National Aeronautics and
Space Administration

NASA HISTORY NEWS&NOTES

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FOUNDATIONS

NASA'S ROOTS IN THE MID-TWENTIETH CENTURY

↗ A booklet entitled "Monroe Methods for Algebra" (held by W. H. Rankins in this photo), which described shortcuts for solving frequently used algebraic formulas with a Monro-Matic calculating machine, was tested by human computers at the NACA's Langley Research Center in 1951. (Photo credit: NACA/Bill Taub)

NASA HISTORY OFFICE
OFFICE OF COMMUNICATIONS

From the Chief Historian

↑ Testing of a North American XP-51B Mustang with cropped wings in the Ames Laboratory's 16-Foot High-Speed Tunnel. Researchers were able to trace the source of a serious rumble to the plane's air scoop below the fuselage. (Photo credit: NACA)

IN THE BEGINNING, the National Advisory Committee for Aeronautics (NACA) was charged with a critical mandate, "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions."[1] No trivial task, given the small amount of resources appropriated at the time and over the next decades.

The NACA was born in the crucible of one war, and it would be the unfortunate sequel to World War I that would truly set research and development on a new course in the United States. As historian Walter McDougall argues, "twentieth-century warfare finally established state-sponsored and directed R & D as a public duty and necessity" as preparation for the next total war became "an imperative of national survival."[2] By any metric, World War II changed the game.

The Cold War generally, and Sputnik specifically, sparked a massive restructuring and funding profile—a process from which NASA emerged on 1 October 1958. For historians willing to tackle them, many key questions remain related to the persistence and configurations of this transformation. What aspects of the Agency's predecessors are with us today? Is there a level of continuity with the NACA pre–World War II experience, or was that transformation complete? Did changes in the United States parallel efforts across the globe? And finally, are there important lessons in this history for NASA as it moves into the future?

> **What aspects of the Agency's predecessors are with us today?**

This spring, the NASA History Office will publish Alex Spencer's edited volume, *A Wartime Necessity: The National Advisory Committee for Aeronautics (NACA) and Other National Research Organizations' Efforts at Innovation During World War II*. This significant

From the Chief Historian (continued)

volume considers the tremendous impact of war on aeronautical research and development undertaken by the NACA at a moment of world crisis. *A Wartime Necessity* also provides an opportunity to assess how this critical inflection point in world history influenced the direction aeronautical, and later aerospace, research and development would take in the early years of the emerging Cold War. What traces of this experience remain in the DNA of NASA today?

An NACA researcher measures the ice thickness on a landing antenna model in the Icing Research Tunnel at the Aircraft Engine Research Laboratory in Cleveland, Ohio. (Photo credit: NACA)

To continue the conversation kicked off in *A Wartime Necessity*, our office is partnering with the German Aerospace Center (DLR) for a March 2025 workshop entitled “NASA and DLR: The Beginnings of Institutionalized Research in the Field of Aviation in the Early 20th Century.” This project will consider not only the contributions of NASA and DLR predecessor organizations, but also how these histories influenced the approaches to research at those institutions moving forward. Crucially, the workshop is also an opportunity to consider the international and transnational contexts for research and development and its long-term impact on our current institutions.

Confronting these questions about our predecessor organizations stimulated our office to take an initial dive into the topic. The result is this issue of *News & Notes*. Here, our historians and archivists explore an array of topics including the creation of NASA Centers, important research and projects, biographies of key individuals, archival and oral history collections, the experience of women at the NACA, and much more. Our goal is not only to share some incredible history but to stimulate new research questions for current scholars. We certainly have much to learn from those who blazed the trail forward.

Hired by the NACA in 1939, Kitty Joyner is believed to be the NACA’s first female engineer. She is pictured at Langley Research Center in 1952. (Photo credit: NACA)

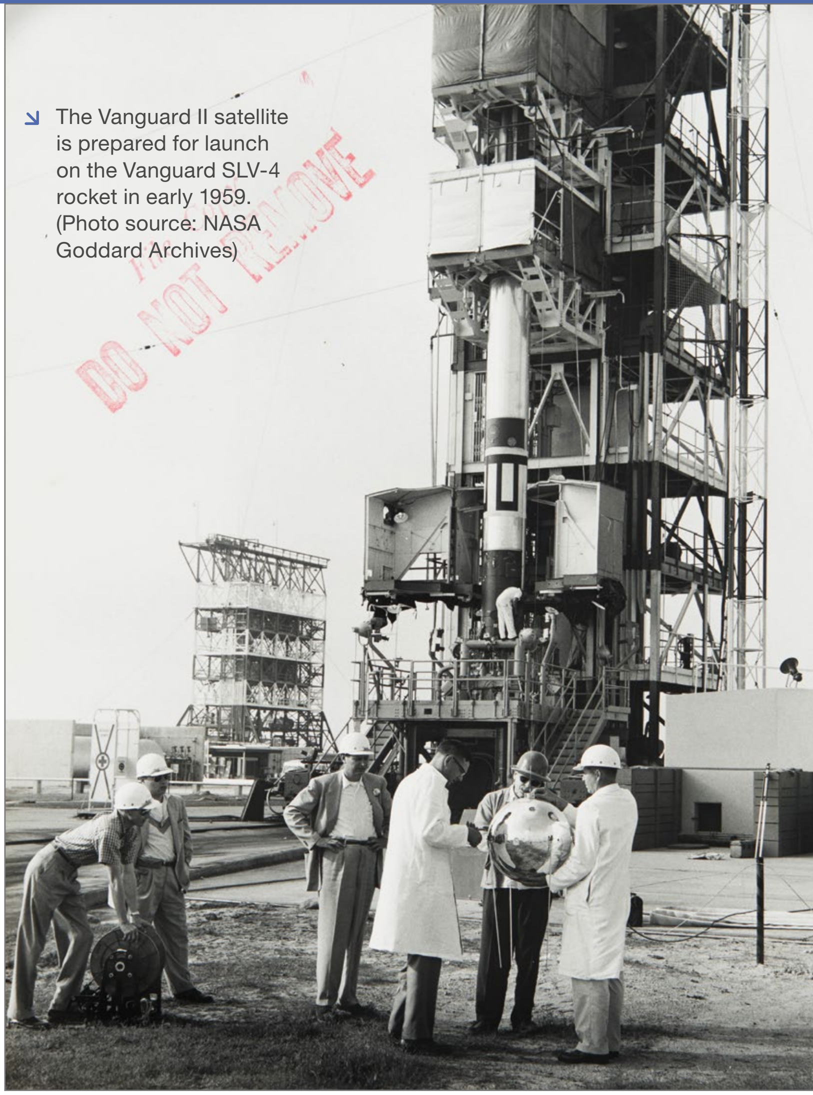
Brian C. Odom
Chief Historian

Endnotes

1. Quoted in Alex Roland, *Model Research: The National Advisory Committee for Aeronautics, 1915–1958, Volume Two* (Washington, DC: NASA SP-4103, 1985), p. 394.
2. Walter McDougall, *...The Heavens and the Earth: A Political History of the Space Age*, 2nd ed. (Baltimore: Johns Hopkins University Press, 1997), p. 5.

Goddard Space Flight Center's Beginnings in Project Vanguard

» By **Christine Stevens**, NASA Chief Archivist



The Vanguard II satellite is prepared for launch on the Vanguard SLV-4 rocket in early 1959. (Photo source: NASA Goddard Archives)

IN THE DAWN OF THE SPACE AGE, a group of scientists and engineers from the Naval Research Laboratory (NRL) had their eye on a new frontier: the uncharted expanse of space. Project Vanguard, initiated in 1955, aimed to launch the first American satellite into Earth orbit as part of the International Geophysical Year (July 1957 to December 1958). Led by NRL, the project envisioned a three-stage rocket design and emphasized scientific instrumentation over military application while showcasing American ingenuity. Project Vanguard had ambitious goals but encountered difficulties. The first five Vanguard launch attempts suffered critical failures, earning it the nickname "Flopnik" in the press. The public, eager for American success in space following the Soviet Union's launch of Sputnik, was disappointed in Vanguard's performance. However, Vanguard's legacy extends beyond its initial setbacks. On 17 March 1958, Vanguard TV-4, also known as Vanguard I, achieved orbit to become America's second satellite and the world's fourth artificial satellite in space. This success marked a major milestone and instilled renewed confidence in the project. Today, Vanguard I remains in space as the oldest satellite orbiting Earth.

The sphere-shaped Vanguard II satellite reflects the scene in this 1959 photo from the preparations for its launch. (Photo source: NASA Goddard Archives)

A few months after the launch of Vanguard I in 1958, the National Aeronautics and Space Act was passed, establishing the National Aeronautics and Space Administration (NASA), and on 1 May 1959, NASA Administrator Dr. T. Keith Glennan announced that the Beltsville Space Center would become Goddard Space Flight Center. The Center would be under the overall guidance of Dr. Abe Silverstein, then Director of Space Flight Development at NASA Headquarters.

Goddard Space Flight Center's Beginnings in Project Vanguard (continued)

Top: The parking area outside Building 1 at Goddard Space Flight Center circa 1960 left room for improvement. **Bottom:** Portable toilets were also parked outside Building 1 circa 1960, when running water at the site was still unavailable. (Photo sources: NASA Goddard Archives)

Recognizing the expertise and dedication of the NRL team, NASA transferred many employees from Project Vanguard to form the nucleus of Goddard Space Flight Center in Greenbelt, Maryland. The migration of NRL scientists and engineers to Goddard was not merely a paperwork shuffle; it was the transfer of their vital knowledge and experience.

Their impact was immediate. While initially tasked with completing Vanguard's mission, Goddard quickly expanded its scope, encompassing Earth science, astrophysics, and space exploration. Early Goddard employees formed the core of several projects, including the Explorer series of satellites and the (Television Infrared Observation Satellite) TIROS Program. They tackled the challenges of satellite communication, laying the groundwork for technologies that would be used for years.

Goddard's dedication ceremony took place on 16 March 1961, but its employees were hard at work well before that day. According to one employee's account, the Applied Mathematics Branch moved from an office in Anacostia to the Greenbelt site on 9 May 1960. Other employees from a Massachusetts Avenue office building in Washington, DC, arrived around the same time. Those early days at Goddard were not easy. Parking lots had not been paved and signs at the Center directed employees to park their cars under a large grove of oak trees. Some buildings did not yet have running water, and portable toilets were located outside.

In celebration of Vanguard II's 60th anniversary in 2019, the Goddard Archives installed newly preserved flight spares of Vanguard II and Vanguard III. Vanguard II hangs in the atrium of Building 33, and Vanguard III hangs in the visitor's center. The Goddard Archives also hosted an event to highlight Goddard's roots in Project Vanguard. In attendance were NRL historian Angelina Callahan, who gave a short talk about NRL and Project Vanguard, and five employees who worked at Goddard when it was first established. The legacy of the early work at NASA Goddard endures, not just in its scientific achievements, but also in its inspiring work exploring the frontiers of the universe. ■

Five of the original employees at Goddard Space Flight Center participated in a celebration of Vanguard II's 60th anniversary in 2019. From left to right, they are Andy Anderson, Ed Habib, Bill Hocking, Ron Muller, and Pete Serbu. (Photo credit: NASA/GSFC)

Flight Research in the NACA Era

An Ames flight mechanic installs a towing apparatus onto P-51B without its propeller prior to a dive test over Muroc Army Air Field in 1944. The tow plane, a P-61A, is out of view. (Photo credit: NACA)

» By **Robert Arrighi**, NASA Historian

FOR MANY, the thought of National Advisory Committee for Aeronautics (NACA) aircraft conjures images of the seminal X-plane and Skystreak flights over the California desert, which broke the sound barrier and laid the groundwork for the space program. The NACA, however, utilized hundreds of conventional aircraft over its 40-plus-year existence to conduct flight research on aircraft components, propulsion systems, safety issues, and high-speed aerodynamics.

The focus here is on flight research, which utilizes traditional aircraft to carry out investigations and can be conducted on any aircraft that meets the requirements for the test. Flight testing, on the other hand, entails flying new or experimental aircraft. Similarly, test pilots fly the latter types of missions, and engineering or research pilots perform the former.

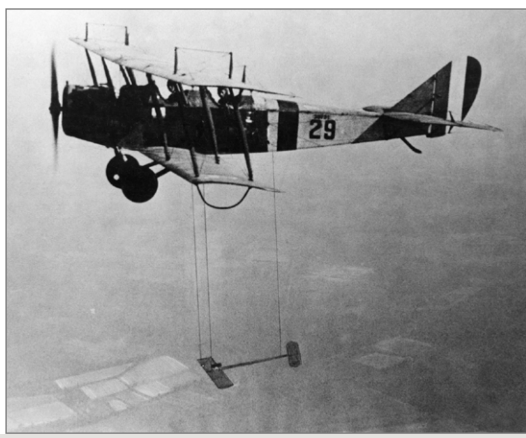
Although the NACA prided itself on its wind tunnels and other ground-based test facilities, research flights were required to validate the tunnel data and obtain measurements for parameters that could not be replicated in facilities, particularly the transonic realm. Flight research often led to new avenues of research unforeseen by engineers.

Although pilots such as Joe Walker, Scott Crossfield, and Neil Armstrong gained fame, flight research relied on a host of unsung researchers to develop the test programs, engineers to integrate the experiment into the aircraft, and technicians to install instrumentation and maintain the aircraft.

