NEWS &NOTES

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FROM THE (FORMER) CHIEF HISTORIAN

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Longtime readers of NASA History *News & Notes* may realize that this is my 10th anniversary appearance on the masthead of our quarterly newsletter. It will also be my last. As of 1 August 2020, I retired from NASA. My 19 years at NASA, 10 as Chief Historian, have been the fulfillment of a childhood dream, filled with challenges I never could have imagined, and a privilege beyond compare. But much as I have loved so many parts of this work, it is time to pass the baton to our next Chief Historian. During my Air Force and NASA careers, I have rarely kept the same job for more than 3 years at a time. A decade in one place must mean that I really loved the work, or that I've finally matured a bit—hopefully, it is a bit of both. As your (former) historian, I can't help but note that there have been six Chief Historians in the 62-year history of our agency. So, 10 years also seems about the right tenure.

Of course, I was incredibly lucky to follow in such brilliant and accomplished footsteps. Our first Chief, Gene Emme, laid the foundation of the NASA history and archival program based (at least in part) on his experience with the Air Force history program. When Gene retired in 1978, after an amazing 19 years as Chief Historian, NASA turned to an Air

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WELL SUITED

By Sarah LeClaire

Nobody knows more about spacesuits than—or loves them as much as—Bill Ayrey.

For over 40 years, Ayrey worked at ILC Dover, the prime NASA contractor for the design, development, and manufacture of spacesuits since 1965. He retired last year as both the manager of the Test Lab and the company historian. While most people would welcome the respite from work and spend their days on a faraway beach with a book and a beer, Bill Ayrey definitely isn't most people. His newfound free time was spent writing *Lunar Outfitters: Making the Apollo Space Suit*, which tells the remarkable tale of the people and events that led to making these state-of-the-art garments.

What becomes evident in *Lunar Outfitters* is what an unlikely choice ILC was for NASA. International Latex Corporation (ILC) was founded in 1937 by Abram N. Spanel in Dover, Delaware. Prior to their partnership with NASA, the company was known primarily for manufacturing bras and girdles made under the brand name Playtex. "ILC was definitely an underdog," chuckles Ayrey. "NASA was accustomed to dealing with your [Northrop] Grummans and North Americans [Aviation Group] and these giant companies who employed tens of thousands of people. They had to find someone to make spacesuits and chose a small company with a couple of engineers who understood what

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OFFICE OF COMMUNICATIONS

From the Chief Historian (continued)

> **MY 19 YEARS AT NASA, 10 AS CHIEF HISTORIAN, HAVE BEEN THE FULFILLMENT OF A CHILDHOOD DREAM, FILLED WITH CHALLENGES I NEVER COULD HAVE IMAGINED, AND A PRIVILEGE BEYOND COMPARE.**

Force historian again, bringing Monte Wright in from the History Department at the Air Force Academy. Monte's relatively short tenure, 1978–82, spanned the lean support-budget years of the birth of the Space Shuttle Program and also overlapped with his successor's term on the NASA History Advisory Committee (then a standing committee of the NASA Advisory Council). From 1983 to 1990, Sylvia Fries brought a new attention to the people behind the technology and forged wider partnerships with the historical community. Among other things, Sylvia established our long-standing fellowship agreement with the American Historical Association. Our fourth Chief Historian was the indefatigable Roger Launius—a person of such insight and productivity that he was eventually poached away by the National Air and Space Museum. However, that didn't happen until he had completed a dozen phenomenal years (1990–2002) at NASA. I'm obliged to mention two things about Roger. First, he, like three of his predecessors, had a background as an Air Force historian. Second, Roger is the person who prompted me to look for a job at NASA as I was retiring from the Air Force in 2001. (Thanks, as always, for the advice, Roger.) In 2003, NASA lured astronomer and historian Steve Dick away from the U.S. Naval Observatory. Steve led the history program through the 50th anniversary of the Agency and also brought a new focus on the societal impact of NASA through a series of conferences and publications. Our fifth Chief Historian is also the only one of this august group who has a minor planet (6544 Stevendick) named in his honor. By the time I was selected as Chief Historian in 2010, my five predecessors had laid an incredible foundation and had established the NASA history program as an exemplar for history programs across the Executive Branch. They set an awfully high bar.

Yet I think the history team across NASA has done reasonably well in some (also) lean years. We have made significant strides in adapting to the new digital landscape that we all live in. Continuing the focus on expanding e-book distribution, our publications now reach an audience in the tens of thousands, rather than being limited to the couple of thousand copies we could afford to print. We've also built on the legacy of a huge web presence (started during the infancy of the internet under Roger Launius) by making our earlier titles also available in free, downloadable PDF format and, just last year, overhauling our website to make it both mobile-friendly and a place where we can make our archival materials more readily available to the public. We've also had pretty good success in the realm of social media, despite my skepticism. With over 2 million followers on Facebook and nearly a million now on Twitter, our team (thanks here go largely to our amazing interns) has made NASA's history a relevant and daily part of the lives of people who might otherwise never have noticed. In a decade with many highlights, the thing that I am most proud of is our small assistance to author Margot Lee Shetterly and the production team of the hit movie *Hidden Figures*. The book and movie are gifts that keep on giving. My guess is that NASA (and other organizations) will continue to reap the harvest for years to come of young women and minorities who will see a powerful example of how they can put their talents to work in science and engineering (and history too, I hope) based on the example of this powerful story. From providing a welcoming archive where Margot could do her research to feeding the insatiable appetite for detail of movie director Ted Melfi, the history

program made a number of small contributions to the *Hidden Figures* phenomenon. It was an investment well worth making.

A few years ago, when I first became eligible for retirement, I promised my boss at the time that I would see the history program through the 50th anniversary of Apollo 11 in 2019. Although I wouldn't recommend retiring in the middle of a pandemic, this year also brought home the importance of spending time with my family. I am looking forward to doing more of that, getting back to flying on a regular basis, and finally tackling the long list of history research and writing projects that I have had to keep on the back burner for the last decade. The good news for NASA is that the history team is an incredibly strong one and is in great hands with acting Chief Historian Brian Odom. To whoever has the honor of serving as NASA's seventh Chief Historian, I wish you every joy and success in caring for our amazing legacy and, especially, in taking care of the NASA history family. To everyone, as always, I wish you Godspeed.

William P. Barry, D.Phil.
NASA Chief Historian 2010–20

As a bookend, we are reprinting Bill's first "From the Chief Historian" message from *News & Notes*, vol. 27, no. 4..

It is such an honor and a delight to be joining the National Aeronautics and Space Administration (NASA) History Program Office. I have had a passion (some might say an obsession) with NASA and with history for as long as I can remember. In fact, the first thing I can remember is sitting in front of our black-and-white TV set and worrying about whether the heat shield would stay in place on John Glenn's Mercury capsule during reentry. From that day, I was hooked on all things aerospace. Much as I tried to convince myself to become an engineer, it became apparent early on that my inclinations and gifts lay elsewhere. I am very much looking forward to putting those skills and my breadth of experience to work with you and everyone else who shares an interest in the history of aerospace. I am particularly pleased to be inheriting the post of Chief Historian from such a distinguished line of predecessors. The NASA history program is in great shape, and I am committed to maintaining its long-standing commitment to integrity and creativity in pursuing our task of collecting, preserving, and disseminating information about NASA and its role in our world. I would particularly like to thank Steve Garber, who has (for the second time) taken the helm for an extended period as Acting Director. Steve has done a remarkable job of juggling two full-time jobs, while simultaneously keeping a steady hand on the wheel as the History Program Office moved from the Office of International and Interagency Relations (formerly External Relations) to the Office of Communications. Thanks, Steve! As we get to know one another in the months ahead, I invite you to share your thoughts, ideas, and suggestions about the NASA history program. You can always reach me at *bill.barry@nasa.gov*, pick up the telephone and call me at 202-358-0383, or drop by room 5N17 at NASA Headquarters. I am looking forward to hearing from you. Until then,

Godspeed.

William P. Barry
Chief Historian

Well Suited (continued)

Bill Ayrey. (Photo credit: Bill Ayrey)

a spacesuit should be. ILC had to work hard to gain NASA's confidence."

They did just that. The little company that could grew to almost 1,000 employees at the height of the Apollo program in the late 1960s, all working together to produce the garment that would be the difference between life and death for an astronaut. The spacesuit had to simultaneously be strong enough to protect from radiation and micrometeoroid impacts and comfortable enough to allow for a full range of motion while pressurized. It was crafted to be both an intravehicular activity (IVA) and an extravehicular activity (EVA) suit. The suits never failed. "The astronauts knew and had total faith in the people who made the suits," says Ayrey. "To have that confidence when they were bouncing around on the Moon's surface and falling down was critical."

Unlike many companies of that time, their workforce was decidedly diverse. Spanel invested time and money in Delaware State University, establishing a program to provide the training needed for future employment opportunities at ILC to this predominantly black college. Their dedication to hiring, integrating, and promoting black workers to all levels was highlighted in the January 1961 issue of *Ebony Magazine*. Additionally, every single part of every Apollo spacesuit was expertly and meticulously stitched together by an all-female crew.

