earth* both beautiful and useful. And we have more books coming your way in 2019.

Finally, I can't finish this without taking a few lines to sing the praises of our interns. This fall Will McCormick, a Ph.D. candidate at Oklahoma State University, juggled a job and his beautiful family in Oklahoma while serving here as a member of our team. I'm not sure when he slept, but it certainly wasn't on the job. His internship with us was relatively short, but he made major contributions. Rachel Carollo, a senior at the University of Colorado Boulder, brought boundless enthusiasm and some killer organizational skills to bear this fall. Her spreadsheet skills made easy work for the rest of us in organizing the Apollo Dialogues workshop in December. We owe a huge debt of gratitude to the both of them for a great fall 2018. Thanks and good luck in the future—although neither of you will need luck with the dedication and skills you demonstrated here.

AMES RESEARCH CENTER (ARC)

Moffett Field, California

By Layne Karafantis and April Gage

In the midst of celebrating 60 years since the creation of the National Aeronautics and Space Administration, the Ames History Office and the Center's Office of Communications have been gearing up to pay tribute to Project Apollo, which landed the first people on the Moon in 1969. Research at Ames in support of Apollo was wide-ranging, and included theoretical and practical work on the teardrop shape of the Apollo command module and its thermal protection system, key elements of the Apollo guidance computer, and Moon sample analysis that yielded insights about Earth's only permanent natural satellite.

Ames' contributions to the American spaceflight program began more than a decade before the first crewed Apollo missions, and even well before the creation of NASA in 1958. Aeronautical engineer (and later Ames Center Director) Harvey Julian Allen pioneered the "blunt body concept," which enabled the successful atmospheric reentry of orbiting spacecraft. In the early 1950s, some rocket engineers were focused on creating the launch vehicles necessary to send an object, such as a ballistic missile, out of our atmosphere. Others, such as Allen, concentrated their efforts on determining how these projectiles might safely return from these heights, given the intense heat caused by atmospheric friction that they are subjected to as they race back toward Earth. While his contemporaries attempted to break the sound barrier, Allen and others at Ames considered how we might cross the thermal barrier. It had long seemed intuitive that a pointy nose cone on a vehicle would best mitigate aerodynamic drag and avoid heating due to friction, but in 1951 Allen suggested that the amount of extreme heat that would be absorbed by a returning craft could be lessened if its nose were blunt, which would strengthen the bow shock wave and increase the pressure drag.

When Ames Aeronautical Laboratory, which had been operating since 1939 as a part of the National Advisory Committee for Aeronautics (NACA), became part of NASA in 1958, new facilities were built at Ames Research Center that would validate the thermal and aerodynamic components of Allen's blunt body theory. The hypervelocity research laboratory used tunnels that tested the effects of extreme speeds from Mach 10 to Mach 25. Research efforts increased in the 1960s, in support of NASA's mission to send humans to the Moon and return them safely to Earth. The Ames Hypervelocity Free-Flight Facility (HFF) opened in 1965, which is where every vehicle in America's space program has since been tested for flight stability at reentry velocities. The Center soon complemented this facility with a number of arc jets, a type of wind tunnel in which ablative materials are tested to determine melting characteristics (among other aspects) found during atmospheric reentry. Research conducted in these arc jet tunnels informed the design of an ablative heatshield that was used on the Apollo command module capsules. Today's Ames Arc Jet Complex continues to provide testing facilities for research in thermal protection materials, vehicle structures, aerothermodynamics, and hypersonic entry.

> **"AMES' CONTRIBUTIONS TO THE AMERICAN SPACEFLIGHT PROGRAM BEGAN MORE THAN A DECADE BEFORE THE FIRST CREWED APOLLO MISSIONS, AND EVEN WELL BEFORE THE CREATION OF NASA IN 1958."**

The design of Apollo spacecraft systems also benefited from the work of Ames scientists and engineers. Stanley Schmidt extended the Kalman linear filter—a statistical technique for correcting trajectories—by combining this approach with optical measurements

of stars and data about the motion of a spacecraft. Schmidt's contribution provided the accuracy needed for NASA to place a capsule into orbit around the Moon. Later called the Kalman-Schmidt filter, this innovation was embedded in the Apollo guidance computer and eventually became part of all air navigation systems. Ames would go on to serve as the peer reviewer and primary internal critic for the Apollo guidance computer. Human factors research at Ames also assisted the Apollo missions. Work in flight simulators led to the development of backup methods that Apollo astronauts would use if systems failed. The Ames navigation simulator showed how an astronaut might use a sextant to navigate using the stars, while research with a five-degrees-of-freedom simulator and centrifuges demonstrated how an astronaut might manually navigate a reentry into Earth's atmosphere.

Once the Apollo astronauts began returning with lunar samples, Ames scientists analyzed the composition of these materials. Upon determining their carbon chemistry, they concluded that the samples did not contain life, which led to their further discovery that the Moon was being constantly bombarded with solar wind and micrometeorites, allowing for a better understanding of lunar weather and the Moon environment. Ames space scientists studied the Moon's composition and the properties of its magnetic fields with special magnetometers to learn about the Moon's geophysics and geological history. NASA used this magnetometer data to develop a satellite, Explorer 35, which mapped permanent lunar magnetic fields. Applications of this technology extended well beyond the Moon, enabling exploration of magnetism in other planets and moons in our solar system.

The History Office at Ames looks forward to continuing to share stories from the Apollo era. We also hope to engage local institutions and support other commemorative efforts. For one example, the USS Hornet Museum in Alameda, California, is planning a number of events in celebration of the Apollo 11 Moon landing, as part of a program they have labeled Splashdown 50. A critical decision that shaped the entire Apollo Program was NASA's choice to recover space capsules from water landings, which allowed for reduced weight and complexity of spacecraft. The USS Hornet, an aircraft carrier now docked at the former Naval Air Station Alameda, had a long and distinguished naval career between 1943 and 1970, but one of its proudest accomplishments came at the tail end of its service, when it was designated the Prime Recovery Ship (PRS) for the Apollo 11 and 12 command modules. The Hornet and its U.S. Navy crew not only retrieved the modules and their astronauts, but supported the quarantine process by devising disinfecting agents and providing Biological Isolation Garments (BIG suits) that encased astronauts during the trip from a recovery helicopter to the ship (during Apollo 11, after which NASA switched to flight suits, respirators, and special sneakers). They also furnished a Mobile Quarantine Facility that housed astronauts, soil samples, personal items, and other equipment while in transit from the splashdown site in the Pacific to the Lunar Receiving Laboratory at Johnson Space Center. This facility, a 1969 Airstream trailer, is currently on display at the USS Hornet Museum. We look forward to coordinating our efforts with this neighboring institution and assisting with its Splashdown 50 events.

GLENN RESEARCH CENTER (GRC)

Cleveland, Ohio

By Anne Mills

Glenn Research Center is pleased to announce the publishing of our new historic facility Web site! It can be found at the following link: ***https://www1.grc.nasa.gov/historic-facilities***. Information about Glenn's facilities that have been part of historic mitigation projects is now consolidated into one site. Visitors can learn more about the Altitude Wind Tunnel, the Propulsion Systems Laboratory, the Plum Brook Rocket Systems Area, and the Special Projects Lab. There is also information about the GRC History Office and the Historic Preservation Program. Many thanks go to archivist Bob Arrighi for making this project a success!

First Man director Damien Chazelle (left) and Mark Armstrong (center) review a flight log book from the NASA Glenn Research Center archives where Neil Armstrong's early flights were recorded.

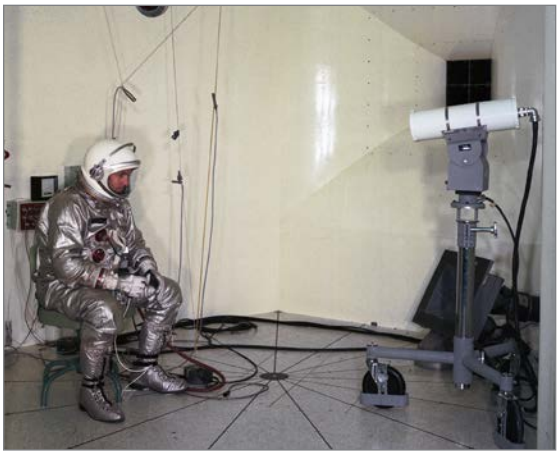
The History Office has supported several special events surrounding the premiere of the Neil Armstrong biopic *First Man*. Glenn Research Center has a special connection with Neil Armstrong as the place where he first started his NASA career. At that time, GRC was known as the National Advisory Committee for Aeronautics Lewis Flight Propulsion Center. Armstrong worked here from February to July of 1955 as a research pilot, flying icing research missions. Also prominently featured in the film was the infamous "gimbal rig"—a facility located at Lewis. Space history buffs may already know that only Mercury astronauts trained in this facility—not Gemini or Apollo crews. While not entirely historically accurate, it certainly made for great entertainment! GRC participated in two special sneak-previews of *First Man*. History Officer Anne Mills made a presentation on the GRC connection to Neil Armstrong. Also making a special appearance were film director Damien Chazelle, and Mark Armstrong—son of Neil Armstrong. Chazelle and Armstrong also toured the NASA Glenn Visitor Center at Great Lakes Science Center, where they were shown the flight log from the Glenn archives that included Armstrong's flights.

