National Aeronautics and
Space Administration

NASA HISTORY NEWS&NOTES

Volume 42, Number 1 Spring 2025

IN THIS ISSUE

The Stratospheric Observatory for Infrared Astronomy (SOFIA) at NASA's Dryden Aircraft Operations Facility in October 2010. In 2010, SOFIA's telescope saw first light and performed its first science observations. (Credit: NASA/Tom Tschida)

NASA HISTORY OFFICE
OFFICE OF COMMUNICATIONS

From the Chief Historian

IN THE FIRST FEW MONTHS OF 2025, NASA will celebrate several significant anniversaries, including the 110th anniversary of the National Advisory Committee for Aeronautics (NACA) (March 3), the 55th anniversary of the launch of Apollo 13 (April 11), and the 35th anniversary of the launch of the Hubble Space Telescope (April 24). Celebrating these important milestones is a way for us as an agency and for the public to reflect upon where we have been and what we have accomplished and to think about what we might accomplish next.

Anniversaries are also vital tools in the historian's toolbox. They offer us an opportunity to reassess our understanding of the past by asking new questions framed by challenges of the present. To look back and wonder what we may have missed the first few times around. Was there something lurking just beneath the surface that made this accomplishment possible—something that, if applied to our current challenges, might make all the difference? Then, through the application of these lessons learned and analogies, we have an opportunity to approach the challenges of today with an informed understanding.

Historical context is developed by weaving what can seem like a series of isolated events into a tapestry of analytical narrative highlighted by complexity and contingency. In his consideration of the birth of the NACA, Roger Bilstein noted that it was just one year before that Robert Goddard began experimenting with rocketry and the Panama Canal opened.[1] That same year (1915), Albert Einstein put forth his general theory of relativity, Thomas Gill at Lowell Observatory captured the first image of Pluto, and Alexander Graham Bell made the first transcontinental call to Dr. Watson. But it was also a year that found Europe engulfed in war and the United States, the birthplace of flight, rapidly falling behind the world in aircraft investment and innovation.

As James Anderson points out in his essay in this issue of *News & Notes*, the creation of the NACA was also "part of a longer peacetime transformation of the relationship between the federal government and scientific endeavors."[2] Context matters. Missing essential variables, employing careless analogies, or purposely overlooking key contributions produces a history that lacks utility at best.

Apollo 13 offers another opportunity to employ historical analysis in how we understand risks associated with spaceflight. The line "failure is not an option" has taken on somewhat

In April 2025, NASA will mark the 55th anniversary of the Apollo 13 mission, an opportunity to reflect on the risks associated with spaceflight. In this photo, flight controllers in the Mission Operations Control Room gather around the console of Glenn S. Lunney as they work to bring the Apollo 13 astronauts home. (Credit: NASA)

From the Chief Historian (continued)

of a canonical directive. While it is certainly true in human spaceflight, it might not be for many other areas of NASA's portfolio. History tells us that we learn quite a great deal from failure. Accepting a certain level of risk is how the agency has achieved many of its greatest accomplishments. One much-discussed example of taking a novel approach to risk was the introduction of "Faster, Better, Cheaper" by NASA Administrator Dan Goldin in the 1990s. But as Robert Arrighi points out in his essay on page 13, the reality of increasing fiscal constraints becomes an important push factor in decisions that have lasting consequences.[3]

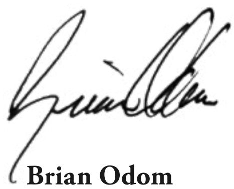
… the reality of increasing fiscal constraints becomes an important push factor in decisions that have lasting consequences.

The Hubble Space Telescope offers another example of learning from operating at the margins of failure and succeeding through innovative design. Launched on April 24, 1990, Hubble initially appeared, at least to the public, to be an appalling failure thanks to the spherical aberration in the primary mirror. That failing was later mitigated via the exquisite engineering associated with serviceability.[4] Preparing for successes while considering adaptations to potential failures is at the core of the historical triumphs we continue to celebrate.

The Hubble Space Telescope's innovative serviceable design allowed for the correction of its mirror flaw and for its adaptation across decades. In this image taken in February 1997, STS-82 astronauts replace several of Hubble's instruments as well as failed or degraded components for the second servicing mission. (Credit: NASA)

Later in the year, we will commemorate milestones in the exploration of the Martian surface. This summer marks both the 50th anniversaries of the Viking 1 and 2 launches (August 20 and September 9) that marked the United States' first Mars landing and return of images from the Martian surface and the fifth anniversary of the launch of NASA's Mars 2020 mission with the Perseverance rover and Ingenuity helicopter (July 30). These anniversaries will be a time for everyone working in the Mars Exploration Program to consider how far we have come and how far we have yet to go.

Mars has always been a key strategic goal in humanity's effort to become an interplanetary species. Anniversaries represent important milestones along that journey. As we move ever closer toward that goal with the Artemis campaign, NASA historians and archivists will be there to celebrate but also document, preserve, and disseminate this critical history. ■



Brian Odom
Chief Historian

Endnotes

1. Roger Bilstein, *Orders of Magnitude: A History of the NACA and NASA, 1915-1990* (Washington, DC: NASA SP-4406, 1989), p. 1.
2. See James Anderson, "The Founding of the NACA" (this issue).
3. Robert Arrighi, "NASA's Tortuous Effort to Consolidate Its Aircraft" (this issue). For more on "Faster, Better, Cheaper," see Howard McCurdy, *Low-Cost Innovation in Spaceflight: The Near Earth Asteroid Rendezvous (NEAR) Shoemaker Mission*, Monographs in Aerospace History No. 36 (Washington, DC: NASA SP-4536, 2005).
4. For more on Hubble, see Christopher Gainor, *Not Yet Imagined: A Study of Hubble Space Telescope Operations* (Washington, DC: NASA SP-4237, 2020).

2025 NASA HISTORY SEMINAR SERIES

Aerospace Latin America

Over the course of 2025, the NASA History Office will present a seminar series on the topic of Aerospace Latin America. This series will explore the origins, evolution, and historical context of aerospace in the region since the dawn of the Space Age, canvasing a broad range of topics including aerospace infrastructure development, space policy and law, Earth science applications, and much more. This collaborative effort seeks to gather insight and research that will conclude in an anthology of essays to be published as a NASA History Special Publication.

Talks will be held on ***Thursdays at 1 p.m. CT via Microsoft Teams.*** To receive details on how to attend, join our mailing list by sending a blank email to history-join@lists.hq.nasa.gov or request a meeting link by emailing Brian Odom at brian.c.odom@nasa.gov.

Upcoming Talks

APRIL 3
Rebecca Charbonneau
American Institute of Physics
The ALMA Telescope: How International Partnerships Transformed Astronomy in Latin America

APRIL 17
Gloria Maritza Gomez Revuelta
El Colegio de México
Tracking NASA in Mexico: How Empalme-Guaymas Bridged Space Technology, Power, and Diplomacy

MAY 1
Hugo Palmarola
Universidad Católica de Chile
NASA in Chile: Technology and Branding of the Main NASA Station in Latin America During the Cold War

MAY 15
Haris Durrani
"Orchestrating" Spectrum: Cuba, Communications Satellites, and U.S. Empire, 1963

JUNE 5
Laura Delgado Lopez
NASA
Unpacking Latin America as an "Emerging" Space Region

JULY 10
Pedro Alonso
Universidad Católica de Chile
NASA in the Most Remote Area: The Laser Station and the Landing Strip on Easter Island During the 1980s

JULY 24
Julie Klinger
University of Delaware
China–Latin America Space Relations

AUGUST 7
Vanessa Freije
University of Washington
On-the-Ground Labor with Outer-Space Technologies: Workers at Mexico's Tulancingo Satellite Earth Station

AUGUST 21
Alejandro Martin Lopez
Instituto de Ciencias Antropológicas, University of Buenos Aires
Under an Entanglement of Skies: A Cultural Astronomy Approach to Our Relationship with the Cosmos

SEPTEMBER 4
Brett A. Houk
Texas Tech University, Lubbock
Amy E. Thompson
The University of Texas at Austin
Lidar and Landscape Legacies in the Maya Lowlands: Insights from Belize

SEPTEMBER 18
Sean T. Mitchell
Rutgers University
The Brazilian Space Program

MEETING TIMES: 2 pm Eastern
1 pm Central
12 pm Mountain
11 am Pacific

The XS-11

and the Transition Away from Mandatory Jet Pilot Training for NASA Astronauts

» By **Jennifer Ross-Nazzal**, NASA Historian

Eleven civilian scientists, later nicknamed "The XS-11," were assigned on July 26, 1967, to begin training as NASA astronauts. Seated at the table, left to right, are Philip K. Chapman, Robert A. R. Parker, William E. Thornton, and John A. Llewellyn. Standing, left to right, are Joseph P. Allen IV, Karl G. Henize, Anthony W. England, Donald L. Holmquest, Story Musgrave, William B. Lenoir, and Brian T. O'Leary. (Credit: NASA)

FLYING IN SPACE has been associated with pilots ever since 1959, when NASA announced its first class of astronauts, known as the Mercury 7. Part of being a professional astronaut meant you were a certified jet pilot. Even the scientist-astronauts, so named to differentiate them from the astronauts assigned to the Mercury and Gemini missions, selected in 1965 and in 1967, received pilot training. Until NASA better understood the impact of weightlessness on the human body, Robert R. Gilruth, head of the Manned Spacecraft Center (MSC) in Houston, believed all astronauts should meet this qualification.[1] But when five scientist-astronauts from the 1967 class had a rocky transition, leading them to resign—due to their disinterest in flying at the cost of their scientific training and no spaceflight opportunities—it eventually led NASA to rethink their idea of having all astronauts become jet pilots. To avoid the dissatisfaction voiced by the scientist-astronauts, the agency made clear to the incoming class of 1978 astronauts, the first to be selected in more than a decade, that they would be generalists committed to the Space Shuttle Program.[2]

Most everyone in the 1967 group came from academia. Three of them came from the Massachusetts Institute of Technology (MIT), including one from the Experimental Astronomy Lab, another from Geophysics, and a third from the Electrical Engineering Department. Some were faculty members, while others held graduate fellowships. Another, Donald L. Holmquest, was completing his medical internship at Houston Methodist Hospital and doctorate at the Baylor College of Medicine. William E. Thornton had recently completed a two-year tour of duty with the United States Air Force Medical Division at Brooks Air Force Base in San Antonio, where he participated in flight surgeon training.[3]

Not everyone agreed that NASA needed more spaceflight crews. The consensus in the astronaut corps was that there were not enough flights to go around and too many spacefarers already. Adding this group of 11 was too many.

When the class arrived in Houston, the scientists and their families became part of the community united in the goal to send a man to the Moon and return him safely by the end of the decade. When asked about their reception, scientist-astronaut Joseph P. Allen recalled, "I would say that our welcome within the NASA community was warm on an individual level."[4] Robert A. R. Parker, another from the group, did not recall "any overt personal antagonism" from the others in the office.[5]

Their transition from academia into a scientific and technological agency was more complicated. Requirements and budgets had changed since their selection. Given space limitations, the new scientist-astronauts and their secretary sat in a cramped, windowless office they called Boy's Town.[6] Everyone from that group remembered how the Chief of Flight Crew Operations, Donald "Deke" K. Slayton, told them that there was no guarantee they would ever fly in space. "Gents," Joe Allen remembered Deke saying, "I've got some bad news for you, and that is, we have been told by the government to take you, but we don't have a job for you, not any one of you. And we've had to make this announcement, but if any of you or many feel that you have more important work to do elsewhere, you will make no enemies by resigning."[7] None chose to, at least not immediately.

Given their tenuous situation, they named their class the XS (pronounced "excess")-11, a play on the situation they found themselves in. NASA did not need them, yet there they were.

Given their tenuous situation, they named their class the XS (pronounced "excess")-11, a play on the situation they found themselves in. NASA did not need them, yet there they were.