During early research flights, the pilots had to manually notate data while maintaining control of the aircraft. This became untenable as technology advanced and aircraft speeds increased, so NACA engineers developed a system that took high-speed photographs of the plane's control surfaces. The NACA's steady improvement of instrumentation in the 1920s and 1930s not only improved the quality of the measurements, but also significantly reduced the number for flights required to obtain the requested data.

NACA flight research got off to an inauspicious start with the preflight cancellation of the first project in 1918 due to delays caused by the construction of the Langley Memorial Aeronautical Laboratory. The first success came almost immediately thereafter, however, when Langley researchers used two Curtiss JN-4 Jennies to

One of Langley's Curtiss JN-4 "Jenny" aircraft flies above fields with a model wing suspended from it. (Photo credit: NACA)



gather stability and loads data to compare with wind tunnel findings.

The NACA's first significant achievement in flight research came in 1923 with the testing of an early supercharger incorporated into a Liberty engine and flown on a De Havilland DH-4. The NACA's addition of radiators to the device eliminated a cooling issue and increased the performance ceiling from 10,000 to 20,000 feet. The system was then successfully tested on three different aircraft models. Superchargers became a key component of nearly all military piston engine–powered combat aircraft.

During the 1920s and 1930s, Langley rapidly increased its complement of both wind tunnels and aircraft. The laboratory utilized over 160 different planes between 1919 and 1940, including a specially designed Boeing PW-9 used to analyze the loads encountered during dives and other high-stress maneuvers.

In the late 1930s, Langley began an extensive effort to study stability and control aspects that affect flight safety and the ability to fly the aircraft with comfort and precision. Langley pilots put more than 60 planes, from single-engine planes to the four-engine B-17 Flying Fortress, through specific maneuvers to record control and motion data. This "flying qualities" program led to the development of specifications for aircraft manufacturers.

Just prior to the onset of World War II, the NACA established two new laboratories—the Aircraft Engine Research Laboratory (today, Glenn Research Center) in Cleveland, Ohio, and the Ames Aeronautical Laboratory in Sunnyvale, California. In both cases, hangars were the first buildings to be completed, and most of the research staff, including the pilots, transferred to the new location from Langley. The first research flights at Ames took place in the fall of 1940, but the construction of temporary offices inside the Cleveland hangar delayed the initial flights there until March 1943.

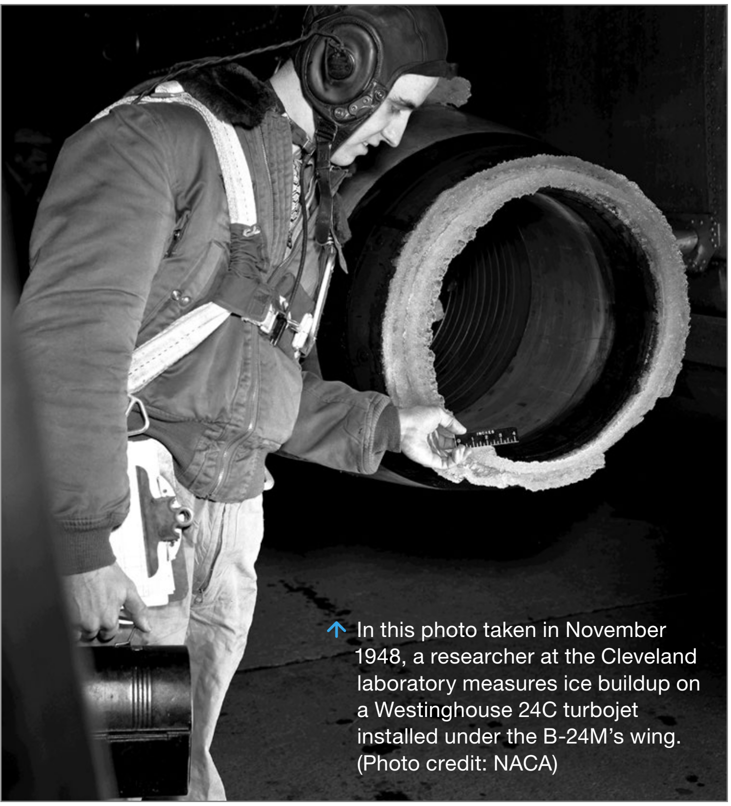
↓ An NACA engineer explains the intensive effort at the Cleveland Laboratory to improve the cooling of the supercharged Wright R-3350 engines that powered the new B-29 Superfortress. The modifications were flight-tested on the bomber in the summer of 1944. (Photo credit: NACA)

The NACA's mission during the war shifted from fundamental research to the quick resolution of operational problems for specific military aircraft.

The NACA's mission during the war shifted from fundamental research to the quick resolution of operational problems for specific military aircraft. The military loaned a bevy of contemporary planes to all three NACA laboratories to use in conjunction with the ground facilities. Langley and Ames focused on aerodynamic and handling issues while the Cleveland laboratory attacked engine-related problems related to cooling, superchargers, and fuel mixtures. For the most part, wartime researchers used the types of aircraft that the studies were intended to improve.

Icing research was one subject investigated by all three NACA laboratories. Langley began the effort in the 1930s by experimenting with different methods of preventing ice buildup on aircraft. Lockheed incorporated the most promising concept, which transferred engine heat to the wings and

Flight Research in the NACA Era (continued)



In this photo taken in November 1948, a researcher at the Cleveland laboratory measures ice buildup on a Westinghouse 24C turbojet installed under the B-24M's wing. (Photo credit: NACA)

other vulnerable surfaces, into a 12-A Electra aircraft for the NACA. In 1940, the 12-A and icing researchers moved to the new Ames laboratory. Ames led the NACA's icing research throughout the war, testing the heat induction system on B-17 and B-24 bombers and a C-46A Commando. The effort led to a Collier Trophy award for NACA engineer Lewis Rodert. In 1946, the icing program was relocated to the Cleveland laboratory, which had performed its own icing research during the war. For nearly a decade, their pilots purposely flew the induction-system-protected B-24M Mitchell and XB-25E Liberator into dangerous icing conditions around the country, initially to examine ice buildup on components and early jet engines, then to study the atmospheric conditions that produced icing droplets. The effort led to advanced instrumentation and federal icing requirements for civilian aircraft.

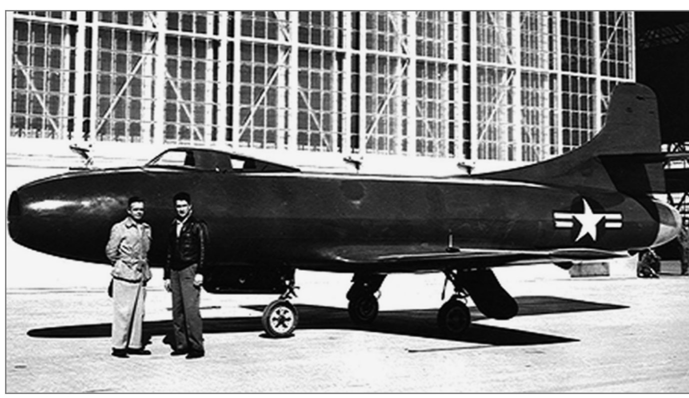
During the war, researchers at Ames were conducting their own drag, loads, and compressibility studies to complement the Langley high-speed flight research. In the summer of 1944, the military allowed Ames researchers to use their Muroc Flight Test Facility in the Mojave Desert. There, a P51-B Mustang without its propeller that was released from a tow plane attained speeds of Mach 0.76. Several months later, Ames returned to Muroc to perform higher-velocity dives using a jet-powered P-80 Shooting Star. These tests were critical in the validation of high-speed wind tunnel data, but the non-fatal crash landings of both aircraft were sharp reminders of the dangers associated with flight research.

The emergence of the jet engine and rocket-powered missile during World War II immediately raised the prospect of supersonic flight. The NACA was just beginning to build small supersonic tunnels, so flight-testing was essential. The Army, Navy, and NACA agreed to collaborate on a program to design experimental research aircraft that resulted in the Bell X-planes and the Douglas D-558s.

In 1946, the NACA established a small facility at Muroc staffed by a modest contingent of Langley personnel to conduct these experimental high-speed research flights, resulting in the breaking of the sound barrier in October 1947. Subsequent studies included swept-wing and delta-wing technologies and the X-15 spaceplane. Muroc would become a magnet for NACA pilots and several future astronauts.

Flight research using conventional aircraft continued at the centers, often using surplus military aircraft as testbeds. In Cleveland, a B-29 bomber was modified to lower full-scale turbojet or ramjet engines from the bomb bay and operate them at high altitudes. Similar tests were carried out using a P-61 Black Widow. In addition, researchers also used the B-29, F-82 Twin Mustangs,

Douglas test pilot Eugene May and NACA research pilot Howard Lilly (right) pose with the Douglas D-558-1 Skystreak #2. On 3 May 1948, Lilly became the first NACA pilot to die on duty when a control system failure caused this aircraft to crash. (Photo credit: NACA)



Technicians load a supersonic ramjet-powered missile onto a B-57 Canberra in September 1957. (Photo credit: NASA)

and later a B-57 Canberra to carry ramjet-powered missiles over Wallops Island. The missiles relayed data as they achieved supersonic speeds during their descent toward the ocean.

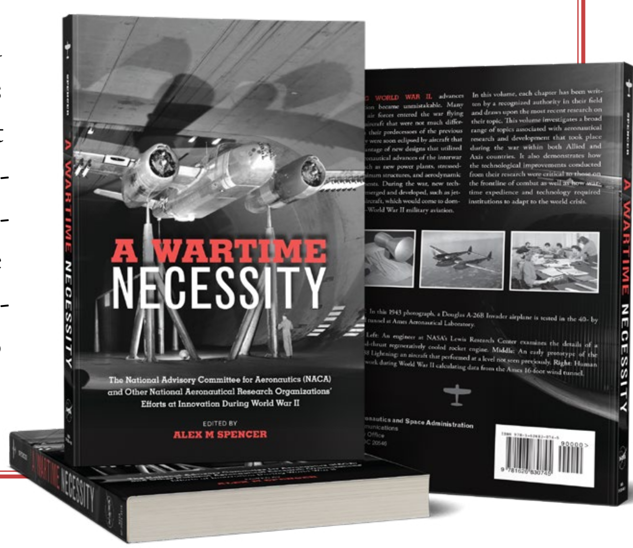
The disbanding of the NACA in 1958 led to a severe curtailment of flight research at the Langley, Ames, and Cleveland laboratories. Although flight research resumed at the three former NACA centers in the late 1960s, often focusing on civilian aviation, scientific research, and remote sensing, it never again reached the peak levels from the 1940s and 1950s. Muroc (today, NASA's Armstrong Flight Research Center) remains the world's premiere atmospheric flight research center.

COMING SOON

A WARTIME NECESSITY

The National Advisory Committee for Aeronautics (NACA) and Other National Aeronautical Research Organizations' Efforts at Innovation During World War II

This newest work in the NASA History Series, edited by Alex M Spencer, investigates a broad range of topics associated with aeronautical research and development during World War II within both Allied and Axis countries. It demonstrates how the technological improvements derived from their research were critical to those on the front line of combat as well as how wartime expedience and technology required institutions to adapt to the world crisis.



ORAL HISTORY

Through Unprecedented Circumstances, NASA's Oral History Team Raced to Preserve Stories from the NACA

» By **Sandra Johnson**, NASA Oral History Lead

In 2005, NASA's Chief Historian, Dr. Steven Dick, asked the Johnson Space Center (JSC) History Office to collect oral histories with former National Advisory Committee for Aeronautics (NACA) employees before the opportunity disappeared. This would be a new project and distinct from the other oral history endeavors that Headquarters had traditionally supported. The NACA alumni group organized reunions periodically at the former agency locations in Virginia, Ohio, and California, and they were gathering near Ames Research Center that fall. Dick realized the importance of capturing the memories and firsthand experiences of the pioneers of aerospace research before they were lost, and he provided funds for the JSC oral history team to travel to the event. The first NACA reunion, held almost 30 years earlier, had boasted 611 participants. A record 810 people took part in Reunion IV in 1991. After that, attendance steadily dwindled, and most of the remaining retirees attending Reunion XI were in their 80s and 90s. Time was of the essence.

After the call to action from the chief historian, the JSC history office manager contacted the reunion organizers to obtain the names of the confirmed attendees and start the project rolling. After identifying potential interview subjects, the team followed established protocol and sent letters of introduction to each attendee, explaining the project, the purpose, and the oral history process. The interview packet also included a copy of a standard release, a list of general interview questions about the NACA, and a biographical form for the participants to send back. Having this information ahead of the reunion allowed alumni the opportunity to decide to participate in a recorded oral history interview or to provide a written response. The team made travel arrangements for California, finalized the interview schedule, and prepared for the new project by researching the NACA's long history. However, before reaching the West Coast, the JSC team had to take an unexpected detour.

Just a month before the reunion, Hurricane Katrina, a devastating Category 5 storm, hit the Louisiana

→ Engineer-in-Charge Dr. Smith "Smitty" DeFrance greets the NACA's Ames Laboratory original staff members as they prepare to have their photo taken on 30 August 1940. (Photo credit: NACA)

Through Unprecedented Circumstances, NASA's Oral History Team Raced to Preserve Stories from the NACA (continued)

and Mississippi coasts with catastrophic results. With more than 1,300 fatalities and damage in the billions of dollars, Katrina's horror played out daily on television and dominated the news cycle for days. The most active Atlantic hurricane season on record at the time also included Hurricane Rita, which formed a couple of weeks later. The fourth-largest tropical cyclone in the Atlantic, with record-setting low pressure after moving into the warm waters of the Gulf of Mexico, Rita rapidly strengthened to a Category 5 hurricane and became the most intense storm ever recorded in the Gulf.

