News & Notes

NASA HISTORY DIVISION
OFFICE OF EXTERNAL RELATIONS

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AUGUST 2008

From the Chief Historian

NASA's 50th anniversary events are now well under way and will culminate in October, the anniversary of the month in which the National Aeronautics and Space Administration (NASA) became operational. Astrophysicist Stephen Hawking recently traveled to Washington to present the latest lecture in the NASA anniversary series begun last year by Mike Griffin. In his lecture "Why We Should Go into Space," Professor Hawking argues that we should be able to take care of our problems on Earth and go into space as well because our future lies in outer space. Meanwhile, NASA Deputy Administrator Shana Dale has been leading a series of "Future Forums" around the country to discuss the role of space exploration in advancing science, engineering, technology, education, and the economy. In addition, readers should be aware of several 50th anniversary publications. *NASA: 50 Years of Exploration and Discovery* contains dozens of articles by NASA personnel, historians, and others in a large magazine format. It is available online (as are the Future Forums, the NASA lecture series, and other features) at NASA's 50th anniversary Web site: *http://history.nasa.gov/50thannnasaconf/index.html*. Another volume, *America in Space*, is a large format coffee table book with iconic as well as rarely seen images from the space program. It is introduced by Neil Armstrong and is now available (cheaply!) from Amazon.com.

This summer, NASA was honored to be only the second government agency ever featured

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The Enduring Legacy of the "Invisible Network"

By Sunny Tsiao, ITT Advanced Engineering & Sciences, author of the new "*Read You Loud and Clear!" The Story of NASA's Spaceflight Tracking and Data Network* (NASA SP-2007-4233)

As the National Aeronautics and Space Administration celebrates its 50-year anniversary on 1 October, there is perhaps one facet of the space program that has not received as much recognition as others. Behind the technology and teamwork that made the pioneering flight of John Glenn and the triumph of Apollo possible was a communication network known as the Spaceflight Tracking and Data Network. This network, the STDN, tracked its first satellite in 1957 when the former Soviet Union shocked the world by launching Sputnik I into orbit. At the height of the space race, 6,000 men and women operated this behind-the-scenes "invisible network" that was central to the success of the space agency's missions. Over the next five decades, the Network played a crucial role on every near-Earth space mission that NASA flew. Not a single mission was compromised due to its failure. It received the first television images from space, tracked Apollo astronauts to the Moon and back, and, today, has evolved into a national resource providing global, 24/7 space communications in the form of the Tracking and Data Relay Satellite System (TDRSS).

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In This Issue:

The Enduring Legacy of the "Invisible Network" (continued)

The history of the STDN is somewhat akin to the history of NASA itself. It has spanned 50 years, experienced tragic setbacks as well as unparalleled success, and pioneered household technologies before they became the everyday essentials that they are today: spinoffs without which we cannot imagine living. The STDN varied greatly over the years and underwent several evolutions. Space communications became the pace setter in utilizing advances in computing power, signal processing, and new digitizing techniques; however, when the network (whose name and acronym had yet to be coined) was first established, it was strictly a network of ground stations using analog technology of the time.

This started at the dawn of the Space Age, when the new Agency set up the world's first global satellite tracking network. Minitrack used radio interferometry, a technique developed in the late 1940s and 1950s to track missiles and high-speed jet aircraft. It used large, football field–sized antenna arrays to receive rudimentary, milliwatt-level radio beacon transmissions at the fixed frequency of 108 MHz. Acceptance by the scientific community of radio interferometry as a spaceflight tracking technique was tepid because the established method was, at the time, optical tracking. John Mengel, Roger Easton, and others at the Naval Research Laboratory not only had to miniaturize and harden the technology for spaceflight, but also had to sell the idea to an unconvinced community at large.

Unified S-Band, or USB, led the way in the mid-1960s. USB was revolutionary for its time, enabling transmission of spacecraft command, telemetry, voice, and television using a single, combined data link. The technique was not entirely new to NASA, however, as the Deep Space Network (DSN) had used it since 1958. USB was important on two fronts. First, it enabled the Agency to communicate with the large, data-intensive observatory class of satellites that the Goddard Space Flight Center was putting into orbit. Second, an Apollo flight to the Moon was on the horizon. The STDN greatly expanded during this time, both geographically and technologically. Satellite Tracking And Data Acquisition Network stations added as far north as Alaska anchored the high-eccentricity, high-inclination orbits of the Nimbus and Alouette, and 26-meter (85-foot) parabolic dish antennas were the largest added to the Network.