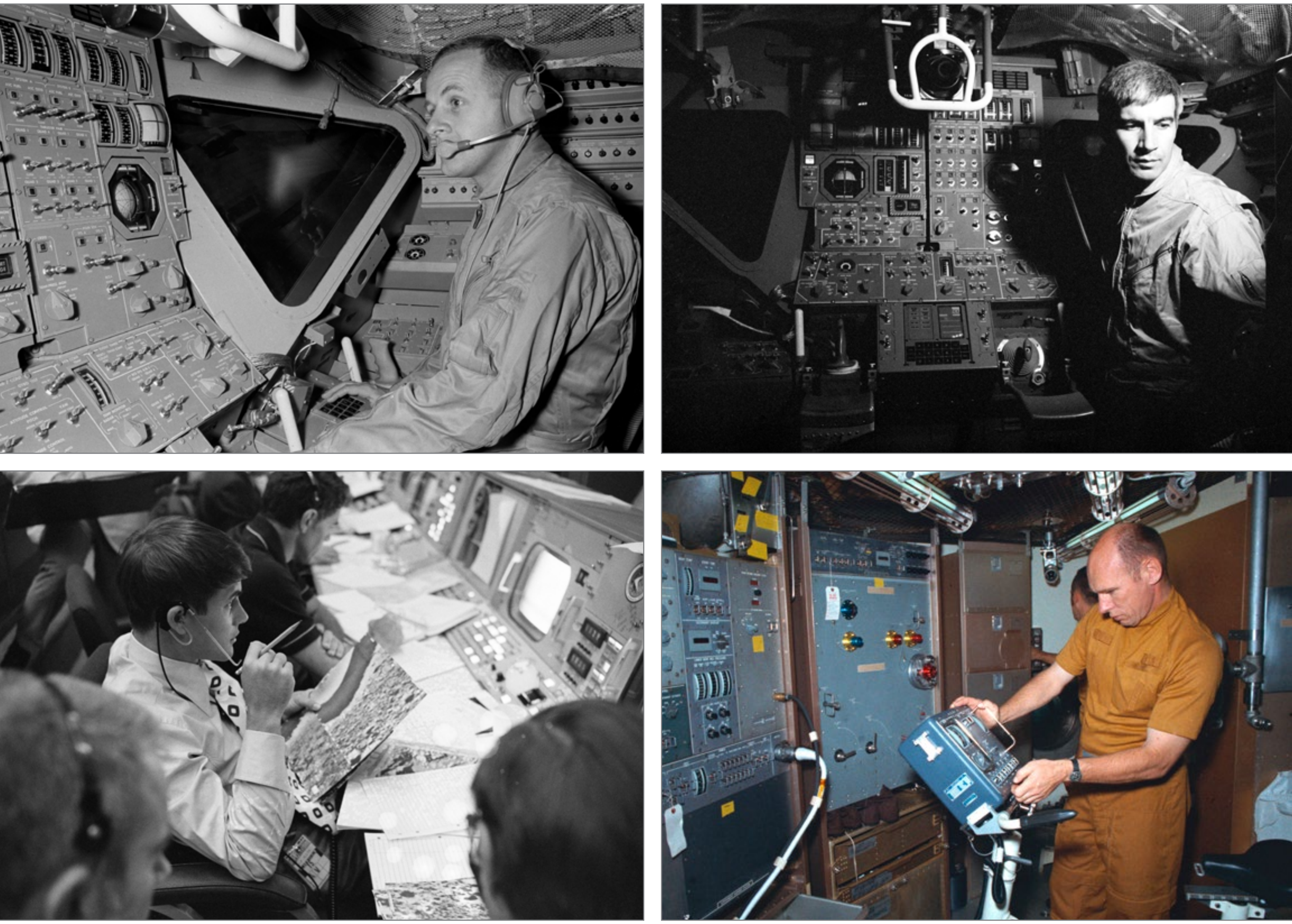
In the spring of 1968, every scientist-astronaut from the 1967 class except Holmquest, who was completing his residency, left Houston to begin 53 weeks of Air Force flight training. The new astronauts logged 240 hours in three aircraft: the T-41A, T-37, and T-38—the aircraft astronauts used to maintain their flight proficiency at the MSC.[8]

Several of the scientist-astronauts found that they exceeded all expectations at flight school. At the end of the program, leadership at each base recognized the top flyers. Allen received top marks at Oklahoma's Vance Air Force Base, earning first place in each category: academics, acrobatics, contact (general flying), formation flying, and instrument flying. The Chief of the Astronaut Office, Alan B. Shepard, congratulated Allen for his outstanding skills: "You have made all of us at NASA very proud."[9] William B. Lenoir, who went to Laughlin Air Force Base, "wondered how I ever lived without this. I took easily to it." He ended up earning three of four awards, including the Commander's Cup.[10]

Two of the XS-11, however, found that their interests fell outside of the cockpit. Transitioning from academic research to flying a jet was not their strength. In April 1968, Brian T. O'Leary dropped out of the program after only 15 hours of flying time at Williams Air Force Base. "Somewhat to my surprise," he wrote, "I found I just don't care for it." An astronomer by training, he left to pursue a career in planetary research.[11] In his memoir he offered two additional reasons for his departure: "the test pilot dominance of astronaut life and the isolation of the Houston operation from the mainstream of scientific (and personal) activity."[12] John A. Llewellyn

→ Astronaut Philip Chapman enjoyed pilot training but left NASA in 1972 to pursue his scientific career. (Credit: NASA)

The XS-11 and the Transition Away from Mandatory Jet Pilot Training for NASA Astronauts (continued)



↑ The XS-11 scientist-astronauts trained for spaceflight and supported Apollo and Skylab missions. Philip Chapman **(top left)** and John Llewellyn **(top right)** train in the Apollo Lunar Module Simulator at the Manned Spacecraft Center in Houston. **(Bottom left)** Joseph P. Allen works as capsule communicator (CAPCOM) in the Mission Operations Control Room during the Apollo 15 mission. **(Bottom right)** William E. Thornton was one of three astronauts who were part of a simulation known as the Skylab Medical Experiment Altitude Test. (Credits: NASA)

found flying difficult and also chose to leave the astronaut corps.[13]

The eight who returned to Houston found new and unique opportunities working on Apollo and Skylab, then known as the Apollo Applications Program. Joe Allen, Philip K. Chapman, Anthony W. England, and Bob Parker all served as mission scientists for the flights that landed on the Moon. Others served as support crew members and worked in Mission Control as CAPCOMs for these historic flights. Story Musgrave became the backup science-pilot for Skylab 2 and served as a CAPCOM. For the final two Skylab flights, Musgrave's colleague, Bill Lenoir, served as backup science-pilot. Thornton participated in the successful Skylab Medical Experiments Altitude Test, a 56-day simulation of a Skylab mission, and later served as a member of the support crew for all three Skylab flights. Karl G. Henize served as a principal investigator for an experiment on board the workshop.

After the first two lunar landings, Chapman expressed concern about the precarious position the space agency found itself in. Public interest in human spaceflight had waned, budgets were in decline, and there was no sign of change on the horizon. Having worked for NASA for three years, Philip Chapman urged the remaining scientist-astronauts in the office, including those selected in 1965, to find an answer to the "crisis facing manned spaceflight."[14] Hearing no overwhelming response to his call, Chapman eventually resigned. When asked why, he said, "It appears that we have to make a choice between losing our competency as pilots or losing our competency as scientists."[15] Five years after his selection, he accepted a position with AVCO Everett Research Laboratories in Massachusetts and planned to return to MIT as a senior research associate.

For those who resigned from the corps and returned to their chosen field, the transition to NASA had not been easy. Some found it hard to reconcile their position as a scientist-astronaut with the flying requirements and other priorities in the office, which did not reflect their interests. Furthermore, the five who left were frustrated by their stalled astronaut career trajectories and feared that their scientific careers would be limited if they stayed in a position where they were afforded few opportunities to do research.

The feelings expressed by some of the scientist-astronauts about flight training stayed on the minds of NASA leadership in the coming years. When NASA announced its first class of Space Shuttle astronauts in January 1978, the question of flight training for the mission specialists came up. Johnson Space Center (JSC) Director Christopher C. Kraft told reporters, "I would prefer to punt" on training mission specialists to become pilots, "because until we get some experience with these people, we see what they want to do, they see what the situation really is in flying this vehicle and what they will be required to do and how they will experience the space flight, that it is premature to judge that."[16] Plus, taking astronauts and sending them to flight school was disruptive to their training program, and there was no guarantee the mission specialists, like some of the scientist-astronauts before them, wanted to learn to fly jets. Besides, NASA had a better sense of the impact of weightlessness on the human body with the experiments performed on the Skylab space station and the research gathered on previous missions. In the end, NASA did not ask the mission specialists if they wanted to attend flight school, and none were sent.

Still, to avoid another rash of resignations from the Astronaut Office, NASA made their expectations clear. The agency wanted applicants "willing to devote most of their careers in the program. They had to be very good in what they were doing. And yet they had to be willing to give it up to do more general things," including flying in the T-38.[17] ■

Endnotes

1 Robert R. Gilruth to George E. Mueller, "Scientists Astronauts," April 6, 1966, Flight Crew Operations Directorate, Box 2, Center Series, Johnson Space Center (JSC) Archives, Houston, TX.

2 This sixth group of astronauts was the last selected by NASA in the 1960s. In 1969, the agency accepted seven of the Air Force Manned Orbiting Laboratory astronauts, and they became the seventh group of astronauts to join NASA's astronaut corps.

3 "Eleven New Scientists to Join MSC Pilots," *Roundup* (August 18, 1967): 1, 3.

4 Joseph P. Allen, interview by author, January 28, 2003, transcript, JSC Oral History Project.

5 Robert A. R. Parker, interview by author, October 23, 2002, transcript, JSC Oral History Project.

6 Brian T. O'Leary, *The Making of an Ex-Astronaut* (Boston: Houghton Mifflin Company, 1970), p. 79.

7 Allen interview.

8 MSC News Release, "Flight Training to Start for Scientist-Astronauts," MSC 68-12, February 29, 1968, JSC Archives, Houston, TX.

9 Allen interview.

10 William B. Lenoir, interview by Rebecca Wright, November 18, 2004, transcript, JSC Oral History Project.

11 MSC News Release, "Withdrawal of Scientist-Astronaut Brian T. O'Leary from Astronaut Program," MSC 68-32, April 23, 1968, JSC Archives.

12 O'Leary, *The Making of an Ex-Astronaut*, p. 206.

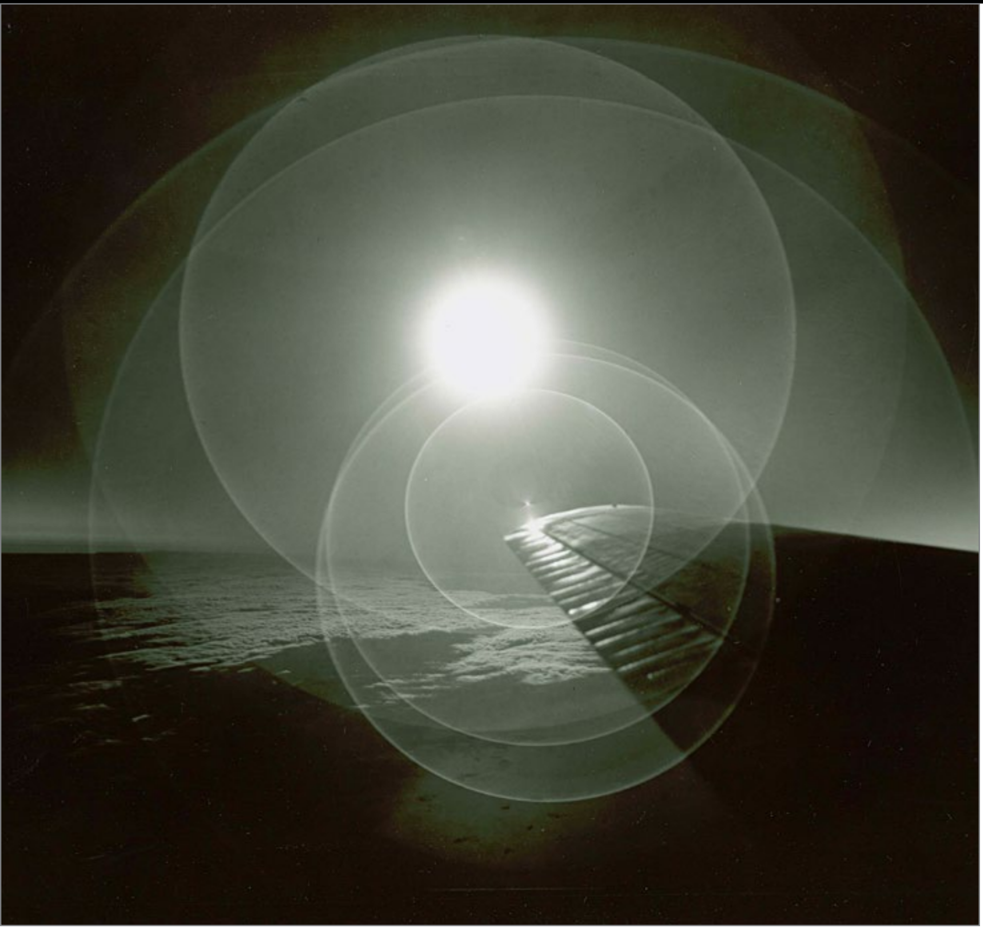
13 MSC News Release, "Withdrawal of Llewellyn from Astronaut Program," MSC 68-63, August 23, 1968, JSC Archives.

14 Phil Chapman to scientist-astronauts, "Icebergs Ahead," August 6, 1970, William Thornton, M.D. Papers, University of Texas Medical Branch, Moody Medical Library, Galveston, TX.

15 Anthony England also chose to resign, citing a lack of flight opportunities. "No Chance to Fly, Astronauts Quit," *Vancouver Sun* (July 15, 1972).

16 "Space Shuttle Astronauts Press Conference," January 16, 1978, transcript, p. 35, NASA Headquarters Archives, Washington, DC.

17 Washington Post correspondents, *Challengers: The Inspiring Life Stories of the Seven Brave Astronauts of Shuttle Mission 51-L* (New York: Pocket Books, 1986), p. 44.