The intensity of the storm as it churned toward the mid-Texas coastline and the recent devastation by Hurricane Katrina combined to trigger one of the largest mass evacuations in United States history. On 21 September, officials began ordering people in low-lying areas along the coast to leave for safer ground, which included parts of Clear Lake and Galveston County, where the team members made their homes. Fears about a second Katrina-like storm created a chaotic event, overwhelming highways and resulting in more than 3 million people attempting to leave the Houston/Galveston area at the same time instead of the planned staggered and orderly evacuation. More than two-thirds of those running were inland from the coast, not in locations that were in immediate danger or under orders to leave. But the devastation from Katrina was still fresh in the minds of residents who did not want to get trapped in flooded homes like the people of New Orleans.

As the orders to leave came for the Galveston County and JSC areas, the history team scrambled to protect and secure the audio and recording equipment, computers, project records, books, and all the preparatory material gathered for the NACA project. Evacuating with the portable recording equipment and research in tow "just in case," no one knew what type of damage would be encountered on return to the area after the storm, much less when or if a flight to California would be available. The team members packed up and joined the throngs hoping to escape with their families and pets to ride out the storm further inland. Widespread gridlock caused 10- to 36-hour road trips that on a normal day would only take 1 to 5 hours. Gas stations along the escape routes quickly ran out of fuel and supplies, causing more problems with stalled vehicles blocking traffic. Temperatures reaching over 100 degrees with high humidity resulted in 107 deaths in the rush to escape, most of those from heat exhaustion.

↓ Hurricane Rita swirling in the Gulf of Mexico, as seen by an Expedition 11 crewmember on the International Space Station on 25 September 2005. The hurricane was heading toward the Texas coast. (Photo credit: NASA)

Widespread gridlock caused 10- to 36-hour road trips that on a normal day would only take 1 to 5 hours.

The storm took a late turn away from the Houston/Galveston area, adding to the traffic snarl across the state, and finally made landfall on the border between East Texas and Louisiana. Leaving a wide swath of destruction in its path, Rita was the strongest hurricane to strike Southeast Texas and Southwest Louisiana since Hurricane Audrey in 1957.

After another long road trip in reverse to get back home, there was no time to relax before the trip to California for the NACA reunion weekend, but the extra effort proved worthwhile and yielded 13 recorded interviews and 59 written biographical submissions. The attendees were welcoming and excited to have a chance to tell their stories and already looking forward to another opportunity in Virginia.

Three years later, at Langley Research Center, NACA Reunion XII provided more willing oral history participants, but because of the aging alumni, it became the last organized event for the

Langley Research Center's Building 1146 is in the foreground in this photograph of the 16-Foot High-Speed Tunnel taken 15 March 1949. (Photo credit: NACA)

NACA. The effort to collect their oral histories continued in 2014 and 2015 and included visits to the former NACA sites in Ohio, Virginia, and California, resulting in 48 more interviews. Their stories capture the experiences of only a handful of people who worked at the facilities but provide the human story of America's endeavor to serve as the leader in aeronautical research and the technical innovations that resulted from their labors. The contributions documented through the project vary widely and reveal the expertise and ingenuity of aeronautical researchers and engineers utilizing wind tunnels, the bravery and thrill of flying test aircraft, the fear and sadness of losing a husband to that service, and the mundane day-to-day work behind the scenes that kept the NACA moving forward.

Young men and women fresh out of school, or just back from serving their nation in World War II, traveled across the country on trains and planes, some for the first time, and made their homes in unfamiliar locations without family support, in questionable accommodations, and in fields of work that were just opening up to women and minorities. By making the decision to join the NACA, many discovered their future—in their career and their lives. They married, put down roots in the area, and raised their families. They transformed their neighborhoods and communities, sometimes labeled "NACA-nuts" by the locals because of their unique way of tackling problems. Some designed and constructed their own homes with help from their colleagues, adding avant-garde options the same way they engineered and built the emerging field of aeronautical research. They developed lifelong friendships and played as hard as they worked. Their memories were shared through smiles and laughter, as well as tears, but most referred to their time with the NACA as the best time of their lives. ■

Read the NACA oral histories

NASA'S ORAL HISTORY COLLECTIONS contain informal interviews dating back to the early days of NASA and conducted by Center historians and authors researching specific subjects for their publications. However, the first large-scale and formally organized oral history program was not established until 1997. At that time, Johnson Space Center Director George Abbey, inspired by the work of historian Stephen Ambrose, commissioned a project to preserve the stories from the pioneers of human spaceflight before the veterans of those programs were lost. Created with the charter to conduct as many interviews as possible with JSC retirees, current employees, and contractors, the transcripts would then be archived and made available for use by researchers and the general public. Known as the JSC Oral History Project, the effort later became a function of the JSC History Office, and the team continued to collect and preserve the history of the Houston center for the next 25 years. Through the team's work, JSC was soon recognized as the Center for excellence for oral history at NASA, and successive chief historians requested additional Agency-wide projects each year beginning in 1999. Over the successive years, the team talked with more than 1,000 participants and contributed over 1,300 interviews to the archives. Now as a part of the larger History and Information Services Division, NASA historians and oral history specialists continue to conduct interviews and add to this impressive collection.

Read NASA's oral histories

Abraham Hyatt in the Early Days of NASA

From Fighting Nazis to Collaborating on Apollo

» By **Julie Pramis**, NASA Archivist

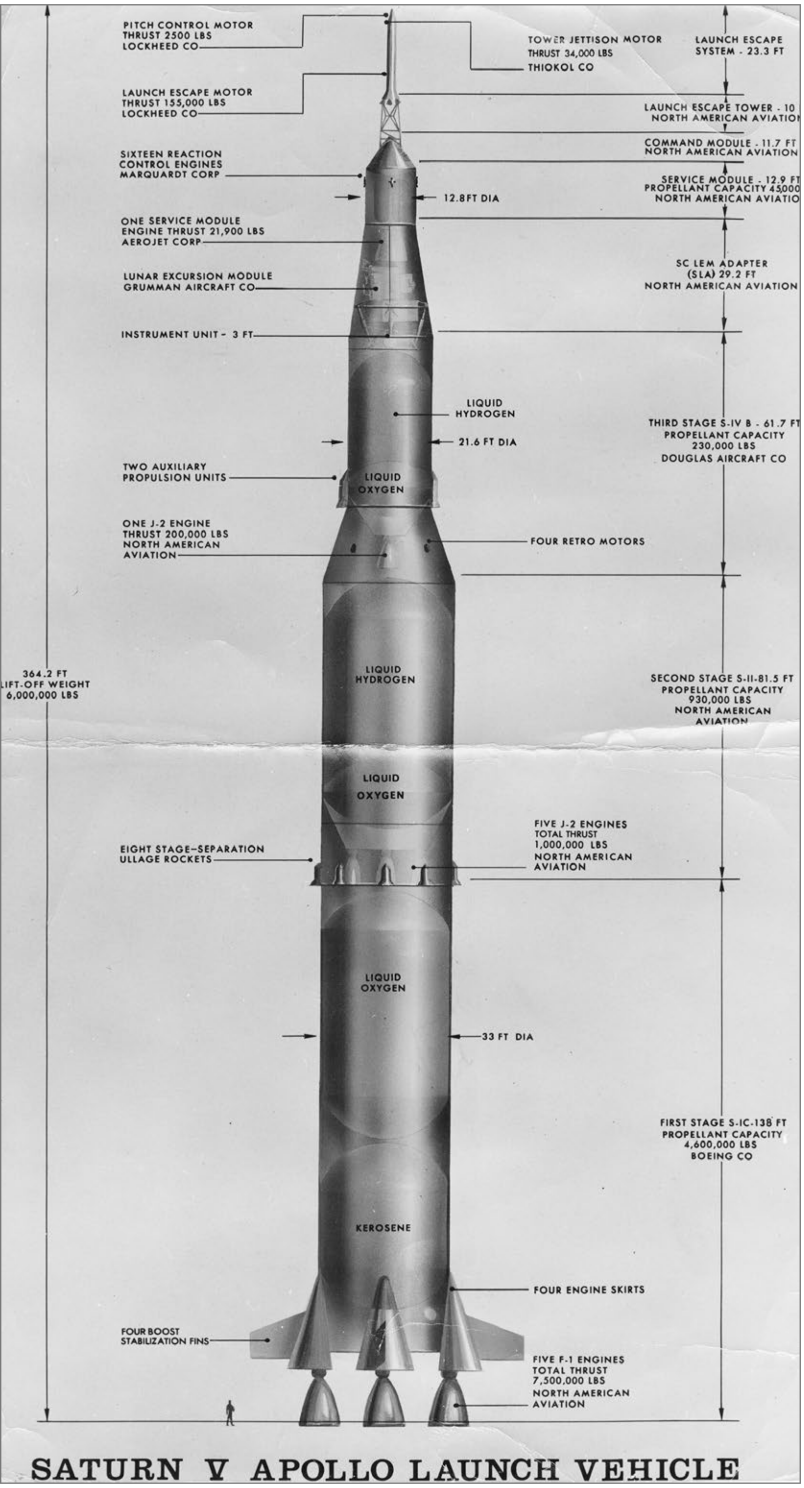
NOVEMBER 1957: Hugh Dryden, Director of Aeronautical Research for the NACA and soon-to-be Deputy Administrator of NASA, brings together leaders from across the federal government, the private sector, and several universities to create the Special Committee on Space Technology. This new committee would advise the U.S. government on the development of a national space program. Among its members was Abraham Hyatt, Chief Scientist and Research Analysis Officer for the Navy Bureau of Aeronautics.

Hyatt had operated under the Navy's Bureau of Aeronautics since his time in active duty as a Marine in World War II (WWII). During the war, he worked with the Bureau gathering intelligence in Germany and Eastern Europe: "[I]t was our function to proceed with the front line troops. When we entered a place where there were any technical work, research or developments going on we were to assess what was there and send the information back."[1] Hyatt and his team members obtained information, then sent their findings on to specialists who could exploit the intel for the allied forces. After the war, Hyatt moved up the ranks with the Bureau's Research Division in progressively higher positions of management.

With this experience, as well as his bachelor's degree in aeronautical engineering from Georgia Tech and his previous work in the private sector for other aircraft companies, Hyatt was an ideal hire when the NACA was absorbed into NASA. The Special Committee published "Recommendations Regarding a National Civil Space Program" in 1958, just as Hyatt was serving as the Assistant Director of Propulsion for the new space agency.

Shortly thereafter, Hyatt would work with members from the Special Committee again, in particular with Wernher von Braun, on the Saturn Vehicle Team. Von Braun received a doctorate in physics in Berlin and, in 1940, had served as a junior SS officer. Following the war, von Braun was moved to the United States as a part of Operation Paperclip—a secret movement of German scientists, engineers, and technicians to work for the U.S. government. Von Braun and Hyatt worked together on Saturn I, under Abe Silverstein, an NACA/NASA employee and American Jew who had

← The Special Committee on Space Technology, called the Stever Committee after its chairman, Guyford Stever, meets at the NACA Lewis Flight Propulsion Laboratory in Ohio, 26 May 1958. Left to right, Edward R. Sharp, Colonel Norman C. Appold, Abraham Hyatt, Hendrik W. Bode, W. Randolph Lovelace II, S. K. Hoffman, Milton U. Clauser, H. Julian Allen, Robert R. Gilruth, J. R. Dempsey, Carl B. Palmer, H. Guyford Stever, Hugh L. Dryden, Dale R. Corson, Abe Silverstein, and Wernher von Braun. (Photo credit: NACA)



↑ Poster of the Saturn V launch vehicle from the Abraham Hyatt Collection in the NASA Headquarters Archives. (Photo source: NASA Headquarters Archive)

worked on aircraft research for World War II combat. To be a fly on that wall!

One critical decision the Saturn Vehicle Team made was to use liquid hydrogen as a second-stage propellant for Saturn I, Block II. This method would then continue to be used for upper stages throughout the Apollo program. Among Hyatt's handwritten notes on the plans for Saturn is a letter he wrote 10 years later to NASA Administrator Dr. Thomas Paine about his team's work:

> there were a handful of decisions which can be classed as truly overriding in their importance to the ultimate success of the Lunar Landing Program…. One of these dominating contributions, I believe, was the decision to use LOX Hydrogen as the propellants for the upper stages of the Saturn Launch Vehicle.[2]

"One of these dominating contributions, I believe, was the decision to use LOX Hydrogen as the propellants for the upper stages of the Saturn Launch Vehicle."

According to Hyatt, consensus from the team on using liquid hydrogen as a propellant took time and convincing, particularly to earn von Braun's agreement. In the end, the Saturn Team left behind a significant legacy on spaceflight history.

In the six short years that he worked for NASA, Hyatt had a great impact on its operations. He started with the Saturn Vehicle Team in the role of Assistant Director for Propulsion Development. Later he would be promoted to Deputy Director for the Launch Vehicle Directorate, and in 1960 he was promoted again to Director of Long-Range Planning and Program Evaluation, a position he held through the remainder of his time at NASA. Hyatt was awarded the NASA Certificate of

Appreciation in 1963, his last year with the Agency.