I first met Bill years ago when working as an intern at the Smithsonian National Air and Space Museum Archives. My project was to arrange and describe the ILC Dover collection of aperture cards and documents that he had donated. He was there to help the Conservation Department on the "Reboot the Suit" campaign to conserve, digitize, and display Neil Armstrong's Apollo 11 spacesuit. One day, our paths crossed, and I asked him about his work. He replied with an infectious enthusiasm. Clearly, this was a man who loved his job and took obvious pride in ILC's accomplishments. The stories he told me that day are captured in *Lunar Outfitters*.

One such tale was of an unusual yard sale. "ILC had such a great run through the Apollo program, but they put all their eggs in one basket," says Ayrey.

> By the time ASTP [Apollo-Soyuz Test Project] and Skylab came around in the 1970s, they were down to a skeleton crew because NASA didn't need any more spacesuits. The Space Shuttle Program was coming, but that was still a few years away. As things wound down, the company found itself in financial straits because money wasn't coming in. John McMullen [ILC's Vice President] decided that they should get rid of the location in Dover and move everything down to the facility in Frederica, Delaware, in 1975. They had to get rid of a lot, so they had a yard sale of sorts. On a cold March Saturday in the parking lot of the Dover plant, they laid out all these surplus things they had, including a TMG [Thermal Micrometeoroid Garment] and multiple bubble helmet shells. People came flooding in. John [McMullen] told me that a woman bought a handful of bubble helmets for $5 or $10 each. She told him, "I'm going to put them over my tomato plants to protect them from

the frost." In the early 2000s, the guy who bought the TMG for $100 came to visit ILC and brought it with him. He asked me what I thought it was worth now. I laughed and said, "I don't know what it would get at an auction, but I bet you could easily get $30,000." I'd say he got the bargain of a lifetime!

Ayrey also writes extensively about the seamstresses who played such a critical role in ensuring the astronauts' safety in the harsh vacuum of space. Roberta "Bert" Pilkenton was one of the best. Growing up, she was taught to sew by her mother and joined ILC in 1963. Once, days prior to Apollo 14, Pilkenton arrived at work to find a very atypical assignment. The engineers at Cape Kennedy determined that the knee convolute in one of the suits was showing signs of wear and tear and needed to be replaced immediately or else the mission could be scrapped. She was to fly to Florida to perform the delicate, complicated fix. Pilkenton was young, newly married, and had never been on an airplane before. Because this was a different time, she called her husband and asked permission. He flatly said no. Despite being terrified of flying and not wanting to upset her husband, she accepted the challenge, knowing exactly how much was riding on her decision. While there were other qualified seamstresses, she was the one that was asked for by name. Within the hour, she found herself on an airplane with a briefcase handcuffed to her right arm to ensure that she did not get separated from the vital components. She spent all that night and most of the morning hunched over the table at Kennedy Space Center's suit laboratory. Bert Pilkenton saved both the day and the mission.

"I wrote the book because I could see that a lot of the folks who were retiring from ILC had no intention of writing their memoirs. After working with them for so many years, hearing their stories and being the big Apollo nerd that I am, I knew that these histories would be lost otherwise," Ayrey explained. "Plus, no one to date had documented the technical details—I wanted to do so for current and future space enthusiasts and engineers. I had three file cabinets full of

Bill Ayrey. (Photo credit: Bill Ayrey)

the original ILC files that luckily never made it to the dumpster. I had these hard facts in front of me, I had the anecdotes from the retirees who worked on Apollo and I put it all together. It had to be done. Nobody else had done this—to marry the technical data and the personal stories of the men and women who made it all happen." And nobody else was as perfectly "suited" to do so as Bill Ayrey.

Lunar Outfitters: Making the Apollo Space Suits, by Bill Ayrey, was published on 6 October 2020 by the University Press of Florida.

This article was written from an interview and does not represent a sponsorship by NASA.

NEWS FROM HEADQUARTERS AND THE CENTERS

NASA HEADQUARTERS

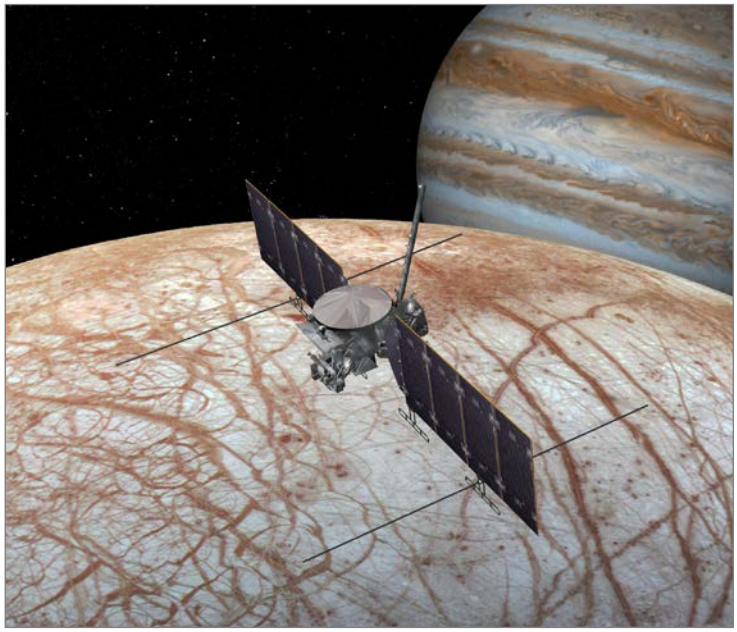
Washington, DC

By Brian Odom

While COVID-19 has certainly impacted several aspects of our work in the office, one bright spot is the continuation and growth of our NASA History virtual "brown bag" talks. This series of online talks explores a variety of topics from across the space history field. These regularly recurring events, hosted on Microsoft Teams, bring the most recent scholarship and current research of aerospace historians and practitioners to the public free of charge.

Our first speaker this past quarter was Jordan Bimm, a postdoctoral fellow at the University of Chicago's Stevanovich Institute on the Formation of Knowledge. Bimm's 20 May talk, "A Push-Button Astronaut: Isolation, Confinement, and Vigilance in Pre-NASA Spaceflight Simulations," explored a simulated, week-long spaceflight conducted in February 1958 at the U.S. Air Force (USAF) School of Aviation Medicine (SAM). During the simulation, a young airman lived sealed inside a tiny, cramped mockup of a spacecraft with no contact with the outside world. In this experiment, the astronaut was not a pilot, but a lower-skilled passive systems monitor, similar to other push-button soldiers of the early Cold War.

The 24 June talk "Gateway to the Stars: Fundamentalism, Space Tourism, and the Cape Canaveral Bible Conference" was presented by Kari Edwards. There, Edwards, a Ph.D. candidate in history at the University of Mississippi, discussed radio preacher Carl McIntire's quest to build a community called "Gateway to the Stars," a fundamentalist Bible conference center on a large tract of land in Cape Canaveral, Florida. Since the earliest days of the space race, McIntire had preached a consistent message, positioning the fight against the Soviet Union for dominance in the heavens as a divine mission and NASA's technological achievements as proof of God's blessings on



This artist's rendering shows NASA's Europa mission spacecraft, which is being developed for a launch sometime in the 2020s. (Image credit: NASA/Jet Propulsion Laboratory [JPL]-Caltech)

America. In her talk, Edwards convincingly argued that McIntire's "Gateway to the Stars" community was a unique example of the often-precarious marriage between religion and scientific progress that characterized the Cold War–era American religious landscape.

Michael Neufeld, a senior curator in the Space History Department at the Smithsonian's National Air and Space Museum, provided another lunchtime presentation on 15 July. In "NASA, the Search for Life and Missions to Europa," Neufeld discussed the proposed NASA "flagship mission" Europa Clipper, a mission planned for a mid-2020s launch and intended to explore one of the Galilean satellites of Jupiter. In his talk, Neufeld discussed the history of Europa science and the program's long and tortuous path to an approved mission. He argued that without the rise of astrobiology and the life-bearing potential of the Jovian moon, it would have been impossible to sustain the necessary level of interest and expenditure.

Neufeld also used the program's development as a window into the politics of NASA planetary exploration in the 21st century.

Our most recent presentation was given by W. Patrick McCray, a professor of history at the University of California, Santa Barbara, and author of the forthcoming work, *Making Art Work: How Cold War Engineers and Artists Forged a New Creative Culture* (Massachusetts Institute of Technology [MIT] Press, October 2020). In his talk, "Frank Malina: Dreamer of Space, Engineer of Art," McCray explored the life and artistic career of Frank J. Malina (1912–81), who was a preeminent rocket engineer, a cofounder of the Jet Propulsion Laboratory, and a professional artist who operated out of a studio in Paris. In his talk, McCray argued that Malina's career was an example of how art, technology, and science, often considered as separate spheres of creativity, sometimes intersect in the form of one individual's life's work.

The History Program Office will continue to offer these engaging programs over the upcoming quarter. Recent speakers and topics include the following:

- 25 August—William Causey, "John Houbolt: The Unsung Hero of the Apollo Moon Landings"
- 16 September—Jennifer Levasseur, "Through Astronaut Eyes: Photography from Early Human Spaceflight"
- 7 October—Kathryn D. Sullivan, "Handprints on Hubble: An Astronaut's Story of Invention"
- 28 October—Bill Ayrey, "Lunar Outfitters: Making the Apollo Space Suit"

For further information on these talks or to be added to the NASA History Listserv, please contact Brian Odom at ***brian.c.odom@nasa.gov*** or Nadine Andreassen at ***nadine.j.andreassen@nasa.gov***.