Photograph of flare effects from the Sun, from a series of photographs documenting the activities of Major Albert W. Stevens at the National Archives. (Courtesy National Archives, NAID: 7419807)

The High-Flying Legacy of Airborne Observation

How Experimental Aircraft Contributed to Astronomy at NASA

» By **Lois Rosson**, NASA Historian

IN JUNE 2011, the Stratospheric Observatory for Infrared Astronomy (SOFIA) chased down Pluto's occultation of a far-away star. The phenomenon, in which Pluto passed in front of the light source, offered astronomers a rare opportunity to observe how light changed as it passed through the dwarf planet's atmosphere. The crossing of these two celestial objects, however, would be temporary and only visible from a specific location over the Pacific Ocean.[1] Pluto's tiny shadow moved at 53,000 miles per hour, and the precise position of Pluto in relation to Earth could not be pinpointed until just before the event took place. Astronomers at the U.S. Naval Observatory and MIT used photographs of Pluto to make more precise predictions, delivering the positioning news to SOFIA 2 hours before occultation while the observatory was 1,800 miles out over the Pacific.[2]

SOFIA's 2011 observation of Pluto followed up on a historic 1988 observation made by the airborne Kuiper Airborne Observatory (KAO) that proved that Pluto had an atmosphere at all.[3] The technical versatility of both flights, conducted from aircraft hurtling stabilized telescopes through the air, speaks to the legacy of airborne astronomical observation at NASA. But how did this idiosyncratic format emerge in the first place? Airborne astronomy, in which astronomical observations are made from a moving aircraft, was attempted almost as soon as airplanes themselves were developed. The first experiment in airborne observation occurred in 1923, just 20 years after the Wright Flyer lifted off the ground in Kitty Hawk, North Carolina.[4]

Early airborne astronomy focused almost exclusively on solar eclipse observation, using shadows to correct astronomical almanacs and maps in the spirit of the 19th-century scientific expedition. On September 10, 1923, the U.S. Navy deployed a fleet of 16 aircraft to measure the centerline of a solar eclipse from the anticipated path of totality.[5] Though largely unsuccessful from a measurement standpoint, the novelty of the excursion generated significant interest from the press and public. A more successful flight

The High-Flying Legacy of Airborne Observation (continued)

> **Captain Albert Stevens…manipulated the cameras at the back of the aircraft and communicated flight directions to the pilot with loud yips—one yip meant turn left, while two indicated right.**

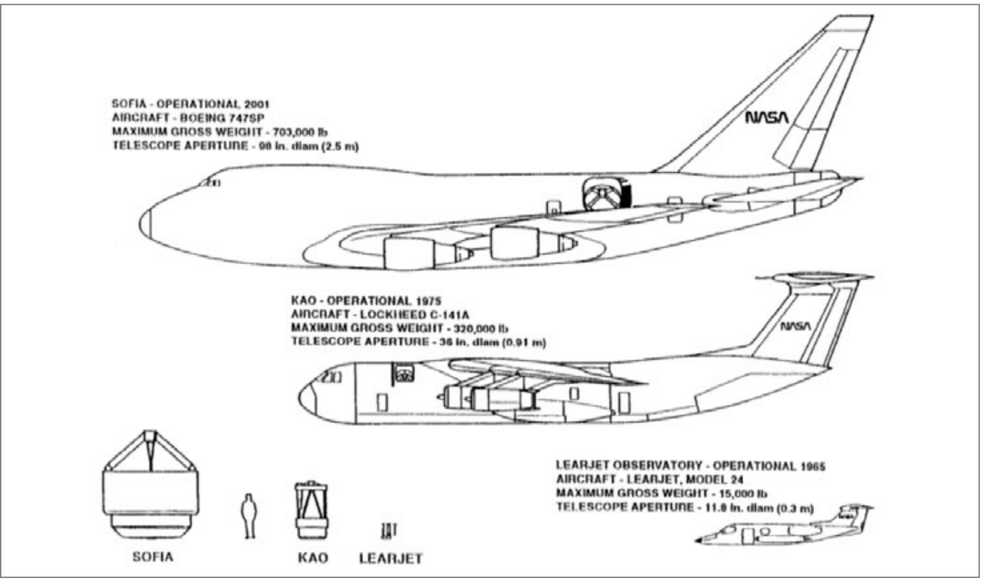
was organized in 1930 by the Naval Observatory, when an Akeley motion picture camera was mounted on a Vought O2U-1 and used to both record the eclipse's shadow on film and record its path for corrections to lunar almanacs. In-flight eclipse observation was attempted again in 1932 by the Army Air Corps and National Geographic Society, in an aircraft that was soon dubbed a "flying laboratory."[6]

In addition to scientific information, the experimental voyage of 1932 offered insights into which propeller settings and carburetor adjustments offered more altitude, what oxygen equipment was necessary to keep pilots conscious, and which variety of cameras provided the best insulation against low temperatures.[7] The photographs were taken at 27,000 feet, an altitude difficult for both the aircraft and the pilots sitting in exposed cockpits blasted by freezing air. The pilots used oxygen masks to counter high-altitude disorientation but wrote instructions for crucial procedures down in big letters on the controls prior to flight, in case of confusion. Captain Albert Stevens, who was part of the original 1923 expedition, manipulated the cameras at the back of the aircraft and communicated flight directions to the pilot with loud yips—one yip meant turn left, while two indicated right.[8]

The transition from propeller to jet aircraft enabled the maturation of airborne astronomical observation in the 1960s.[9] As Cold War tensions heightened, the United States prioritized high-altitude observation technologies, and NASA's 1958 formation provided a new institutional base for airborne astronomy. The first jet-based high-altitude astronomical

Captains Albert Stevens (left) and St. Clair Streett before a high-altitude flight in 1935. (Courtesy of the National Air and Space Museum, Smithsonian Institution, SI 92-5823)

The Sun's corona as seen during the total solar eclipse on June 8, 1937. This photo was taken by Major Albert W. Stevens from 25,000 feet. (Courtesy of the National Archives, 18-AWS-6-5)



Size comparison between SOFIA (top), KAO (middle), and Learjet (bottom) observatories. (Credit: NASA)

observation occurred in 1963 when NASA Ames, the National Geographic Society, and Douglas Aircraft used a DC-8 to observe a solar eclipse. The aircraft's speed allowed it to "chase" the lunar shadow, extending totality from 100 to 142 seconds.[10] The success of this mission prompted NASA to acquire a high-flying Convair 990 in 1965, naming it Galileo. While initially used for eclipse studies, Galileo played a pivotal role in early infrared spectroscopy. Gerard Kuiper's observations on board the aircraft revealed that Venus's thick atmosphere was not composed of water but primarily carbon dioxide. This insight reshaped understanding of planetary atmospheres.[11] Additionally, Galileo enabled measurements of Earth's atmospheric temperature and infrared-absorbing gases. The aircraft remained in service until 1973, when it collided with a Navy plane near Moffett Field, California. By 1968, NASA had installed an open-port 12-inch telescope on a Learjet, allowing infrared studies of Jupiter, Saturn, targets in the Orion constellation, and the Milky Way's center.[12]

The success of NASA's airborne infrared astronomy efforts led to the development of the 36-inch telescope–equipped Kuiper Airborne Observatory (KAO), which flew from 1974 to 1995.[13] KAO's discoveries included the rings of Uranus, the composition of Halley's Comet, and the existence of Pluto's atmosphere, which it confirmed in 1988 by watching the dwarf planet's passage in front of a 13th magnitude star.[14]

Encouraged by KAO's success, NASA and German partners proposed SOFIA in 1985. SOFIA, a larger aircraft with a larger telescope, represented the development of high-altitude infrared astronomy into bigger and more sophisticated observatories.[15] But airborne astronomy's expedition-like nature remained—SOFIA's 2011 observation of Pluto's occultation epitomized its dual legacy as both an

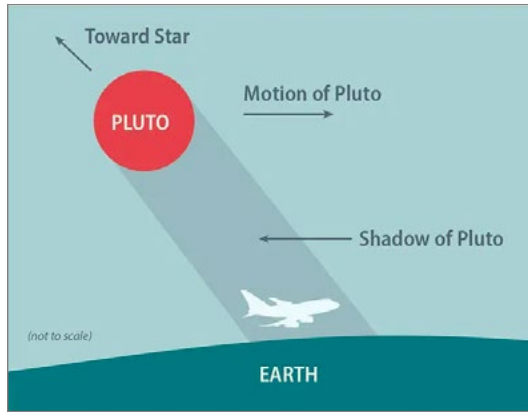


Diagram illustrating SOFIA's occultation chase. (Credit: NASA)

airborne observatory and an experimental aircraft. Capturing Pluto's roughly 2-minute passage required precision calculations and a far-flung excursion over the South Pacific.[16] The aircraft's speed and altitude allowed it to position itself along Pluto's shadow path, capturing critical data that helped paint a fuller scientific picture of the dwarf planet's atmosphere. SOFIA captured a second Pluto occultation in 2015, just 15 days before NASA's New Horizons spacecraft became the first probe to fly by our distant neighbor. The two observations together offered a point of comparison, strengthening NASA's catalog of information about the dwarf planet's atmosphere.

Beyond its contributions to planetary science, SOFIA's role as an experimental aircraft continued a long tradition of repurposing and modifying high-altitude platforms for scientific discovery. From propeller aircraft chasing eclipse shadows to jetliners outfitted with infrared telescopes, SOFIA was a 21st-century example of how airborne platforms could push the boundaries of astronomical observation. ■

The High-Flying Legacy of Airborne Observation (continued)

Endnotes

1 Mike Wall, "NASA's SOFIA Flying Telescope May Be Mothballed This Year," Space.com, March 5, 2014.

2 "SOFIA's Telescope Views Pluto Occultation," NASA, December 29, 2022.

3 Kevin Schindler, "How a Flying Telescope Proved Pluto Has an Atmosphere," Astronomy.com, June 3, 2015.

4 Wendy Whiting Dolci, "Milestones in Airborne Astronomy: From the 1920's to the Present," SAE Technical Paper 975609, 1997, p. 1.

5 Ibid., p. 2.

6 Observations were made on the Honey Lake expedition of 1930. Dolci, "Milestones in Airborne Astronomy," p. 2.

7 "Photographing the Eclipse of 1932 from the Air: From Five Miles Above the Earth's Surface, the National Geographic Society-Army Air Corps Survey Obtains Successful Photographs of the Moon's Shadow," *National Geographic Magazine* (November 1932): 581–596.

8 Dolci, "Milestones in Airborne Astronomy."

9 In May 1948, observers on board a Boeing B-29 Superfortress were able to comfortably observe an eclipse obscured for ground observers by bad weather. The four-engine B-29 was designed for high-altitude flight, although its initial purpose was strategic bombing, and far exceeded the cost of the entire Manhattan Project in its development. Dolci, "Milestones in Airborne Astronomy," p. 3.

10 In 1973, scientists on board the Concorde 001 recorded 1 hour and 14 minutes of totality by traveling at 1,300 miles per hour at 50,000 feet. Dolci, "Milestones in Airborne Astronomy," p. 4.

11 Dolci, "Milestones in Airborne Astronomy."

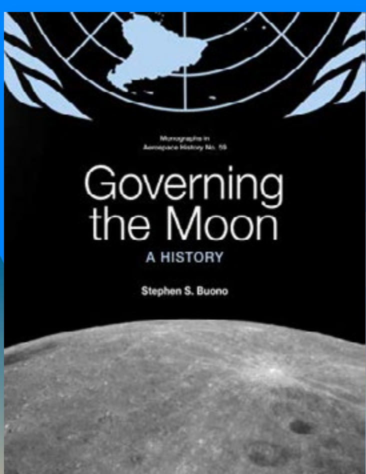
12 Ibid., p. 7.

13 Edwin F. Erickson and Allan W. Meyer, *NASA's Kuiper Airborne Observatory, 1971–1995: An Operations Retrospective with a View to SOFIA* (Moffett Field, CA: NASA SP-2013-216025, December 2013), p. 217.

14 Schindler, "How a Flying Telescope Proved Pluto Has an Atmosphere."

15 Erickson and Meyer, *NASA's Kuiper Airborne Observatory.*

16 Calla Cofield, "How NASA's Flying Observatory Revealed Secrets About Pluto," Space.com, January 14, 2016.



NASA's Tortuous Effort to Consolidate Its Aircraft

» By **Robert Arrighi**, NASA Historian and Archivist

↑ Three ER-2 aircraft fly over the Golden Gate Bridge in April 1996 on their final flight out of NASA Ames before redeployment to Dryden. (Credit: NASA/Eric James)

THIRTY YEARS AGO, on January 6, 1995, NASA Administrator Dan Goldin announced, "We've started a revolution at NASA. It's real. We have a road map for change. We've already begun."[1] Thus began one of the agency's most daunting endeavors, a top-to-bottom reassessment of NASA's processes, programmatic assignments, and staffing levels. One of the most controversial aspects of this effort was the proposal to transfer nearly all of the agency's research aircraft to Dryden Flight Research Center (today known as Armstrong).

The fall of the Soviet Union in late 1991 eased international tensions but left the United States with a massive budgetary deficit. Although NASA's budgets, staffing, and infrastructure had grown in the 1980s, Congress's reluctance to fund the Space Exploration Initiative in the early 1990s signaled a new era of fiscal constraint.