The "Recommendations Regarding a National Civil Space Program" report, Abraham Hyatt's letter to Dr. Thomas Paine, several of his handwritten notes on the Saturn Vehicle Team, and the images shown here are all available to view and research in the NASA Archives' Abraham Hyatt Collection in the Headquarters Archives. A digital copy of the transcript of Hyatt's oral history interview is available upon request from the Headquarters Archives. The Abraham Hyatt Collection holds materials from the breadth of his adult life and career. Beyond everything already described above: his personal correspondence, speeches given to Congress, involvement with the American Institute of Aeronautics and Astronautics, lectures at the Massachusetts Institute of Technology, and more. Further materials about his work at NASA are also available from other collections in the archive, all of which just scratch the surface of a fascinating life and career. ■

↑ Abraham Hyatt receives the NASA Certificate of Appreciation in 1963. (Photo source: NASA Headquarters Archive)

Endnotes

1. John W. Young Oral History Interview, 28 June 1974, transcript available in the NASA Headquarters Archives.
2. Abraham Hyatt, letter to Dr. Thomas Paine, 24 November 1969, "[Papers on hydrogen propulsion/Saturn/Apollo]," HQ-2019-07, box 15, folder 3, NASA Headquarters Archives, Washington, DC.

The Journey to Adulthood
First Stop, NACA

A group of women scientists at NASA's Langley Research Center in 1959. From left to right, they are Emily Stephens Mueller, Jean Clark Keating, Dottie Lee, Katherine Collie Speegle, Ruth Whitman, and Lucille Coltrane. (Photo credit: NASA/Bill Taub)

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

FOR YOUNG AMERICAN WOMEN, securing a job at one of the National Advisory Committee for Aeronautics (NACA) laboratories and sites in the 1940s and 1950s represented the first step on their path to adulthood. A position with the NACA promised women financial independence and allowed them to transition from adolescence and, for many, the opportunity to move out of their childhood homes. Here, at these research laboratories and sites, young single women established their careers; met, dated, and married their husbands; built lifelong friendships; started their families; and even had some fun along the way. Some stayed for many years, while others left after marriage and returned after raising their children. As was expected, most of these women accepted positions in traditionally female occupations; they were secretaries, stenographers, typists, nurses, and librarians. Others worked as mathematicians or computers, and a handful as engineers. While some saw women as temporary employees assisting with the war effort, or as wives and mothers first and foremost, some men saw what these girls had to offer, if given the chance. For most young women working at the NACA, that great adventure known as life began when they received their job offer.

Many came to the NACA after completing high school or earning their baccalaureate degree. To encourage girls to apply for open positions, the Civil Service Commission offered the civil service exam in some high schools. Students who took the exam and received a high rating remembered how this accomplishment incentivized women to work for the federal government. Some were as young as 17 when they received offers to become secretaries or typists. Opportunities abounded for women with degrees in mathematics, and the NACA recruited

The Journey to Adulthood (continued)

women from female colleges across the South to fill computer and mathematician positions at the Langley Memorial Aeronautical Laboratory in Hampton, Virginia. On the West Coast, the committee relied on word of mouth to attract computers and offered positions to women attending California colleges. The need for mathematicians was so great that Eleanor "Jerry" Jaehnig received an offer even before she graduated from Winthrop College in South Carolina. Higher pay and a chance to work on cutting-edge research encouraged women to reconsider the traditional path to adulthood, as a wife and mother, and to instead consider a career with the NACA.[1]

The staff of the 4-foot by 4-foot Supersonic Pressure Tunnel at Langley gather for a photo on August 15, 1956. (Photo credit: NACA)

Like many Americans, young women were increasingly mobile in the 1940s and 1950s, often moving to seek better opportunities. Leaving home could be the ticket to building a secure future. Plus, moving enabled women to break free from their parents and their generational attitudes about what girls could and should do. They made their own decisions on their own terms.

One of the first decisions they had to make after being hired was how to reach their destination and then find a place to live. Sugenia M. Johnson ended up in Norfolk and had to find her way over to Hampton with her luggage. Not knowing any better, she ended up accepting a ride from a kind stranger at the train depot, who she later learned was the local bookie's girlfriend. As she explained, options for housing for single women were limited. She secured a spot in government housing, which she described as a "a two-story chicken coop. That's the only way I could explain it." The unit had been shoddily constructed during the war, and, she recalled, "The woman that was in charge of it looked like a madam."[2]

Another young woman, Mary Ann Johnson, had never flown on a plane before and did not know what to expect once she arrived at Langley. "I just thought it would be something different. I thought, well, this sounds like fun." She flew into Norfolk and took the ferry into Hampton Roads. She did not know where she would stay and had no car, but she located a temporary place to stay and waited for her roommate, who arrived three or four months later. Finding housing in Hampton could be difficult, so some of the girls rented rooms from local homeowners and took meals at a nearby boarding house.[3]

Transportation to and from the labs was also an issue for young women without vehicles. Some of the women relied on male colleagues to drive them to and from work, while others took the bus.

For those who moved from out of state to work at one of the labs, the surrounding communities had a familiar feel. Mary Ann Johnson likened South Hampton to "a college campus" when she arrived. "It was so filled with young people—young single people." None were bored or lonely. Leisure activities were affordable and enabled youth to share experiences that drove them together. Groups of young people hung out together and bowled, skied, cheered on local baseball teams, and attended picnics and dances. To let off steam after work, employees grabbed a beer or shared a meal. Many of "these people were just out of school, and they were really spreading their wings."[4]

"...these people were just out of school, and they were really spreading their wings."

—Mary Ann Johnson

Concentrated in clerical positions, young women handled the paperwork generated by their divisions and offices. Engineers and scientists relied on their secretaries to type their reports and handle correspondence. There was so much typing at the Lewis Flight Propulsion Research Lab in Ohio that June C. Bahan-Szucs recalled being asked if she like to type. When she replied yes, her supervisor said, "'Well, you'd better. You're going to be typing a lot.' And boy," she added, "that was the greatest understatement of the world." NACA technical reports were complicated. In addition to summarizing research findings and conclusions, these reports included statistics, charts, figures, and equations—all of which clerks had to learn to type. And mistakes were "not acceptable in any form, any shape. It had to be perfect." On top of that, the publications had to meet NACA standards.[5]

Even though their tasks could be overwhelming, these young women found a way to make their work fun. To ensure they had not made any mistakes, they often read the papers out loud, but because they did not know how to pronounce the Greek symbols or aeronautical terms, they "made up our own Greek. We made some other pronunciations that were quite funny, like a manometer, that was a man-o-meter." When reading "the equations, instead of deltas, you'd have triangles, and then instead of psis, you'd have pitchforks, and then you'd have all manner of things." Those readings often broke out in fits of laughter because the paper sounded so silly.[6]

As was the case with clerical work, women held a near total monopoly on library positions within the NACA. Jane S. Hess, who served as a librarian at Langley, worked closely with engineers, pilots, and scientists. She was involved in aeronautical and flight research and learned "all about it," she said. "I had to know about it because I had to acquire the proper materials." To identify the books and journals the lab needed access to, she formed a library committee that included a researcher from each division. This team, along with her guidance, helped build an outstanding scientific library.[7]

Nursing was another female occupation at the NACA. They worked in the dispensary, where they saw employees with "colds, stomach aches, hangnails, cuts, bruises, hangovers [after a] bad night, and of course, pneumonia." If someone had a serious injury, they sent them to the nearby hospital, but most of the time the nurses made their own decisions without consulting a physician. Marilyn Lunney, who worked at Lewis, explained, "You learn very soon that you make choices and decisions you are going to have to live with, and so was the patient." She also educated patients who had received a diagnosis "but had no clue what it was. … They'd come in with whatever books they found, 'Can you tell me what this means? Can you tell me what that means?'"[8]

Other women at the NACA worked as computers. They read flight tape and film, analyzed the data, and plotted figures. Using their Friden calculators or slide rules, they filled out data sheets. One of those computers, Mary Ann Johnson, called this type of work "very boring" until she started working more closely with engineers on their projects. "I went to school to do all of this," she thought to herself. "All I'm doing is punching this little machine."[9]

Some engineers saw potential in many of the young female computers and provided them with opportunities to gain greater responsibility and more authority. Philip Donely at Langley assigned Jaehnig the task of measuring the gravity and speed of the P-40 aircraft using a V-G recorder. "He did a lot for me," she said. "He was determined that he was going to make an engineer out of me," but was disappointed when she

Portrait of Marilyn Lunney. (Photo credit: NACA)

A Langley computer works with a Friden machine nearby. (Photo credit: NACA)

got married and quit working. Maxime A. Faget trained Dorothy B. "Dottie" Lee to become an engineer, after she filled in for his secretary while she was on her honeymoon. Lee worked as a computer, and later as a mathematician, but agreed to substitute for Faget's secretary because one of her projects at the time "was to solve a triple integral for an engineer, so it didn't require using my calculator. I could just do it at my desk." She shared an office with his secretary, so she worked on her triple integral while answering the phone and handing out the mail. After the two weeks were up, Faget asked her to join his group, so she worked for the Pilotless Aircraft Research Division, and she eventually spent time at Wallops Island testing rockets.[10]

Finding a job, especially one that paid well and was fulfilling, was important to becoming an adult, but the NACA was not all about work. Forming romantic relationships and long-lasting friendships was another important step toward reaching adulthood that the committee helped to foster.

One secretary described the NACA as "a lovely marriage factory." In at least one instance, Lewis's Director, Edward R. Sharp, played matchmaker. When he visited the onsite clinic, he joked with his youngest nurse, Marilyn, who was still single. "Have you not found anybody out here yet? Do I need to hire some more young engineers?" he

> One secretary described the NACA as "a lovely marriage factory."

asked. "I want to be sure we get you a good guy. Now, tell me what you're looking for." When she said many of the men who came to the clinic needed help with "hangnails and hangovers," he replied, "Oh they're just looking you over." Once she started to date Glynn Lunney (her future husband) Sharp asked her, "Do you think this one is okay, or do I need to hire some more?" After all, there were plenty of fish in the sea. (Bahan-Szucs recalled that at one point there were 80 men for every woman on site.) That did not mean that every man was "Mr. Right." Sharp just had to find her the right one. Finding a match at Lewis and the other labs was sometimes more complicated.[11]

For the young women working in Personnel, it might have been a bit easier to find someone suitable because they had access to employee records and photos. Bahan-Szucs joked that the women working there determined "who we wanted to date by how much money they made, how cute they were, and if they were single. You know, we really had it made."[12]

The young women also had to figure out how to handle some of the men they worked with. There were some issues with so few women working on site. Some men harassed the women. Many ogled them from a distance. There was such concern about men, who overwhelmingly outnumbered the women, and their bad behavior (whistling or watching the women walk to lunch—with binoculars) that the supervisor of the clerical staff armed her employees with cayenne pepper and refused to let her girls go to the cafeteria alone. They relied on the buddy system. None recalled any real danger, however, and some sneaked out without their pals "because it was so much fun" to have the men appreciate their moxie.[13]

Besides dating, the women formed friendships with each other. Many were around the same age, and they stayed in touch after they married and throughout their lives. "One of the most wonderful things [about the NACA]," Bahan-Szucs shared, "are the friends that I have developed and kept all through the years." These friendships extended to the couples working at the NACA.[14]

Receiving a job with the NACA was an integral step for young female employees becoming adults and learning to make their own life choices for the first time. Leaving home was a leap of faith during those years but allowed these women to spread their wings. They faced many new decisions such as where to live, with whom to live, and how to get to work and navigate a whole new unfamiliar world of aerospace research. Although some NACA engineers saw women's primary role as that of mother and wife, some saw their promise and offered them opportunities to challenge this bias. While the women at the NACA worked hard, everyone made time for fun, new experiences, and friendships, which were maintained even after marriage and raising children. Their NACA years, these women believe, represented the start of their most fulfilling years of life. ■

Endnotes

1 Eleanor "Jerry" Jaehnig, interview by Sandra L. Johnson, 2 April 2014, transcript, NASA Headquarters NACA Oral History Project (hereafter NHNOHP); Sheryll Goecke Powers, *Women in Flight Research at NASA Dryden Flight Research Center from 1946 to 1995* (Washington, DC: NASA SP-4506, 1997), p. 11.

2 Sugenia M. Johnson, interview by Rebecca Wright, 2 April 2014, transcript, NHNOHP.

3 Mary Ann Johnson, interview by Sandra L. Johnson, 3 April 2014, transcript, NHNOHP; Jaehnig interview.

4 Mary Ann Johnson interview; Jaehnig interview.

5 June C. Bahan-Szucs, interview by Sandra L. Johnson, 29 September 2005, transcript, NHNOHP.

6 Ibid.

7 Jane S. Hess, interview by Sandra L. Johnson, 2 April 2014, transcript, NHNOHP.

8 Marilyn K. Lunney, interview by Rebecca Wright, 11 June 2014, transcript, NHNOHP.

9 Mary Ann Johnson interview.

10 Jaehnig interview; Dorothy B. "Dottie" Lee, interview by Rebecca Wright, 10 November 1999, JSC Oral History Project.

11 Bahan-Szucs interview; Lunney interview.

12 Bahan-Szucs interview.

13 Ibid.

14 Ibid.

The NACA's Collier Trophy Awards

FOR OVER 100 YEARS, the annual Collier Trophy has signified the greatest achievement in the aerospace field from the previous year. NASA's most recent award, with a Northrop Grumman–led industry team, recognized the success of the James Webb Space Telescope. In the years before NASA, the celebrated breakthroughs from the NACA relied on processes and methods more than any unique gadget. Individuals led, but people—teams, not singular mythical geniuses working in solitude—have advanced the insights that contribute to the performance, efficiency, and safety of aeronautical technology.