On the publication front, the History Program Office is seeing considerable progress on numerous projects. Chris Gainor's excellent operational history of the Hubble Space Telescope (HST), entitled *Not Yet Imagined*, has now completed layout and is moving toward printing. Abundant stunning images produced over its 30 years of operations highlight the observatory's decades of returns, and this edifying account of that history balances both the intricately complex operational efforts and the cutting-edge scientific returns.

Other forthcoming projects include the *FY 2019 Aeronautics and Space Report of the President,* which will be available soon thanks to the History Program Office's Cat Baldwin as well as Michele Ostovar and the team at the Communications Support Services Center (CSSC). Efforts are already under way to collect inputs for the report for FY 2020. Past reports are available at ***https://history.nasa.gov/presrep.html***. Final touches are also under way on *The Wind and Beyond: A Documentary Journey into the History of Aerodynamics in America, Volume III: Other Paths, Other Flyways*, edited by James R. Hansen and Jeremy R. Kinney. This long-awaited third volume to the series highlights how the "historical development of aerodynamics has always involved options, alternatives, and various ways of doing things." Watch for this one soon as a NASA History e-book. With lots of other projects in various stages of production on topics ranging from a history of near-Earth objects to NASA's Discovery Program, the next year looks to be a busy one.

"WITH LOTS OF OTHER PROJECTS IN VARIOUS STAGES OF PRODUCTION ON TOPICS RANGING FROM A HISTORY OF NEAR-EARTH OBJECTS TO NASA'S DISCOVERY PROGRAM, THE NEXT YEAR LOOKS TO BE A BUSY ONE."

Office Update

By Catherine Baldwin

We have been so lucky this summer and fall to have marvelous interns. Our two interns this summer were Michael Plocinik and Alejandro Pérez. Michael is a rising junior at Clarkson University, studying mechanical engineering, and Alejandro is a rising senior at Columbia University, majoring in Hispanic studies and poetry. They did a marvelous job through difficult times, working from home and handling quick tone shifts in social media to keep up with national news. It was exciting to have interns with such different academic backgrounds and interests. We wish them the best of luck as they go on to other pursuits.

This fall, we are sharing our three interns with the Office of the Chief Scientist (OCS). Loren Stephens is a senior at Smith College studying astronomy; Felicia Ragucci is a junior at Dartmouth College studying English and literature with a minor in biology; and Jade Fischer is a senior at the Massachusetts Institute of Technology (MIT) studying Earth science and American studies (double major) with a minor in physics. While they attend our meetings and write our social media, each intern is responsible for a different historical research project set by OCS. The topics include the Discovery Program, the Neutral Buoyancy Simulator, and the Great Observatories Program.

AMES RESEARCH CENTER (ARC)

Moffett Field, California

By April Gage and James Anderson

After more than 73 years in a career devoted to public service, cutting-edge aeronautical research, and the promotion of NASA history, John W. "Jack" Boyd, Senior Adviser for History and Senior Adviser to the Center Director, has officially retired. This past 19 August was not only Jack's official last day on the job, but also his 95th birthday.

The Center collected text and video well-wishes for Jack that were shared with him on that day, as an in-person gathering to celebrate the occasion had to be postponed due to the pandemic. In addition to a flag flown over the U.S. Capitol Building that will be presented to Jack, congratulatory letters from Ames Center Director Eugene Tu and government representatives are also planned. Additional tributes are forthcoming. Knowing Jack, retirement will not slow him down and his valuable contributions as a living institutional memory and heart for Ames will continue.

In 1944, three years before Jack Boyd left his home state of Virginia for California and Ames Aeronautical Laboratory, he began studying for his bachelor's degree in aeronautical engineering as a cadet at Virginia Polytechnic Institute and State University (Virginia Tech). He would later tell the Langley recruiter that he did not want to go to Langley but preferred instead to go to Ames and see California for the first time.

Jack Boyd came to Ames from Virginia in 1947 as an aeronautical engineer. He distinguished himself in research that led to the conical camber and the development of canard configurations for application to supersonic flight. In 1965, Jack was awarded an Alfred P. Sloan Fellowship in Executive Development at Stanford University, and he later went on to serve as a Deputy Director at both Ames and Dryden

(present-day Armstrong) Flight Research Center, an Associate Director and an Associate Administrator for management at NASA Headquarters, and the Ames Center Ombudsperson.

In 2008, Jack received the NASA Headquarters History Division Award. The award cited his "energetic outreach and promotion of NASA history and for making history relevant to NASA's present and future." Jack was instrumental in the establishment of the Ames History Office in 2003, and he has served as the Senior Adviser for History in addition to his role as Senior Adviser to the Center Director. Upon receiving the history award, Jack paraphrased a favorite quote of his, saying that "Historians never finish their work; for various reasons they simply abandon it," as reported in the May issue of *Astrogram* from that year.

Meanwhile, Center historian James Anderson and archivists April Gage and Danielle K. Lopez continue work on multiple projects, including the two ambitious data collection projects *Women of Ames* and the *Ames Research Center Response to COVID-19*. A separate and complementary proposal has also been submitted to the Ames Innovation Fair by the Office of Communications. The proposal, titled *Voices of Ames*, is an internal oral history campaign that seeks to capture this historic moment from the point of view of the Ames workforce, documenting in their voices how their work and their lives have adapted and changed in the year 2020. This effort also intends to help enable the expansion of representation of the Ames workforce in our archives and, by extension, our Center's future histories.

Another opportunity for filling in coverage in the history archives has arisen as a result of an effort under way in records management. The Ames Records Manager is undertaking a massive analysis of the Center's holdings in the Federal Records Center (FRC) in preparation for processing them out of the FRC. This effort will include scheduling material in accordance with NASA's Records Retention Schedule and ultimately obtaining authorization to either dispose of it or transfer it to the National Archives. By current estimates, the extent of the material is 8 to 10 thousand cubic feet. The Records Manager is sharing documentation about the undertaking with history and archives stakeholders at the Center in order to provide the opportunity for those groups to also assess the holdings and identify portions to capture for local reference collections to support future research capabilities. Given the volume of records, the process of appraising, selecting, digitizing, and ultimately maintaining a subset of the material would be cost- and labor-intensive. The Center historian and archivists are working together to consider how to approach this task.

JOHNSON SPACE CENTER (JSC)

Houston, Texas

By John Uri

The JSC History Office continues to operate in teleworking mode. New face-to-face interviews for the Oral History Project continue to be temporarily suspended, although the office has discussed the use of Microsoft Teams on a trial basis. Jennifer Ross-Nazzal and Sandra Johnson continue to process transcripts from already-completed interviews to be able to add them to the JSC History Portal as soon as the interviewees approve them for release. During this time, the team is also taking advantage of opportunities to attend webinars and other training and enrichment events.

The JSC History Office is proud to announce that Jennifer's book *Making Space for Women* passed a major milestone when the Texas A&M University Faculty Advisory Committee unanimously approved the manuscript for publication by the Texas A&M University Press. Using the oral history narratives of 21 women, this pathbreaking work looks at women's challenges and opportunities at JSC over the past 50 years. Although much work still lies ahead, we eagerly anticipate the publication of this unique, important volume that will make a significant contribution to the field of women and spaceflight.

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

The History Office met with representatives from JSC's Engineering Directorate to discuss preserving documents related to JSC's Building 44. Possible ideas for collaboration discussed included pairing an intern with Engineering to preserve some papers related to Building 44 and the Apollo-Soyuz Test Project (ASTP). Another approach, discussed with JSC's University Affairs Office, might include funding a faculty fellowship for some of this work. We will continue to pursue this potential collaboration with JSC Engineering.

Jennifer participated in an interview to be published in an upcoming issue of the Society for History in the Federal Government's (SHFG) newsletter, *The Federalist*. She also was interviewed by *New Mexico Magazine* about local places with a significant space history connection, including the White Sands Test Facility and Apollo astronaut training sites.

On 22 June, NASA Alumni League (NAL) JSC Chapter representatives presented the University of Houston–Clear Lake (UHCL) with a check outside the Alfred R. Neumann Library to kick off a student internship to provide archival support for the JSC Collection within the UHCL Archive. Approximately

NASA Alumni League (NAL) JSC Chapter members presented an endowment check to UHCL. From left and behind the check are NAL representative Cyndi Draughon, UHCL Associate Director of Development for University Advancement Richard Zalesak, NAL representative Denny Holt, JSC archivist Mark Scroggins, and NAL representative Sylvia Stottlemyer. In front, holding the check, are Neumann Library Executive Director Dr. Vivienne McClendon and NAL representative Greg Blackburn. (Photo courtesy of UHCL)

20 years ago, JSC established a Space Act Agreement with the UHCL Archive to maintain custody of historically significant records accumulated by JSC's History Office. The agreement provides archival space for the JSC records, provides public access for these materials, and lays out other requirements. UHCL's processing of donated retiree records supplements the previous archival work completed on the various series, including Apollo and Shuttle. Beginning in fall 2020, the student intern will work alongside the UHCL archivists to formally process donations into the growing JSC Collection, along with responding to research requests. JSC archivist Mark Scroggins, who manages the Space Act Agreement with UHCL for the JSC History Collection, participated in the ceremony.