It was in this environment that Goldin introduced the "Faster, Better, Cheaper" doctrine, which replaced larger missions with smaller, less expensive endeavors and sought ways to work smarter and more efficiently. This effort intensified the following year as the new Clinton administration strove to make the federal government achieve more with fewer resources. In addition to the much-publicized redesign of the space station, NASA sought institutional ways to increase efficiency. One proposition was the consolidation of the agency's research aircraft at Dryden. The concept was not new, but it had more traction in the post–Cold War environment.

The proposal, conceived by Dryden management, primarily impacted NASA's original facilities—Langley Research Center, Ames Research Center, and Lewis Research Center (today, Glenn). Flight research had played a critical role at these three former National Advisory Committee for

Dan Goldin in Langley's hangar shortly after becoming administrator in 1992. (Credit: NASA)

Aeronautics (NACA) laboratories since their establishment decades earlier, with scores of research aircraft used over the years.

The first attempt to transfer the agency's research planes to Dryden, which took place in the early days of the space program, was largely unsuccessful. Dryden failed at two additional attempts in the 1970s to convince the agency to relocate its aircraft. A decrease in flight programs led to NASA's decision in 1981 to make Dryden a subsidiary of Ames. Ames remotely managed Dryden but transferred most of its fleet to the facility. Richard Hallion later noted, "Ames may have gained Dryden, but Dryden expanded its dominion over the agency's flight testing activities."[2]

By 1994, Dryden had increased its research programs to a sufficient level to regain its status as an independent center. It again began assessing the benefits of basing NASA's research aircraft at its facility. This coincided with the White House's order for federal agencies to improve their efficiency and effectiveness. The change in congressional leadership that fall led to even stronger calls to reduce the size of the federal government. Despite trimming NASA's five-year budget plan by 30 percent and eliminating 1,500 federal positions, Goldin was instructed to produce an additional $5 billion reduction over the next five years without impacting Shuttle or space station activities.

Throughout 1994, several NASA teams worked to determine new approaches for streamlining agency processes. It was these studies that Goldin referred to in his January 1995 press conference announcing the start of an agency-wide Zero Base Review (ZBR). The ZBR required each center to justify all elements of its budget without using residual baselines from previous budget requests. This included the justification for retaining any aircraft. A Headquarters team incorporated the centers' feedback with elements of the previous studies.

Goldin announced the ZBR findings on May 18, 1995. The plan would retain all 10 centers, with each one assigned a particular mission and "center of excellence" designation. The ZBR sought sharp cuts to overhead, infrastructure, and staffing levels rather than research programs. In addition, a number of legacy programs were reassigned to different centers.

Not surprisingly, the ZBR also called for the consolidation of research aircraft at Dryden and a reduction in the number of administrative aircraft. Dryden representatives initially reported that the consolidation would save the agency $9 million annually, but they soon boosted to that figure to $23 million. Dryden would be the only center not to lose jobs under ZBR plan.

The proposed consolidation brought immediate responses from not only the affected centers, but also the research programs that relied on the aircraft. Basing planes in California would require Langley and Lewis to transport support teams and equipment across the country on a regular basis. It was also noted that research flights often had to be flown in specific geographical locations.

> **The proposed consolidation brought immediate responses from not only the affected centers, but also the research programs that relied on the aircraft.**

While NASA established a Dryden-led Aircraft Consolidation Team to coordinate the consolidation process, the agency's Office of Inspector General (OIG), led by Roberta Gross, undertook an intensive review of the plan. Inspectors visited the centers, conducted interviews, and scrutinized previous studies. They found inconsistencies regarding everything from the number of planes involved, costs of existing operations at the centers, and the required infrastructure investment for Dryden.

NASA Inspector General Roberta Gross testifies at a congressional hearing in 1997. (Credit: CSPAN)

There was widespread congressional pushback in September 1995, with Diane Feinstein, John Glenn, and others urging NASA to justify its actions before proceeding with the consolidation. Gross testified that estimated savings were questionable, the impact on research was not fully considered, and startup cost estimates were inaccurate. In addition, some alleged savings involved planes that were already scheduled for transfer before consolidation.

Goldin conceded the findings and paused the consolidation effort in early 1996. "I do accept the criticism of the GAO [Government Accountability Office] that some of our analysis is sloppy. I won't apologize for it because good people did good analysis with good intents, but we are going to listen to them."[3]

The OIG's final report in August 1996 predicted that it would require 52 years to make up investment needed at Dryden. In September 1996, congressional representatives from Virginia and Ohio added riders to the NASA budget bill that prevented the transfer of NASA aircraft located east of the Mississippi River during fiscal year 1997.

The response in California was not as strong since the OIG report affirmed that the transfer of Ames's aircraft to Dryden was, indeed, cost-effective. Most of the Ames fleet, including its DC-8 observatory and ER-2 high-altitude planes, were moved to Dryden in 1997.

Coming to the realization that the consolidation plan was not cost-effective, the agency sought to achieve savings by transferring Langley and Lewis aircraft to external organizations. Despite having acquired it just a couple of years earlier and having invested $2 million in modifications, Lewis was forced to relinquish its DC-9 microgravity research plane in 1997. Several other aircraft were disposed of as well. Langley sent a Beechcraft B-200 to Dryden and transferred two others.

Lewis continued to use its Learjet 25 and De Havilland Twin Otter to support solar cell calibration and icing research, respectively. Despite researchers' protests, Headquarters pressed the

Dryden's existing fleet of research aircraft are posed on the ramp in July 1997. Included are the X-31, F-15 ACTIVE, SR-71, F-106, F-16XL Ship #2, X-38, Radio Controlled Mothership, and X-36. (Credit: NASA/Tony Landis)

↑ Lewis's fleet of aircraft in the midst of the consolidation debate in July 1997. Only the Learjet 25 and Twin Otter would survive. (Credit: NASA)

center to find new homes for these vehicles and to cease all flight research by December 31, 1999.

> The agency's justification shifted from cost savings to safety.

The agency's justification shifted from cost savings to safety. In February 1999, Headquarters suspended Lewis's flight research, citing the inherent dangers of icing research and the lack of "critical mass" in the center's Flight Operations group required to support the effort. After an inter-center team of experts determined that there were no major safety concerns, the center was permitted to resume flight operations for another year.

On June 28, 1999, Goldin visited Langley to announce that there would be no further attempts to transfer the center's aircraft. Two days later, Michael DeWine, a senator from Ohio, met with Goldin to express dismay over NASA's continued effort to force Lewis to transfer its two remaining planes. That September, DeWine included amendments to NASA's appropriations bill that prohibited the relocation of Lewis aircraft to other centers and the duplication of one center's research capabilities at another.

In response to DeWine's persistent pressure regarding Lewis's flight operations and the importance of icing research, the NASA OIG issued a report in July 2000 that "found that NASA terminated research flight operations at Lewis prematurely without adequately evaluating all of the alternatives, performing cost-benefit analyses, or developing a long-term plan for conducting the icing research."[4]

The center was allowed to carry on its flight research indefinitely, bringing an end to the agency's five-year attempt at aircraft consolidation. ■

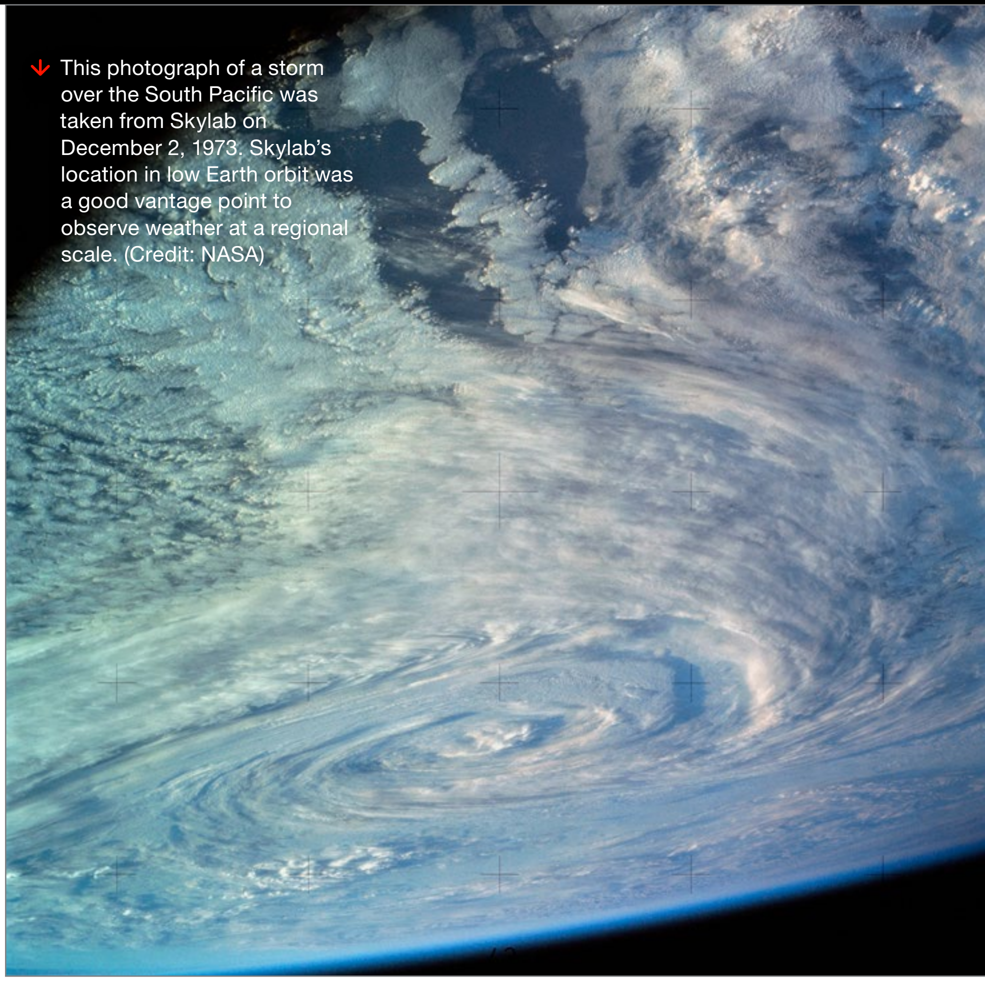
Endnotes

1. Statement of Daniel Goldin, NASA administrator, before the Committee on Science, January 6, 1995.
2. Richard P. Hallion, *On the Frontier: Flight Research at Dryden 1946–1981* (Washington DC: NASA SP-4303, 1984).
3. Statement of Daniel Goldin, NASA administrator, before the Subcommittee on National Security, International Affairs, and Criminal Justice Committee on Government Reform and Oversight, September 11, 1996 (Washington DC: Government Printing Office, 1997).
4. Office of Inspector General, "Review of Research Flight Operations at the Glenn Research Center," July 17, 2000, NASA Glenn History Collection, Directors Collection, Cleveland, OH.

The Space Between

Mesoscale Lightning Observations and Weather Forecasting, 1965–82

» By **Brad Massey**, NASA Historian



This photograph of a storm over the South Pacific was taken from Skylab on December 2, 1973. Skylab's location in low Earth orbit was a good vantage point to observe weather at a regional scale. (Credit: NASA)

SKYLAB ASTRONAUT Edward G. Gibson looked down at Earth often during his 84 days on NASA's first space station. From his orbital vantage point, Gibson took in the breathtaking views of our planet's diverse landscapes. He also noted the interesting behavior of the planet's most powerful electrical force: lightning.

While gazing down at South America's Andes Mountains, Gibson noted that a thunderstorm generated recognizable lightning patterns over a broad area. The timing and number of bolts, Gibson said, seemed to be dictated by some kind of collective organization. As he looked on, a strike would occur and then be followed by two or three simultaneous bolts over an area he estimated to be 500 square miles. "A few things impressed me here: one is the fact that they could go off simultaneously or near simultaneously over a large distance—sympathetic lightning bolts, if you will, analogous to sympathetic flares on the sun," Gibson recalled.[1]

Gibson's words were of great interest to the lightning researchers affiliated with NASA's Severe Storms and Local Research Program and others who believed observing Earth's lightning from low Earth orbit generated valuable data that meteorologists could use to better forecast dangerous storm characteristics and behavior. With these motivations in mind, researchers created new Earth- and space-based experiments from the mid-1960s to the first Space Shuttle missions in the early 1980s that observed lightning on a regional level. These included the NASA-sponsored Atmospheric Variability Experiments (AVE) and the Night/Day Optical Survey of Lightning (NOSL) Experiment that was performed by astronauts on STS-2, STS-4, and STS-6.

Mesoscale Weather Forecasting

Researchers in NASA's Severe Storms and Local Research Program and their partners worked to better understand the characteristics and behavior of powerful storms in the 1960s and 1970s. One of the program's most important initiatives involved gathering data on storm systems on a mesoscale (regional) level.

In the early and mid-1960s, meteorologists often relied on tools that gave them either very broad or very localized views of storm activity. For example, early weather satellites like those in the Television and InfraRed Observation Satellite (TIROS) and the Applications Technology Satellite (ATS) series provided expansive pictures from space of

The Space Between (continued)

Earth's weather systems. These helped forecasters predict the movement and impact of large weather events, like hurricanes and frontal systems. Meteorologists coupled these satellite data with local ground reporting information, generated by ground-based sensors, aircraft, and other terrestrial tools to build weather forecasting models.