Today, the Goddard Space Flight Center in Greenbelt, Maryland, is unquestionably NASA's lead Center for all near-Earth space communications. This, however, was not always the case. When the United States began sending humans into space in the early 1960s, something interesting happened within the NASA culture—a culture in which Field Centers notoriously act as independent fiefdoms. For unpiloted (unmanned) science and application satellites, there was no debate as to who was in charge; it was clearly Goddard. Things were more ambiguous, however, when it came to the "manned" side of the house. Here, both Goddard and Houston's Manned Spacecraft Center (today the Johnson Space Center) had a stake. In a move that would engender dissention between Greenbelt and Houston for years, NASA Headquarters delegated to Greenbelt the full responsibility for running the STDN. Rifts between the two Centers developed immediately—a result of the "Not Invented Here" mindset—as Houston questioned the wisdom of using a Goddard-run network to support human missions. Much of the ensuing success on what could have been a very divisive issue came down to effective personal relationships between key individuals within that same NASA culture who recognized the problem at both Centers. The leadership of men like Ozzie Covington, Bill Wood, Tec Roberts, and Chris Kraft should not be understated.

A paradigm shift resulted in the cost-conscious, double-digit inflation days following Apollo. This shift, coupled with ongoing advances in digital signaling methods, greatly impacted the way NASA conducted its tracking and data operations. This effect became most evident in the last two decades as the STDN migrated from networking a large number of ground stations to utilizing a few satellites in orbit to help track other spacecraft. The planning, development, and implementation of the Tracking and Data Relay Satellite System heavily influenced the history of the STDN. As sprawling as the Network had become, it was still ground-based and, as such, was limited, able to communicate with a low-Earth-orbiting satellite for only some 15 to 20 percent of the time. TDRSS provided a space-based tracking and data relay solution enabling nearly continuous coverage for most Earth-orbiting spacecraft.

Although today TDRSS is a national resource, it had its growing pains. One was the radical procurement approach—called "innovative" by proponents at the time. In an effort to get the project started without committing to a future purchase of a suite of satellites, NASA decided to *lease rather than buy* TDRSS. For what it deemed a support program, NASA considered leasing to be a viable option that was no riskier than buying. Impetus for this fundamental departure in the way NASA did business was not complicated and, as usual, came down to the price tag. By obtaining this capability from industry on a long-term, fixed-price service basis, the Agency hoped to save money while at the same time spurring on the commercial space sector. When the time came to implement the system, however, NASA, by selecting a prime contractor with no previous aerospace experience, nearly doomed TDRSS before it had a chance to prove itself. Although using a contractor did not work on TDRSS, it *was* innovative and ahead of its time, as today commercialization has undeniably become a part of the Agency's modus operandi.

With the TDRSS Space Network (SN) operational by 1989, the "availability of the system" enabled the phasing down of many STDN ground stations, particularly those located outside the United States. The advent of an operational SN did not mean, however, that ground stations were not needed; they were, just not in the same way. The Ground Network, or GN, now had a new mission: science. Today, GN emphasis is on data acquisition at remote, extreme-latitude outposts and at rocket ranges to support Earth science, atmospheric research, and range safety.

The changing landscape of the STDN also paralleled the way NASA changed its focus throughout the years. The Agency's updated mission in the era of information-age revolution, commercialization, and international cooperation has directly shaped and transformed the Network in recent years. Root causes driving such change usually trace to two factors: technology and cost reduction. The demand for better technology is always a driver. On top of this, as space moves from the realm of government sponsorship to become a commercial commodity, cost reduction in today's world of instantaneous global communications is more exigent than ever. The dramatic, literally year-to-year jump in computer speed, improvements in fiber-optic and transmission bandwidth performance, and the exponential growth of the Internet have all made the ever-increasing demand for higher bandwidths (traffic) at lower bit-error-rates (accuracy) ubiquitous. The STDN pushed this in many ways. Few, for example, know that NASA was instrumental in bringing the Internet to the South Pole. The use of these technologies (and their spinoffs) follows the trend in

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space communication in which NASA has historically set the precedent but is now heavily influenced by the commercial sector.