To capture the impacts of the coronavirus pandemic on the JSC workforce, our production coordinator, Sandra Johnson, continues to spearhead an effort to gather information in real time from the JSC community. By benchmarking efforts by several museums, universities, and libraries, the web-based content management system, still under development, will capture personal experiences, stories, and multimedia submissions provided by employees on the internal JSC Knowledge Management website. The information will be archived for future research and used as the first step in determining and preparing for a follow-on oral history project to capture how this unprecedented event affected people, processes, and procedures across the Center. We look forward to rolling out this project in the near future.

The JSC History Office continues to actively participate in an effort led by the JSC External Relations Office (ERO) to commemorate key moments leading up to the 20th anniversary of permanent occupancy of the International Space Station (ISS) on 2 November 2020. Feature articles summarized extravehicular activities on the ISS; celebrated Flag Day with a look at the American flag flown aboard the first and last Shuttle flights and then stowed aboard the ISS for nine years while awaiting the next American spacecraft; remembered the first Shuttle-Mir docking during STS-71; and described preparations for the first ISS expedition during the summer of 2000, including the arrival of the Zvezda Service Module.

We continue to work with the JSC ERO to publish a series of articles commemorating other significant historical milestones, such as the 50th anniversaries of Apollo 14 and follow-on Moon landing missions, the 45th anniversary of the Apollo-Soyuz Test Project in July 2020, and the 40th anniversary of STS-1 in April 2021. The content is posted on the www.nasa.gov website and JSC's Facebook and Twitter accounts. Select articles are posted on JSC's *Roundup Reads*, and abstracts of the articles appear online in JSC's *Roundup Today*. The features often highlight the anniversaries of less-celebrated events and people that were nevertheless important in the various spaceflight endeavors. We would like to thank history and archive personnel at other NASA Centers for their valued help and contributions to many of these products. We would especially like to thank Elaine Liston at Kennedy Space Center for her unending supply of *Spaceport News* back issues, uninterrupted by the coronavirus pandemic. In early August, we reached a significant milestone with the publication of the 285th article since the series began three years earlier.

MARSHALL SPACEFLIGHT CENTER (MSFC)

Huntsville, Alabama

By Brian Odom

At the Marshall History Office, work continues on multiple projects despite the significant impact of COVID-19. The telework status of the History Office staff has limited our ability to support some research projects. However, thanks to previous work digitizing important collections within the archives, limited support for reference requests has been possible.

Planning continues for the upcoming March 2021 symposium—"NASA and the Rise of Commercial Space." The successful return of SpaceX's Crew Dragon carrying astronauts Bob Behnken and Doug Hurley for DM-2 serves as a reminder of the changing

The SpaceX Crew Dragon Endeavour spacecraft is seen as it lands with NASA astronauts Robert Behnken and Douglas Hurley aboard in the Gulf of Mexico off the coast of Pensacola, Florida, Sunday, 2 August 2020. (Photo credit: NASA/Bill Ingalls)

nature of space exploration. By exploring the long history of how we got to this point, the symposium seeks contributions exploring a range of questions including the following:

- How has the concept of "commercial space" evolved in different fields and disciplines?
- What have been the major events and milestones in the emergence and evolution of commercial space activities in the United States and internationally?
- How has the U.S. government assisted or impeded the emergence and evolution of the commercial space activities?

The planning committee collaborated with the editor in chief of *NewSpace: The Journal of Space Entrepreneurship and Innovation*, Ken Davidian, on an explanatory overview piece for a forthcoming issue of the journal. There, committee members discuss the key themes of the symposium as well as the evolving nature of how scholars and participants have defined what exactly we mean by commercial space. For more information on the symposium, visit the web page at *https://www.nasa.gov/centers/marshall/history/nasa-and-the-rise-of-commercial-space-symposium.html* or contact Brian Odom at *brian.c.odom@nasa.gov*.

Work also continues on the edited volume of essays entitled *NASA and the American South*. COVID-19 has impacted that project by limiting the ability of some authors to access key archival collections—a common experience of many researchers over the past months. Emerging from the 2019 symposium of the same name, this collection of essays examines factors shaping the impact NASA has had on the South over the past 60 years and explores how that Southern "accent" has affected the development of NASA's organizational culture, technology development, and programmatic goals. Despite the delays, editing for this volume should conclude by late fall.

In the archives, efforts are under way to develop new collections to support future research projects related to the Discovery and New Frontiers Programs such as Origins, Spectral Interpretation, Resource Identification, and Security–Regolith Explorer (OSIRIS-REx); Juno; New Horizons; and many more. Started in 1992, the Discovery Program was intended as a complement to NASA's larger "flagship" planetary science explorations with the goal of achieving outstanding results by launching a greater number

This artist's concept of the Lunar Prospector shows the spacecraft in lunar orbit. Instrument masts are fully deployed. (Photo credit: NASA)

of smaller missions using fewer resources and shorter development times. The purpose of those projects is to deepen human understanding of the solar system by exploring the planets, their moons, and small bodies such as comets and asteroids. Building upon the innovative approach of the Discovery Program, the New Frontiers Program missions tackle specific solar system exploration goals identified as top priorities by the planetary science community. The strategy is to explore the solar system with medium-class spacecraft missions that conduct high-science-return investigations that add to our understanding of the solar system. The archival collections being developed in the Marshall History Office will include documentation related to key decision points and program results as well as oral histories with project and program team members. For more information on the Discovery and New Frontiers Programs, visit the NASA Planetary Missions Program Office site at *https://www.nasa.gov/planetarymissions/index.html*.

OTHER AEROSPACE HISTORY NEWS

AMERICAN ASTRONAUTICAL SOCIETY (AAS) HISTORY COMMITTEE

By Michael Ciancone

2019 Emme Award for Astronautical Literature

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

International Academy of Astronautics (IAA) History Series

The series editor, Dr. Rick Sturdevant, reports that the edited papers for the International Astronautical Congress (IAC) 2017 (Adelaide, volume editor: Michael Ciancone) are in the hands of Univelt. Univelt reports that they expect to complete work on the 2017 volume by August 2020 and publish by October 2020. The edited papers from IAC 2018 (Bremen, volume editor: Hannes Mayer) are in work with the volume editor. Otfrid Liepack expects to provide Univelt with the edited papers from IAC 2019 (DC, volume editor: Liepack) by September 2020.

2020 Ordway Award for Sustained Excellence in Spaceflight History

The Ordway Award is named in memory of Frederick I. Ordway III (1927–2014), human spaceflight advocate and chronicler of the history of rocketry and space travel. The award recognizes exceptional, sustained efforts to inform and educate on spaceflight and its history through one or more media, such as 1) writing, editing, or publishing; 2) preparation and/or presentation of exhibits; or 3) production for distribution through film, television, art, or other nonprint media. The award is managed by the Ordway Panel of the AAS History Committee. Members of the Panel are Michael Ciancone (Chair), Robert Godwin, Dr. Valerie Neal, Ron Miller, Dr. John Logsdon (2019 recipient), and John Noble Wolford (2019 recipient). The Panel is in the process of considering nominated candidates and plans to inform AAS Headquarters of selection(s) by September 2020.

NASA HEADQUARTERS ARCHIVES IN THE TIME OF COVID-19

By Robyn Rodgers

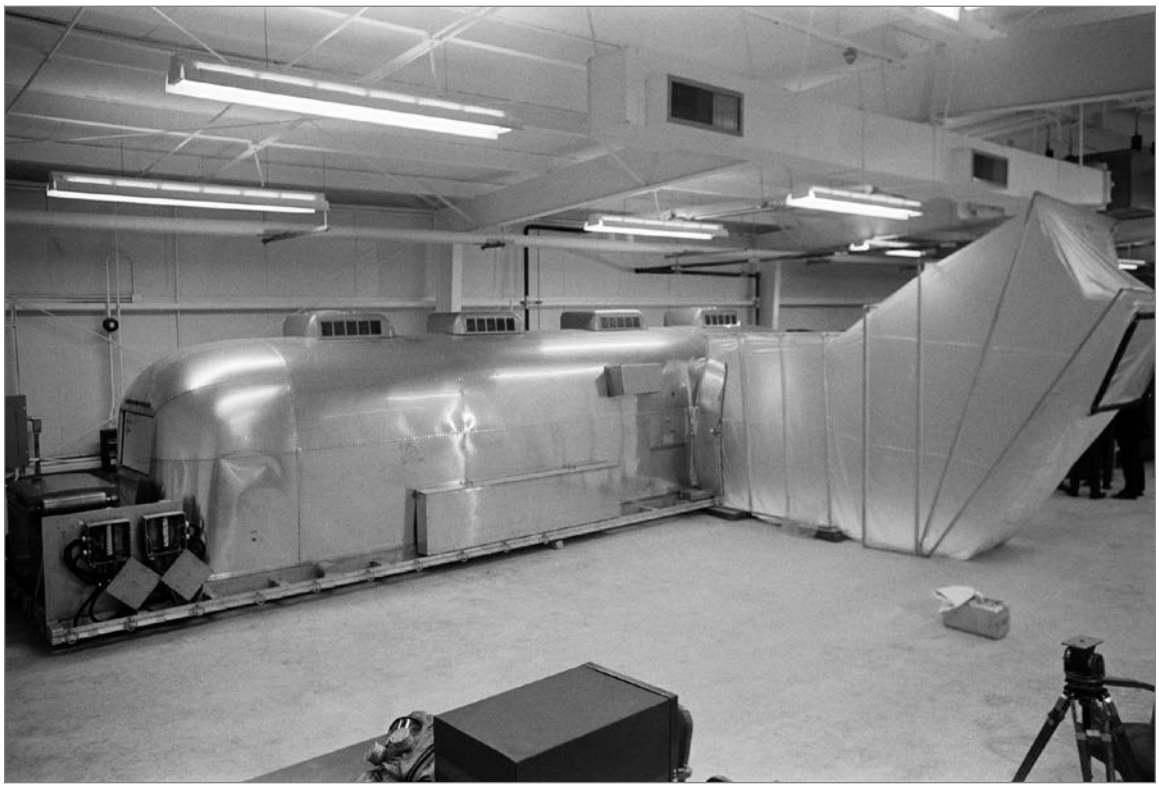
On the last day in the office, there was a fair round of cleaning and packing up. In a sense, it was a bit like going on vacation; one does not want to come home to trash not taken out, dishes in the sink, or laundry in the washer. Archival staff dusted shelves, wiped chairs and other flat surfaces, pulled plugs, sorted drawers, forwarded phones, and ran a visual inspection down every aisle and shelf in the facility. In case there is any truth to the movie *Night at the Museum*, some boxes received instructions about playing nicely with others. (Still looking at you, Mercury files.) Staff made notes about textual processing projects as reminders for where things left off. Precise disaster kit locations were memorized in the dark so that if something happened, I could verbally walk security to exactly where it sits. Somewhere along the line, we got the idea that we would be away for "something like a month-ish." That was five months ago at the time of this writing.