Although the combination of broad and local data improved forecasts in the 1960s, it did not enable meteorologists to precisely track and model where a thunderstorm cell was headed in the next 6 hours, where exactly the strongest area of a frontal system might strike, or what types of clouds would spawn tornadoes and lightning strikes. To more reliably predict these events and others, mesoscale data were needed.[2]

Edward G. Gibson works with an Earth-observing camera during a Skylab training session at Johnson Space Center. Gibson observed interesting lightning pattens from space during the Skylab 4 mission. (Credit: NASA)

> Although the combination of broad and local data improved forecasts in the 1960s, it did not enable meteorologists to precisely track and model where a thunderstorm cell was headed in the next 6 hours, where exactly the strongest area of a frontal system might strike, or what types of clouds would spawn tornadoes and lightning strikes.

Researchers affiliated with NASA's storm research initiatives thus conducted AVE in the 1960s and 1970s to bolster mesoscale research and improve weather forecasting. This series of seven experiments compiled vast datasets from weather balloons, aircraft, ground-based sensing devices, radar, weather satellites, and other sources to observe storm characteristics on a regional scale over periods of one to three days.

In a summary of the 1979 Atmospheric Variability Experiment-Severe Environmental Storms and Mesoscale Experiment (AVE-SESAME), researchers noted that the data gathered could be used to "develop improved storm forecast capability through the development of models of severe storms and their environment that use space technology and conventional ground-based data sources."[3]

These experiments, and others like them, produced datasets on lightning that highlighted its mesoscale properties and its potential to help forecasters create better models. Like Gibson's Skylab ruminations on the patterning, size, and regional behaviors of lightning, researchers determined that strikes often occurred on a mesoscale and that better observations and understandings of atmospheric electricity could bolster the accuracy of forecasts.

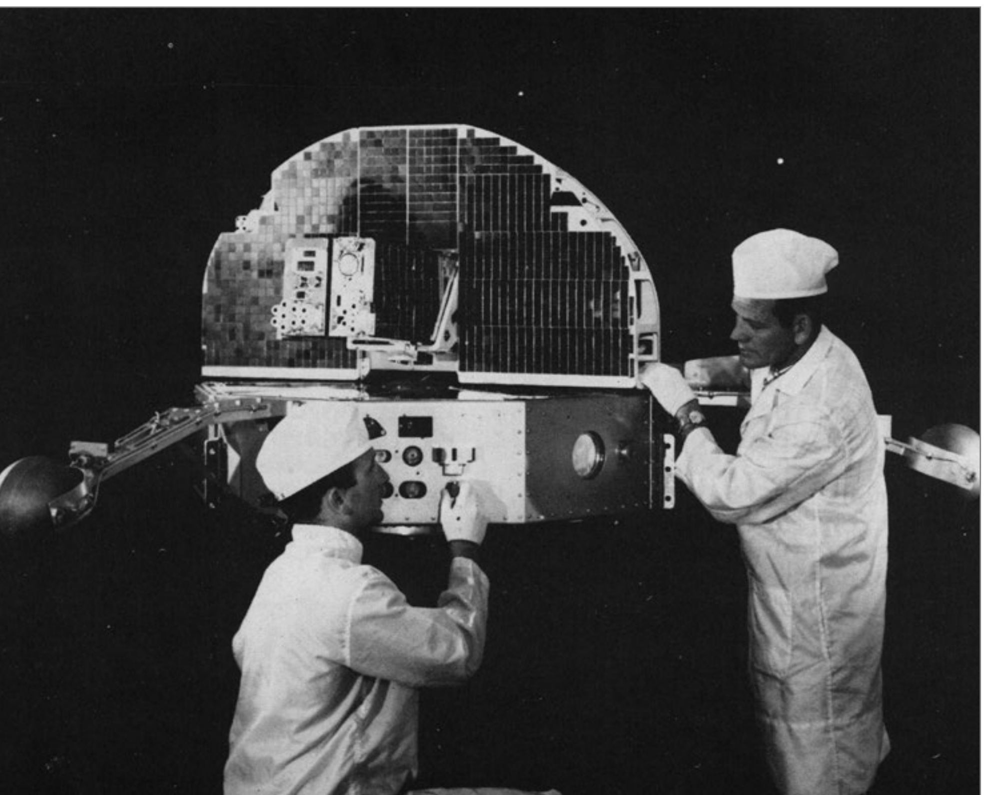
New Lightning Observations from Space

A cohort of lightning researchers committed to expanding space-based lightning studies assembled in 1979 for a NASA-sponsored event dubbed "Workshop on the Need for Lightning Observations from Space." At the event, James Dodge, a program manager in NASA's Earth Science Division, spoke about lightning's relationship to severe weather and meteorological forecasting. Dodge argued that experiments of the 1960s and 1970s revealed that if researchers could observe lightning strikes from low Earth orbit and catalog each strike, they could better understand storm behavior and predict dangerous weather. "It seems clear that if data from a satellite-borne lightning mapper were available, we could conduct simultaneous studies of the lightning discharge patterns and the meteorological environments of specific storms," he wrote.[4]

Viewing lightning from space was not a novel concept when the workshop commenced in 1979. Along with Gibson's lightning observations and recollections from his time on Skylab, lightning scientists had affixed optical sensors to the Orbiting Solar Observatory (OSO) satellites. For example, sensors on OSO-2 (launched on February 3, 1965) captured data that revealed that the vast majority of lightning activity occurring at nighttime took place over land, not the oceans, an observation later confirmed by OSO-5. Furthermore, the Department of Defense satellites of the Defense Meteorological Satellite Program (DMSP) and Vela V had sensors that collected lightning data.[5]

Still, Dodge and the researchers at the workshop knew that there were still many things they did not know about lightning, and they believed that emerging technologies and new experiments would open new doors of understanding and improve storm forecasting. In the workshop's proceedings, researcher Bobby N. Turman wrote that new lightning-observing tools and sensors, particularly those placed in lower orbits, would expand the scientific and applied fields of lightning studies. "The space shuttle experiment being planned…is a good start in this direction," Turman wrote.[6]

The OSO-2 satellite, pictured here, was one of the first orbiting satellites outfitted with sensors that could detect lightning strikes. (Credit: NASA)



Shuttle Observations

NASA's Space Shuttles were billed, in part, as orbiting Earth science laboratories. Lightning researchers knew this, and in response they created the NOSL Experiment, designed to be conducted on Space Shuttle flight decks.

Bernard Vonnegut of the Atmospheric Sciences Research Center at the University of Albany–State University of New York was NOSL's principal investigator, and the experiment was sponsored by NASA's Severe Storms and Local Weather Research Program, which was managed by James Dodge. Like Dodge, Vonnegut highlighted the real-world applications of information gleaned from NOSL and lightning studies. In a NASA technical memorandum, Vonnegut and his team wrote, "Scientists performing research in atmospheric electricity are studying a phenomenon that not only has scientific research interest but also practical applications. The knowledge of the mechanisms that produce the electrical activity in storm cells could provide information for potential forecast, warning, and control of severe storms."[7]

NOSL depended on astronauts to record lightning strikes from space. NOSL's equipment included a handheld 16mm camera, data recorder, accessory pack, and a whole lot of wire. The NOSL camera recorded on magnetic tape both optical images of lightning bolts and lightning's electronic output. To conduct NOSL, astronauts were instructed to point the camera out the flight deck window and

STS-4 commander Thomas K. Mattingly II wrestles with the wiring of the NOSL camera and recorder while aboard Columbia. Mattingly and other astronauts captured valuable footage with the NOSL camera, but for subsequent experiments, equipment was mounted to the payload bay and operated by mission control. (Credit: NASA)

record storm footage. Although they could not dictate exactly what footage astronauts recorded, Vonnegut's team hoped astronauts would capture mesoscale-length cloud-to-cloud lightning discharges, tornadic lightning, lightning discharges above thunderstorm clouds, maritime thunderstorms, and more. In short, it was a long mesoscale wish list.[8]

After a successful lobbying effort, NASA leadership included NOSL on STS-2, STS-4, and STS-6. Those first two missions were busy test flights for the two-person crews. Despite their jam-packed schedules, the NASA astronauts on board conducted the NOSL experiment and captured valuable lightning footage for researchers that confirmed the existence of mesoscale lightning behavior. As the Shuttle Columbia passed over South Africa on November 13, 1981, STS-2 pilot Richard H. Truly recorded several lightning strikes caused by a regional storm. Months later, T. K. Mattingly and Henry W. Hartsfield captured footage of a large thunderstorm over Brazil during the STS-4 mission.[9]

NOSL investigators deemed the experiment a success. The recordings provided evidence that some lightning bolts were around 60 miles (100 kilometers) long. Other recorded footage substantiated Gibson's observation of synchronized discharges within regional-sized storm systems. For example, NOSL captured evidence of two bolts, 50 miles away from one another, striking simultaneously. In short, NOSL provided evidence supporting the theory that lightning was often a mesoscale event; therefore, data on lightning could be used to improve forecast models.

NOSL provided evidence supporting the theory that lightning was often a mesoscale event; therefore, data on lightning could be used to improve forecast models.

The Space Between (continued)

The experiment also reinforced the scientific desire to continue to conduct regional lightning observations in orbits lower than most of the era's weather satellites. "The results show that the Space Shuttle is particularly well suited for obtaining data on mesoscale lightning discharges that are too large to be photographed from a high-altitude airplane or too distant to be resolved from a geostationary satellite," investigators concluded. Put more simply, viewing lightning from the Space Shuttle proved to be a mesoscale sweet spot.

The Legacy of Mesoscale Observations

The NOSL experiment affirmed James Dodge's, Bernard Vonnegut's, and other researchers' beliefs that orbital observations of lightning from the Space Shuttle would provide important data for researchers and weather forecasters. This success paved the way for future NASA-sponsored lightning studies.

Although NOSL, AVE, and other experiments conducted from the 1960s to the early 1980s did not come close to uncloaking all of lightning's mysteries, they paved the way to new mesoscale experiments and tools that have allowed researchers to compile valuable data on lightning that forecasters have used to protect life, limb, and property on Earth. ■

Endnotes

1 B. Vonnegut, O. H. Vaughan Jr., M. Brook, and P. Krehbiel, "Mesoscale Observation of Lightning from Space Shuttle," NASA Technical Memorandum 86451, September 1984.

2 "Atmospheric Experiments Being Conducted at MSFC," *Daily Sentinel* (July 10, 1977).

3 Quote from Kelly Hill, Gregory S. Wilson, and Robert E. Turner, "NASA's Participation in the AVE-SESAME '79 Program," SESAME News, no. 1 (November 1979): 1329. This document also briefly chronicles the goals and results of the AVE experiments that preceded it. "Balloon Program Checks Satellite Data," *Daily Sentinel* (May 15, 1974); Kelly Hill and Robert E. Turner, "NASA's Atmospheric Variability Experiments (AVE)," *Bulletin of the American Meteorological Society* 58:2 (February 1977): 170–172. For a summary of another AVE experiment, see "No, Those Aren't UFOs, They're NASA Balloons," *Tampa Tribune* (May 11, 1974); "Atmospheric Experiments Being Conducted at MSFC."

4 *Proceedings: Workshop on the Need for Lightning Observations from Space*, NASA Report CP-2095, July 1979.

5 For a concise summary of satellite lightning experiments, see Bobby N. Turman, "A Review of Satellite Lightning Experiments," *Proceedings: Workshop on the Need for Lightning Observations from Space*, pp. 61–80; "Poseidon Test, Space Observatory Launches at Ready," *Miami Herald* (January 21, 1969); Richard E. Orville and Ronald W. Henderson, "Global Distribution of Midnight Lightning: September 1977 to August 1978," *Monthly Weather Review* 114 (June 17, 1986); J. G. Sparrow and E. P. Ney, "Lightning Observations by Satellite," Nature 232 (1971): 540–541.

6 Turman, "A Review of Satellite Lightning Experiments," p. 76.

7 Bernard Vonnegut, Otha H. Vaughan Jr., and Marx Brook, "Nighttime/Daytime Optical Survey of Lightning and Convective Phenomena Experiment," NASA Technical Memorandum, NASA TM-78261, February 1980.

8 Ibid.

9 Bernard Vonnegut, Otha H. Vaughan Jr., and Marx Brook, "Thunderstorm Observations from the Space Shuttle," NASA Technical Memorandum, NASA TM-82530, June 1983.

NASA ORAL HISTORY

Adding Color to the Moon

» By Sandra Johnson, Oral History Lead

↑ The "color" of Jack Kinzler's U.S. flag against the gray of the Moon, as viewed by Neil Armstrong and Buzz Aldrin from inside the Lunar Module. (Credit: NASA)

MANNED SPACECRAFT CENTER (MSC) Director Robert R. Gilruth placed a call to Jack Kinzler less than four months before the Apollo 11 launch. Gilruth asked him to attend a meeting with a high-level group of individuals from both MSC and NASA Headquarters to discuss ideas for celebrating the first lunar landing. Kinzler, in his capacity as the chief of the Technical Services Division, arrived ready to present his suggestions for commemorating the achievement. However, this was not the first time Kinzler had received such a call from Gilruth asking him for his input.