JET PROPULSION LABORATORY (JPL)

Pasadena, California

By Julie Cooper

The Jet Propulsion Laboratory has played a significant role in the robotic exploration of Earth, the Moon, our solar system, and beyond, including operation of the Deep Space Network. However, it's not widely known that JPL also supported the Apollo program, contributing to the collection of scientific and technical information that made it possible for astronauts to journey safely to the Moon and successfully explore it.



In December 1964, hearing tests were conducted in the acoustic reverberation chamber of JPL's Environmental and Dynamic Testing Laboratory. The tests verified that Apollo astronauts could hear an audio warning tone above the noise generated by the huge Saturn C5 launch vehicle.

Groups of Apollo astronauts periodically visited JPL to look at photographs of the lunar surface. In July 1966, the head of the Materials Research Section provided images recently received from Surveyor 1. This information reduced concerns about rocks, dust, or terrain that might make it impossible to safely land, walk, drive, or take photographs on the surface of the Moon.

The Solar Wind Spectrometer (SWS) was designed and tested by JPL. It detected and measured solar plasma that reached the surface of the Moon and transmitted the data to Earth. The first one was deployed during Apollo 12 on 19 November 1969. The next day, after the Lunar Module (Intrepid) left the Moon to rejoin

Left to right: Dr. Leonard Jaffe; tour guide Barney Huber; and astronauts Al Worden, Ken Mattingly, and Jack Swigert.

In this 1967 photo, an astronaut practiced removing the Solar Wind Spectrometer from its container and deploying it.

JPL developed a prototype rock-breaker/can-sealer to handle lunar rocks.

the Command Module and the dust had settled, the SWS was turned on and sensor covers opened. It was not turned off until 15 January 1977.

JPL also developed a rock-breaker/can-sealer to handle lunar rocks. A glove box operator would put the lunar sample in place and the device's rock-breaker attachment could apply up to 16 tons of pressure to split the rock into a manageable size. With a change to the can-sealer attachment, the device could then seal the sample in a round metal can. The samples were then sent to scientists around the United States for analysis. The rock-breaker/can-sealer device needed to be self-contained, hand operated, and have no power source or hydraulic components. It had to fit in a 12-inch cube, be easily moved and disassembled, and made of aluminum and stainless steel so that it would not contaminate the lunar samples. Two of these devices were delivered to the Lunar Receiving Laboratory at the Manned Spacecraft Center (now Johnson Space Center) so that tests could be run before the launch of Apollo 11 in July 1969.

JOHNSON SPACE CENTER (JSC)

Houston, Texas

By John Uri

For three days in August, the JSC History Office hosted the 2018 Annual NASA History Program Review at the White Sands Test Facility in Las Cruces, New Mexico. We want to especially thank our hosts at White Sands for all their efforts in planning for the meeting and their outstanding support and hospitality during the event. The venue, the great speakers, and informative tours made the review a great success.

We continue to expand our extensive oral history collection. Jennifer Ross-Nazzal and Sandra Johnson completed all the planned interviews in fiscal year (FY) 2018 for three projects: the JSC Oral History Project, NASA Headquarters, and the NASA Science Mission Directorate. They also conducted a series of interviews with members of the team who performed the cryogenic thermal-vacuum testing of the James Webb Space Telescope here at JSC in 2017.

Early in FY 2019, they will close out an interview series with several key NASA leaders: Lesa Roe, Robert Lightfoot, Mike Hawes, and Scott Hubbard. The transcripts of the interviews will be uploaded to the JSC History Portal once the subjects have approved them for release.

Sandra responded to a series of ongoing requests for oral history audio from filmmakers working on projects for the National Geographic Channel, the Smithsonian Channel, C-SPAN, and a variety of other independent film and production companies, as well as a playwright working on a production about former NASA computer and mathematician Annie Easley. Most of these requests are related to projects in work for upcoming Apollo anniversaries.

Our JSC Historian, Jennifer Ross-Nazzal, supported the recently released motion picture, *First Man*, by providing answers for historical accuracy as the filmmakers worked through the filming and final editing process. Also, in recognition to the amount of time she spent with the support effort, her name appears in the credits at the end of the film. Jennifer was also asked to participate in two recent events. On 25 September, she gave the opening lecture of an eight-lecture series

JSC Historian Jennifer Ross-Nazzal presenting a lecture at Rice University as part of the Women in Space lecture series (top). Image credit: NASA/John Uri. Jennifer Ross-Nazzal during a Q&A session with film producer Rory Kennedy after a showing of her film *Above and Beyond: NASA's Journey to Tomorrow* at JSC (bottom). (Credit: NASA/Bill Stafford)

titled "Women in Space," sponsored by the Glasscock School of Continuing Education at Rice University in Houston. During the invited lecture, Jennifer spoke about the experiences of women at JSC. On 4 October, Emmy-winning filmmaker Rory Kennedy (daughter of the late Senator Robert F. Kennedy) was at JSC for a showing of her Discovery Channel film *Above and Beyond: NASA's Journey to Tomorrow*. Jennifer led the Q&A with Rory after the showing.

In recognition of upcoming significant space anniversaries, the JSC History Office is working with the JSC External Relations Office on a continuing series of articles posted on the nasa.gov Web site and JSC's Facebook and Twitter accounts. Abstracts of the articles appear online in JSC's Roundup Today. The features highlight the anniversaries of less celebrated events and people that were nevertheless crucial to achieving the Moon landing within President Kennedy's timetable. We recently passed a milestone by publishing the 100th Web article since the series began in August 2017.

The JSC History Office continues its effort to publish Ross-Nazzal's book *Making Space for Women*, in collaboration with the JSC University Research, Collaboration and Partnership Office. The manuscript is currently undergoing peer review at Texas A&M University Press.

John Uri attended the 79th annual meeting of the American Association for State and Local Historians (AASLH), held 26–29 September in Kansas City, Missouri. Although the conference was not geared toward space history, several of the breakout sessions provided useful information for JSC History Office activities, such as social media outreach. It was also an excellent networking opportunity.

The History Office team is working to relocate the current JSC History Portal and the heritage Shuttle-Mir Web site to space on another server, where they will be supported and protected for the foreseeable future. Also, over the last year, a series of interns have been tasked with upgrading the look and feel of the History Portal, and the changes will provide the History Office with easier control over content updates as well as a more modern format. We hope to complete both projects look soon.

STENNIS SPACE CENTER (SSC)

Stennis Space Center, Mississippi

By Jessica Herr

In 1966, Mississippi's Stennis Space Center (SSC) started the impossible: testing the rockets that would send humans to the Moon. In 1969, the first humans stepped onto its surface. Then, in 1975, SSC took the knowledge and expertise from the Apollo era and brought it to the reusable, efficient Space Shuttle Main Engine. In 1981, Space Shuttle Columbia launched. The Shuttle missions expanded our time in space, allowed us to study the effects of long-duration space travel on people and equipment, and supported the experiments on the International Space Station about how humans can live and work in space.

Closeup of RS-25 engine testing. (Credit: Aerojet Rocketdyne)

In 2015, SSC fired up the RS-25 engines for the Space Launch System (SLS). These rockets will propel humans beyond the Moon and into deep space. The first test of the RS-25 occurred on 9 January 2015. Four engines will be in the SLS core stage. These engines will run at a higher pressure and the propellant will be cooler than on the engines of the Space Shuttles. NASA is on its way back to the Moon and onward to Mars—something that once was thought as impossible as putting human footprints on the Moon.

"THESE ENGINES WILL RUN AT A HIGHER PRESSURE AND THE PROPELLANT WILL BE COOLER THAN ON THE ENGINES OF THE SPACE SHUTTLES. NASA IS ON ITS WAY BACK TO THE MOON AND ONWARD TO MARS—SOMETHING THAT ONCE WAS THOUGHT AS IMPOSSIBLE AS PUTTING HUMAN FOOTPRINTS ON THE MOON."

OTHER AEROSPACE HISTORY NEWS

AMERICAN ASTRONAUTICAL SOCIETY (AAS) HISTORY COMMITTEE

Michael Ciancone, Chair

2018 Ordway Award for Sustained Excellence in Spaceflight History

The Ordway Award is named in memory of Frederick I. Ordway III (1927–2014), a 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 non-print media. The award is managed by the History Committee of the AAS.