> "SOMEWHERE ALONG THE LINE, WE GOT THE IDEA THAT WE WOULD BE AWAY FOR 'SOMETHING LIKE A MONTH-ISH.' THAT WAS FIVE MONTHS AGO...."

In the early days, there was a lot of checking in. Checking on direct reports, checking on Center History staff, checking on local coworkers, and—yes—checking on senior leadership because they are people, too. There were meetings—so many meetings. There were new patterns to learn regarding one's bandwidth, household noise, pets, and other family members working at home. Those who have kids still in school faced unique challenges, too. There were lessons about your mic, other people's mics, who is echoing and why, how webcams actually work, and that angles are not just an Instagram thing. I learned to put my laptop up on two thick books or folks got a fabulous view of my three chins. Introverts faced different challenges than extroverts, and some were surprised at what they were learning about themselves and their partners/housemates/pets/neighbors. As this way of working became the new norm, the checking in due to COVID-19 became less necessary, but far more necessary for many other reasons. The year 2020 will not leave historians with nothing to do.

In early March 2020, when it became apparent that COVID-19 was going to cause a drastic shift in the way the government did business, information changed quite literally by the minute. Decisions made early in a meeting would shift partway through because a staff member brought something new in. Senior staff would leave a leadership briefing, and somewhere between the ninth floor and their office door, that information would change. All the notes they had sent via e-mail to their staff to start drafting were now only partially applicable, or nor at all. In the middle of the redraft, information and decisions reverted based on communications coming in from Centers, details released by public health officials, and decisions made by the Office of Personnel Management (OPM). To ensure that properly vetted information went out in a timely manner, drafts were started, abandoned, restarted, and then edited. Frankly, they had to have labels. To do otherwise just about guaranteed that superseded information would go out. NASA cares about people, and the reputation for veracity is vital. Public Affairs staff needed to do their utmost best to ensure that information was as accurate as it could be at the time of release. They were talking to the country. They were talking to their friends, neighbors, coworkers, and children. They were talking to themselves. It had to be as right as it could be.

In years to come, historians, researchers, and students will seek to answer the question "How did NASA react during the pandemic?" Each office, from the ninth floor down to the concourse level, has its own story to tell. The press releases, official statements, e-mails, and drafts only tell a small part of that. There are still program office records from across the Agency and peoples' experiences that require consideration. Across the industry, archivists are doing something that contradicts many of our best practices: we are collecting in real time. While there are many opinions about it, it is happening. The federal government is still in COVID-19 response mode, so those efforts will continue for quite some time. There are going to be gaps and conflicting information, especially in the earliest days. Interviews will have stories that do not line up, even from people who were in the same meeting. Each Center has its own stories that will create the whole. There will be similarities and differences. There will be direct conflict. There will come a time where researchers working through a collection will be aghast that we didn't retain something and that we "should have known!" They will likely be right, too. Archives and history reflect the human experience, and normally collection practices come with the benefit of the long view. We do not have that right now, which in itself is going to make for interesting professional research for future archivists. For now, we are working to get it right knowing that the informational labyrinth reflects the actual experience and tells a story of its own.



Exterior view of Mobile Quarantine Facility MQF-001, including the transfer tunnel. Credits: NASA

CONNECTIONS BETWEEN POETRY AND SPACE

By Alejandro Pérez, NASA History Intern, Summer 2020

PART 1: TRACY K. SMITH AND THE HUBBLE TELESCOPE

Floyd William Smith, the father of the 22nd Poet Laureate of the United States, Tracy K. Smith, was an optical engineer who worked on NASA's Hubble Space Telescope.

In her Pulitzer Prize–winning book *Life on Mars*, Tracy K. Smith explores her sense of wonder regarding the vastness and enigmatic nature of the universe: the same sense of wonder her father probably felt while working on the telescope.

Perhaps the most important theme in Smith's book is the unknowability of the universe: how it is our home, but also something completely foreign to us. In her poem "My God, It's Full of Stars," she imagines that "space might be choc-full of traffic / bursting at the seams with energy we neither feel / nor see."[1] She further expands on this idea that the universe is something we cannot fully understand in her poem "The Universe Is a House Party." In the beginning of the poem, she writes that it is "the kind of party / your neighbors forget to invite you to," and at the end of the poem, she says "it's ours."[2] To her, the universe is a strange party because it is our own and also not. We belong to it but are not in control; we are a part of it but do not know how it works.

Through her writing, Tracy K. Smith demonstrates that the job of the poet is not that different from that of the engineers who worked on the Hubble Space Telescope. Poetry, she suggests, is an attempt to question what we know and explore the unknown; it is an attempt to place ourselves within a larger landscape and try to make sense of who we are.

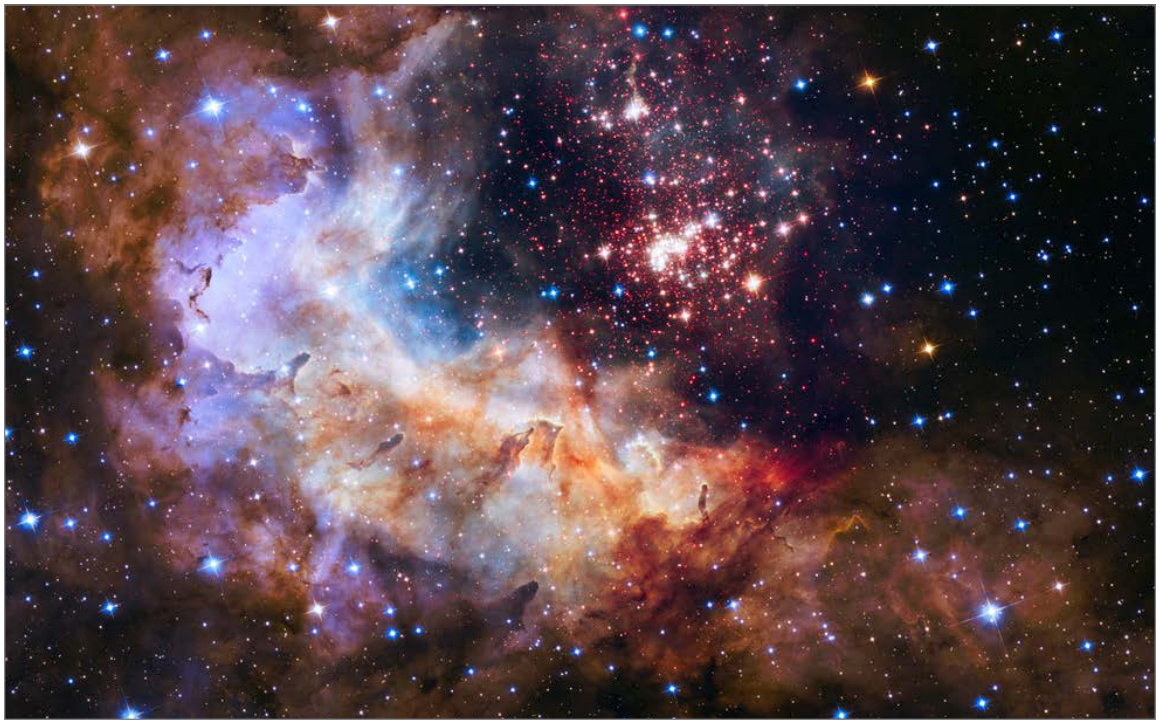
"THROUGH HER WRITING, TRACY K. SMITH DEMONSTRATES THAT THE JOB OF THE POET IS NOT THAT DIFFERENT FROM THAT OF THE ENGINEERS WHO WORKED ON THE HUBBLE SPACE TELESCOPE. POETRY, SHE SUGGESTS, IS AN ATTEMPT TO QUESTION WHAT WE KNOW AND EXPLORE THE UNKNOWN; IT IS AN ATTEMPT TO PLACE OURSELVES WITHIN A LARGER LANDSCAPE AND TRY TO MAKE SENSE OF WHO WE ARE."