For more on each award up to the Hubble Space Telescope, see ***From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners***, edited by Pamela E. Mack (NASA SP-4219). Relevant chapters are highlighted below.

1929 Low-Drag Engine Cowling

It defied intuition that covering a hot radial engine to streamline its aerodynamics could also cool the engine, but that was exactly what happened after the NACA systematically tested cowling variations and found a custom design that achieved both. The NACA lacked, however, an analytical understanding for why their cowling design worked. As new engines and new aircraft were built, the award-winning cowling was not plug-and-play. It was not a radical innovation. The NACA responded in the 1930s by modifying their approach, applying more mathematics, and gaining fundamental insight into the airflow involved (after winning the award). In this 1929 photo, a Langley flight crew installs an experimental low-drag cowling on the Fokker Trimotor.

See James R. Hansen, "Engineering Science and the Development of the NACA Low-Drag Engine Cowling."
(Photo credit: NACA)

1946 Wing De-Icing System

Like the NACA cowling, thermal de-icing was not a radical innovation, nor did the work rely on much theory. Instead, an NACA team led by Lewis Rodert (front row, center) employed practical experimentation in flight to address a deadly problem that had plagued aircraft operations for years. They investigated and refined multiple approaches to de-icing before and during World War II. Their experimental, cut-and-try methods provided insight for both industry and the military, who had been devising their own de-icing systems. The NACA continued the work in its Icing Research Tunnel, which initially wound down in the late 1950s with icing seemingly solved, but returned to prominence with advances in aviation that presented new icing problems for helicopters and more efficient jets.

See Glenn E. Bugos, "Lew Rodert, Epistemological Liaison, and Thermal De-Icing at Ames."
(Photo credit: NACA)

The NACA's Collier Trophy Awards (continued)

1947 Supersonic Flight

Unlike the NACA cowling and the de-icing work, flying faster than sound was a culmination of more than two decades of high-speed flight research at the NACA, blending practical engineering approaches with theoretical, scientific knowledge. When that work contributed to the success of the Bell X-1, it was John Stack who had been leading the team of NACA researchers engaged in the effort. Stack was a co-recipient of the trophy for breaking the sound barrier. He shared the award with two other individuals: Lawrence Bell and Chuck Yeager.

See John D. Anderson, Jr., "Research in Supersonic Flight and the Breaking of the Sound Barrier."
(Photo credit: NACA)

1951 Slotted-Throat Wind Tunnel

Four years later, Stack and his associates won the award again, this time for the work that led to the transonic wind tunnel. In 1946, NACA physicist Ray Wright had realized that partially opened walls in a wind tunnel would more accurately simulate the atmosphere, since a wind tunnel's walls were well known to distort the air flow. Stack led the team that first prototyped the slotted concept and then quickly converted Langley's existing 8-Foot High-Speed Tunnel into the 8-Foot Transonic Tunnel. Its test section is shown in the photo. Other NACA tunnels soon followed suit. It was the first time the Collier Trophy had recognized a specific research tool, as opposed to specific airplanes, flights, or pieces of equipment.

See Steven T. Corneliussen, "The Transonic Wind Tunnel and the NACA Technical Culture."
(Photo credit: NACA)

1954 Whitcomb's Area Rule

Tests conducted in the newly converted 8-Foot Transonic Tunnel at Langley led directly to the NACA's fifth and final Collier Trophy before the advent of NASA. Richard Whitcomb, seen here in the test section of the 8-Foot Tunnel, devised the Area Rule. The rule's influence is evident in the signature "Coke bottle" shape of the fuselage, which dramatically reduces drag at high speeds. The adoption of the rule in airplane design can be seen in virtually every transonic or supersonic aircraft from the era. Whitcomb was awarded the trophy a mere two months after his classified work had been made public.

See Lane E. Wallace, "The Whitcomb Area Rule: NACA Aerodynamics Research and Innovation."
(Photo credit: NACA)

The Origins of International Relations at NASA

Arnold Frutkin's Principles for Space Cooperation

» By **Steve Garber**, NASA Historian

Prominent Soviet scientists from the Commission for Interplanetary Travel of the Soviet Academy of Science visited NASA Langley Research Center in November 1959. Arnold Frutkin is in the second row, just right of center, wearing a light-colored jacket. (Photo credit: NASA)

HOW DID NASA'S EFFORTS at international cooperation come about? While NASA's predecessor organization, the National Advisory Committee for Aeronautics (NACA), dates back to 1915, it was largely focused on strengthening American domestic aeronautics capabilities in the face of international competition. Things changed, however, in 1958 with the passage of NASA's founding charter, the National Aeronautics and Space Act. The "Space Act" explicitly called for peaceful "cooperation by the United States with other nations and groups of nations in work done pursuant to this Act."1 So NASA and other government leaders needed a basic blueprint for when and how to cooperate in space, given that geopolitics often intervened in specific efforts.

Enter Arnold Frutkin. NASA's first international relations chief early on laid out some fundamental, if informal, principles for international cooperation.[2] As background, it is useful to be familiar with a little bit of Frutkin's personal biography.

Frutkin was born in 1918, and after graduating from college in 1940, he worked as an economist, served in the Navy during World War II, and then worked as a journalist for over a decade. In 1957, his career pivoted when he became involved with the International Geophysical Year (IGY), as the Director of the Office of Information and Deputy Director for International Affairs at the National Academy of Sciences' Committee for the IGY. Shortly after the birth of NASA in 1958, Frutkin came aboard in 1959, essentially as the head of NASA international relations. He worked in this role for two decades, with his title changing a few times along the way.[3]

Frutkin deliberately framed NASA international relations as a choice between foreign aid and support versus literal cooperation, favoring the latter.

Early in his career at the Agency, Frutkin deliberately framed NASA international relations as a choice between foreign aid and support versus literal cooperation, favoring the latter.[4] This was perhaps the most fundamental tenet underlying his philosophy. While he may not have laid down his principles for NASA international cooperation in a formal policy document, he did write about them and express them in oral histories. His international relations staff members and successors have largely embodied and espoused these principles in various forms to this day.

The Apollo-Soyuz Test Project joint flight readiness review was signed in Moscow in ceremonies on 22 May 1975. Academician Vladimir A. Kotelnikov (on left) and NASA Deputy Administrator George M. Low (in center) are seen affixing their signatures to the ASTP document. Kotelnikov was the Acting President of the USSR Academy of Sciences. Seated at far left is Professor Konstantin D. Bushuyev, the Soviet Technical Director of ASTP. Dr. Glynn S. Lunney, the U.S. Technical Director of ASTP, is seated on Dr. Low's left. Arnold W. Frutkin (in the light jacket standing behind Dr. Low) was the NASA Assistant Administrator for International Affairs. Academician Boris N. Petrov (in dark suit), Chairman of the USSR Council for International Cooperation in the Exploration and Use of Outer Space, is standing behind Kotelnikov. (Photo credit: NASA)

Frutkin's first principle was simply no exchange of funds. This meant that NASA would not pay foreign governments to cooperate on aerospace projects, nor the reverse. A corollary of this was that training for foreign nationals would be paid for by their home nation.[5] Aside from such training, if one country paid another for specific work, it would be more of a contractual or aid relationship, rather than genuine collaboration.

The principle of no exchange of funds was directly related to Frutkin's second principle: mutual national interest.[6] Again, if a project was only in one nation's interest, it would not be true cooperation.

Third, there should be substantive scientific value to each instance of international cooperation that also reflected broad national merit. While this may sound obvious, an alternative of domestic political goals could rapidly become a slippery slope. For example, Frutkin recounted an anecdote in the early 1960s in which a developing country requested assistance with a small rocket experiment that would have taken place on its independence day; this experiment would have been clearly visible for hundreds of miles, even in a neighboring, rival country. Frutkin and other NASA personnel rejected this proposal as blatantly political and lacking scientific merit.[7] Frutkin also emphasized that the content should reflect national goals, not just those of scientists in a particular discipline.

FRUTKIN'S PRINCIPLES OF INTERNATIONAL COOPERATION

- No exchange of funds
  - Training for foreign nationals paid for by their home nation
- Mutual national interest
- Substantive scientific value with broad national merit
  - Basic scientific research as less sensitive than technology development
- Civilian character
- Project-by-project basis
- Government-to-government negotiations with central technical authorities

As a corollary, Frutkin encouraged cooperation in less sensitive areas of basic scientific research, as opposed to aerospace technologies such as launch vehicles, at least initially.[8] Presumably part of his rationale was what later became known as "dual-use" considerations, whereby certain technologies could be used for either civilian or military use (e.g., rockets could launch scientific payloads into space, or they could be used as Intercontinental Ballistic Missiles).

Fourth, NASA's international cooperation efforts should be civilian in nature.[9] NASA was deliberately created as a civilian organization, but this point should not simply be assumed. Since the Wright brothers first flew successfully, the military has understandably been interested in aerospace technology. The NACA and then NASA have made significant contributions to national security over the years, but Frutkin's point was that cooperation with foreign militaries should be left to the U.S. military.

Frutkin also believed that cooperation should be framed on a project-by-project basis, providing flexibility to tailor efforts based on specific, evolving scientific and national needs.[10]

Sixth, these international cooperative projects should be negotiated with central governmental technical authorities, rather than on an indirect diplomatic basis or with individual foreign companies or research institutes.[11] People from NASA's international counterpart agencies would understand their specific technical needs more than State Department or Foreign Ministry diplomats per se. Negotiations with individual foreign entities other than central technical authorities would lack the foreign policy imprimatur of the foreign national government.

Although perhaps never codified in a formal policy document, Frutkin's principles have held up over the decades. Staff in NASA's Office of International and Interagency Relations still use these as an operating framework and mention them in public presentations.[12] While there certainly have been exceptions to these principles, in general they have proved to be an effective means for a technical, civilian agency to navigate the complicated waters of geopolitics. ■

Endnotes

1 See https://www.nasa.gov/history/national-aeronautics-and-space-act-of-1958-unamended/ (accessed 27 February 2024).

2 The principles in this article are gleaned from Arnold Frutkin's oral history with Rebecca Wright, 11 January 2002, pp. 5–7; https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/NASA_HQ/Administrators/FrutkinAW/FrutkinAW_1-11-02.pdf (accessed 27 February 2024), and Arnold W. Frutkin, *International Cooperation in Space* (Englewood Cliffs, NJ: Prentice Hall, 1965), p. 35.

3 From 1959 to 1963, Frutkin was Director of International Programs; from 1963 to 1978, he was Assistant Administrator for International Affairs; for brief periods in 1978, he was Deputy and then Acting Associate Administrator for External Affairs; and from 1978 to 1979, he was Associate Administrator for External Relations before retiring. See, for example, his oral history with Wright.

4 Frutkin, *International Cooperation*, p. 32.

5 Frutkin oral history with Wright, pp. 5–7.

6 Ibid.

7 Frutkin, *International Cooperation*, p. 33.

8 Ibid.

9 Frutkin oral history with Wright, pp. 5–7.

10 Frutkin, *International Cooperation*, p. 35.

11 Ibid.

12 For a slightly dated, but still useful, country-by-country survey of NASA's international cooperation efforts, see https://www.nasa.gov/technology/global-reach-a-view-of-nasas-international-cooperation/ (accessed 27 February 2024).

Pearl I. Young (second from left) is pictured at LMAL on 24 May 1927. (Photo credit: NACA/Langley)

Pearl Irma Young

The Lasting Impact of the NACA's First Female Technical Employee

» By **Dr. Caitlin Milera**, Director of the North Dakota Space Grant Consortium and North Dakota NASA Established Program to Stimulate Competitive Research, and Research Assistant Professor at the University of North Dakota

PEARL IRMA YOUNG was a scientist, an educator, a technical editor, and a researcher. Her work at the National Advisory Committee for Aeronautics (NACA) and later at the National Aeronautics and Space Administration (NASA) has had lasting impacts on the scientific community. She was a trailblazer not only for women, becoming the first female technical employee of the NACA in 1922, but for all in the field of aerospace. Young made significant contributions to the scientific community throughout her career, most notably through her publication, the *Style Manual for Engineering Authors*.[1] In addition to her technical work, Young forged lasting friendships, traveled the globe, and believed in a world bigger than herself.

Pearl Young was born on 12 October 1895 in Taopi, Minnesota, the second oldest of 11 children. She worked through school as a "domestic," which often included household duties such as maid and caregiver, and graduated from Rugby High School in North Dakota in 1914.

Young continued to work her way through college and was active in service to her community, through the Young Women's Christian Association and the Phi Beta Kappa Honor Society. At a time when it was highly uncommon for women to even attend college, let alone major in *one* STEM field, Young graduated with *honors* as a *triple* major in physics, mathematics, and chemistry from the University of North Dakota (UND) in 1919.

Young then served as physics faculty at UND and taught at Alvarado Schools in northern Minnesota before beginning her career with the NACA. Her scores in physics and chemistry on the Civil Service Examination qualified her for a technical position at the NACA, with her first day at the agency on 4 April 1922. Young was about to begin a decades-long career with the NACA, starting with Langley Memorial Aeronautical Laboratory (LMAL).