In the 1990s, "Faster, Better, Cheaper" drove much of the way business was conducted in the space industry, both commercially and in the government. This sobering experience affected the space program in ways ranging from economics to performance (and, some would say, safety). Entrepreneurial communication companies such as DataLynx and SvalSat entered the playing field. Their multimission terminals offered users the advantage of low-cost services: pay only for what you use. Information technology companies and government agencies like NASA were their targeted users. These service providers now routinely rely on the Internet infrastructure for data access and file transfers. So, in a way, while NASA was building the Network infrastructure that won the space race, the rest of the world caught up.

Regardless of the era, international cooperation has always been vital to the success of the STDN. Take Mexico, for instance, in the early days of the Manned Space Flight Network (MSFN). A Guaymas Tracking Station was considered critical by the Tracking and Ground Instrumentation Unit of Langley, which was then responsible for planning the MSFN. Establishing the station, though, turned out to be an arduous process, one that required great patience and perseverance. One of the obstacles was Mexico's deep government bureaucracy. Internal political strife and open anti-American sentiments were also prevalent in the late 1950s. Talks began in the spring of 1959. It was not until June of 1961, however, that the station opened, and then only after the appointment of a carefully selected ad hoc Mexico-U.S. Commission for Space Observations. While Mexico's position rested firmly on mutual scientific cooperation, it was personally obvious to Edmond Buckley (NASA's first Associate Administrator for Tracking and Data Acquisition) that the actual possibility for mutually beneficial scientific cooperation of the sort desired by the Mexicans would be for projects *other than* Mercury. But with the first orbital flight then scheduled for the following year, Buckley felt that collaboration was necessary because of the geographical importance of a station in Mexico (since it would be the first to see the Mercury capsule after it crossed the Pacific following a loss of signal at Hawaii).

Science notwithstanding, the agreement establishing a NASA tracking station in Mexico was quite significant, as it was the first real cooperative project between the two neighboring states since before World War I. Both the State Department and the U.S. Embassy made it clear at the time that the agreement was momentous, representing a big step to bettering relations with our southern neighbor—one that went beyond merely space exploration and Project Mercury. Conversely, other places such as Australia, where as many as 10 sites were active at one time, welcomed the opportunity to participate in this new frontier and openly adopted the U.S. space program as their own. Met with great patriotic pride, for instance, was NASA's decision for the Parkes Observatory of the Commonwealth Scientific and Industrial Research Organisation to receive the Apollo 11 extravehicular activity (EVA) downlink. Indeed, the Canberra Deep Space Communication Complex on the outskirts of the capital remains active to this day as part of the DSN. This hallmark of "nationalizing the stations" began early. For operational efficiency, diplomatic expediency, and promotion of goodwill, NASA turned to the local workforce, training technicians and managers to run foreign stations. Santiago, one of the original Minitrack sites

established in 1957, perhaps best illustrated this practice. Today, half a century later, it is still run entirely by the University of Chile.

With the push for lights-out operations (unattended autonomous operation), will the human element so integral to the STDN's last 50 years endure? What does the future hold? Finally, what is the public perception and awareness of the STDN in terms of everyday benefits? As often as space is associated with advanced technologies, the people are still the ones who moved the program, who ran the Network, and who left their legacies. More than anything else, the story of NASA's Spaceflight Tracking and Data Network is about these unsung heroes of the space program.

From the Chief Historian (continued)

at the Smithsonian Institution's Folklife Festival, held on the National Mall. Over a two-week period in late June and early July, NASA fielded many exhibits and put together numerous panels to discuss the full range of NASA's programs and the diverse people who make them happen. The History Division organized two "Why We Explore" panels that included Roger Launius, Mike Neufeld, and Paul Ceruzzi (all from the National Air and Space Museum [NASM]); Jim Garvin (Goddard Space Flight Center Chief Scientist); and me. All NASA Centers participated in the Festival, which has a reputation for its hot weather and exotic themes.

Over the past year, our oral history team, Rebecca Wright and Sandra Johnson, have been hard at work undertaking interviews with Center Directors and senior management at Headquarters. The results will be published in a volume in the NASA History series entitled *NASA at 50: Interviews with NASA Senior Leadership*. This volume will present a snapshot of the hopes of NASA's senior leadership, as well as perceived problems, in the Agency's 50th year.