The discoveries of the Hubble Telescope have undoubtedly provided us with a better understanding of the space we inhabit. Thanks to it, we have discovered that there are at least 10 times more galaxies than previously thought, that most galaxies contain massive black holes, that the universe is accelerating and expanding, and that it is approximately 13.8 billion years old.

To this day, the telescope, which Floyd William Smith once worked on, is still active, orbiting Earth at a speed of approximately 5 miles per second, uncovering the secrets of our galaxy and beyond.

1 Tracy Smith, *Life On Mars* (Minneapolis: Graywolf Press, 2011), p. 10.

2 Ibid., p. 13.



The brilliant tapestry of young stars flaring to life resembles a glittering fireworks display in this Hubble Space Telescope image. The sparkling centerpiece of this fireworks show is a giant cluster of thousands of stars called Westerlund 2. The cluster resides in a raucous stellar breeding ground known as Gum 29, located 20,000 light-years away from Earth in the constellation Carina. Hubble's Wide Field Camera 3 pierced through the dusty veil shrouding the stellar nursery in near-infrared light, giving astronomers a clear view of the nebula and the dense concentration of stars in the central cluster. The cluster measures between 6 light-years and 13 light-years across. (Photo credit: NASA, the European Space Agency [ESA], the Hubble Heritage Team [Space Telescope Science Institute (STScI)/AURA], A. Nota (ESA/STScI), and the Westerlund 2 Science Team)

PART 2: NERUDA, WHEELOCK, AND WORDEN

Pablo Neruda's book *Memorial de Isla Negra*, published in 1963, features a poem entitled "The Future Is Space," possibly inspired by the space race taking place at the time.

In this poem, Neruda says that in our earthly life we are like fish in a suffocating river. Meanwhile, he claims that space is a removal from Earth's oppressive and claustrophobic nature. For Neruda, space is an idyllic place because it is uninhabited; because all the streets, forests, and homes there are empty.

Neruda's poem suggests that there is a clear connection between poetry and space. Just like the astronaut, the poet is driven by a desire to imagine other, possibly better worlds. And maybe the poet, writing alone in some far-off corner, free from every distraction, experiences a sense of solitude—a sense of freedom and bliss only comparable to that which an astronaut may feel.

Al Worden, a Command Module pilot on the Apollo 15 mission, wrote about his space travel in his poem "Rising from Earth." In it, he writes, "We climb on plumes of thunder / Into a rising sun / And away from reality."[3] With these verses, it seems as if

3 Al Worden, "Rising from Earth," available at *http://www.collectspace.com/resources/fallingtoearth_risingfromearth.html* (accessed 5 November 2020).

On 24 June 2016, Expedition 48 Commander Jeff Williams of NASA photographed the brilliant lights of an aurora from the International Space Station. (Photo credit: NASA/Jeff Williams)

Worden is mirroring Neruda's thoughts that space travel is a form of escapism, of leaving behind all the troubles of Earth. Also, in a similar manner to Neruda, Worden's poem seems to celebrate solitude. He says that in space he is "floating in nothingness" and is "insignificant," and that upon leaving Earth, "everything is suddenly right."[4]

However, Worden's space is not the idyllic place that Neruda imagined it to be. It is also a place of longing. Worden says, "Goodbye my friends / You are gone" and "Earth is floating aimlessly, serenely." It is clear that even in space, Worden cannot help but miss his friends; throughout his journey, he keeps looking back at Earth, like a man moving out of the only home he has ever known, struggling to leave it behind.

Worden suggests that space travel is part escapism, part longing. And maybe writing a poem is the same—partly entering a different realm, partly remembering and clinging to the past.

Another NASA astronaut who has written many poems about his space travels is Doug Wheelock, veteran of mission STS-120, Expedition 24, and Expedition 25. To him, poetry and space go hand in hand because "[a]ll the great poets wrote from a sense of loss," and space travel is filled with loss. Wheelock says that in space, "[y]ou begin to miss the sights and sounds and smells of the Earth." And maybe in space, you are able to remember the smells and sounds that on Earth you barely even noticed, and maybe these memories lead to a desire to write. For Wheelock, "[e]veryone becomes a poet when they're in space."

Ultimately, what is clear is that poetry and space are not two opposite worlds that never collide. Their relationship is symbiotic. Space travel leads to poetry, and poetry finds inspiration in space.

4 Ibid.

"EXTRA, EXTRA! ALL ABOUT X-PLANES!"

By Michael Plocinik, NASA History Intern, Summer 2020

If you're like me, and you're passionate about airplanes, or aeronautics, or flying in general, then prepare yourself for (hopefully) one of the most exciting articles you'll read this week. But, if your passions lie elsewhere, don't worry—you'll still learn some awesome history, and you'll have some fun information for your next trivia night. I'll be talking about a series of aircraft called the X-planes, and we'll discuss how they've shaped our past and are framing our future. I'd also like to mention that for all my enthusiasm, I can only cover the tip of this subject's iceberg, and this article is meant to be a fun overview and introduction, not a comprehensive fact sheet. For those entirely unfamiliar, allow me to "ex-plain" (get it, because, "X-plane" and "explain," and, hah…oh, boy): the X-planes are a diverse group of aircraft engineered to explore and push the boundaries of aeronautical sciences. They're also probably the coolest things to ever exist, but maybe I'm a little biased. Perhaps the epitome of my personal definition of the X-planes is the very first aircraft in the series, the Bell X-1.

The Bell X-1 was the first-ever crewed aircraft to achieve supersonic flight. I could bore you with the specifics of its design, but I think it'd be more fun to do a sort of thought experiment. Imagine a fairly large bullet. Now, add thin, straight wings to it. Put on a proportionally sized tail for stability. Hollow it out and throw a rocket engine into it. And finally, add a small capsule at the front for a tiny pilot to rest comfortably at the controls. Now scale it up to the size of a functional fighter airplane of the 1940s era, and there you have it: a Bell X-1 supersonic aircraft.

This straightforward but effective design was especially clever for its simplicity. Instead of trying to design a completely new shape for speeds exceeding Mach 1, engineers modeled the plane after a 0.50 caliber round from a machine gun, which was already known to be stable when flying faster than sound. Similarly, backward-swept wings, like the ones we see on modern aircraft, were considered for the design, but straight wings were chosen because more was known about their behavior at the time. A rocket engine was chosen in part because air-breathing jet engines and propellers were not yet advanced enough to produce the desired thrust. Combining the body shape with

The Bell X-1 supersonic aircraft in flight in 1947. (Photo credit: U.S. Air Force [USAF]/Lieutenant Robert A. Hoover)

the propulsion system (and not forgetting to add the wings!) resulted in an aircraft that not only shattered physical boundaries but also began one of the most revolutionary series of projects in aeronautical history.

Another aircraft that I believe embodies the spirit of the X-planes program is the X-14. Like all X-planes, the information we gained from the development of the X-14 has influenced major design choices since its creation (and if you turn your head and squint, it looks like it has giant nostrils, so that's a fun bonus). This aircraft stands out to me in the array of X-planes because of its unique and almost sci-fi-like ability to take off and land completely vertically while still resembling a conventional aircraft. Let's see how such a design can manage this feat.

As we can all imagine, a jet engine effectively produces a force in the direction it is "pointing." Usually, the engines are fixed so that they "point" in one direction at all times. The generated force is large enough to push the aircraft forward, and the shape of the wings generates a force to lift the aircraft upward, and so the aircraft can accelerate on a runway and take off. But what if we could point some of that force in any direction we wanted without moving the engine? Could we push the airplane directly up, without needing a runway for takeoff? The X-14 answered that question. Its two engines were installed directly inside its fuselage, with the inlets centered on the nose. By using complex internal systems, the engines were able to create "vectored thrust," which allowed the aircraft to push the force from its jet engines in different directions. In a couple of test flights, the X-14 demonstrated that vertically taking off, hovering, transitioning into forward flight, and vertically landing were all possible by carefully positioning these directed forces.

The Bell X-14B aircraft on ramp at NASA's Ames Research Center on 2 August 1971. (Photo credit: NASA/Lee Jones)

This accomplishment of engineering was achieved in the late 1950s, and its applications can be easily found today. Perhaps the most notable examples of "vectored thrust" are in our modern fighter jets, such as the F-35 series. The F-35 aircraft are some of the most advanced aircraft to date, and they feature practical vertical takeoff and landing (VTOL) capabilities via a large fan and other outlets for directed thrust in their fuselages. F-35 aircraft routinely use this technology to land safely on oceanic aircraft carriers. Other modern aircraft use a similar technology to direct exhaust backward, creating "reverse thrust," which can be useful for decelerating after touchdown while landing. Similarly, some aircraft direct afterburner exhaust by changing the shape of the cone-like nozzle to achieve tighter turns and steeper ascents. By experimenting with new concepts, the designers of the X-14 created an aircraft that looks like it has huge nostrils produced the potential for amazing future designs.

But while it's nice to marvel at our successes, it's important to examine our failures as well. And while the X-29 certainly was not a failure, we don't see many aircraft like it nowadays for good reasons. We can all picture a modern passenger airplane, with the wings swept backward in a cool, aerodynamic fashion. Well, the X-29 experimental fighter aircraft was basically the living model of "hey, what if we did that…except *in reverse*?" The X-29 featured uniquely forward-swept wings, which were supposed to reduce aerodynamic drag, create a more efficient weight distribution, and allow for superior maneuverability. However, the design also came with a plethora of challenges, such as aerodynamic instability and additional twisting and bending forces.