The recipients of the 2018 Ordway Award are as follows:

- **Dennis R. Jenkins** is recognized for sustained excellence in documenting aviation and space history and in making U.S. aerospace achievements accessible to the public.
- **Ron Miller** is recognized for sustained excellence in the field of space art and offering a tantalizing glimpse of the future.
- **Miles O'Brien** is recognized for sustained excellence in journalism through his coverage of spaceflight activities.

THE AAS EMME SELECTION PANEL

Don Elder, Chair

2017 Emme Award for Astronautical Literature

The AAS Emme Selection Panel has been busy this past summer reviewing titles submitted for this award. After careful consideration, the panel has selected the following recipient of the 2017 Emme Award as follows:

Neil M. Maher, *Apollo in the Age of Aquarius* (Cambridge, MA: Harvard University Press, 2017).

FROM "ONE GIANT LEAP FOR MANKIND" TO A SET OF AMAZING WEB RESOURCES: THE APOLLO LUNAR SURFACE AND FLIGHT JOURNALS

by Stephen Garber, Colin Fries, Ken Glover, and David Woods

On the occasion of the upcoming 50th anniversary of the Apollo 11 mission, it is worth calling attention to a set of special resources that the NASA History Division proudly maintains: the Apollo Lunar Surface Journal (ALSJ) *http://history.nasa.gov/alsj/* and the Apollo Flight Journal (AFJ) *http://history.nasa.gov/afj/*. Almost 30 years ago, while working at the Los Alamos National Laboratory, Eric Jones began poring over air-to-ground transcripts from the Apollo missions and sat down with Jack Schmitt of Apollo 17 to correct, annotate, and generally understand what these technical conversations signified. After a number of sessions, Schmitt agreed that the ALSJ promised to be worthwhile and wrote to the other moonwalkers urging their participation. All but two joined the project. From these humble roots, the ALSJ has grown into an encyclopedic, authoritative record of what happened while 12 astronauts walked on the Moon.

In 1996, the NASA History Division began hosting the ALSJ on our Web site, with Eric as the editor. Over time, Ken Glover in Canada joined Jones as co-editor of the ALSJ. Eric Jones retired to Australia in 1999 and kept up his ALSJ work without missing a beat. Amazingly, Jones and Glover have overseen the work of hundreds of volunteers who have contributed to the report in myriad ways.

And this is the crux of the journals: teamwork. Jones has kept the focus on the missions and on being as thorough and accurate as possible. This has led to a virtuous cycle, in which so many of the relevant astronauts and so many dedicated volunteers from around the world have joined forces to make the journals so outstanding.

In the mid-1990s, after volunteering to scan and format some hard-copy NASA History books for our nascent NASA History Web site (this was before the advent of pdfs!), David Woods in Scotland was inspired by the ALSJ to come up with the idea of a companion site covering what happened on the Apollo astronauts' journeys to and from—rather than on the surface of—the Moon. Thus, the AFJ was born.

The ALSJ and AFJ have proved to be invaluable resources for both NASA employees and the general public to learn about the historic Apollo program. They are consistently top-ranked among the many NASA Web sites, tallying millions of visitors each month. The amount of data they comprise can be staggering: tens of thousands of pages and untold gigabytes of text, audio, and video files. Even before the concept of knowledge management became widespread, the journals and their editors were incredible storehouses of raw data and analysis regarding the who, what, where, when, how, and why of the Apollo missions.

ERIC JONES

I grew up in the 1950s, reading a great deal of science fiction, starting with the Tom Corbett series but soon graduating to Heinlein, Asimov, Clarke, and others. I was also fascinated by the von Braun articles in *Collier's* magazine and by the Disney TV programs based on them. Later on, I became interested in the question of how a lunar science base might

evolve into a permanent lunar settlement and, in 1986–87, embarked on a two-part sabbatical from Los Alamos, spending time in Melbourne, Australia, and Anchorage, Alaska, reading economic history in search of insights. British explorer Captain James Cook is an important historical link between Australia and Alaska, and I read 20th century editions of his journals created by New Zealand historian J.C. Beaglehole. At some point after my return from Anchorage, I realized that I needed to understand what was involved in getting work done on the Moon. I visited NASA Johnson, where I was introduced to the transcripts of the air-to-ground communications between the Apollo crews and the flight controllers in Houston.

Then, because Apollo 17 scientist-astronaut Jack Schmitt lived in Albuquerque—only 2 hours away from Los Alamos—and was a frequent visitor to the Laboratory, I was able to arrange a bit of time with him to ask about his lunar experience and to talk to him about my first ideas about what would become the ALSJ. He was interested, and, after I acquired both audio tape copies of the air-to-ground communications and photocopies of the transcripts, we began meeting at his office in Albuquerque to talk about what was going on during Apollo 17 lunar surface operations. He was very patient in the face of my ignorance and has been very supportive over the years.

139:57:46 Duke: Hey, is it Friday or Saturday down there?

139:57:51 England: You know, I had to think about that last night. In fact, I had to ask Kathy. It's Saturday.

139:57:56 Duke: Okay; thank you. Saturday morning?

139:58:01 England: Rog. It was a nice, humid, but sunny morning when I came in.

139:58:09 Duke: Good show. What is your GET (Ground Elapsed Time) now?

139:58:13 England: Say again, Charlie?

139:58:19 Duke: (Speaking very slowly) What is the present GET? Over.

139:58:24 England: Okay, it's about 10 minutes 'til eight in the morning.

139:58:34 Young: (Lecturing) GET; Ground Elapsed Time.

Excerpt from the annotated Apollo 16 transcript showing astronaut Charlie Duke talking with Ground Control following wake-up procedures on the day of the mission's second extravehicular activity. The page can be accessed at the Apollo Lunar Surface Journal at *https://www.hq.nasa.gov/alsj/a16/a16.eva2wake.html*.

As an additional note: During the mission review sessions for Apollo 15 that Dave Scott and I did in the early nineties, we had fun talking about some of the names he, Jim Irwin, and Capcom Joe Allen chose for craters and other features at the Hadley landing site—names honoring the work of some of the science fiction/fantasy authors I had read: Durin's Bridge (Tolkien), Rhysling (Heinlein), Earthlight (Clarke), and Dune (Frank Herbert).

KEN GLOVER

I've been fascinated by Apollo ever since I was a small boy, in the same era that the lunar missions took place. I would voraciously read anything about Apollo that I could get my hands on, continuing right through into adulthood, when the Internet joined books, newspapers, and magazine articles as a source of information about Apollo. In about 1995 I discovered the Apollo Lunar Surface Journal Web site and began devouring all that it had to offer. Eric Jones—who, in spite of our geographical separation, would eventually become my very close friend—very kindly and patiently responded to my initial correspondence, answered my questions, and encouraged me to submit lists of comments, suggestions, and typos. Ever since those first days, I am proud to have contributed to both the ALSJ and the AFJ, and to have had the opportunity to interact with many dedicated journal contributors from around this increasingly small world.

DAVID WOODS

As each major anniversary of Apollo 11 came around, my childhood fascination with the program was reignited and fanned. Twenty, then twenty-five years arrived, each bringing new sources of information and greater tales to tell. Just prior to the 25th anniversary, the Internet arrived in my house, and, like everyone who uses this modern marvel, I gravitated to what interested me. A Usenet group, sci.space.history, was a common haunt and I lurked there, amazed at the breadth of knowledge to be found. One day, someone posted about a Web site that held much of the transcript of Apollo 17's exploration of the lunar surface,

and so I was introduced to the rapidly expanding Apollo Lunar Surface Journal. I could barely believe that such a rich resource would be available for free, especially considering that the core text was annotated with well-written explanations from its author and comprehensive recollections from most of the crewmen who visited the Moon.

The ALSJ's editor, Eric Jones, proved to be a tactful, patient, and engaging man who welcomed the input of outsiders if he considered it useful to the journal's mission. I threw my oar in, slowly cranking up my involvement to the point that I scanned NASA History books for the Web. But the journal lacked something I craved. I wanted to know about the flying portions of the Apollo missions, not just their time on the surface. I suggested to Eric that I attempt an "Apollo Flight Journal." To my astonishment, he put me in touch with David Scott, commander of the Apollo 15 mission, who proved eager to help with the accurate dissemination of Apollo's history.

I chose to tackle a flight journal for Apollo 15 first, partly because of Scott's contributions, but also because Apollo 15 was as good an example of an advanced Apollo mission as you could hope to find. If I only ever got to do one mission for the AFJ, this was a good one to do. In 1998, its first pages began to trickle out and soon I began to see the same volunteering spirit be attracted to the AFJ as had assisted with the ALSJ. People from around the world offered help and sent lists of typos. Some folk took their involvement far, creating complete journals of some of the flights which came via me to the site.

The most astonishing aspect of the AFJ for me has been its use as a reference across a much wider cultural spectrum than I ever imagined. I've seen it being credited in books, television documentaries, rock music albums, and, most recently, a major motion picture. It is for this reason that although the journal helped to divert me into being an author, my energies have returned to working to advance its content as far as I can.