During Young's time at LMAL, she served in roles such as Laboratory Assistant and Junior Physicist, and she made contributions in the Instrumentation and Aerodynamics Divisions, as well as the Technical Editing Offices. While at LMAL, Young also worked as a part-time reporter for the local newspaper and even interviewed Eleanor Roosevelt for a front-page feature story.

Referring to her early years with the NACA, Young stated, "Those were fruitful years. I was interested in good writing and suggested the need for a technical editor. The engineers lacked the time to make readable reports."[2] Three years after this suggestion, Young was reassigned to the role of *Assistant* Technical Editor in the Publications

Pearl Irma Young (continued)

↑ Pearl Young and the Technical Report Editing Section pose for a photo at AERL on 3 February 1947. Young is seated on the far right in the patterned dress. (Photo credit: NASA)

Section, in 1935. After six years in that role, Young earned the title of *Associate* Technical Editor in 1941.

It wasn't until 1943 that Young was promoted to *full* Technical Editor. She had been invited to transfer to the newly established NACA field center, the Aircraft Engine Research Laboratory (AERL) in Cleveland, Ohio (now known as NASA Glenn Research Center) to lead a new technical editing section. Her section included women with STEM degrees who were responsible for editing technical reports of all STEM areas. The AERL's *Wing Tips* described Young's office as one that embodied "constant vigilance" and encompassed a "rigidly trained crew."[3] There, Young published the infamous *Style Manual for Engineering Authors*.

In his 1995 speech honoring Pearl Young's many accomplishments, William Hewitt Phillips (Young's colleague and friend) stated that after Young created what was known as *the* style manual, "Reports soon became known for their form and accuracy as well as their technical content."[4] Young has even been referred to as the "architect of the NACA Technical Reports System."[5] AERL's *Wing Tips* described Young's manual as "setting forth rules structurally sound. This manual assists NACA authors to present their findings tactfully, strategically, and with telling force."[6]

"Reports soon became known for their form and accuracy as well as their technical content."

—William Hewitt Phillips

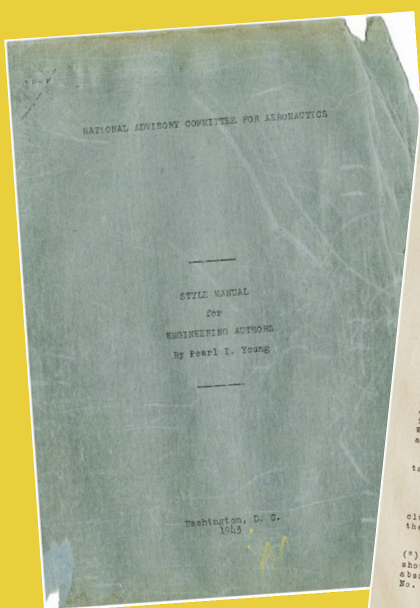
Young's development of this style manual was further essential for efficient World War II operations. "Reports became shorter, more concrete, and less polished in appearance but perhaps never before had they been so thoroughly read and so urgently requested."[7] Reports following Young's style manual were also instrumental in communicating technological progress across the United States, as well as to a global audience, even being translated into multiple languages.

PEARL YOUNG'S 1943 STYLE GUIDE PRESERVED

In addition to being the first female technical employee at the NACA, Pearl I. Young is also known for spearheading the effort to establish a standard of excellence for the NACA's technical reports and becoming Langley's first Chief Technical Editor. In 1943, she authored a document entitled *Style Manual for Engineering Authors*, which served as a style guide for authors at Langley and other NACA laboratories. Her methodology for editing became the standard for the agency and helped build its reputation as a preeminent aeronautical research institution.

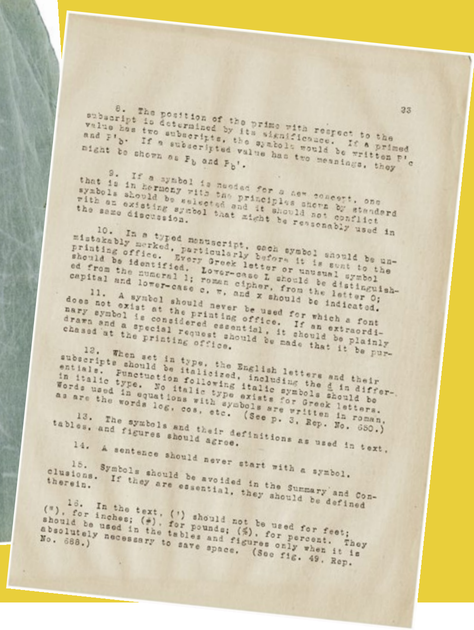
In late 2023, an original copy of Young's *Style Manual*, located in Langley's technical library, was scanned by Langley's Office of the Chief Information Officer photo archives team, revealing that the paper was deteriorating and had suffered some water damage. Langley's history and archives program manager, Rob Wyman, brought this to the attention of NASA's History and Information Services Division.

"Although we knew that photocopies of this original publication were located at a few other NASA libraries, we wanted to try and determine whether or not this one was the sole remaining original," Wyman said. "I've been in touch with other Centers' archives and libraries, and as best I can tell, this is the only original that remains in NASA's possession. Because of that, it's important we treat it as the preservation copy. We don't have an archivist at Langley, so I'm coordinating with the NASA chief archivist to transfer it to another NASA archives where it can be properly preserved to minimize further deterioration."


NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

STYLE MANUAL
for
ENGINEERING AUTHORS
By Pearl I. Young

Washington, D. C.
1943


33

8. The position of the prime with respect to the subscript is determined by its significance. If a primed value has two subscripts, the symbols should be written P'_c and P'_b. If a subscripted value has two meanings, they might be shown as P_b and P_b'.

9. If a symbol is needed for a new concept, one that is in harmony with the principles shown by standard symbols should be selected and it should not conflict with an existing symbol that might be reasonably used in the same discussion.

10. In a typed manuscript, each symbol should be unmistakably marked, particularly before it is sent to the printing office. Every Greek letter or unusual symbol should be identified. Lower-case l should be distinguished from the numeral 1; roman cipher, from the letter O; capital and lower-case c, w, and x should be indicated.

11. A symbol should never be used for which a font does not exist at the printing office. If an extraordinary symbol is considered essential, it should be plainly drawn and a special request should be made that it be purchased at the printing office.

12. When set in type, the English letters and their subscripts should be italicized, including the d in differentials. Punctuation following italic symbols should be in italic type. No italic type exists for Greek letters. Words used in equations with symbols are written in roman, as are the words log, cos, etc. (See p. 3, Rep. No. 650.)

13. The symbols and their definitions as used in text, tables, and figures should agree.

14. A sentence should never start with a symbol.

15. Symbols should be avoided in the Summary and Conclusions. If they are essential, they should be defined therein.

16. In the text, (') should not be used for feet; ("), for inches; (#), for pounds; (%), for percent. They should be used in the tables and figures only when it is absolutely necessary to save space. (See fig. 49, Rep. No. 688.)

Following Young's time at the NACA, she made lasting contributions as a professor of engineering physics at two universities, and she even returned to NASA after teaching, to complete research on historical aviators.

But what truly makes Young's story so inspiring is not necessarily her technical achievements. It was her character that played a pivotal role in lasting positive impacts on the lives of others. Despite the countless barriers that women faced in STEM and at the NACA/NASA, Young persisted. She did so through acts of advocacy, establishing a network of connectedness, and in remaining true to her authentic self.

Young's fierce advocacy for herself and others sometimes required that she challenge authority or resist change. She stood up for her editing section when male supervisors wrongfully accused them of making mistakes. She wrote official proposals to properly classify her office in the Research Division at the AERL. She regularly recognized others' talents and efforts, such as securing extra personnel to lessen unbearable workloads or writing official memorandums to ensure that deserving colleagues earned rightful promotions at the NACA. She regularly acknowledged the contributions of her entire team for shared achievements, including the infamous style manual. Young's active advocacy ensured that she and her colleagues were all able to persist. Young often referred to these actions as "raising hell."[8]

Given her advocacy, it is no surprise that Young lived a life full of connections with her colleagues and friends. She enjoyed cookouts, parties, picnics, poker nights with cocktails, swimming, Pearl Irma Young (continued)

↑ On a UND Alumni Trip in Hawaii in 1960, Pearl Young is pictured at the top of the stairs, waving with fellow UND alumni. (Photo source: Pearl Young Papers [1927–1995]; OGLMC1602, box 1, folders 1–13, scrapbooks 1–4, Elwyn B. Robinson Department of Special Collections, Chester Fritz Library, University of North Dakota, Grand Forks)

Young's active advocacy ensured that she and her colleagues were all able to persist. Young often referred to these actions as "raising hell."

golf, dogs and dog shows, photography (especially of nature), riding, theater, and (likely her favorite) travel. Young traveled to Europe with friends via steamship in 1927, and she even flew aboard the Hindenburg in 1936. In 1960, she also joined a UND alumni trip to Hawaii. She kept scrapbooks of each of her travels, full of poetry and journaling, always fully immersed in the world around her. She wrote of her appreciation for those in service positions, such as chauffeurs, porters, "sweet" store clerks, secretaries, and maids. Young consistently did small things to improve the lives of those she encountered in her life, seemingly never missing an opportunity to lift others up. Pearl Young's achievements and actions at the NACA, NASA, and in higher education paved the way for generations of women in STEM to dismantle barriers and continue to persist. ■

For more about Pearl Young and the sources used for this article, be sure to read Caitlin Milera's dissertation, "Ms. Pearl Irma Young: 'Raising Hell' for Women in STEM Fields and Women at NASA, 1914–1968," available at https://commons.und.edu/theses/4279/.

Endnotes

1 P. I. Young, *Style Manual for Engineering Authors. National Advisory Committee for Aeronautics* (Washington, DC: NACA CN-154, 1943), p. 822.

2 O. Gresmer, "Space Women: Pioneer Aviator's Diary Puts Technical Editor on His Trail," *Cleveland Plain Dealer* (August 1959), NASA Glenn Research Center Archives.

3 "Pearl I. Young and Her Editorial Staff," *Wing Tips* (3 September 1943), NASA Glenn Research Center History Office.

4 Pearl Young Papers (1927–1995), OGLMC1602, box 1, folders 1–13, scrapbooks 1–4, Elwyn B. Robinson Department of Special Collections, Chester Fritz Library, University of North Dakota, Grand Forks.

5 NASA, "NACA/NASA 1915–2015: Solving decades of aviation challenges," 2015, https://www.nasa.gov/wp-content/uploads/2023/07/naca-nasa-aero-contributions-timeline.pdf.

6 "Pearl I. Young and Her Editorial Staff," *Wing Tips* (3 September 1943), NASA Glenn Research Center History Office.

7 P. I. Young, "Reports—Laboratory Product," *Wing Tips* (15 February 1946), NASA Glenn Research Center History Office.

8 Pearl Young Papers (1927–1995); P. I. Young, "Reports—Laboratory Product" (15 February 1946).

Langley's Unusual "Igloo": The World's First High-Speed Wind Tunnel

» Submitted by **Rob Wyman**, NASA Langley Research Center History and Archives Program Manager

↑ This photograph, taken 13 March 1936, shows the HST on the shores of the Back River. Its igloo-shaped test section with 1-foot-thick concrete walls can be seen in the foreground of the picture, with the Propeller Research Tunnel behind it and the Full-Scale Tunnel to the right. (Photo credit: NACA)

AS INTEREST in the field of high-speed aerodynamics increased in the early 1930s, the existing wind tunnels at the NACA Langley Memorial Aeronautical Laboratory—today known as NASA Langley Research Center—proved too small and underpowered for effective high-speed aircraft testing. Understanding that a new facility in Hampton, Virginia, would give U.S. engineers a decided advantage in the ever-growing aeronautical field, Langley's director of research, George W. Lewis, authorized the design and construction of a larger high-speed wind tunnel in 1933.

Construction of the 8-Foot High-Speed Tunnel (HST), including its unique concrete-encased, igloo-shaped, 8-foot-diameter test chamber, was funded by the Public Works Administration and was completed in 1936 at a cost of $266,000.

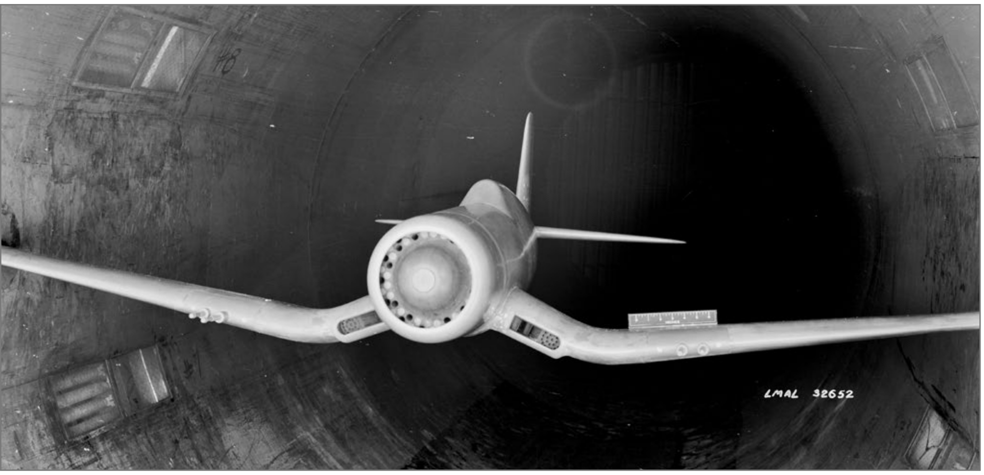
The tunnel complex was located on the original 1917 parcel of land—allocated to the NACA by the U.S. Army—along the southwest branch of the Back River, land today that is home to a variety of U.S. Air Force commands.