Kinzler began his career at the National Advisory Committee for Aeronautics' (NACA's) Langley Memorial Aeronautical Laboratory in Virginia in 1941 as an aircraft model maker. After completing an apprenticeship program, he learned machining and eventually advanced to assistant supervisor of the machine shop. By 1959, the space race was on, and Gilruth, then director of the Space Task Group (STG) at Langley, asked Kinzler to consider joining him in a new venture to put a man in space. As Kinzler recalls, "I had been reading books about spaceflight and listened to some of the lectures that were available at the time, and I was primed, ready to jump onboard whenever he asked me."

Still under construction in 1961, the MSC in Houston would be the new center supporting human spaceflight. Kinzler and his expanding team began moving equipment and personnel to temporary locations in southeast Houston and established the Technical Services Division. Three years later, approximately 180 highly skilled technicians, specializing in machining, sheet metal work, welding, electronics, modeling, plastics, and electroplating, along with a field test group and a scuba team, moved into their new offices and shop areas at the center.

So, when the call came from Gilruth to join the planning meeting for the first lunar landing, Kinzler went prepared with two ideas—a plaque and a flag. Both suggestions received approval, and he was told to go forward with his plans. "So I got an action item out of the committee saying, 'It's up to you. You go do it.' That was all I had, 'Go do it.'" Kinzler turned to his assistant chief, David McCraw, and together they came up with a prototype for a plaque to be installed on the Lunar Module (LM) descent stage ladder. The finalized stainless-steel plaque contained the signatures of all three Apollo 11 astronauts—Neil A. Armstrong, Edwin E. "Buzz" Aldrin Jr., and Michael Collins—along with the signature of President Richard Nixon. The top of the plaque depicted the Eastern and Western Hemispheres and the inscription, "HERE MEN FROM THE PLANET EARTH FIRST SET FOOT UPON THE MOON. JULY 1969 A.D. WE CAME IN PEACE FOR ALL MANKIND."

> "So I got an action item out of the committee saying, 'It's up to you. You go do it.' That was all I had, 'Go do it.'"

Jack Kinzler photographed in 2008 holding a copy of the commemorative plaque designed and built by him and his team for the Apollo 11 mission. The original plaque, installed on a leg of the Lunar Module, remained on the Moon. (Credit: Sandra Johnson)

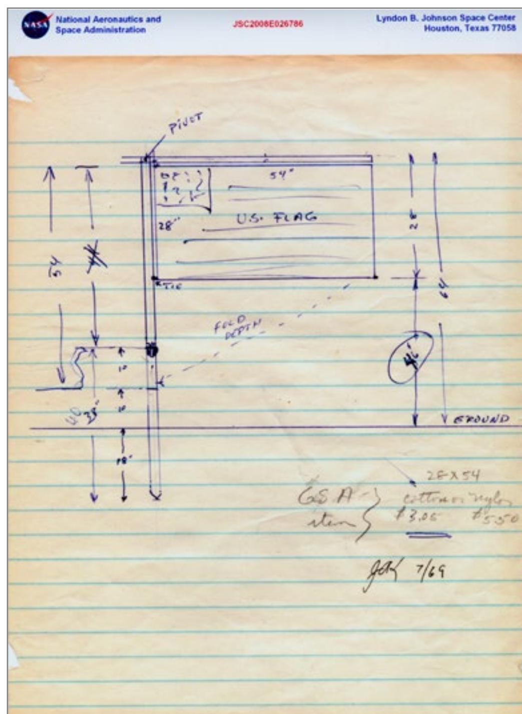
Kinzler believed that the people of the United States would also want to see an American flag to commemorate the enormous accomplishment of landing a man on the surface of the Moon. "So I suggested we have a free-standing flag. I was given an action item in this same meeting to go ahead and design a deployment system. What we have is a series of pipes and tubes and hinges, and we have a nylon flag that's three-by-five feet in size, and that combination was all something that I came up with." Again with the help of McCraw, Kinzler sketched his idea of a freestanding, full-size flag on a telescoping flagpole.

Kinzler proposed hemming the top of a standard-issue nylon flag and inserting a telescoping curtain rod so that once unfolded, the rod or crossbar could be extended to allow the flag to appear to "fly." He credits this idea to his memory of watching his mother making curtains years before. A hinged latch connected the crossbar to the pole and allowed it to be held perpendicular to the pole once the latch was locked into position. A loop of material connected the bottom of the flag to the pole. The pole itself was gold anodized aluminum tubing about one inch in diameter and telescoped out to about 6 feet. The upper portion of the pole then fit into a base tube consisting of a hardened steel ring fitting and tip; this allowed the astronauts to use their geological hammers to drive the assembled pole into the lunar surface to a minimum depth of approximately 10 inches and marked on the pole with a red ring. A second red ring at 18 inches indicated the maximum depth to prevent the flag from being too low next to the astronauts. The flag assembly was a low-cost endeavor—$5.50 for the flag and about $75 for the aluminum tubing.

"We had to be able to have somewhere to put [the flag] that would be easy to have access. So, we went out to this mockup that we had there and Dave and I looked it over, and we thought, 'If they come down the descent ladder and walk around about three steps to the side, if we hang it underneath the armrest of the ladder, that'd be a nice, handy place.' So, we did. We designed a way to fasten it on the underside of the descent ladder armrest, and we added pip pins. You just squeeze them, and when you pull them out, a ball intercept releases itself and then you can just take the thing right off. So then I had the design."

After the development of a protective heat shroud for the flag assembly, Kinzler created step-by-step procedures for packing the flag, installing it on the LM, and deploying it on the Moon. He then trained Armstrong and Aldrin on the deployment procedures and supervised the assembly and packing of the flag. With the Apollo 11 launch date fast approaching, a chartered Learjet flew the plaque and flag, along with Kinzler and George Low (manager of the Apollo program), to Kennedy Space Center in Florida. Under Kinzler's supervision, the installation of the plaque and flag assembly took

A photo of the original drawing made by Jack Kinzler of the design for the folding U.S. flag to be erected on the Moon during the Apollo missions. (Credit: NASA)



Adding Color to the Moon (continued)

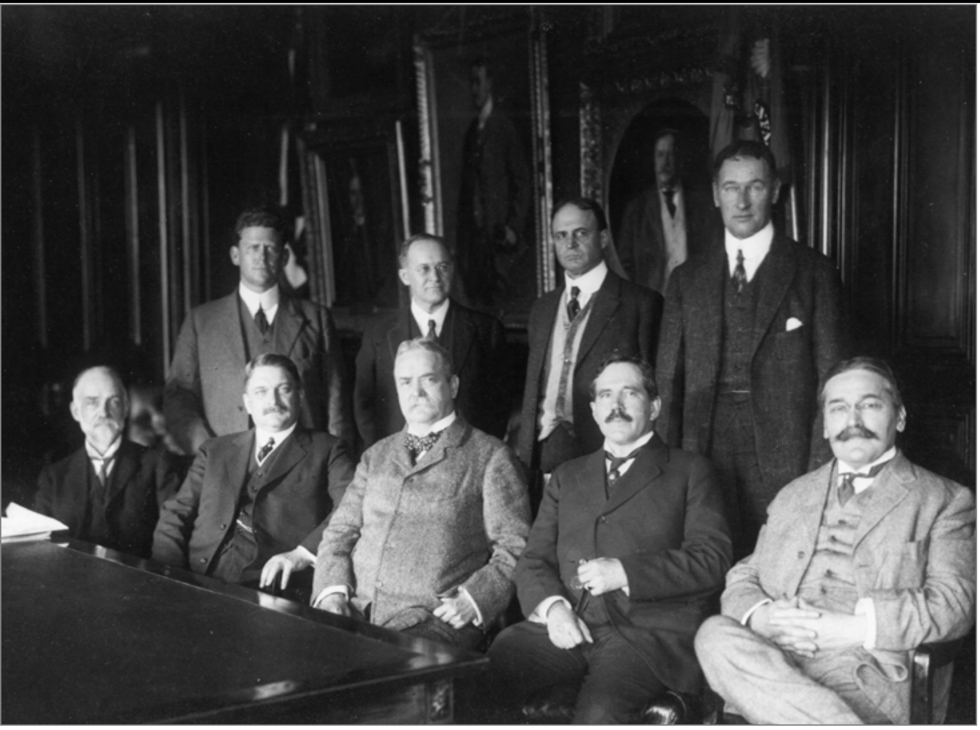
place just hours before launch as the LM sat on top of the Saturn V rocket.

On July 20, 1969, as the world watched in awe, humans landed on another celestial body for the first time. They carried with them these two items for all future generations—a simple stainless-steel plaque and an inexpensive American flag. Along with those items was a straightforward message: "We came in peace for all mankind." But the design of those two items demonstrated something else—NASA's can-do spirit to rise to a challenge.

As Kinzler described the attitude at the time, "We, as a group of people, didn't worry about everything being just exactly according to Hoyle [strictly according to rules]. Improvise is the word we used many, many times." Because of that improvisational determination, Kinzler and his Technical Services Division received multiple agency awards. But one of his favorites was a simple photo of their flag on the Moon. "This one is signed, 'To Jack Kinzler, with thanks for adding the color to this picture.' Now, that was a novel thing for them to say, the color being the red, white, and blue of the flag. That was special. And it's signed by Neil Armstrong and Buzz Aldrin."

Explore Jack Kinzler's full oral history interviews

Top: David McCraw of the Technical Services Division standing next to a mock-up of the Lunar Module. The location of the flag assembly and the commemorative plaque can be seen on the ladder area where the astronauts would descend to the lunar surface. **Bottom:** Shown in this view (left to right) are Tom Moser, Billy Drummond, David McCraw, and Jack Kinzler as they worked to fold and pack the U.S flag on top of a table in Jack Kinzler's office in Building 9 at JSC. (Credits: NASA)



The NACA met for the first time on April 23, 1915, shortly after it was founded. This photo, taken at the meeting, shows nine of its members. Seated, from left to right, are Dr. William Durand, Stanford University; Dr. S. W. Stratton, Director, Bureau of Standards; Brigadier General George P. Scriven, Chief Signal Officer, War Department; Dr. C. F. Marvin, Chief, United States Weather Bureau; and Dr. Michael I. Pupin, Columbia University. Standing, from left to right, are Holden C. Richardson, Naval instructor; Dr. John F. Hayford, Northwestern University; Captain Mark L. Bristol, Director of Naval Aeronautics; and Lieutenant Colonel Samuel Reber, Signal Corps Charge, Aviation Section. Also present at the first meeting (not shown) were Dr. Joseph S. Ames, Johns Hopkins University; the Honorable B. R. Newton, Assistant Secretary of the Treasury; and Dr. Charles D. Walcott, Secretary of the Smithsonian.

The Founding of the NACA

» By **James Anderson**, NASA Historian

ONE HUNDRED TEN YEARS AGO this month, NASA's predecessor organization, the National Advisory Committee for Aeronautics (NACA), was founded. The date of the anniversary marks the passage of a rider to a naval appropriations bill that established the NACA for the modest sum of $5,000 annually. Telling the story of the NACA's founding in this manner—using March 3, 1915, as the moment in time to represent the NACA's beginning—is true, but it overlooks two crucial aspects of the founding. The founding was both a culmination and a turning point for science and aeronautics in the United States.

As a culmination, the founding of the NACA before the entry of the United States into the First World War was part of a longer peacetime transformation of the relationship between the federal government and scientific endeavors over the decades following the Civil War. As a turning point, the NACA represented the creation of a sustained nexus for aeronautical expertise that served the country for four subsequent decades after 1915, leading up to its transformation into NASA.

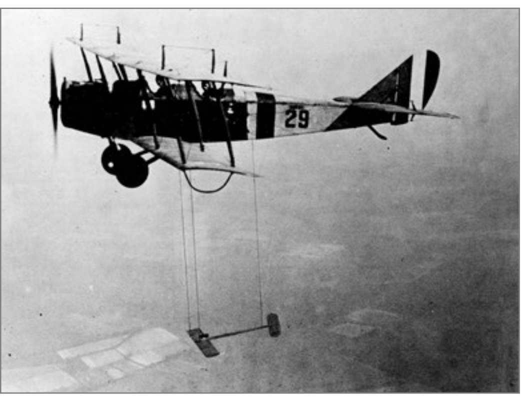
By 1915, aeronautics had not really developed as a field with much practical application. The federal government had provided some limited support for aeronautics before the NACA. Smithsonian Secretary Samuel Langley received both Smithsonian and War Department funding for work on his "Aerodrome" flying machines. Still, American experimentation with the practical aspects of powered and controlled flight remained limited even as the era witnessed the advent of revolutionary technologies such as the automobile and electrification. Even after the first successful flight of the Wright brothers, the priorities of American industry remained elsewhere; and it was difficult to generate political support to invest in aeronautics. As news of the Wright brothers' accomplishment spread, high-profile demonstrations in the following years helped galvanize aeronautical development in Europe at a pace that soon left America behind with respect to aeronautical development.

As that realization came into undeniable focus by 1914, the context for the NACA's creation also required some restraint in order to preserve the Wilson administration's policy of American neutrality at the time. The assumption was that immediately establishing an aeronautical laboratory would appear to be preparation for war.