"I COULD BARELY BELIEVE THAT SUCH A RICH RESOURCE WOULD BE AVAILABLE FOR FREE, ESPECIALLY CONSIDERING THAT THE CORE TEXT WAS ANNOTATED WITH WELL-WRITTEN EXPLANATIONS FROM ITS AUTHOR AND COMPREHENSIVE RECOLLECTIONS FROM MOST OF THE CREWMEN WHO VISITED THE MOON."

STEVE GARBER AND COLIN FRIES, NASA HISTORY WEB CURATORS

The journals are remarkable in multiple ways. What other Federal agency utilizes the incredible capacity of volunteer "citizen scientists" (even before this term became in vogue) and "citizen archivists," let alone people literally oceans away? How many other such volunteers manage the efforts of hundreds of other volunteers in turn? What Government-hosted Web sites are comparable in terms of the sheer breadth and depth of their scope on a particular topic, while remaining accessible to lay researchers, technical specialists, journalists, and historians?

While NASA has accomplished great technical achievements, it's always been about the people. Fittingly, in the case of the journals, it's been a true privilege for us to work with Eric, Ken, and David and we hope to continue this partnership for many years to come. We have no compunctions about referring difficult Apollo questions to these three gentlemen, who are true experts. More importantly, they are unfailingly easygoing, cooperative, polite, helpful, generous, and grateful for whatever help we can provide, while they do the enormous lion's share of the work. They embody the best of both teamwork and leadership. They make us realize the possibilities of what can be accomplished with the right people with amazing skills and terrific attitudes.

THE HERO'S JOURNEY IN THE FILMS *STAR WARS* AND *2001*

By Colin Fries, NASA HQ Archivist

The Millennium Falcon with C3PO running in the background (Credit: From the collection of Frederick I. Ordway, III.)

The labels *hero, antihero*, and *superhero* are tossed about loosely in our popular culture, but what is the essence of heroism really? The landmark study, *The Hero with a Thousand Faces* by Joseph Campbell, who lived from 1904 to 1987, provides us with an answer that has influenced many creative artists including film directors Stanley Kubrick and George Lucas. Campbell was a professor of literature at Sarah Lawrence College in New York and specialized in comparative mythology and comparative religion.

According to Campbell, all myths are rooted in shared archetypal energies or the collective unconscious throughout human cultures and times. These archetypes manifest in myths that represent templates for how to live an "authentic" life. To achieve this, to reach one's true potential and expand consciousness, the individual must avoid the distractions that plague everyone who dwells on this plane of existence, e.g., fame, power, enslavement of will to others, and the lure of materialism.

The hero's journey is the "monomyth" with elements common to all the others. It begins with a call to adventure, which yanks the individual from the ordinary world into the supernatural or contact with a higher power. He or she may at first be reluctant, feeling that he or she is not up to the task. Then a mentor or guide provides the inspiration to accept the challenge. The individual then crosses the threshold and is tested by enemies, traps, or dangers that must be overcome to return with the boon for the ordinary world. He or she may be physically resurrected as a result of trials or perhaps be cleansed and psychologically reborn from a close encounter with death or with the supernormal. The prize may be a magical talisman, a solution to a problem (such as freedom for the hero's people), or it may be a new perspective. Whatever it is, the hero's society will never be the same.

One of the obstacles to becoming an authentic human being is an oppressive government. One of Campbell's favorite myths, *Theseus and the Minotaur*, is a case in point. In order to solidify his power as king, Minos of Crete was required to sacrifice a bull to pay homage to the gods. Poseidon, his patron god, provided one from his own herd, but Minos, in his hubris, kept the divine animal and substituted a bull from his own herd for the sacrifice. As punishment, Poseidon cursed Pasiphaë, Minos's wife, to fall in love with the bull. The result of this union was the Minotaur, a

monster with the head of a bull and the body of a man. The labyrinth, built by the architect Daedalus, became its home. The horror was magnified as Minos decreed that the Minotaur would be fed young men and women from Athens as tribute. Minos's tyrannical rule dragged on until the Athenian hero Theseus heard the call to slay the monster. With the help of Daedalus and the king's daughter Ariadne, Theseus freed his people from the evil tyrant and also got the girl!

According to Campbell, ancient kings followed the practice of sacrificing themselves after seven years or at the end of their rule. By defying tradition and displaying hubris before the gods, Minos became the tyrant that Campbell terms "Holdfast." The Holdfast is the prototype for all future despots—Galactic emperors included.

After George Lucas finished reading Campbell's *Hero* in early 1977 he typed up a nine-page treatment for what he first called *The Empire Strikes Back*. It was a tighter version than his first attempt at outlining Star Wars: "*Intimate that a rewarding, good life is within one's reach despite adversity, but only if one does not shy away from the hazardous struggles without which one can never achieve true identity,*" he wrote in his notes.[1]

Campbell, in conversations with journalist Bill Moyers in the series The Power of Myth, which aired on PBS a few months after his death in 1988, explained how the universal hero's journey could still be relevant to modern daily life and culture:

> Lucas and Campbell had become good friends after the filmmaker, acknowledging a debt to Campbell's work, invited the scholar to view the Star Wars trilogy. Campbell reveled in the ancient themes and motifs of mythology enfolding on the wide screen in powerful contemporary images. On this particular visit, having again exulted over the perils and heroics of Luke Skywalker, Joe grew animated as he talked about how Lucas 'has put the newest and most powerful spin' to the classic story of the hero.
>
> "And what is that?" I [Moyers] asked.
>
> "It's what Goethe said in Faust but what Lucas has dressed in modern idiom– the message that technology is not going to save us. Our computers, our tools, our machines are not enough. We have to rely on our intuition, our true being."
>
> "Isn't that an affront to reason?" I said. "And aren't we already beating a hasty retreat from reason, as it is?"
>
> "That's not what the hero's journey is about. It's not to deny reason. To the contrary by overcoming the dark passions, the hero symbolizes our ability to control the irrational savage within us…and Luke Skywalker was never more rational than we found within himself the resources of character to meet his destiny."
>
> "…The ultimate aim of the quest must be neither release nor ecstasy for oneself, but the wisdom and power to serve others." One of the many distinctions between the celebrity and the hero, he said, is that one lives only for self while the other acts to redeem society.

"AFTER GEORGE LUCAS FINISHED READING CAMPBELL'S *HERO* IN EARLY 1977 HE TYPED UP A NINE-PAGE TREATMENT FOR WHAT HE FIRST CALLED *THE EMPIRE STRIKES BACK.*"

1 Brian J. Jones, *George Lucas: A Life*, (New York: Brown and Company, 2016), 263.

> "…the Force moves from within. But the force of the Empire is based on an intention to overcome and master. Star Wars is not just a simple morality play, it has to do with the powers of life as they are either fulfilled or broken and suppressed through the action of man."[2]

In a later discussion with Bill Moyers, Lucas explained Campbell's influence on his work:

> Well, when I did "Star Wars" I consciously set about to recreate myths and the—and the classic mythological motifs. And I wanted to use those motifs to deal with issues that existed today…Joe Campbell, who asked a lot of the interesting questions and exposed me to a lot of things that made me very interested in a lot more of the cosmic questions and the mystery. And I've been interested in those all my life, but I—I hadn't focused it the way I had once I got to be good friends with Joe…Well, there's a—again, a mixture of all kinds of—of mythology and religious beliefs that have been amalgamated into the movie, and I've tried to take the ideas that seem to cut across the most cultures, because I'm fascinated by that and I think that's one of the things that I really got from Joe Campbell, was that—what he was trying to do is find the common threads through the various mythology, through the—the religions.[3]

When Darth Vader/Anakin Skywalker is unmasked, he is no more than a machine man. Despite formerly wielding immense power, he is in essence no more than an unformed being:

"He has not developed his own humanity. He's a robot. He's a bureaucrat living not in terms of himself, but in terms of an imposed system."[4] If you cannot find a way to use the system to attain your human purpose, the system will smash you. All tyrannical regimes operate this way. It is King Minos once more.

Mythology is also the underpinning of the film, *2001: A Space Odyssey.* When Arthur C. Clarke and Stanley Kubrick began their collaboration in 1964, they sought to incorporate parallels to the Homeric epic. Odysseus was the famed Greek bowman who was the only living mortal able to string his bow, the bow of Apollo. After his ordeal, which included defeating the Cyclops Polyphemus, he returned home to Ithaca to dispatch his wife's suitors, who presumed him dead. So, in a nod to the epic, the protagonist of *2001: A Space Odyssey* was named Dave Bowman. His nemesis was the computer HAL 9000, which had a Cyclopean single glowing eye. Designed to be the crew's guide and benefactor, its initial working name was Athena, the patron goddess of Odysseus.