While creating an aircraft with these disadvantages may seem counterintuitive, it was the perfect opportunity to test new technologies to compensate for the

The Grumman X-29 experimental fighter aircraft in flight over California's Mojave Desert in 1985. (Photo credit: NASA)

flaws. Newly conceived composite materials were used to construct the body to account for the twisting and bending loads. Advanced computerized systems were implemented to help maintain control and provide maneuverability despite the aircraft's inherently unstable body shape. Most uniquely, vortex flow control (VFC) as a concept was tested in practicality. VFC isn't what happens when you swirl your straw around in your chocolate milk to make that fun little whirlpool—instead, it is essentially injecting air into the vortices created by the shape of the aircraft. These injections would change the direction of vortex flow and "create corresponding forces on the nose of the aircraft to change or control the nose heading."[1] Successful testing showed promise and potential for VFC's incorporation into future designs.

Despite the numerous tests conducted and advancements made, it was found that a forward swept-wing configuration did not demonstrate the reduced aerodynamic drag as earlier studies had theorized. The disadvantages of forward swept wings outweigh the benefits, and so designers usually take more conventional and practical approaches when creating modern aircraft. (In other words, backward wings *look really cool*, and we learned a lot, but "normal" wings just work a bit better in most cases.) The X-29 exemplifies an ambitious and curious design that, while not optimal for its original purpose, could be seen again in the future.

Authors could write endlessly about the history and contributions of the X-planes. I could say that the X-15 Hypersonic Research Program alone deserves pages about its contributions to aeronautics. I could say that each and every X-plane has made profound contributions—the technology tested in the X-33 was used in developing future reentry vehicles, and the X-34 was supposed to demonstrate the capabilities of reusable launch vehicles, and so forth.[2] Or, I would love to write paragraphs about the X-48 and its attempts to create a blended wing-body as a model for futuristic airliners (okay, seriously, that one's pretty cool; you should look it up).[3] I could talk for an almost annoying amount of time about the X-59's quieted supersonic boom and how my university has plans to make a small scale model to hang in the atrium of one of our buildings.[4]

I am running out of my allotted space, but I implore you to research more about the X-planes. If I've succeeded in my purpose of writing this article, then maybe you'll give it a look. If not, then hey, at least maybe you'll be able to help us finally win our next trivia night.

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1 NASA Armstrong Flight Research Center, "X-29 Advanced Technology Demonstrator Aircraft," Fact Sheet, 5 November 2015, *https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-008-DFRC.html* (accessed 5 November 2020).

2 NASA Marshall Space Flight Center, "X-33 Advanced Technology Demonstrator," Historical Fact Sheet, *https://www.nasa.gov/centers/marshall/news/background/facts/x33.html* (accessed 5 November 2020); NASA Armstrong Flight Research Center, "X-34 Advanced Technology Demonstrator," Fact Sheet, 28 February 2014, *https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-060-DFRC.html* (accessed 5 November 2020).

3 NASA Armstrong Flight Research Center, " X-48 Hybrid/Blended Wing Body," Fact Sheet, 28 February 2014, *https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-090-DFRC.html* (accessed 5 November 2020).

4 NASA, "X-59: Quiet Supersonic Flight," *https://www.nasa.gov/specials/X59/* (accessed 5 November 2020).

RESEARCH AUTHORIZATIONS

By Robyn Rodgers

In a 15 May 2013 article in Langley's *Researcher News*, "Through a Scanner Carefully: NACA's Delicate History" (found at *https://www.nasa.gov/centers/langley/news/researchernews/rn_NACAScanning.html*), Jeremy Vann talks about some of the work required to take a single page of a National Advisory Committee for Aeronautics (NACA) Research Authorization (RA) file through to the scanner. "Just to even get to this document right here, I have to go through these staples…. Then there are these staples behind these." At the time, Vann, now a Records Operations Analyst, was working to scan about 50 feet of the more than 220 feet of the National Advisory Committee for Aeronautics Research Authorizations from 1919 to 1952. Since then, the RAs have come to live at the NASA Headquarters Historical Reference Collection (HRC). There is a great deal of processing work for it, and in this time of working remotely, that cannot happen. With 220 cubic feet to process, a finding aid that spans over 250 pages, and that many staples, what is in the collection that makes it so worth the investiture of resources? What will the HRC do to make the collection into something that is not only purposeful but also functional in a way that users not only can use it, but also want to do so?

The Historical Reference Collection at NASA Headquarters in Washington, DC. (Photo credit: Catherine Baldwin)

Jim Hansen's book *Engineer in Charge: A History of the Langley Aeronautical Laboratory, 1917–1958* addresses that exact question. As he is a far greater writer than myself, rather than paraphrasing, I will let those words stand here on their own:

> …[T]he single most important source for aeronautical history at Langley is the NACA research authorization files. These files permit the historian to recreate the entire NACA research procedure for a given project from the raw research idea through the final polished report.

Government contracting is now its own profession, and today, "Statements of Work" define a project. Some consider these RAs the predecessor of that concept. In a sense, that is true, but there is so much more for a researcher to work with. Upon approval, the chair of the executive committee signed the authorization. In theory, that gives a researcher the sense that senior leadership had eyes on all the work going on. Hansen notes in chapter 2 that such approval was often a formality and there was great leniency in the process, with engineers going ahead with projects without approval in place. In itself, what sort of project was explicitly approved and what prompted managers to look the other way tells a fascinating story about the dynamics of the NACA, especially as the United States

moved toward World War II (WWII). There are often handwritten notes in the margins that give evidence about what each link in the chain may be thinking about the project. That does not happen on today's Statement of Work. Because a paper was expected out of the authorization, there was more attention paid to the administrative details such as title and numbering than there is today, because that information is used differently now. The sequential style of ordering makes it easier to see the bigger picture of priority and research directions. Finally, correspondence regarding the authorization stays in the file. Names of staff, especially those who do not always make it to the first page of Google, become discoverable, and one can see how those early names progressed up the ladder—or didn't, depending on one's gender, education, marital status, and ability to get one's name on reports. These names, both unknown and known, become especially illustrative when examined against larger trends, such as post–World War I developments, the recruitment of very young talent, employment during the Depression, and the ramp-up to WWII. None of the RAs have been examined for this kind of storytelling. An example of this recruitment of very young talent is Frederick Norton, who at age 25 became Langley's Chief Physicist.

Hansen notes that the RA files are not easy to work with, even with the administrative information intact. This is especially true when doing technical rather than social research. Much of this work was exploratory. The conceptual nature means that there was not a taxonomy in place and requires researchers to think differently about their search. In our keyword-driven society, that can be frustrating. For example, the word "aeroacoustics" emerged in the 1950s when jet engine noise became a field of study. In the RAs, that early information may or may not have a lead under "Sources of Noise in Aircraft" with nine separate files; "Developments of Noise-Making Device for Use on Dive Bombers," with two files; "Investigation of Aerodynamic Characteristics of Noisemaker," with three files—but one is empty; or "Investigations To Reduce Noise Emanations from Airplanes," with five files.

As NASA goes forward with Artemis, it is easy to understand how the study of past work may inform future technology, but there is research potential beyond that. The NACA's research focused on work intended for the use of others. For example, both the 1933–38 research on "Resistance of Plates Coated with Ship Bottom Paint" and 1937's "Experimental Investigation of the Problem of Surface Roughness" were of importance to the Navy during WWII, and they are still being discussed under the guise of frictional resistance and antifouling coating. As the NACA became NASA in 1958, the business model changed. Outside entities now engage in research and development for the benefit of NASA and its mission. This evolution comes via changes in politics, technology, and cost-benefit analysis, among other things. As the Agency carries out the mission and commercial space becomes even more of a norm, it opens the door for the questions of returning to the previous method of doing business.

"FROM TECHNICAL, SCIENTIFIC, BUSINESS, AND SOCIOLOGICAL PERSPECTIVES, THE RESEARCH POTENTIAL OF THE RA COLLECTION IS BOUNDLESS, BUT NOT IF IT CANNOT BE USED, AND NOT IF PEOPLE CANNOT SEE THE CONNECTIONS BETWEEN THE PAST WORK AND THE FUTURE."

From technical, scientific, business, and sociological perspectives, the research potential of the RA collection is boundless, but not if it cannot be used, and not if people cannot see the connections between the past work and the future. In the aforementioned article about the collection, Gail Langevin notes that some research areas in the past stopped due to technology

gaps, price considerations, or imagination. As technology has moved far past where those gaps occurred, researchers have an opportunity to connect all of the pieces together in a way that stimulates new ideas. Langevin uses the hybrid wing concept to explain. It was a popular area of study after WWII, hit a technology block, and was abandoned. Technology resolved itself, and researchers were back to testing a hybrid wing aircraft in the 14- by 22-foot tunnel in 2012; it was just a new kind of hybrid wing. In an effort to help researchers make these connections, archivist Sarah LeClaire has taken several disparate sources and created a fully text-searchable finding aid (available at *https://history.nasa.gov/rg-6_naca.html*), available on the website under Record Group 6 National Advisory Committee on Aeronautics. As one of her first projects after coming on board, she took the several sources of information, all created by different people for different purposes, along with the handwritten notes, and (without Adobe!) created the finding aid. It is worth noting for future generations that this finding aid was created during the days of COVID-19 mandatory telework, so there may be small changes made once staff are able to return to on-site work. At approximately page 274, depending on how one's screen parses, is appendix A. This is the "Assessment and Comments on Historical Value" on some of the very earliest of the Research Authorizations. The description gives a very detailed explanation of the earliest RAs. It had been part of the Milton Collection. The box numbers no longer match after rehousing, but the information is still very valuable.