This tunnel was a landmark in wind tunnel design at the time. It was the first continuous-flow high-speed tunnel, meaning it could operate almost indefinitely, thereby giving engineers sufficient time to run their tests and check their results. Its test section was large enough to accommodate large-scale models, and even actual sections of aircraft, at speeds approaching the speed of sound. For the first time, Langley engineers had a research tool that could supply high-speed test results on a large scale.

Early research in the HST included the investigations of lift and drag effects caused by various bumps on an airplane's wing. One example of this was a 1937 test on the drag effects of rivet size, type, and arrangement.

Leading up to and during World War II, much of the lab's work involved refinement of manufacturers' designs, ranging from fighters through bombers like the B-29. Wartime research also focused on stability and control problems being experienced by early military aircraft during high-speed flight.

After the war, NACA researchers turned their attention to solving many of the basic problems that were preventing aircraft from reaching supersonic



↑ A model of Vought's F4U-1 Corsair with a high-speed cowling was tested in the 8-Foot High-Speed Tunnel in April 1943. Between 1941 and 1945, Langley tested 137 different airplane types in its various tunnels or in flight, including virtually all types that saw combat service. Of note, this photo was taken before the tunnel was converted to a "slotted-throat" tunnel. (Photo credit: NACA)

speeds. To achieve supersonic flight, an aircraft would have to fly briefly in the transonic range, the speed regime between subsonic and supersonic flight, so knowing what happened to aircraft in this transition zone was critical to the design of supersonic fighters and bombers in the postwar era.

Tunnel testing at transonic speeds was needed, but there was a problem. As the airflow speed approached the speed of sound, the wind tunnels began to "choke" because of compressibility effects and shock waves that formed in the tunnel sections. This choking interfered with the accuracy of the data measurements within the test section, rendering much of the data useless. The future of supersonic flight depended upon finding a solution to the choking problem.

Langley physicist Ray H. Wright observed that interference from wind tunnel walls could be minimized by placing slots in the test section, a concept that became known as "slotted throat" design. These slots were strategically positioned at critical locations in the throat of the test section. In February 1950, the HST was shut down and slotted walls were added to the test section. The test runs provided encouraging and promising results. The slotted-throat tunnel worked, and the shock waves and other compressibility effects were minimized to a point where it became possible to accurately evaluate aerodynamic characteristics of aircraft models through the speed of sound.

Langley now had the first wind tunnel in the world that would give accurate test results in the transonic range. The slotted-throat concept was immediately put to work testing the next generation of American aircraft.

Other Langley high-speed tunnels went on to incorporate the slotted-throat design, but it was here in the 8-Foot HST where the original slotted throat led to other revolutionary aerodynamic breakthroughs.

This tunnel continued in use until being deactivated 1956. For the next 15 years, the 16,000-horsepower motor, drive shaft, and fans were kept operational through scheduled maintenance. In 1976, the fan blades, hub, nacelles, shaft, and turning vanes were removed and sent to Wright-Patterson Air Force Base in Ohio, where they were used in the construction of a new facility in the early 1980s.

The historical significance of the HST and its many contributions to aerospace technology were recognized

→ In the mid-1950s, the slotted throat test section of the HST facilitated important research in body and wing design for supersonic aircraft. Langley engineer Richard Whitcomb, shown here, used the tunnel to develop the revolutionary "area rule" principle that demonstrated how using a "wasp-waisted" or "Coke-bottle" shaped fuselage for supersonic jet fighters would allow them to break the sound barrier. For his efforts, Whitcomb was awarded the 1954 Collier Trophy for the greatest achievement in aviation. (Photo credit: NACA) when it was designated a National Historic Landmark in 1985. The office portion of the facility was remodeled and leased to the Air Force in the early 2000s, while the tunnel circuit remained abandoned. In 2011, the tunnel circuit was demolished, and in 2016 the office portion of the building and test chamber of the 8-Foot HST were permanently transferred to the Air Force.

Although the wind tunnel itself is gone, after undergoing extensive renovations, the remaining original office spaces and wind tunnel test chamber will be used by staff from the U.S. Air Force Air Combat Command's headquarters, Directorate of Operations.

The NASA Langley history and archives program worked closely with the Air Force to provide them with the history of the tunnel, as well as photographs and artifacts that will be on display in the test section to help document and share the significant aeronautical advances that came from the research conducted there over the years. ■

↑ The HST's test chamber was converted into a conference room for the U.S. Air Force's Air Combat Command, seen here during ongoing renovations in September 2022. (Photo credit: NASA/Rob Wyman)

News from Around NASA

CALL FOR PAPERS: NASA and Archaeology from Space

A Symposium in Honor of Dr. Thomas L. Sever

18–19 September 2024 • Washington, DC

THE ORGANIZERS invite proposals for papers to be presented at a two-day symposium to be held in person 18–19 September 2024 in Washington, DC. We welcome diverse voices and perspectives to examine the history of NASA and archaeology from space.

The purpose of this symposium is to honor the pioneering work of former NASA archaeologist Dr. Thomas L. Sever in the field of archaeology and remote sensing over his many decades of service and numerous contributions. The symposium also seeks to provide insight and contextualization of past archaeology projects at NASA, highlight the current state of the field in terms of research and capabilities, and point to new opportunities in government and commercial sectors.

Potential topics include, but are not limited to, past archaeological projects, technology/capability developments, geopolitical considerations, assessments of the current state of remote sensing/archaeology, future trajectories, potential breakthroughs, and interdisciplinary approaches.

Presentations might also consider the impact of environmental, geopolitical, social, and cultural issues on archaeology/remote sensing projects over the decades and today.

The symposium will be a combination of panel discussions, keynote talks, and presentations on current NASA and industry capabilities. The intention is to publish an anthology of selected papers.

Submission Procedures

If you are interested in presenting, please send your presentation's title, an abstract of no more than 300 words, and a short biography or curriculum vitae, including affiliation, by 15 April 2024 to Brian C. Odom or Kelsey Herndon. Questions about the symposium are also welcome.

Learn more about Dr. Thomas Sever's archaeological research.

NASA HISTORY OFFICE LUNCHTIME SPEAKERS

The NASA History Office invites you to attend these upcoming presentations on Microsoft Teams. Join our mailing list for event links.

20 March, noon ET
Chris Gunn
"Documenting the Development of the James Webb Space Telescope through Photography"

17 April, 12:30 p.m. ET
Caitlin Milera
"A STEM Pioneer at the NACA and NASA: The Pearl Young Story"

22 May, noon ET
Andrew J. Ross
"Ranges of Empire: U.S. Missile Ranges, Planetary Infrastructure Building, and Global Militarism, 1945–65"

News from Around NASA (continued)

CALL FOR PAPERS

Contributions of the DC-8 to Earth System Science at NASA: A Workshop

21–22 August 2024 • Washington, DC

Jointly organized by the NASA History Office and the Earth Science Division, this workshop seeks to document the important contributions of airborne campaigns implemented on NASA's DC-8 Airborne Science Laboratory. The workshop will be a combination of keynote talks, panel discussions, and roundtables. The intention is to publish an anthology of selected papers of key presentations.

NASA's DC-8 aircraft recently completed nearly four decades of service to NASA, with its retirement in early 2024 following the completion of the Airborne and Satellite Investigation of Air Quality campaign. The DC-8, which NASA acquired in 1985, was a workhorse aircraft for the Airborne Science Program of NASA's Earth Science Division (ESD), serving as the primary platform—or one of several platforms—of many airborne campaigns. Its contributions are legendary, from flying as part of the first polar stratospheric ozone campaigns in the late 1980s through campaigns focused on ice sheets, sea ice, terrestrial ecology, greenhouse gases, and air quality that continued throughout its lifetime.

Besides the process knowledge that the DC-8 provided, it served as an important proving ground for new instrumentation and techniques that helped pave the way for their eventual use in ESD's spaceflight program; as a source of calibration/validation data for ESD's satellite instruments; and as a flying laboratory for students, postdocs, and early-career professionals to design, build, and test instruments and acquire and analyze data. It also was the primary platform for NASA's now-15-year-old Student Airborne Research Program (SARP), which has provided hands-on opportunities for well over 400 young scientists and has an outstanding "STEM retention rate" for its past participants.

In this workshop, ESD and related investigator communities are invited to share examples of the scientific, programmatic, and human achievement of the DC-8 over its nearly four decades of service to NASA. Besides descriptions of the science accomplished, workshop planners invite discussion of "lessons learned" about the operation of a large airborne research laboratory that can be used as NASA moves ahead with furnishing and outfitting the DC-8's successor, a B-777 that NASA acquired in 2023 in response to a strong recommendation from a 2021 report by the National Academies of Science, Engineering, and Medicine that said ESD needed to have such a platform following the retirement of the DC-8 (Airborne Platforms to Advance NASA Earth System Science Priorities: Assessing the Future Need for a Large Aircraft).

Workshop planners are seeking proposals for papers from ESD and related investigator communities—including academia, interagency and international partners, and private-sector/nonprofit entities—that detail scientific and programmatic results, lessons learned, and personal examples of how the DC-8 advanced science, informed decisions, and provided training opportunities for several generations of NASA workers.

If you wish to present a paper, please send an abstract of no more than 250 words and a short biography or curriculum vitae, including affiliation, by 31 March 2024 to Dr. Brian C. Odom. Questions about the symposium are also welcome.

More about the DC-8 program.

News from Around NASA (continued)

NASA History and Archives Branch Personnel Updates

On the heels of her internship in the summer of 2023, **Julie Pramis** was hired as an archivist at NASA Headquarters in the fall. Born and raised in Northern Virginia, Julie graduated with a Master of Science in Library and Information Sciences degree from The Catholic University of America in May 2023. After completing work on the Abraham Hyatt collection (see p. 13), she is currently working on the Gordon Johnston collection at Headquarters, which covers topics such as the Viking and Galileo missions and Earth science technology.

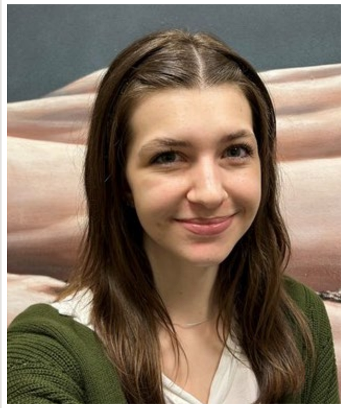
↑ Julie Pramis recently joined the Archives Program staff at NASA Headquarters. (Photo courtesy of Julie Pramis)

In December 2023, the NASA History and Archives Branch team said a tearful goodbye to the leader of the Agency's Archives Program, **Holly McIntyre**. Holly had worked as an archivist at Goddard Space Flight Center since October 2015, stepping into the role of Acting Chief Archivist in 2020. Her masterful work in planning for the digital preservation of assets and work to standardize the archival policy and archival work across the Agency were vital contributions to the future of the Archives Program. She is now working as the Digital Asset Management Section Supervisor at The Johns Hopkins University Applied Physics Laboratory.

Jessica Kelly, a Houston-area native, started her first internship at NASA's Johnson Space Center in January 2022 while working on her Master of Library Science degree. In fall 2022, she temporarily relocated to Maryland for an in-person internship with the Goddard Archives. Jessica graduated in December 2022 and did a remote internship with the NASA Archives in the spring of 2023, working on its digital archive, transitioning into a temporary role on the Archives team upon its completion. In January of this year, she was hired as an archivist working at the Agency level supporting all of the Centers. She is currently standing up the permanent Agency web archiving program, assisting the NASA Center archives with migration of their archival descriptions into our Agency-wide virtual archive, and providing archival support in person at Johnson Space Center for their physical collections and backlog. Outside of work, she is an avid reader, gardener, and collector of vintage clothes (to match the eras of the records she works with).

↓ Jessica Kelly poses at the Shuttle Avionics Laboratory (SAIL) at NASA's Johnson Space Center in front of the open Space Shuttle payload mock-up. (Photo courtesy of Jessica Kelly)

INTERN SPOTLIGHT



With a longtime interest in NASA's history, **Emily Goss** joined the NASA History Office as an intern for the spring 2024 term. Emily has a bachelor's degree in history and is currently getting her Master of Library and Information Studies degree with a focus on archives. Working from Langley Research Center, she is doing the important work of processing and describing the Center's unprocessed archival collections.

Jessica Herr, who served as the archivist and history point of contact at NASA's Stennis Space Center, departed in January after nearly eight years with the Agency. She has taken a position as the librarian at the Armed Forces Retirement Home in Gulfport, Mississippi.