Kubrick and Clarke also intended to examine the nature of all human myths in their film. This invariably led Kubrick to delve into the influential *The Hero With A Thousand Faces*. He quoted a passage to Clarke about the nature of the hero's journey that Campbell had outlined as "separation-initiation-return." They also referenced Nietzsche's *Also sprach Zarathustra*, in which humankind is referred to as a transitional species. They viewed mythology as a template. The entire species was on a hero's journey from "ape to angel" as Clarke expressed it.[5]

The plot points of the film shifted slightly as the years stretched on, but the core ideas remained. Kubrick's perfectionism dominated the creative process and Clarke contributed from time to time. The finished work can be interpreted as mainly Kubrick's take on late-20th century human progress. The alien monoliths

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2 Joseph Campbell and Bill Moyers, *The Power of Myth* (New York: Anchor, 1991), xiii-xiv, 179.

3 BillMoyers.com Staff, "The Mythology of 'Star Wars' with George Lucas," June 18, 1999, *https://billmoyers.com/content/mythology-of-star-wars-george-lucas/*, accessed November 21, 2018.

4 Campbell and Moyers, 177–178.

5 Michael Benson, *Space Odyssey: Stanley Kubrick, Arthur C. Clarke, and the Making of a Masterpiece*, (New York: Simon & Schuster, 2018), 3.

at the end of the "Dawn of Man" sequence provided the spark that led to advanced tools: machine marvels such as Space Stations, Space Shuttles, computers, and lunar bases. Nevertheless, something was missing in the mix; the recipe lacked a key ingredient. The species had hit a dead end and they knew it. To express this idea, Kubrick limited the dialogue in the film to a bare minimum. When we do hear it, it sounds flat and matter-of-fact. Human behavior had become routinized and attuned to the cosmic dance tempo of its sophisticated tools. The species was compelled to seek the next evolutionary step and that necessitated investigating the alien signal emanating from Jupiter. So what did they do? They built a better machine to manage the mission and the human crew. HAL 9000 was their greatest achievement—and, ironically, their greatest failure:

> The new name Kubrick and Clarke ultimately settled on compounded two terms, signifying a *H*euristically programmed *Al*gorithmic computer. The terms behind the acronym, and possibly the acronym itself, were originally suggested by Marvin Minsky, cofounder of MIT's Artificial Intelligence Laboratory. "Heuristics are, of course, rules of thumb, tricks or techniques that might work on a problem or often work, but aren't guaranteed," Minsky commented in 1997. "Algorithmic implies inviolate rules, such as, *If A, then B, and A, therefore B*. HAL was supposed to have the best of both worlds. This duality between algorithms and heuristics—between dogmatic rules and interactive, and trial-and-error paths to a solution—already hints at the core conflict that HAL would experience when asked to keep the mission's true purpose from the waking astronauts.[6]

HAL, though artificial intelligence, was also attempting to become an "authentic" entity and achieve a level of creative thought and self-actualization, but because of his rigid algorithmic programming, he suffered

A 1966 photograph from a set during filming of "2001: A Space Odyssey" at the MGM-British studios in Borehamwood, England. (Credit: NASA)

what in human terms would be called a psychotic break. Here again we see the tension between the demands of the state (algorithmic) versus the individual's reach for his true potential (heuristic). HAL became the symbol of the limitations of his creators. Remember how Campbell advised us not to rely on our machines but to shut them down? That is exactly what Dave Bowman did to HAL. Bowman used his intuition to survive HAL's attack. Then and only then was he able to complete his and humankind's mission to become the transcendent being that became known as the "Star Child."

Of course, there have been many other classic and not-so-classic literary works, not directly influenced by Campbell, in which we can see the hero's journey at work. Richard Adams has privately and publicly thanked Campbell for inspiring his fiction. The rabbit hero in his novel *Watership Down* owes his mythic journey to *Hero*. David Byrne, co-founder of the band the Talking Heads, wrote in a 2007 post on his blog: "Seems to me, as with myths and fairy tales, we marvel and get sucked into minor but infinite variations of

6 Ibid, 127.

the same limited set of tales; the Joseph Campbell 'hero with a thousand faces.' How those narratives resonate in our own hearts and minds seems almost genetically predetermined. It's that strong."[7]

The Australian film director, screenwriter, and producer George Miller is another professed disciple of Campbell. He is fond of telling about how an Aboriginal Australian tribe agreed to grant permission to film one of his *Mad Max* movies at one of their sacred sites. Kata Tjuta is a rock formation sacred to the native peoples of the Outback. When Miller described the story of Max, "a hero who sacrifices his self-interest to gain redemption and renewal," they recognized the story as similar to their own traditional stories.

Jerry Garcia of the Grateful Dead acknowledged his debt to Campbell the mythologist, and his bandmates, guitarist Bob Weir and drummer Mickey Hart, became friends with Campbell. As a tribute, the band performed the Hart composition, "The African Queen Meets the Holy Ghost" at a conference they attended with him.[8]

Campbell realized that mythology, too, needs to adapt. It is a guidebook that explains to us who we are as people. We live in a global village with almost instantaneous communication capabilities to anywhere on this planet. In today's world, that mythology is sadly lacking. Campbell speculated on what that new mythology might be:

> When you see the earth from the moon, you don't see any divisions there of nations or states. This might be, the symbol, really, for the new mythology to come. That is the country that we are going to be celebrating. And those are the people that we are one with.[9]

7 *https://davidbyrne.typepad.com/db/page/28/*

8 *Joseph Campbell and the Power of Myth* (DVD and viewer's guide), (Silver Spring, MD: Acorn Media Group Inc.: 2012), 2–4.

9 Campbell and Moyers, 41.

HAND-PAINTED MOONS, ROLLERCOASTERS, AND APOLLO

By Rachel Carollo, Fall 2018 NASA History Intern

Since the founding of NASA in 1958, astronaut training has been a crucial part of operations, making sure they are prepared for advanced spaceflight. In the 10 years leading up to the Apollo 11 Moon landing, much of NASA's resources were allocated toward astronaut training, which includes microgravity training, underwater spacewalk simulations, and the Lunar Landing Training Vehicle (which Neil Armstrong crashed in 1967… oops). In a way, the Gemini missions were NASA's training for the Apollo missions, giving the Agency crucial experience and opportunities to troubleshoot problems with the advanced space operations needed to reach the Moon. One lesser-known training program was built at the Langley Research Center in the early 1960s, and was known as Project LOLA (Lunar Orbit and Landing Approach)

This large-scale training model was designed to teach astronauts to maneuver the lunar lander around the Moon and eventually land. It simulated guiding the spacecraft through the Moon's thin atmosphere, which is one-sixth of that of Earth. This rollercoaster-like apparatus took the collaboration of hundreds of specialists and $2 million to complete. Together with artists, cartographers, and geologists, NASA engineers shaped, built, and shaded geologically accurate scale models of the Moon based on satellite and telescope

images of its surface. The LOLA artists filled in the details on the huge models by hand, and used a special airbrush technique to create the illusion of depth and three-dimensional lunar features.

However, the detailed models were just the beginning, as the apparatus itself had to convincingly simulate the landing procedure in microgravity. In a makeshift cockpit with a closed-circuit television system and various controls, the pilot would maneuver past the four large-scale models that simulated the view from different altitudes upon approach. Familiarity with the surface of the Moon was crucial for navigation to the module's landing site. In addition to the unfamiliar atmosphere, scientists were also concerned that the harsh light reflecting from the Moon's surface could be disorienting for the astronauts. As a result, the simulation took place in a dark room and the models were lit from below with harsh light so that astronauts could experience these conditions. The rollercoaster-like nature of the simulation, coupled with the harsh light, made it a disorienting experience for many astronauts and the program was dismantled a few years into the Apollo missions.

It is estimated that more than 400,000 people were involved in some capacity with the shared goal of landing American astronauts on the Moon, but not all of them were engineers and scientists. Projects like LOLA show how a myriad of professionals contributed to this goal and how people from a diverse spread of backgrounds and careers made it possible to successfully and safely fulfill President John F. Kennedy's vision of landing astronauts on the Moon.

Every person that worked with NASA in those 10 years had an essential role in the historic Apollo missions. Every person who has worked for NASA in the 50 years since then has contributed to the knowledge, innovations and discoveries that bring us closer to understanding our place in the universe. So, here's to 50 more years of discovery for NASA—and hopefully some more space-themed rollercoasters for the rest of us!