By now, the question of digitization must be rattling about one's head. At the time of this writing, there are several challenges to that idea. As former Chief Historian Bill Barry has noted several times in the past year, NASA does not have an electronic document management system in place to be able to support the preservation portion of digitizing this collection. Without that system, spending the money to digitize is wasteful because there is no platform to manage the description, access, or continued preservation of the files not just of this collection, but of all of them. In keeping with the construction analogy I am so fond of, the money is better spent on acquiring a real estate agent, the land, and a good contractor before buying shutters, paint, and the landscape company. The second challenge is that staff members are off-site and have been since March 2020; as of this writing, there is not a date when we will be back. In "Through a Scanner Carefully: NACA's Delicate History," Vann noted the physical mechanics of this work. The average age of this paper is 70 years old. Removing staples is a delicate task, especially if they were Navy issue, circa WWII. Those staples were serious, and there is a particular method to lifting them, which requires a steady hand, some patience, and a bit of vocabulary that would secretly make the Navy proud. Policy prohibits the removal of the documents from the facility, and best practices require specific environmental controls and line-of-sight security, among other things. Until all of those things happen, this collection will not undergo further digitization beyond what Vann accomplished.

> **"REMOVING STAPLES IS A DELICATE TASK, ESPECIALLY IF THEY WERE NAVY ISSUE, CIRCA WWII."**

This collection is something of which to be proud. The research value is immense, and not just to historians looking to document the past. This collection is the thing on which our Agency built itself, yes; it is also part of the thing on which we build our future. The material holds promise for today's historians; science, technology, engineering, and mathematics (STEM) researchers; and students—but also tomorrow's administrators, who want to know "how;" labs that want to know "if"; program offices that want to know "why"; and the public, who are entitled to know all of that.

NIEBERDING'S MISSIONS TO POST-SOVIET RUSSIA

By Bob Arrighi

"It must be a slow day at the Center," quipped Joe Nieberding as he stepped to the podium before a full auditorium of colleagues at NASA's Lewis Research Center (now called Glenn) on 28 July 1992. The crowd was anxious to hear from the veteran engineer and launch vehicle expert about his recent fact-finding missions to Russia, just months after the collapse of the Soviet Union. For the next 80 minutes, Nieberding discussed interactions with Russian space officials and shared personal video that provided rare glimpses into the former Cold War foe's aerospace facilities and cultural sites.

Lewis would soon work with the Russians on several space programs, including the Spacebridge to Moscow telemedicine effort, microgravity experiments on the Mir space station, and the design of a new power system for Mir. The Center also led NASA's interactions with Russia during the design of the International Space Station. The first exchanges, however, were Nieberding's 1992 trips to Moscow.

Space Station Freedom option A showing two Soyuz Assured Crew Return Vehicle (ACRV) capsules docked at berthing ports. (Image credit: NASA)

> **"WITH THE DISSOLUTION OF THE SOVIET UNION, WHICH CULMINATED IN DECEMBER 1991, U.S. INSTITUTIONS RECOGNIZED OPPORTUNITIES FOR COLLABORATION."**

With the dissolution of the Soviet Union, which culminated in December 1991, U.S. institutions recognized opportunities for collaboration. At the time, NASA was struggling with the design and costs of Space Station Freedom (SSF). The early SSF designs included a safe area where the crew could shelter during emergencies until a Space Shuttle arrived. The grounding of the Shuttle fleet after the 1986 Challenger accident, however, prompted NASA to pursue a "lifeboat" vehicle that would remain docked at the station.

In October 1991, Russia's NPO Energia offered the use of its workhorse Soyuz TM stage, which performed this role on Mir. The Soyuz, however, would require significant modifications to meet U.S. requirements. During appropriations hearings in February 1992, members of Congress urged NASA to explore the Soyuz option until the United States could develop a larger rescue vehicle of its own.

Russian launch vehicles could not reach the SSF's planned orbital inclination of 28.5 degrees, so it was necessary to determine the feasibility of launching the Soyuz from Florida using U.S. expendable launch vehicles or the Shuttle. The Agency issued a preliminary report in early 1992 based on available Russian documents, but additional data were required.

It was at this point that NASA sent Nieberding and a handful of other experts to Russia to obtain the information. As Chief of the Advanced Space Analysis Office, Nieberding was responsible for helping plan the Center's roles in future space missions. In addition, he had 20 years of launch vehicle integration and trajectory experience with Atlas-Centaur and Titan-Centaur programs.

With only a few days' notice, the delegation traveled to Moscow from 20 to 25 March 1992 to assess the feasibility of pairing the Soyuz TM and its cargo version, Progress, with U.S. launch vehicles. Nieberding gathered information on the spacecraft's propulsion system, power requirements, shroud, and trajectories from enthusiastic Russian counterparts. Yuri Semenov, head of NPO Energia, stated, "I didn't find any questions [for] which our specialists cannot give you the right answer. And maybe it was a secret, but it *is not* a secret now." From the data, Lewis engineers created performance models that indicated that the vehicles could be paired with either Titan III or Atlas IIAS.

"ON 12 JULY 1992, GOLDIN AND A CONTINGENT THAT INCLUDED NIEBERDING…BEGAN A FIVE-DAY MOSCOW VISIT DURING WHICH GOLDIN SIGNED AN AGREEMENT TO DEVELOP JOINT EARTH OBSERVATION AND LIFE SCIENCES PROGRAMS, USE RUSSIAN NETWORKS TO OBTAIN DATA FROM GALILEO, AND PLAN FUTURE ASTRONAUT EXCHANGES."

In June 1992, new NASA Administrator Dan Goldin and the head of the new Russian Space Agency agreed that space was an ideal venue to demonstrate the new collaborative relationship between the former rival nations. This led to the signing of a presidential space agreement that outlined future cooperation in space. In addition, NASA and NPO Energia formally initiated studies of the Soyuz as a rescue vehicle.

On 12 July 1992, Goldin and a contingent that included Nieberding and representatives from several U.S. agencies began a five-day Moscow visit during which Goldin signed an agreement to develop joint Earth observation and life sciences programs, use Russian networks to obtain data from Galileo, and plan future astronaut exchanges.

Nieberding followed up his earlier Soyuz inquiries and reviewed Russian launch vehicles. Eager for business, the Russian firms promised reduced rates for hardware, launch services, and advanced test facilities. Between the tours and socializing, however, there was limited time to discuss the important technology questions. While grateful for the willingness of the Russians to share information, Nieberding was frustrated by the loss of precious time dealing with translations, cultural misunderstandings, and extended lunches. Nonetheless, the trip yielded valuable information regarding their vehicles.

A week later, Nieberding was back at NASA Lewis describing his travels to the assembled Lewis staff. During the March trip, he had taken 3 hours of personal video that was subsequently edited down to 60 minutes for the presentation. The video contained remarkable footage of key meetings, renowned veterans of the Soviet space program, the Star City training site, and the Mir Control Center. Nieberding also documented the Moscow subway, the Kremlin, and everyday life on the streets.

In October 1992, Larry Diehl and John Sankovic of the Space Propulsion Technology Division traveled to Moscow to further review Russian chemical engines and launch vehicles. Sankovic's fluency in Russian expedited the talks. The Advanced Space Analysis

Office soon enlisted the services of a Russian-speaking Center librarian, Irene Shaland, and her husband, Alex. Shaland, who was well versed in both Russia's language and ethos, served as a key interpreter and valuable liaison. She helped integrate the interactions with the Russians and created a class to teach Lewis personnel about Russian culture.

U.S. engineers generated 12 different designs for their own rescue vehicle between 1986 and 1995, but the lack of funding prevented any development. Meanwhile, NASA's first Soyuz feasibility studies were completed in late 1992 and early 1993.

In February 1993, newly elected President Bill Clinton gave NASA three months to reinvent the space station with a significantly reduced budget and schedule. He also directed the Agency to explore ways to allow the Russians to launch their own laboratory and habitation modules to the station. As part of the redesign team, Nieberding focused on Russian launch vehicles, and Shaland facilitated the discussions during a Russian delegation's three-week visit.

A White House advisory committee reviewed the proposals and selected a new design in June. Since the development of a U.S. rescue vehicle was stalled, they recommended using the Soyuz. Lewis trajectory analysis clearly determined that the station's orbital inclination had to be aligned with that being used for Mir. The alteration of the station's inclination to 51.6 degrees permitted the launching of Soyuz and modules from launch pads in Russia but significantly degraded the Shuttle's lift capability. NASA's Soyuz-integration studies effectively ended, as there was no longer a need to pair Soyuz with U.S. launch vehicles or the Shuttle.

In December 1993, President Clinton announced that Russia would be a full partner in what was now called the International Space Station. An improved Soyuz TM-A was approved as the rescue spacecraft. In 1995, NASA pursued the use of the X-38 lifting body as a rescue vehicle. The effort was canceled in 2001, and the Soyuz continues to serve as the ISS's lifeboat today.

Nieberding retired in 2000 after 34 years at the Center. He has since held numerous consulting positions for NASA and other agencies and formed Aerospace Engineering Associates with fellow NASA alumnus Larry Ross.

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