Also in connection with NASA's 50th anniversary, the History Division is making a concerted effort to place more material online, in accordance with the National Aeronautics and Space Act provision to make the results of NASA's activities available to the widest public. *Astronautics and Aeronautics Chronology*, a day-by-day chronology of National Advisory Committee for Aeronautics (NACA) and NASA events from 1915 to 1995, is now available at *http://history.nasa.gov/series95.html#chron*. Two other volumes bringing this "A&A" series up to date are currently being researched and written. In addition, our Chief Archivist, Jane Odom, and her archives team have been hard at work placing press kits, press releases, mission transcripts, and Administrator speeches online. You will find this wealth of material at *https://mira.hq.nasa.gov/history/*. Special thanks to Jane, Colin Fries, Liz Suckow, and John Hargenrader for making these additions possible. Many more history volumes are available online at *http://history.nasa.gov/series95.html*, where you will find that we have revamped the Web site (ably overseen by Steve Garber) in order to make these volumes more accessible.

NASA's 50th-anniversary activities will culminate with our conference "NASA's First 50 Years: A Historical Perspective," to be held 28–29 October in the NASA Headquarters auditorium. Administrator Mike Griffin will give the opening keynote speech on "NASA at 50," followed by Howard McCurdy on "Inside NASA at 50,"

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From the Chief Historian (continued)

an update of his 1993 book *Inside NASA*. The program will also feature Lawrence Bergreen, well-known author of *Over the Edge of the World: Magellan's Terrifying Circumnavigation of the Globe* (2003) and *Voyage to Mars: Mankind's Search for Life Beyond Earth*. Over the course of two days at NASA Headquarters, historians will discuss NASA's role in aeronautics, human spaceflight, space science, life science, and Earth science, as well as cross-cutting themes ranging from space access to international relations in space and NASA and the public. Among the questions to be addressed are these: What are the lessons learned from the first 50 years? What is NASA's role in American culture and in the history of exploration and discovery? What if there had never been a NASA? Based on the past, does NASA have a future? The full agenda is printed elsewhere in this newsletter, and abstracts may be found at *http://history.nasa.gov/50thannnasaconf/history_home.html*. The meeting is free and open to the public and will be followed by published proceedings as usual.

Fifty years ago, the National Aeronautics and Space Act creating NASA had just been signed on 29 July, and all of NASA's potential energy was about to unfold as kinetic energy. While there have been disappointments (as expressed in the forthcoming proceedings of our "Remembering the Space Age" conference) and tragedies, one could hardly have imagined the triumphs that did in fact occur, both on the human and robotic side and in aeronautics. In this 50th-anniversary year alone, NASA has successfully launched three Shuttle missions, made major additions to the International Space Station with the European Columbus and Japanese Kibo modules, launched the Gamma-ray Large Area Space Telescope (GLAST) observatory, and landed Phoenix on Mars (even as Spirit and Opportunity continue rolling); furthermore, it will undertake one of its most complex missions in October with the fifth Hubble servicing mission. It is surely a record to be proud of, even as NASA is implementing plans to return humans to the Moon and Mars.

In closing, the NASA History Division is saddened to note the passing of Dr. Robert C. Seamans, Jr., on Saturday, 28 June. During a very distinguished career, Dr. Seamans served as the NASA Associate Administrator and Deputy Administrator during much of the Apollo era. A friend of the History Division and a devotee of history and the lessons that can be learned from it, he wrote two books in the NASA History series, an autobiography and a managerial account of the Apollo program, both available at *http://history.nasa.gov/Biographies/seamans.html*. You will also find there the Administrator's statement on Dr. Seamans's death, along with biographical information. It is no exaggeration to say that, although not an astronaut, in his own way Bob Seamans had "the right stuff."

Have a good summer!

Steve Dick

News from Headquarters and the Centers

Headquarters Historical Reference Collection

Jane Odom continues to evaluate and acquire new material for the Historical Reference Collection. She appraises material and directs the subsequent processing of collections. Jane continues to answer reference requests and facilitate the entry of our international visitors into the building. Additionally, she is publishing the remaining Administrators' and Deputy Administrators' speeches to the Headquarters Historical Reference Collection Web site. These speeches and other useful historical materials may be found at *https://mira.hq.nasa.gov/history/.*

Collectively, Colin Fries, John Hargenrader, and Liz Suckow all share reference duties, answering inquiries received by e-mail, assisting walk-in researchers, and assisting Jane with Freedom of Information Act (FOIA) requests. This quarter, they lent a hand to the Headquarters Library staff, helping them pack materials to be sent to the NASA Center for Aerospace Information for scanning. Liz and Colin worked together to complete the reprocessing of a 62-cubic-foot collection of human spaceflight reports (Gemini through Shuttle).