As a nexus for aeronautical expertise, the NACA developed quickly and maintained at its core the main committee, which was comprised of no more than 12 members by law. Congress authorized the president to appoint two members from the War Department; two from the Navy; one member each from the Smithsonian, the Weather Bureau, and the Bureau of Standards; plus no more than five additional experts who were "acquainted with the needs of aeronautical science, either civil or military, or skilled in aeronautical engineering or its allied sciences."[1] This ensured that the government would always have a majority on the committee.

Government representation on the Committee was not monolithic in its thinking. Government members brought a variety of priorities and perspectives to the table.[2] Among the members, the Army and the Navy had naturally supported technological development since the early years of the republic. As institutions, however, neither was founded to supervise and direct scientific study like the NACA, even if the aims included the practical application of science. The Smithsonian also represented a unique case in which its pre–Civil War founding came about as the result of a legacy bequeathed to the United States. Debated over years in Congress, legislation eventually passed that established the Smithsonian as a federal institution outside of the three branches of government and committed to increasing and diffusing knowledge. That charter aligned much more with scientific endeavors than it did with solving practical problems.

In this photo taken in 1921, one of the first three Curtiss JN-4H aircraft the NACA borrowed for flight research tows a model of an aircraft wing for comparison to tunnel results. (Credit: NASA)



Leveraging specific scientific expertise as needed had become easier with the growth and development of American universities after the Civil War…

What about the two bureaus that were part of the NACA? Their work focusing on practical problems rather than the open-ended investigation of scientific disciplines was not a new approach. This practical problem solving was a key activity of the many federal bureaus that had developed over the previous decades. Leveraging specific scientific expertise as needed had become easier with the growth and development of American universities after the Civil War, which were patterned after the German university system. This meant greater emphasis on research, and it produced more experts in specific fields, enabling the relatively small, focused bureaus to leverage such expertise in solving problems that benefited the economy and everyday people.

The proposal for the NACA—which came through the Smithsonian—included language in the law that left the door open for an eventual laboratory. By 1917, the NACA was breaking ground for its first laboratory building just three months after the United States had formally entered the war. Langley Memorial Aeronautical Laboratory spent the next two decades as the only NACA laboratory until the suspicion that another great war was imminent led to the establishment of the NACA's second laboratory in 1939 and its third in 1941. The NACA retained much of its original character even through the 1950s as jet engines and rockets pushed the boundaries of aeronautics before the next great turning point in 1958, when the NACA became NASA. ■

Endnotes

1. Public Law 271, 63rd Congress, approved 3 March 1915. The committee increased from 12 to 15 in 1929 to accommodate aeronautical representation from the Department of Commerce after passage of the Air Commerce Act of 1926 and later the Civil Aeronautics Act of 1938. After the creation of the Department of Defense, the committee expanded one final time from 15 to 17. In each instance, the government maintained the majority.
2. Ideas were quite literally brought to the table since the committee would meet in person. The committee members received no salary for their NACA service since they each had other existing professional appointments that they maintained throughout. The annual funding that Congress approved supported committee activities such as reimbursement for travel and the preparation of reports.

Remembering the DC-8 Airborne Science Laboratory at NASA

NASA's DC-8 flying laboratory flew Earth science missions from 1987 to 2024. Expert maintenance allowed the aircraft to conduct research on six continents and study ice fields on the seventh—Antarctica. (Credit: NASA/Lori Losey)

» By **Bradley Lynn Coleman**, NASA Historian

THE NASA HISTORY OFFICE and NASA Earth Science Division cohosted a workshop on the recently retired NASA DC-8 Airborne Science Laboratory (1986–2024) at the Mary W. Jackson NASA Headquarters Building in Washington, DC, October 24 and 25, 2024. The workshop celebrated the history of the legendary aircraft; documented DC-8–enabled scientific, engineering, education, and outreach activities; and captured lessons of the past for future operators. Officially titled "Contributions of the DC-8 to Earth System Science at NASA: A Workshop," the event concerned all aspects of the DC-8 story. The workshop featured 38 individuals (speakers, panelists, and moderators) from NASA Headquarters, five NASA centers, eight universities, the SETI Institute, and the National Oceanic and Atmospheric Administration (NOAA). Many other DC-8 veterans attended the event in person or online.

NASA's involvement in airborne science predated the DC-8 Airborne Science Laboratory. The agency's first objective, according to the National Aeronautics and Space Act of 1958, involved "the expansion of human knowledge of phenomena in the atmosphere and space."[1] Subsequent legislation expanded NASA's role in atmospheric and Earth system science.[2] A fleet of NASA airborne platforms allowed the agency to study the environment, develop new technologies, verify satellite data, and monitor space vehicle activity.[3]

NASA operated two large flying laboratories before the DC-8 Airborne Science Laboratory. Both aircraft, converted Convair 990s, succumbed to catastrophic accidents. The first, known as Galileo, collided with a U.S. Navy P-3 Orion near Moffett Field, California, in April 1973, killing 11 NASA personnel.[4] Its replacement, Galileo II, crashed on takeoff at March Air Force Base in July 1985.[5] While there were no fatalities in the second accident, the ensuing fire consumed the aircraft and its instruments. The loss of Galileo II left a gaping hole in NASA's ability to conduct essential scientific and engineering work.

In January 1986, after months of bureaucratic scrambling, the agency bought a former commercial airliner (DC-8-72) for $24 million.[6] Following a major overhaul, the DC-8 Airborne Science Laboratory arrived at NASA Ames Research Center during the summer of 1987. Even then, former NASA program manager Estelle Condon remembered at the DC-8 workshop, "There was an enormous task in front of them [the aircraft team], just a huge task to get all the relay racks, all the wiring, all the ports for the windows to be designed and built so that when the scientists finally came, all that instrumentation could actually be put on the aircraft" for its first scientific campaign, the high-profile interagency Antarctic Airborne Ozone Expedition (AAOE). The NASA Ames Research Center staff, she added, worked "day and night and every weekend to make the plane ready.… It's a miracle that they were able to put everything together and get it to the tip of South America in time for the mission."[7] That historic campaign—AAOE data contributed to the global ban on chlorofluorocarbons—marked the beginning of the remarkable career of the DC-8 Airborne Science Laboratory.

The DC-8 workshop exposed the larger importance of the NASA Airborne Science Program. "While we've got kind of a meeting that's organized around a platform [DC-8], it's important to recognize, what makes airborne science so special at NASA is the way we bring together platforms, sensors, systems, people, and opportunities," Earth Science Division Associate Director Jack Kaye emphasized in his opening remarks. "[T]he DC-8, in terms of ability to carry a lot of people and instruments on long range operations out of many airports under a variety of conditions…it's a really versatile, flexible platform that's allowed for lots of science."[8] While NASA space missions received most of the public's attention, Karen M. St. Germain, director of NASA's Earth Science Division, later noted, airborne science is essential to the NASA mission. "This is the grassroots of science," she stressed. "It's where many of the great ideas are born. It's where a lot of the fledgling sensor technologies are demonstrated."[9] The DC-8 advanced science at NASA and beyond.

Several workshop participants described and analyzed the scientific campaigns of the DC-8 flying laboratory. Langley Research Center scientist James Crawford, for example, talked about the airplane's contribution to NASA's tropospheric field campaigns. Joshua Schwarz from NOAA discussed the airplane's role in global atmospheric monitoring. "It was clear that the DC-8 was going to make things possible that wouldn't otherwise be possible," Schwarz concluded after his first encounter with the DC-8.[10] The former manager of NASA's Upper Atmosphere Research Program, Michael Kurylo, surveyed the aircraft's contribution to NASA's understanding of stratospheric chemistry. In doing so, he touched on the culture of NASA airborne science. "You know, the scientists were always referred to [by NASA pilots and groundcrew] as coneheads.… Too much college, not enough high school," Kurylo explained. "But you know, it was a great time for all of us who are involved in the airborne missions."[11] Investigators used data collected aboard the DC-8 to write articles, reports, and papers on important scientific topics.

A large aircraft capable of extended scientific campaigns, the DC-8 Airborne Science Laboratory produced a strong community of people. The DC-8 accommodated many investigators from NASA, other government agencies, universities, and international organizations on extended global missions. Agency officials also moved

DC-8 workshop participants at NASA Headquarters, October 2024. (Credit: NASA/Rafael Luis Méndez Peña)

the DC-8 base of operations several times between 1986 and 2024, thereby demanding tremendous cross-center cooperation.[12] "Looking around the room, it's clear that what brought us together [for the workshop] is more than just an aircraft," Nickelle Reid from NASA Armstrong Flight Research Center observed. "It's been a shared commitment, decades of passion and dedication from scientists, yes, but also mechanics, technicians, integration engineers, project managers, mission planners, operations engineers, flight engineers, mission directors, mission managers, logistics technicians and, of course, pilots. This village of people has been the beating heart of the DC-8 program."[13] This DC-8 community was central to the success of the workshop.

NASA Mission Manager Walter Klein with Chilean students on board the DC-8 Airborne Science Laboratory in Punta Arenas, Chile, March 2004. (Credit: NASA/Jim Ross)

> "Looking around the room, it's clear that what brought us together is more than just an aircraft."
>
> —Nickelle Reid

The DC-8 Airborne Science Laboratory created unique opportunities for international engagement. "One thing we did a lot was international collaboration," Yunling Lou from NASA's Jet Propulsion Laboratory explained. "I think it really helped—not just doing the collaboration [to accomplish a specific mission]—but doing the training, the capacity building in these countries" to build the community of global scientists and engineers.[14] "The DC-8 and our other airborne assets are more than just science laboratories," NASA Langley Research Center Deputy Director Trina Dyal emphasized. "These assets are opportunities for science, diplomacy, international collaboration, cross learning, educational inspiration, and goodwill."[15] The campaigns of the DC-8 Airborne Science Laboratory routinely involved foreign students, institutions, and governments.[16]

Closer to home, the flying scientific laboratory affected the lives of many U.S. students and early-career professionals. NASA's Student Airborne Research Program (SARP), for example, has integrated American students into DC-8 scientific missions since 2009.[17] "I want to make sure the NASA historians understand that the DC-8 is the premier flying laboratory on the planet, bar none," NASA program manager Berry Lefer said. "But in addition to being the world's premier flying [scientific] laboratory, it's the world's premier flying classroom. And you've seen over the whole three-decade life of the DC-8 that education and outreach, student involvement has been a hallmark of the DC-8."[18] Several SARP alumnae, including Yaítza Luna-Cruz, now a program manager and program executive at NASA Headquarters, delivered testimony on the impact of the SARP program at the workshop. "SARP unleashed my potential in ways that I cannot even describe," Luna-Cruz explained. "You never know what a single opportunity could do to shape the career of a student or early career researcher.... The DC-8 changed my life, and I'm hoping that's a story that can be repeated year after year" with the coming of NASA's new Boeing 777 airborne laboratory.[19]

The DC-8 Airborne Science Laboratory flew its last scientific campaign, the international Airborne and Satellite Investigation of Asian Air Quality mission, in April 2024, before retiring to Idaho State University (ISU). Today,

Remembering the DC-8 Airborne Science Laboratory at NASA (continued)

↑ University students and mentors at Armstrong Flight Research Center in 2019 as part of NASA's Student Airborne Research Program. (Credit: NASA)

students in the ISU aircraft maintenance program work on the airplane to develop real-world technical skills, continuing the DC-8's mission as an educational platform. "That sets our students apart," ISU College of Technology dean Gerald Anhorn told workshop attendees. "Our students have that opportunity because of your [NASA's] donation" to the school.[20]

The agency, meanwhile, has acquired a Boeing 777 to support its ongoing airborne scientific research. The new aircraft will allow for longer flights with larger payloads and more researchers than the DC-8 Airborne Science Laboratory. Several members of the Boeing 777 team from NASA Langley Research Center attended the workshop in Washington. "I mentioned I was in charge of the replacement for the DC-8," Boeing 777 lead Martin Nowicki explained. "Over the last two days, here, it's become pretty apparent that there's no replacing the DC-8…it's carved out its own place in history. It's just done so much." Looking forward, workshop participants identified useful lessons of the past for future operators. But, above all, Nowicki concluded, "What we're really here to do [with the Boeing 777] is carry the torch, the legacy, and just continue all the stuff that we've talked about the last couple of days."[21] DC-8 workshop-related materials are available at the NASA History Office in Washington, DC. ■

Endnotes

1. National Aeronautics and Space Act of 1958, Public Law 85-568, 72 Stat. 426 (1958).
2. See, for example, Section IV, National Aeronautics and Space Administration Authorization Act of 1976, Public Law 94-39, 89 Stat. 218 (1975).
3. For more on the history of airborne science at NASA, see Ernest Hilsenrath, "Flying the 'Gap' Between Earth and Space: NASA's Airborne Science Program," *Earth Observer* 32, no. 5 (2020): 4–14.
4. "Midair Collision Near Coast Base Kills 16," *New York Times* (April 13, 1973): 78.
5. "19 Safe as NASA Plane Blows Tire at March Air Base," *Los Angeles Times* (July 18, 1985): A33.
6. Samuel W. Keller to William F. Ballhaus Jr., January 17, 1986, File 011656, Headquarters Archives, NASA, Washington, DC. The purchase price included the initial costs of modification.
7. Remarks by Estelle Condon, October 24, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
8. Remarks by Jack Kaye, October 24, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
9. Remarks by Karen M. St. Germain, October 25, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
10. Remarks by Joshua Schwarz, October 25, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
11. Remarks by Michael Kurylo, October 24, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
12. NASA officials later based the DC-8 Airborne Science Laboratory out of the University of North Dakota (Grand Forks Air Force Base) and Armstrong Flight Research Center.
13. Remarks by Nickelle Reid, October 25, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
14. Remarks by Yunling Lou, October 24, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
15. Remarks by Trina Dyal, October 25, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
16. Hilsenrath, "Flying the 'Gap' Between Earth and Space," pp. 12–13.
17. Emily L. Schaller et al., "High-Flying Interns: NASA's Student Airborne Research Program (SARP)," *Bulletin of the American Meteorological Society* 103, no. 4 (April 2022): E1061–E1077.
18. Remarks by Berry Lefer, October 24, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
19. Remarks by Yaítza Luna-Cruz, October 24, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
20. Remarks by Gerald Anhorn, October 25, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.
21. Remarks by Martin Nowicki, October 25, 2024, DC-8 Workshop Recording, NASA History Office, Washington, DC.