Artists used paintbrushes and airbrushes to recreate the lunar surface on each of the four models comprising the LOLA simulator. (Credit: NASA)

Project LOLA. Test subject sitting at the controls. (Credit: NASA)

NASA'S UNIVERSITY RELATIONS IN THE AGE OF APOLLO

By William McCormick, Fall 2018 NASA History Intern

When looking back at Apollo it is easy now to think of Neil Armstrong's small step and humanity's giant leap as inevitable. We know the end of the story and its epic heroes are part of American lore. However, when President John F. Kennedy stood before Congress on 25 May 1961 and committed this nation "to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth" the National Aeronautics and Space Administration (NASA) was only a little more than 2 years old. Alan Shepard's Freedom 7 suborbital flight, which made him the first American in space, had occurred only 20 days before Kennedy's speech. On that day, a successful result was far from inevitable and would require an effort of immense scope. As Kennedy put it, "…in a very real sense, it will not be one man going to the Moon—if we make this judgment affirmatively, it will be an entire nation. For all of us must work to put him there."[1]

President John F. Kennedy meets with NASA Administrator James E. Webb in the Oval Office at the White House. (Credit: Abbie Rowe/White House Photographs/John F. Kennedy Presidential Library and Museum.)

The shared work of Apollo would require that America utilize an aerospace infrastructure that did not have the necessary capacity in 1961. NASA administrator James Webb saw a robust relationship between the Agency and American universities as a crucial driver in expanding that capacity. In explaining NASA's universities relationship to the Bureau of the Budget (BOB) in December 1961, Webb wrote:

> Space science and technology represent frontier areas not now taught as such in universities… NASA needs people highly trained in these areas. These people are needed not only within the NASA organization, but also in the industrial concerns participating in the NASA program… In order to obtain the needed personnel NASA must help provide the universities with resources needed to produce them.[2]

Webb's vision for NASA-university relations was in some ways as revolutionary as Apollo itself. Throughout the decade of the 1960s this relationship would not only support the American Moon race but would be an impetus for the expansion of research facilities across the country and would influence a generation of researchers in the space sciences through a widespread distribution of grants and contracts. Even with such successes as well as the ultimate success of Apollo, Webb's "Sustaining University Program" (SUP) fell short of his even loftier ambitions.

1 John F. Kennedy, "Address to Joint Session of Congress May 25, 1961," *https://www.jfklibrary.org/learn/about-jfk/historic-speeches/address-to-joint-session-of-congress-may-25-1961, accessed November 21, 2018*.

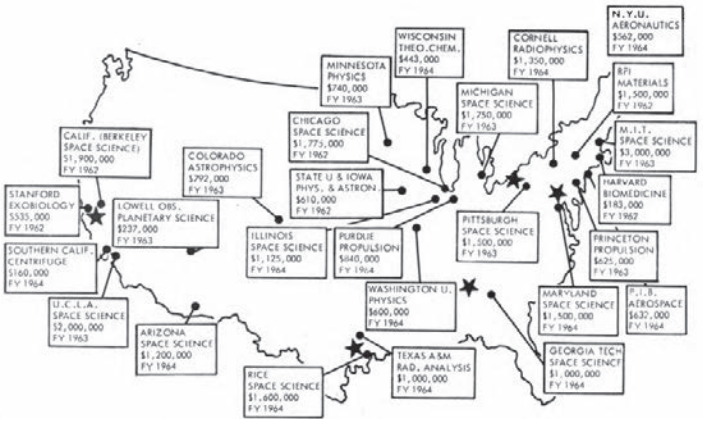
2 W. Henry Lambright and Edwin A. Bock, *Launching NASA's Sustaining University Program* (Syracuse, NY: Inter-university Case Program, 1969), VII–3.

NASA's first administrator, T. Keith Glennan, established the environment in which NASA would pursue President Kennedy's vision and Administrator Webb would establish the SUP. Glennan's approach, one of a lean Federal staffing structure supported by contractors, continues to shape NASA to the modern day, but his focus was not on education relationships in particular. With Webb's arrival and President Kennedy's lunar landing directive, an intentional focus on external relationships with higher education emerged quickly. The Agency undertook a review of the scope of its university programs and determined that in order to meet the pace of scientific development necessary to reach the Moon within the decade that "it was essential that additional steps be taken to enhance the participation of the educational community in the space program."[3]

From this period of self-reflection, the SUP took shape. For much of Webb's tenure, though, it would include characteristics unique to his vision for the role of government and higher education in everyday American life. In the administration of the SUP, Webb cared not only about the impact of the program on Apollo but the philosophical role of universities in economic and social development. Apollo was viewed not just as an end but also as a means. "It served as an arena for a technological race with the Soviet Union for pride and prestige" but also as a mechanism for NASA to invest "in ways that would help the country, including having government work with universities and industry in terms of regional economic development."[4]

The SUP developed along four core trajectories, laid out by Webb in his justification letter to the BOB:

1. project support for individual professors,
2. institutional support for interdisciplinary research projects,
3. trainee programs, and
4. facility grants.[5]



This is a map of investments in Sustaining University Program research facilities as they existed on 1 March 1965. (Credit: NASA)

The SUP endeared itself to the universities by providing funding in general areas of space science and leaving specific research problems to investigators. The program provided continuity of support with a creative step-funding model, another boon to the participating institutions. Members of Congress also appreciated the breadth of trainee programs, generating NASA trainees "in universities and colleges of almost every state of the Union."[6]

By 1965, NASA had also distributed grant funding in support of almost 30 facilities across the country in what would become a lasting legacy of the SUP. The memorandums of understanding that laid out the terms for these grants incorporated Webb's socioeconomic vision.

> Where additional research facilities are urgently needed to conduct such research in support of

3 T. L. K. Smull, *The Nature and Scope of the NASA University Program* (Washington, D.C.: Scientific and Technical Information Division, National Aeronautics and Space Administration, 1965), 6.

4 John M. Logsdon, *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program,* vol. II, External Relationships (Washington, D.C.: National Aeronautics and Space Administration, 1996), 417–18.

5 Lambright and Bock, *Launching NASA's Sustaining University Program*, VII–3.

6 Homer E. Newell, *Beyond the Atmosphere : Early Years of Space Science*, Dover ed. (Mineola, N.Y.: Dover Publications, 2010), 226–27.

> the national space effort, and the institution involved has demonstrated its intent to seek ways in which the benefits of this research can also be applied to the social, business, and economic structure of the United States, NASA may supplement research support with funds necessary for the construction of such facilities.[7]

The language in many of these memos concluded that it was the university's responsibility to seek ways that "such research can contribute to the economic, social, and general well-being of the nation."[8] Webb's increasing frustration that higher education was happy to take NASA funding but then missing the mark with regard to larger societal impact ultimately led to the winding down of the SUP. He expressed such frustration as early as 1962, writing to Stanley Draper of the Oklahoma City Chamber of Commerce about his desire that there be an interdisciplinary approach to national programs in science and technology and a close relationship between business and universities to enable leaders to utilize resources to solve local problems. "Frankly, most of these university and business groups simply don't seem to get the idea."[9]

Following a surge of research and facilities grants in the early period of the Moon race, budget allocations for the SUP shrank in the mid-1960s, dwindling to a quarter of their high by fiscal year 1968. Staffing was reorganized as well and the creation of the Office of University Affairs along with the SUP budget scale down marked at least an unofficial end of the program as it was originally conceived.[10] An internal study in 1968 concluded that the universities had not taken seriously the expectations of innovation and multidisciplinary engagement and/or that these goals were often poorly understood.[11]

"WEBB'S INCREASING FRUSTRATION THAT HIGHER EDUCATION WAS HAPPY TO TAKE NASA FUNDING BUT THEN MISSING THE MARK WITH REGARD TO LARGER SOCIETAL IMPACT ULTIMATELY LED TO THE WINDING DOWN OF THE SUP."

While NASA achieved many of its goals, including the success of Apollo itself as well as an enhanced bond between the Agency and American higher education that continues to this day, James Webb was left disappointed by the outcomes of the SUP because he did not see lasting and meaningful change in the universities' relationship to the communities around them. A vast network of institutions worked in unison to support NASA in sending Apollo to the Moon but fell short of Webb's larger goals to leverage space technology for economic, social, and cultural change at a local level. With the Sustaining University Program James Webb and NASA found it a more formidable leap, perhaps, to generate social change than to take steps on the Moon.

7 Smull, *The Nature and Scope of the NASA University Program*, 36–37.

8 Ibid., 37.

9 Lambright and Bock, *Launching NASA's Sustaining University Program*, IX–8.

10 Newell, *Beyond the Atmosphere: Early Years of Space Science*, 236.

11 Task Force to Assess NASA University Programs, *A Study of NASA University Programs* (Washington, D.C.: Technology Utilization Division, National Aeronautics and Space Administration, 1968), 4–5.

RECENT PUBLICATIONS

Compiled by Chris Gamble

Limiting Outer Space: Astroculture After Apollo, by Alexander C.T. Geppert (Palgrave Macmillan, April 2018). This book propels the historicization of outer space by focusing on the post-Apollo period. After the Moon landings, space exploration lost much of its popular appeal, cultural significance, and political urgency. With the rapid waning of the worldwide Apollo frenzy, the optimism of the Space Age gave way to an era of space fatigue and planetized limits. Bringing together the history of European astroculture and American-Soviet spaceflight with scholarship on the 1970s, this volume examines the reconfiguration of space imaginaries from a multiplicity of disciplinary perspectives.