Individually, Liz completed the appraisal of nearly 20 cubic feet of material recalled from the Federal Records Center related to the Electronics Research Center, a former NASA installation. She made copies of historically significant items from those boxes and added them to the Historical Reference Collection. Liz is also doing preservation photocopying of the biographical files of our earliest astronauts and rehousing the originals in archival-quality folders. She processed a small collection of Office of Life and Microgravity Sciences reports and appraised a 1-cubic-foot collection of Automated Information Systems Division (Code NT) chronological correspondence files. Additionally, Liz successfully completed training at the summer session of the National Archives' Modern Archive Institute.

John continues to scan 18 cubic feet of Office of Safety and Mission Assurance chronological correspondence files. He completed a preliminary inventory of the oral histories collected by Craig Waff for an unpublished deep space navigation history. He finished processing the J. D. Hunley Launch Vehicle Technology Collection and the Carl Pilcher Space Science Collection. John is adding and captioning new images for the GReat Images in NASA (GRIN) photo database.

Colin continues to maintain and improve the History Division Web site and worked with the Headquarters Library staff and Information Center staff to update the ordering form on the Web for NASA 4000 Series publications. He recently processed a 12-cubic-foot collection of solar exploration material and a 2-cubic-foot collection of source files for a Goddard Space Flight Center history. He is currently processing a 7-cubic-foot collection of John Sloop materials. Colin continues to scan 9 cubic feet of the Office of External Relations chronological correspondence files. He helped fact-check a number of NASA 50th-anniversary items as well as the appendices for the 2007 Aeronautics and Space Report of the President. In May, Colin successfully completed a Dreamweaver Basics training course at Headquarters.

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News from Headquarters and the Centers (continued)

And finally, kudos to John and Colin, who were honored with a NASA Group Achievement Award at the Headquarters Awards Ceremony in May as part of a team that fact-checked the book *America in Space: NASA's First Fifty Years.*

Ames Research Center (ARC)

Jack Boyd delivered the kickoff presentation for the NASA Ames Director's Colloquia Summer Series. Organized by NASA Ames Chief Scientist Stephanie Langhoff, these colloquia draw huge audiences of summer interns and of Ames employees wanting to learn more about their colleagues in other divisions. Speakers give an overview of their careers, explore their role in the history of their disciplines, and help the interns understand how to build a career in science within NASA. In addition to Jack's overview history of the Center, other history-infused presentations scheduled for the summer include James Arnold on entry vehicles, Lynn Rothschild on life in extreme environments, Louis Allamandola on infrared astrophysics, and David Des Marais on exploration for habitable environments.

Jack Boyd and Glenn Bugos published an article entitled "Accelerating Entrepreneurial Space: The Case for an NACA-Style Organization" in Space Policy (August 2008). April Gage authored guidelines for citations to documents from the NASA Ames archival collections and produced a new summary of the collections. These are posted on a reorganized portion of the History Office Web site featuring finding aids to materials related to the history of NASA Ames (see *http://history.arc.nasa.gov/finding_aids.htm*).

Intern Allison Tara Sundaram processed approximately 10 cubic feet of photographic and audiovisual material from the History Office's largest collection, the Pioneer Project Records, 1952–96. Accumulated by the Pioneer program project office, the records depict the design, deployment, and data collection phases of the Pioneer 6–9, 10–11, and Venus spacecraft, such as contractor photographs depicting various stages of spacecraft assembly, snapshots of project teams, and images taken from the spacecraft (e.g., views of the planet Jupiter captured by Pioneer 10). Allison produced an inventory of the material, relocated it to a stable environment, rehoused and performed preservation measures on it (including painstaking measures to preserve approximately 7 cubic feet of photographs originally contained in 38 binders), and produced a container list describing the material to the folder and item level. Allison's efforts will extend the lifespan of the records and greatly improve access to this rich portion of the collection.

Dryden Flight Research Center (DFRC)

Christian Gelzer has finished the draft of his truck fairing monograph, and copies are with outside readers for comment.