John W. "Jack" Boyd's contributions to NASA spanned 73 years. (Credit: NASA)

John W. "Jack" Boyd (1925–2025)

On February 20, 2025, John W. "Jack" Boyd died at the age of 99. Boyd began his seven-decade career in 1947 as an aeronautical engineer for the Ames Aeronautical Laboratory at Moffett Field, California. He was promoted into leadership in the late 1960s, serving in multiple roles at Ames Research Center, Dryden Flight Research Center, and NASA Headquarters. In 1985, he left government to take a position as a chancellor for research and adjunct professor, but returned to Ames in 1993 to serve as the senior advisor to the director, senior advisor for history, and center ombudsman until his retirement in 2020.

The NASA History Office remembers Jack as a tireless champion for history, an invaluable colleague, and dear friend to those who ever had the privilege of knowing him. ■

Read NASA's news release remembering his contributions

News from Around NASA

NASA History Program Award Presented to Sandra Johnson, Oral History Lead

Each year, the NASA History Office recognizes the outstanding work of one of our staff members. We are happy to announce that Sandra Johnson, who leads our oral history program, is the recipient of this award for 2024. Her exceptional efforts in conducting, processing, and disseminating NASA's oral histories are foundational to the office's work. Besides her work conducting numerous oral history interviews, most recently for NASA's Science Mission Directorate, as well as processing the transcripts, she works hard to make them available to the public. Outside the agency, she is highly regarded as an expert in the field.

Sandra Johnson is the very deserving 2024 recipient of the NASA History Program Award. (Credit: NASA)

Sandra's experience, her detail-oriented nature, and her willingness to help also make her an incredible resource for the agency. She knows her space history and can often quickly answer obscure inquiries that would otherwise take hours of research. Her nimble work developing history content on the NASA website has also been an important contribution to conveying NASA's history to the public. Congratulations, Sandra!

New Archivists at Headquarters and Goddard

The NASA History Office congratulates **Alan Arellano**, who joined our archiving team at NASA Headquarters last year, on his recent move to support the Goddard Space Flight Center archives. Replacing him at NASA Headquarters, we welcome **Kate Mankowski**.

Kate earned her master of library and information science (MLIS) degree from Syracuse University and has worked for several federal library contracts, including positions at Goddard, the National Library of Medicine, and the National Oceanic and Atmospheric Administration. These positions have given her a variety of experience, including expertise in copyright research and working with metadata. Outside of work, Kate is a talented musician, currently playing violin with the Columbia Symphony Orchestra and viola with the Victorian Lyric Opera. She takes delight in reading and is a lover of tea.

↑ Kate Mankowski. (Photo courtesy of Kate Mankowski)

The NASA History Office Welcomes Spring Interns

The NASA History Office is pleased to be joined by two interns this spring who will be working closely with NASA's archival collections.

Rebecca Massey worked as an intern at Goddard Space Flight Center for the fall 2024 term, and is returning to the center in Greenbelt, Maryland, for the spring. She is a graduate student at the University of Maryland studying library and information science, with a focus on archives and digital curation. She is passionate about preserving both cultural memory and scientific data for future generations. Originally from Pennsylvania, Rebecca moved to Maryland to attend Towson University, where she earned her bachelor's degree in English with a focus on writing. Her work at Goddard consists of processing archival collections relating to the culture and history of the center, as well as digitizing textual records.

↑ Becca Massey. (Photo courtesy of Becca Massey)

Alejandra Lopez joins Johnson Space Center (JSC) as a recent graduate of the University of North Texas with a MLIS degree and an archival studies concentration. During her time at JSC, Alejandra will process and describe accessioned analog collections. In doing so, she will help make the materials available for use in the agency's archive catalog. Alejandra has always had an interest in space exploration and a professional interest in accessibility. She looks forward to helping further research and resources through her work. Alejandra is excited for everything she will have the opportunity to learn during her time at NASA. ■

↑ Alejandra Lopez. (Photo courtesy of Alejandra Lopez)

NASA HISTORY OFFICE SPEAKERS SERIES

The NASA History Office invites you to attend these upcoming presentations on Microsoft Teams.

Join our mailing list for event links.

June 11, 2025, noon ET

Aaron Bateman
Assistant Professor of History and International Affairs
George Washington University

Technology, Politics, and the Rise and Fall of the Strategic Defense Initiative

Upcoming Meetings

MARCH 19–21, 2025
Annual Robert H. Goddard Space Science Symposium
College Park, Maryland
https://astronautical.org/events/goddard/

MARCH 26–29, 2025
National Council on Public History Annual Meeting
Montreal, Quebec
https://ncph.org/conference/2025-annual-meeting/

APRIL 3–6, 2025
2025 Organization of American Historians (OAH) Conference on American History
Chicago, Illinois
https://www.oah.org/conferences/oah25/

APRIL 7–10, 2025
40th Space Symposium
Colorado Springs, Colorado
https://www.spacesymposium.org/

APRIL 9–12, 2025
American Society for Environmental History (ASEH) 2025 Annual Conference
Pittsburgh, Pennsylvania
https://aseh.org/events

MAY 7–9, 2025
The Global Space Exploration Conference 2025
New Delhi, India
https://www.iafastro.org/events/global-series-conferences/global-conference-on-space-exploration-2025/

MAY 29–30, 2025
Society for History in the Federal Government Annual Meeting
Washington, DC
https://shfg.wildapricot.org/page-18398

JUNE 4–7, 2025
Policy History Conference 2025
Charlotte, North Carolina
https://cai.asu.edu/phc2025

JULY 21–25, 2025
2025 American Institute of Aeronautics and Astronautics (AIAA) Aviation and Aeronautics Forum and Exposition
Las Vegas, Nevada
https://www.aiaa.org/aviation

JULY 21–27, 2025
Experimental Aircraft Association (EAA) AirVenture
Oshkosh, Wisconsin
https://www.eaa.org/airventure/

AUGUST 24–27, 2025
ARCHIVES * RECORDS 2025
(88th Annual Meeting of the Society of American Archivists)
Anaheim, California
https://www2.archivists.org/conference

SEPTEMBER 3–6, 2025
Society for Social Studies of Science (4S) Conference 2025
Seattle, Washington
https://www.4sonline.org/meeting.php

SEPTEMBER 8–10, 2025
American Astronautical Society's John Glenn Memorial Symposium
Cleveland, Ohio
https://astronautical.org/events/john-glenn-memorial-symposium/

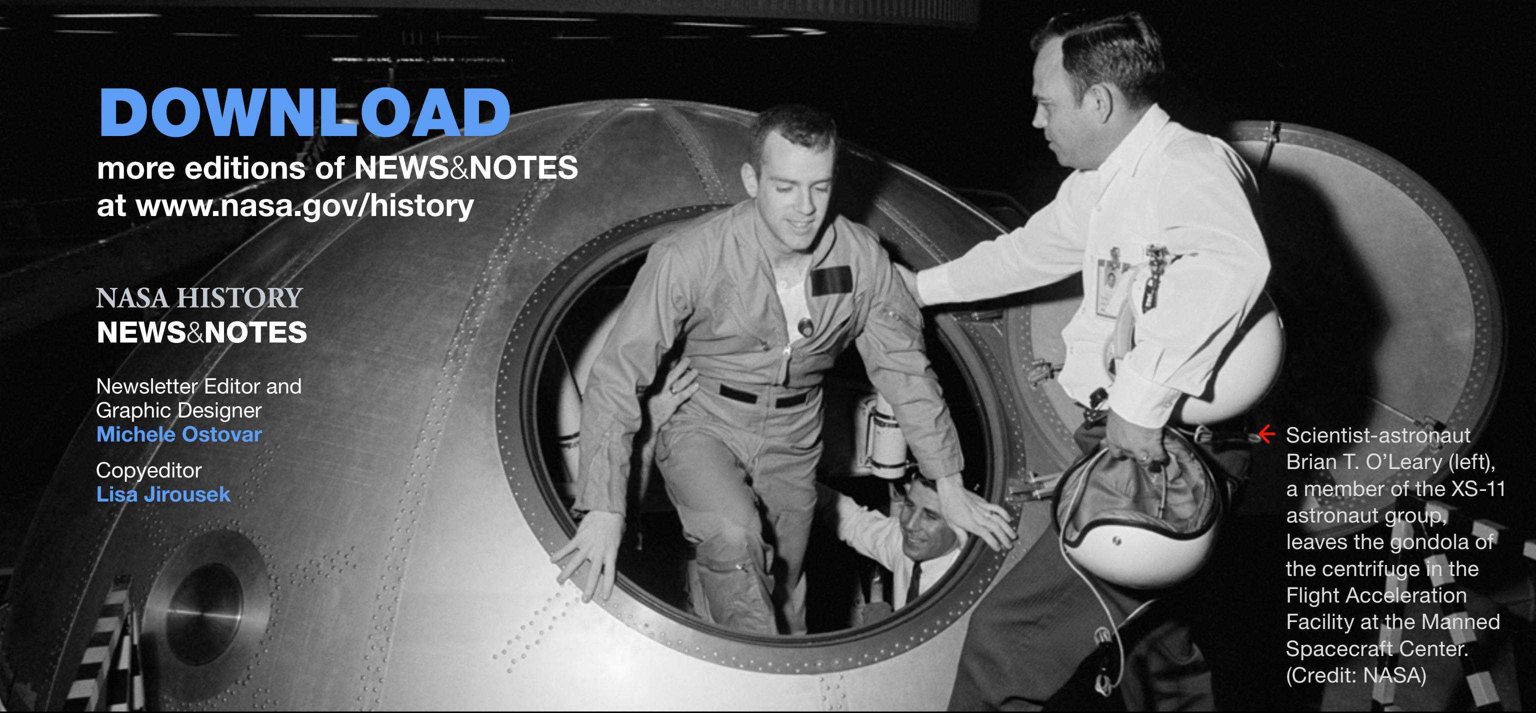
DOWNLOAD

more editions of NEWS&NOTES at www.nasa.gov/history

NASA HISTORY
NEWS&NOTES

Newsletter Editor and Graphic Designer
Michele Ostovar

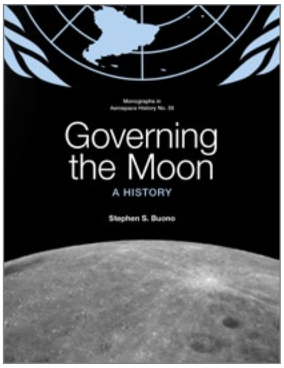
Copyeditor
Lisa Jirousek



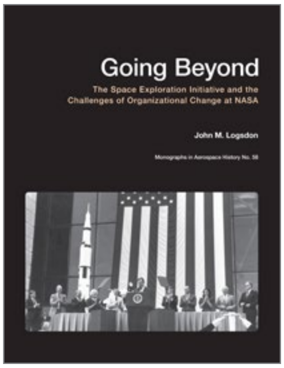
Scientist-astronaut Brian T. O'Leary (left), a member of the XS-11 astronaut group, leaves the gondola of the centrifuge in the Flight Acceleration Facility at the Manned Spacecraft Center. (Credit: NASA)

EXPLORE

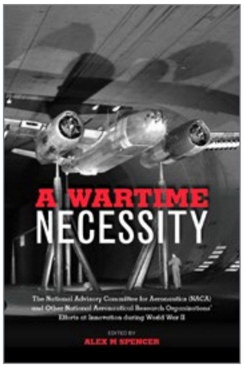
New Titles in the NASA History Series



Governing the Moon: A History
By Stephen S. Buono



Going Beyond
By John M. Logsdon



A Wartime Necessity
Edited by Alex M Spencer

FOLLOW

NASA History on Social Media

X
@NASAhistory

Facebook
@NASAHistoryOffice

Flickr
nasacommons

National Aeronautics and Space Administration

Mary W. Jackson NASA Headquarters
300 E Street SW
Washington, DC 20546

www.nasa.gov