Computer Simulations of Space Societies, by William Sims Bainbridge (Springer, June 2018). At the intersection of astronautics, computer science, and social science, this book introduces the challenges and insights associated with computer simulation of human society in outer space, and of the dynamics of terrestrial enthusiasm for space exploration.

Chasing the Demon: Chuck Yeager and the Band of American Aces Who Conquered the Sound Barrier, by Dan Hampton (William Morrow, July 2018). At the end of World War II, a band of aces gathered in the Mojave Desert on a Top Secret quest to break the sound barrier–nicknamed "The Demon" by pilots. Chasing the Demon tells for the first time the extraordinary true story of humankind's quest for Mach 1, the speed of sound. Here, of course, is 24-year-old Captain Chuck Yeager, who made history flying the futuristic Bell X-1 faster than the speed of sound on 14 October 1947. Officially Yeager was the first to achieve supersonic flight, but drawing on new interviews with survivors of the program, including Yeager's former commander, as well as declassified files, Hampton presents evidence that a fellow American—George Welch, a daring fighter pilot who shot down a remarkable 16 enemy aircraft during the Pacific War—met "The Demon" first, although he was not favored to wear the laurels as he was now a civilian test pilot and was not flying the Bell X-1.

The Soviet Space Program: First Steps: 1941–1953 (The Soviets in Space Series), by Eberhard Rödel (Schiffer, July 2018). This concise history is the first book in a new series on the Soviet space program and features many rare photographs, diagrams, and charts. The story begins with the Soviet Union's pre- and early-war developments in rocket technology, then covers the discovery and study of the V-2 rockets at Peenemünde, Germany.

Space Law and Policy in the Post-Soviet States (Essential Air and Space Law), by Nataliia Malysheva (Eleven International Publishing, July 2018). The intention of this book is to fill the gap of knowledge about law and policy in the field of exploration and use of outer space, which is being carried out by the new independent states that appeared on the world map after the dissolution of the USSR. In the focus of the book—the survey of state management of space activities, international space cooperation of the relevant countries, their national space legislations, etc.

Space Law in the European Context: National Architecture, Legislation and Policy in France (Essential Air and Space Law), by Philippe Clerc (Eleven International Publishing, July 2018). This book provides a comprehensive study on space law and policy in France. Part I describes the role played by the law to build up the French Space Policy though the establishment of the *Centre national d'etudes spatiales* (CNES), the French space agency. It gives a historical overview of the functioning of CNES, how its public space projects are authorized, financed, and controlled by the government and parliament and how these projects are implemented in an international and national framework, especially in relationship with the private industry. The interactions with

the European governance, the legal instruments and space programs of the European Space Agency (ESA) and the European Union (EU) are also discussed. Part II details the legal background: the law-making process among parliament, government, industry, experts, and CNES. It also reviews the current functioning of the French Space Operation Act of 2008 as a legal instrument, designed to regulate and promote the private space entrepreneurship under its jurisdiction. Uniquely, the annexes of this book contain the whole legislation in the French version and its English translation. Additionally they provide unpublished working documents: a comparison list of usual space law definitions and a table of concordance on different technical provisions between different FSOA texts and several international standards on space.

The Astronaut Maker: How One Mysterious Engineer Ran Human Spaceflight for a Generation, by Michael Cassutt (Chicago Review Press, August 2018). The book takes readers inside NASA to learn the real story of how George W.S. Abbey rose to power, from young pilot and wannabe astronaut to engineer, bureaucrat, and finally director of the Johnson Space Center. During a 37-year career, mostly out of the spotlight, he oversaw the selection of every astronaut class from 1978 to 1987, deciding who got to fly and when. He was with the Apollo 1 astronauts the night before the fatal fire in January 1967. He was in mission control the night of the Apollo 13 accident and organized the recovery effort. Abbey also led NASA's recruitment of women and minorities as Space Shuttle astronauts and was responsible for hiring Sally Ride. Written by Michael Cassutt and informed by countless hours of interviews with Abbey and his family, friends, adversaries, and former colleagues, this book is an insider's account of ambition and power politics at NASA.

Space Entrepreneurship: Facing the Next Frontier, edited by New York Times Company (New York Times Educational Publishing, August 2018). Spaceflight used to be something that only governments participated in, often in conjunction with military defense. Today, however, space is a new, wide-open frontier for entrepreneurs and corporations to develop and implement new kinds of space travel and habitats. What was once done just for exploration and advancing science is now a competition for companies such as SpaceX and Virgin Galactic, who seek to develop products that not only bring humans into space and allow them to live there, but also generate profits for the entrepreneurs who create them. These articles explore this phenomenon, including its advances and setbacks.

Deep Space Commodities: Exploration, Production and Trading, by Tom James (Palgrave Macmillan, August 2018). The author has brought together top professionals in academia, astropolitics, space engineering, and space law to explore the exciting opportunities and challenges businesses face in the new off-planet economy. With quadrillions of dollars of mineral wealth and frozen water within our reach, the stakes may be high, but so are the rewards.

Accessory to War: The Unspoken Alliance Between Astrophysics and the Military, by Neil deGrasse Tyson and Avis Lang (W. W. Norton & Company, September 2018). Spanning early celestial navigation to satellite-enabled warfare, *Accessory to War* is an examination of the intersection of science, technology, industry, and power. In this book, the authors examine how the methods and tools of astrophysics have been enlisted in the service of war.

The Penguin Book of Outer Space Exploration: NASA and the Incredible Story of Human Spaceflight, edited by John Logsdon (Penguin Classics, September 2018). Renowned space historian John Logsdon traces the greatest moments in human spaceflight by weaving together documents from NASA's history with his expert narrative guidance. Beginning with Wernher von Braun's vision for voyaging to Mars and closing with Elon Musk's contemporary plan to get there, this volume traces major events like the founding of NASA, the first American astronauts in space, the Moon landings, the Challenger accident, the daring Hubble Space Telescope repairs, and more

How to Live in Space: Everything You Need to Know for the Not-So-Distant Future, by Colin Stuart (Smithsonian Books, September 2018). Grounded in space science, planetary biology, and rocket science, this guide propels readers through takeoff, life in orbit, terraforming, and the long-term effects of space on the human body. Infographics and full-color illustrations help *How to Live in Space* to answer your burning questions, including: How do you sleep in microgravity? How do you grow food without water? Will your muscles waste away out there? How do you protect yourself from radiation? This is a lighthearted yet informative guide to a life far from terra firma.

Spacecraft: 100 Iconic Rockets, Shuttles, and Satellites That Put Us in Space, by Michael H. Gorn and Giuseppe de Chiara (Voyageur Press, September 2018). This illustrated aerospace history profiles and depicts spacecraft from Sputnik 1 through the International Space Station, and everything in between, including concepts that have yet to actually venture outside Earth's atmosphere. Illustrator and aerospace professional Giuseppe De Chiara teams up with aerospace historian Michael Gorn to present a collection of profiles depicting and describing the design, development, and deployment of these crewed and uncrewed spacecraft.

Facing the Heat Barrier: A History of Hypersonics, by T.A. Heppenheimer (Dover Publications, September 2018; A reprint of NASA SP-4232 published in 2007). This volume from The NASA History Series presents an overview of the science of hypersonics, the study of flight at speeds at which the physics of flows is dominated by aerodynamic heating. The survey begins during the years immediately following World War II, with the first steps in hypersonic research: the development of missile nose cones and the X-15; the earliest concepts of hypersonic propulsion; and the origin of the scramjet engine. Next, it addresses the re-entry problem, which came to the forefront during the mid-1950s, showing how work in this area supported the piloted space program and contributed to the development of the orbital shuttle. Subsequent chapters explore the fading of scramjet studies and the rise of the National Aerospace Plane (NASP) program of 1985–1995, which sought to lay groundwork for single-stage vehicles. The program's ultimate shortcomings—in terms of aerodynamics, propulsion, and materials—are discussed, and the book concludes with a look at hypersonics in the post-NASP era, including the development of the X-33 and X-34 launch vehicles, further uses for scramjets, and advances in fluid mechanics. Clearly, ongoing research in hypersonics has yet to reach its full potential, and readers with an interest in aeronautics and astronautics will find this book a fascinating exploration of the field's history and future.

Portrait of the Apollo 1 prime crew for first Apollo space flight. From left to right are: Edward H. White II, Virgil I. "Gus" Grissom, and Roger B. Chaffee. Their assignment to this crew was announced on March 21, 1965. On January 27, 1967 at 6:31 p.m. EST during a routine simulated launch test onboard the Apollo Saturn I rocket, an electrical short circuit inside the Apollo Command Module ignited the pure oxygen environment and within a matter of seconds all three Apollo 1 crewmembers perished.