Curtis Peebles's *The Spoken Word*, vol. 2, *Beyond the Sky*, is in page layout, with an expected publication this fall. It is a collection of history interviews dealing with the (then) NASA Flight Research Center's space-related activities, from the X-15 through the first flight of the Shuttle. Meanwhile, he continues slogging through material for his comprehensive book on scramjets in NASA's history.

In June, the American Institute of Aeronautics and Astronautics (AIAA) published Peter Merlin's *From Archangel to Senior Crown: Design and Development of the Blackbird*. This is a technological case study and lessons-learned analysis of Lockheed's A-12/YF-12/SR-71 family of aircraft, including NASA's use of the airplanes as flying laboratories. It also includes a CD-ROM with additional documentation, photos, and video. The book primarily targets professional and student engineer audiences but may also be of interest to a general readership. In conjunction with the 50th anniversary of NASA, he has assembled an exhibit called "Space Race to Space Partnership—The Evolution U.S.-Russian Relations in Orbit." The display, containing artifacts and memorabilia from the past half-century of space exploration, is installed as a temporary exhibit in the Dryden Visitor's Center through the end of December.

Betty Love continues to sort material in the archive collection. She is currently making another pass at the Roy Bryant collection. Bryant was, at his retirement, the longest continuous NASA employee at the Center, having come to work for the NACA in the early 1950s. His career spanned five decades here.

Glenn Research Center (GRC)

After many long months of planning, the Glenn Research Center Archives has moved into its new home. The Center library, archives, learning center, records management, and forms area have all moved into a shared space that will be known as the "Knowledge Resources and Information Services" area. The processed collections of the archives are located within the library. Unprocessed collections and artifact storage are now in a separate area to provide a better working environment for researchers and our archivist.

The new Altitude Wind Tunnel (AWT) Web site, *http://awt.grc.nasa.gov*, was made available to the public in May. The home page has 360-degree, panoramic photographs of the interior and exterior of the tunnel. The Interactive History page launches a Flash multimedia piece that includes a detailed chronological history, facility layouts with photos, a documentary, related technical reports, and several hundred videos and images.

The Facility section describes the wind tunnel and test chambers in detail. The pages include descriptions of the refrigeration system, control rooms, and other facility topics. The Mitigation pages describe the historical mitigation being done prior to the demolition of the facility. It includes related documents and photographs. The Research section has a two-part event timeline, a timeline of AWT/Space Power Chambers (SPC) tests, and PDFs of 21 historical documents. The Students pages include short narrated animations that describe how the AWT and SPC work, brief histories of wind tunnels and vacuum chambers, and glossaries. The Gallery page includes over 1,300 images, which have captions and high-resolution versions.

Many thanks go to Bob Arrighi (WYLE) and the Logistics and Technical Information Division Information Technology Services and Imaging Technology Center for their hard work on creating these outstanding and informative AWT resources.

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News from Headquarters and the Centers (continued)

Goddard Space Flight Center (GSFC)

After several decades without a formal history program, Goddard Space Flight Center recently hired Glen Asner to serve as the Center's Senior Historian. Glen is grateful to the following individuals at Goddard for their efforts to establish the position: Barbara Thompson, Chair of the History Committee; Mark Hess, Chief of Public Affairs; and Harley Thronson, Associate Director for Advanced Concepts and Planning.

Glen began his career at NASA in December 2004 in the Headquarters History Division, where his responsibilities included overseeing the publication of history monographs, the Aeronautics and Space Report of the President, and *News and Notes*. He left the History Division in April 2007 to serve as an International Program Specialist in the Space Operations Division of the Headquarters Office of External Relations. Glen enjoyed his work in international relations, particularly his experience serving as the lead NASA official for the International Space Station Advisory Committee, but he is thrilled to get back to research and writing.

Glen's primary responsibility at Goddard is to write a brief history of the Center, focusing on its contributions to science, technology, and society. He also is working with Steve Garber to complete their joint study of the history of the Vision for Space Exploration. While Glen has few administrative responsibilities in his new position, he looks forward to coordinating with the Goddard History Committee and assisting the Office of Public Affairs in preparing for Goddard's 50th anniversary in 2009.

Johnson Space Center (JSC)

The History Office at Johnson Space Center nears the completion of a pilot project being conducted at the request of the Center's Chief Knowledge Officer. The Space Shuttle Program Tacit Knowledge Center project team conducted 20 interviews with current and former key members of the Shuttle Program to collect details of critical program decisions, information on management tools and processes, and lessons learned within area of expertise. The effort included talking with individuals at NASA Centers in Florida, Mississippi, Alabama, and Texas.