After filling in since Holly McIntyre's departure, **Christine Stevens** became NASA's new Chief Archivist in February. Christine studied history at the University of Delaware, graduating in 2017. In February 2018, while in graduate school, she became a Pathways Intern in the Goddard Archives. In 2019, she graduated with her Master of Library and Information Studies degree with a concentration in Archival Studies from the University of Alabama and was hired as an archivist at Goddard. In 2020, she harvested seeds from Goddard's Moon Tree, a sycamore grown from a seed flown on Apollo 14, and sprouted second-generation Moon Trees, two of which were planted at Goddard to celebrate the 50th anniversary of Apollo 14. Christine's favorite part of being a NASA archivist is learning about the people who have made NASA what it is today, and she is excited to continue preserving NASA's history. In her free time, she enjoys horseback riding; gardening; and hanging out with her dog, Louie.

Christine Stevens, NASA's new Chief Archivist, grew this second-generation Moon Tree from seeds harvested from the Moon Tree outside the visitor's center at Goddard Space Flight Center. In 2021, she planted two of the resulting young trees at Goddard in celebration of Apollo 14's 50th anniversary. (Photo courtesy of Christine Stevens)

NASA History Program Award 2023 Recipient: Michele Ostovar

» By Brian Odom, NASA Chief Historian

Please join me and the NASA History Office in congratulating our 2023 NASA History Program Award recipient, Michele Ostovar!

Over the past year, Michele has led our office's public communication efforts on our NASA History social media platforms; served as editor for *News & Notes*; headed the NASA History Web Modernization activity; coordinated the *Aeronautics and Space Report of the President*; and much, much more. Michele has accomplished all this with superior leadership, innovative thinking, and an unmatched initiative to take on new challenges and opportunities.

Communications Lead Michele Ostovar is the 2023 recipient of the NASA History Program Award. (Photo courtesy of Michele Ostovar)

Other Aerospace History News

Fellowships in Aerospace History: Applications Due 1 April

The Fellowships in Aerospace History are offered annually by NASA to support significant scholarly research projects in aerospace history. These fellowships grant the opportunity to engage in significant and sustained advanced research in all aspects of the history of aerospace, from the earliest human interest in flight to the present, including cultural and intellectual history; economic history; history of law and public policy; and the history of science, engineering, and management. NASA provides funds to the American Historical Association (AHA) and to the History of Science Society (HSS) to allow both associations to award fellowships. Three fellowships will be offered for the 2023–24 term; applications will be entered into consideration for all three fellowships:

- AHA Fellowship in Aerospace History
- AHA Fellowship in the History of Space Technology
- HSS Fellowship in Aerospace History

Applicants must possess a PhD in history or in a closely related field or be enrolled as a student (having completed all coursework) in a doctoral degree-granting program. Preference will be given to scholars at early stages in their careers. Stipends may be awarded only to U.S. citizens or permanent residents.

The fellowship term is for a period of six to nine months and should commence no later than January of the fellowship term. The fellow will be expected to devote the term largely to the proposed research project and to write a report and present a public lecture on the fellowship experience.

For details on the fellowship and how to apply, visit https://www.historians.org/awards-and-grants/grants-and-fellowships/fellowships-in-aerospace-history. Questions can be directed to awards@historians.org.

Call for Submissions for fPET 2024

» By Zach Pirtle, fPET Co-Chair

The 2024 Forum on Philosophy, Engineering, and Technology (fPET 2024) will take place at Karlsruhe Institute of Technology (KIT) in Karlsruhe, Germany, 17–19 September 2024. An optional satellite workshop on Normative Energy Ethics follows on 20 September 2024.

The conference will bring together researchers from the fields of engineering, philosophy, and neighboring disciplines such as technology assessment to address the theme of Understanding, Assessing, and Designing Responsible Futures. fPET 2024 will provide an opportunity to meet like-minded researchers and to present and discuss issues on the intersection of engineering and philosophy.

The mission of fPET is to encourage reflection on engineering, engineers, and technology and to build bridges between existing organizations of philosophers, engineers, and scholars in related fields.

The organizers invite abstracts for paper presentations, posters, panels, and experimental sessions on the following (broad) topics:

- Philosophy of engineering and technology
- Ethics, social philosophy, and political philosophy in engineering and technology
- Practitioners' reflections on engineering and technology
- Epistemology of engineering and technology
- Engineering and technology education
- Interdisciplinary studies of engineering and technology, especially (but not limited to) technology assessment (TA), responsible innovation (RI), value-sensitive design (VSD), and science and technology studies (STS)

We explicitly welcome proposals addressing new or underexplored topics, the reflective submissions of engineers or other technology practitioners, and abstracts of an interdisciplinary nature. The deadline for abstract submissions is 15 March 2024.

Visit http://www.fpet2024.org for guidelines for submitting abstracts, conference registration, and other details of the fPET conference and following workshop. Please direct any queries related to the conference to fpet2024@itas.kit.edu. ■

Remembering Richard Truly

» By Michele Ostovar, NASA History Communications Lead

↑ Richard H. Truly was NASA's eighth Administrator, but the first who had been to space. (Photo credit: NASA)

FORMER ASTRONAUT and NASA Administrator Richard H. Truly, who flew some of the first flights of the Space Shuttle, passed away on 27 February 2024 at the age of 86.

Truly was born on 12 November 1937 in Fayette, Mississippi. He graduated from the Georgia Institute of Technology in 1959 with a bachelor's degree in aeronautical engineering. It wasn't until his time at Georgia Tech that he became interested in aviation and applied for flight school, earning his wings as a naval aviator in the fall of 1960. His acceptance into test pilot school sent him to the U.S. Air Force Aerospace Research Pilot School at Edwards Air Force Base, California, in early 1964. It was there that Chuck Yeager set him on a course to the space program and he was selected as an astronaut for the U.S. Air Force's Manned Orbiting Laboratory (MOL) program.

↓ Richard Truly (far right) poses for a photo with fellow Approach and Landing Tests astronauts on 17 September 1976. (Photo credit: NASA)

In his 2003 oral history, Truly comments, "we worked like the devil from that day until that program was eventually cancelled in 1969 by President Nixon." At NASA Deputy Administrator George Mueller's request, the seven youngest MOL astronauts, including Truly, were transferred to NASA.

Once at NASA, Truly began working on the Skylab program, serving as a CAPCOM for the Skylab missions in 1973 and 1974 and again for the Apollo-Soyuz mission in 1975.

In 1977, Truly was part of a team of four astronauts that flew the Enterprise orbiter for the Space Shuttle Program's Approach and Landing Tests. He made his first flight to space with Joe Engle on his 44th birthday—12 November 1981—on the second test flight of the Shuttle, STS-2.

Nearly two years later, Richard Truly served as the mission commander on his second and final spaceflight, the six-day STS-8 mission, notable for being the first night launch and landing of a Space Shuttle. Not long after this flight, he left NASA to become the first commander of the Naval Space Command, established 1 October 1983. He didn't have any intention of returning to NASA, but after the Challenger disaster in January 1986, he was sent to NASA Headquarters to lead the accident investigation and the Shuttle's return-to-flight efforts. He described it as the toughest job he'd ever done.[1]

Shortly after the Shuttle returned to flight in 1988, Truly was nominated by President George W. Bush to become NASA's eighth Administrator, serving in this role until April 1992.

Current NASA Administrator Bill Nelson shared his heartfelt sentiments in the Agency's 29 February 2024 press release: "Richard had the makings of someone who understood that we choose to do great things not because they are easy, but because they are hard. … I invite all those who care for humanity's quest to reach ever higher to join me in saying farewell to a great public servant." ■

Endnote

1 Paul Brocker, "Library Conversations. The Richard H. Truly U.S. Space Program Collection: An Interview with Vice Admiral Richard H. Truly," *Check It Out* 6, no. 3 (fall 2007): 7.

Upcoming Meetings

20–22 MARCH 2024
American Astronautical Society's Annual Robert H. Goddard Memorial Symposium
College Park, Maryland
https://astronautical.org/events/goddard/

26–28 MARCH 2024
International Astronautical Federation Spring Meetings 2024
Paris, France
https://www.iafastro.org/events/iaf-spring-meetings/iaf-spring-meetings-2024.html

3–7 APRIL 2024
American Society for Environmental History Annual Meeting
Denver, Colorado
https://www.aseh.org/events

8–11 APRIL 2024
39th Space Symposium
Colorado Springs, Colorado
https://www.spacesymposium.org/

11–14 APRIL 2024
2024 Conference on American History
New Orleans, Louisiana
https://www.oah.org/conferences/oah24/

12–15 APRIL 2024
National Council on Public History Annual Meeting: "Historical Urgency"
Salt Lake City, Utah
https://ncph.org/conference/2024-annual-meeting/

30–31 MAY 2024
Society for History in the Federal Government Annual Meeting
Washington, DC
https://shfg.wildapricot.org/page-18391

13–14 JUNE 2024
Discovery@30, New Frontiers@20 Symposium
Washington, DC
Contact Dr. Brian Odom for information

20–21 JUNE 2024
Environmental Justice in Space Workshop
Virtual meeting
https://bit.ly/ejis-workshop

9–11 JULY 2024
International Conference on Transdisciplinary Engineering 2024
London, England
https://www.te2024.org.uk/

9–14 JULY 2024
Society for the History of Technology (SHOT) Annual Meeting
Viña del Mar, Chile
https://www.historyoftechnology.org/annual-meeting/2024-joint-icohtec-shot-annual-meeting/

15–17 JULY 2024
American Astronautical Society's John Glenn Memorial Symposium
Cleveland, Ohio
https://astronautical.org/events/john-glenn-memorial-symposium/

16–19 JULY 2024
European Association for the Study of Science and Technology (EASST)–Society for Social Studies of Science (4S) Joint Conference 2024
Amsterdam, Netherlands
https://www.4sonline.org/meeting.php

22–28 JULY 2024
Experimental Aircraft Association (EAA) AirVenture
Oshkosh, Wisconsin
https://www.eaa.org/airventure/

29 JULY–2 AUGUST 2024
2024 AIAA Aviation and Aeronautics Forum and Exposition
Las Vegas, Nevada
https://www.aiaa.org/aviation

21–22 AUGUST 2024
Contributions of the DC-8 to Earth System Science at NASA: A Workshop
Washington, DC
https://www.nasa.gov/history/contributions-of-the-dc-8-to-earth-system-science-at-nasa-a-workshop/

15–17 AUGUST 2024
ARCHIVES * RECORDS 2024 (88th Annual Meeting of the Society of American Archivists)
Chicago, Illinois
https://www2.archivists.org/conference

17–19 SEPTEMBER 2024
2024 Forum on Philosophy, Engineering, and Technology Meeting
Karlsruhe, Germany
https://www.fpet2024.org

18–19 SEPTEMBER 2024
NASA and Archaeology from Space: A Symposium in Honor of Dr. Thomas L. Sever
Washington, DC
https://www.nasa.gov/history/nasa-and-archaeology-from-space/

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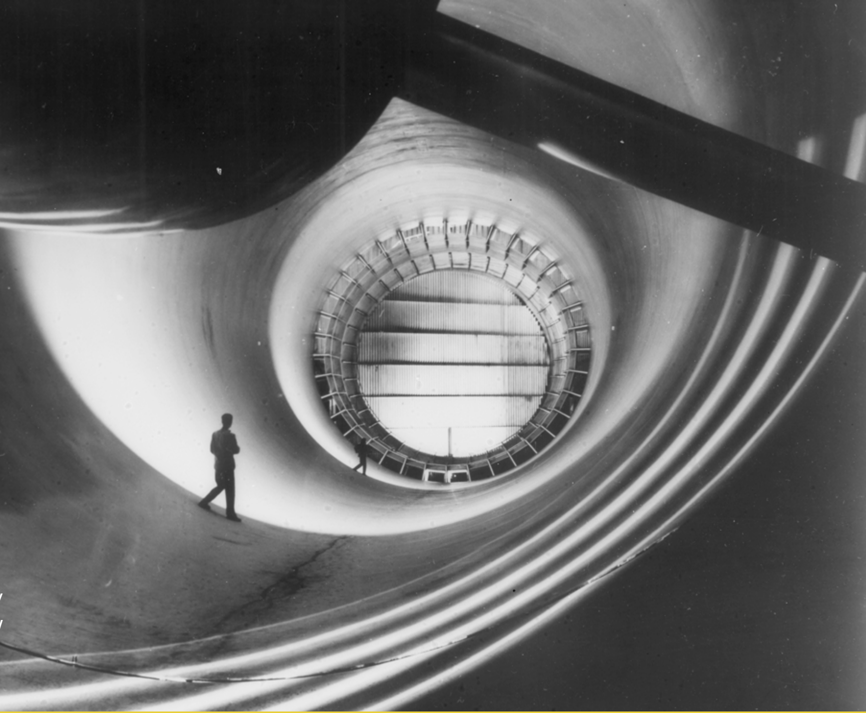

The 16-Foot High-Speed Tunnel (HST) was the first wind tunnel built in the West Area of what is now NASA's Langley Research Center. This photo, taken in March 1951, is a view from inside the tunnel. (Photo credit: NACA)

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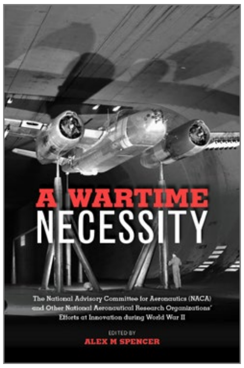

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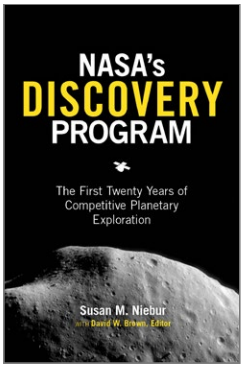

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