First Fleet: NASA's Space Shuttle Program 1981–1986, by John Chakeres (Daylight Books, September 2018). First Fleet began more than 30 years ago with the launch of the first Space Shuttle Columbia in 1981. With special access to photograph the Shuttle operations at the Kennedy Space Center, John Chakeres began his multiyear project photographing the five original Space Shuttles. The images in *First Fleet* are a

One of the first steps taken on the Moon, this is an image of Buzz Aldrin's bootprint from the Apollo 11 mission. Neil Armstrong and Buzz Aldrin walked on the Moon on July 20, 1969. (Credit: NASA)

look at the sensational launch and landing operations of the Space Shuttles. In addition, the photographs Chakeres managed to capture represent a technical achievement as the photographer invented a special remote-trigger device in order to properly capture the action from a safe distance.

Safely to Earth: The Men and Women Who Brought the Astronauts Home, by Jack Clemons (University Press of Florida, September 2018). In this a one-of-a-kind memoir, Jack Clemons—a former lead engineer in support of NASA—takes readers behind the scenes and into the inner workings of the Apollo and Space Shuttle programs during their most exciting years.

Wally Funk's Race for Space: The Extraordinary Story of a Female Aviation Pioneer, by Sue Nelson (The Westbourne Press, September 2018). In 1961, Wally Funk was among the an unsanctioned group of American pilots who went through a series of rigorous physical and mental tests. One of Funk's scores beat all the male Mercury 7 astronauts' scores, including that of John Glenn's, the first American in orbit. But just one week before the final phase of training, the program was canceled. A combination of politics and prejudice meant that none of the women ever flew into space. Undeterred, Funk went on to become America's first female aviation safety inspector, though her dream of being an astronaut never dimmed.

Laika's Window: The Legacy of a Soviet Space Dog, by Kurt Caswell (Trinity University Press, September 2018). The unforgettable story of Laika the Soviet space dog, the Cold War, and the Space Race between the United States and the Soviet Union. The author examines Laika's life and death and the speculation surrounding both. Profiling the scientists behind Sputnik II, he studies the political climate driven by the Cold War and the Space Race that expedited the satellite's development. Through this intimate portrait of Laika, we begin to understand what the dog experienced in the days and hours before the launch, what she likely experienced during her last moments, and what her flight might mean to history and to humanity.

Columbus in Space: A Voyage of Discovery on the International Space Station, by The European Space Agency (Penguin Random House UK, September 2018). In 2008, Europe's first space laboratory was launched to the International Space Station. Ten years later the Columbus lab is still circling 400 kilometers above our heads at 17,500 mph and providing scientists a place to run out-of-this-world experiments. To celebrate a decade of European science and technology in space this book recounts the story of the Columbus laboratory: from vision to mission and from daily operations to science. Richly illustrated with graphics and statistics of life and research in space, the book offers a glimpse into the cutting-edge of humanity's exploration of our universe.

NASA Operations Manual: 1958 onwards, by David Baker (Haynes Publishing UK, October 2018). The *NASA Operations Manual* tells the story of America's civilian space agency, the facilities it operates, where they are and what they do. It explains how much NASA costs the American taxpayer and looks at what it returns to the taxpayer in benefits to the economy. With more than 300 photographs, line drawings, and charts, this book tours the United States, describing the Centers of excellence and the

Facilities where rockets are tested, satellites are built, and humans prepare for space

Apollo: VII – XVII, by Floris Heyne, Joel Meter, Simon Phillipson and Delano Steenmeijer (teNeues Publishing Company, October 2018). This photobook features previously unpublished photographs from the NASA archives—now meticulously digitized—captured by the Apollo astronauts during their missions. From some 27,000 NASA images, the book's authors have curated 225 of the most remarkable Apollo mission pictures, creating avivid document of one of the most seminal events of the 20th century. It includes a detailed foreword from NASA astronaut, Walter Cunningham.

First Man—The Annotated Screenplay, by Josh Singer and James R. Hansen (Titan Books, Annotated edition, October 2018). This book is the official companion to the movie and features a wealth of stunning photography, alongside the full shooting script. Academy Award®-winning screenwriter Josh Singer (*Spotlight*) and James R. Hansen, whose book *First Man* is the only authorized biography of Armstrong, provide an in-depth commentary on the challenges of dramatizing a fact-based historical motion picture. Exclusive annotations separate those facts from the dramatic fictions the filmmakers utilized, as well as explain the overarching dramatic choices made in telling the story of the man behind the icon.

Spaceflight: A Concise History, by Michael J. Neufeld (The MIT Press, October 2018). In this book, the author offers a concise history of spaceflight, mapping the full spectrum of activities that humans have developed in space. The author begins with the origins of space ideas and the discovery that rocketry could be used for spaceflight. He then discusses the Soviet-U.S. Cold War space race and reminds us that NASA resisted adding female astronauts even after the Soviets sent the first female cosmonaut into orbit. He analyzes two rationales for the Apollo program: prestige and scientific discovery. He describes the internationalization and privatization of human spaceflight after the Cold War, the cultural influence of space science fiction, including *Star Trek* and *Star Wars*, space tourism for the ultra-rich, and the popular desire to go into space.

Enceladus and the Icy Moons of Saturn (Space Science Series), edited by Paul M. Schenk, Roger N. Clark, Carly J. A. Howett, Anne J. Verbiscer and J. Hunter Waite (University of Arizona Press, 3rd edition, November 2018). With active geysers coating its surface with dazzlingly bright ice crystals, Saturn's large moon Enceladus is one of the most enigmatic worlds in our solar system. Underlying this activity are numerous further discoveries by the Cassini spacecraft, tantalizing us with evidence that Enceladus harbors a subsurface ocean of liquid water. Enceladus is thus newly realized as a forefront candidate among potentially habitable ocean worlds in our own solar system, although it is only one of a family of icy moons orbiting the giant ringed planet, each with its own story. This book brings together nearly 80 of the world's top experts writing more than 20 chapters to set the foundation for what we currently understand, while building the framework for the highest-priority questions to be addressed through ongoing spacecraft exploration.

FORTHCOMING PUBLICATION

Apollo: The Mission to Land a Man on the Moon, by Al Cimino (Chartwell Books, April 2019). This is the story of the Apollo Missions with all of its ups and downs, including the 1967 cabin fire that killed the entire crew of Apollo 1 and the oxygen tank explosion that caused Apollo 13 to limp back toward Earth using the Lunar Module as a "lifeboat." But despite the Apollo program's many setbacks, 12 men walked on the Moon and their place in American history was assured forever.

Disclaimer: The History Division wishes to thank volunteers Mike Ciancone and Chris Gamble, who compiled this section for us. Please note that the edited descriptions here were written by Chris and Mike from promotional material and do not represent an endorsement by NASA.

UPCOMING MEETINGS

The annual meeting of the American Historical Association (AHA) will be held **3–6 January 2019** in Chicago, Illinois. *Visit https://www.historians.org/annual-meeting* for more details.

The annual American Astronautical Society (AAS) Goddard Memorial Symposium will be held **19–21 March 2019** in Greenbelt, Maryland. Visit *http://astronautical.org/events/goddard* for more details.

The annual Spring Meetings of the International Astronautical Federation (IAF) will be held **26–28 March 2019** in Paris, France. Visit *http://www.iafastro.org* for more details.

The annual meeting of the National Council on Public History (NCPH) will be held **27–30 March 2019** in Hartford, Connecticut. Visit *https://www.ncph.org* for more details.

The annual meeting of the Organization of American Historians (OAH) will be held **4–6 April 2019**. Visit *http://www.oah.org* for more details.

The semi-annual Mid-Atlantic Regional Archives Conference (MARAC) will be held **11–13 April 2019** in Morgantown, West Virginia. Visit *https://www.marac.info* for more details.

The annual meeting of the Society for History in the Federal Government (SHFG) will be held **25–26 April 2019** in Washington, DC. Visit *http://www.shfg.org/Annual-Meeting* for more details.

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MOMENT IN NASA HISTORY

Gerald D. Griffin, foreground, stands near his console in the Mission Operations Control Room (MOCR) during Apollo 15's third extravehicular activity (EVA) on the lunar surface. Griffin is Gold Team (Shift 1) flight director for the Apollo 15 mission. Astronauts David R. Scott and James B. Irwin can be seen on the large screen at the front of the MOCR as they participate in sample-gathering on the lunar surface. August 2, 1971. (Credit: NASA. Image ID: S71-41852)
https://images.nasa.gov/details-S71-41852.html

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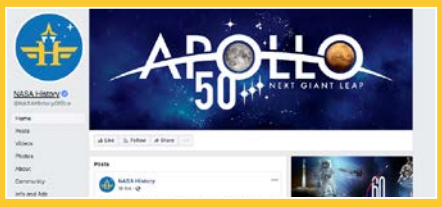

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