The team also conducted oral history sessions with some of the NASA experts who participated in the recent Smithsonian Folklife Festival. These included famed climatologist Claire Parkinson from Goddard Space Flight Center; Jim Sokolik, head of the High Altitude Life Support Team, Dryden Flight Research Center; and Ron Woods, longtime spacesuit technician at Kennedy Space Center. In the near future, the transcripts of the interviews will be posted online as part of the NASA Headquarters Oral History Project.

On 1 July, approximately 200 science, math, and technology teachers attended a presentation provided by the History Office. The educators were at JSC as participants in the U.S. Department of Education Teacher-to-Teacher Initiative Program. The history team presented a 40-minute multimedia presentation, designed especially

for the teachers, entitled "NASA's Science and Technology Through a Historical Lens." Earlier this year, the History Office staff offered a brief program on the decisions impacting the origins of the space agency to local members of the National Management Association, and they facilitated an advanced oral history workshop at Rice University for 30 participants who were in Houston for the annual meeting of the Society of Southwest Archivists.

Work is in progress at JSC on *Legacy of the Space Shuttle: Scientific and Engineering Accomplishments*, a 700-page book tentatively set to be published in 2010. The publication will be written by multiple authors, and JSC Historian Jennifer Ross-Nazzal is coauthoring four chapters for this book. These detail the 1) milestones, or history, of the program; 2) impact of the accidents on the program and lessons learned; 3) social and cultural impacts; and 4) economic impacts of the Shuttle on the aerospace industry from 1970 to 2010.

Sandra Johnson, the History Office Production Coordinator, recognized the need for an Audio Digitization Project and began identifying at-risk audio CD recordings in the NASA JSC History Collection housed at the University of Houston-Clear Lake. She implemented a system including upgraded audio recording equipment and a digital audio workstation to meet the recommendations for digital audio preservation by various sound archive research centers, including the Library of Congress. Since January 2007, all oral history recordings have been "born digital" and processed as digital files. Earlier this year, she began a systematic effort to digitize all of the audio CDs within the JSC Collection, and, to date, more than 750 digital conversions have been completed.

Later this year, the History Office and the University of Houston Center for Public History will release a magazine as part of the university's Houston History series. This issue honors the 50th anniversary of NASA by focusing on the Agency's Center located in Houston during the years 1958–78. Included will be an interview with pioneer flight director Chris Kraft, articles on historic preservation efforts, and numerous images from the JSC archives.

"NASA's First 50 Years: A Historical Perspective" Conference

The purpose of this conference is a scholarly analysis of NASA's first 50 years. Over two days at NASA Headquarters, historians will discuss NASA's role in aeronautics, human spaceflight, space science, life science, and Earth science, as well as cross-cutting themes ranging from space access to international relations in space and NASA and the public. You can access the NASA 50th Anniversary Conference Web site at *http://history.nasa.gov/50thannnasaconf/index.html*.

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"NASA's First 50 Years: A Historical Perspective" Conference (continued)

Venue: NASA Headquarters Auditorium
300 E Street SW
Washington, DC 20546

Audience: NASA employees, scholars, and the general public in an auditorium that holds approximately 250 people.

Agenda

Day 1 Tuesday, 18 October 2008

Opening

9:00 Keynote 1: NASA at 50
Michael Griffin (NASA Administrator)

9:30 Keynote 2: Inside NASA at 50
Howard McCurdy (American University)

Session I: Cross-Cutting Themes

10:00 Fifty Years of NASA Administrators: Continuity and Change
W. H. Lambright (Syracuse University)

10:30 Space Access: NASA's Role in Developing Core Launch-Vehicle Technologies
J. D. Hunley

11:00 NASA's International Relations in Space
John Krige (Georgia Institute of Technology)

11:30 NASA and the Public
Linda Billings (SETI Institute)

Session II: Aeronautics

1:00 The Critical Transition from NACA to NASA: A Prosopographical Analysis
James Hansen (Auburn University)

1:30 NASA Aeronautics: A Half-Century of Accomplishments
Tony Springer (NASA)

2:00 Evolution of Aeronautics Research Methodology
Rob Ferguson

2:30 NACA, NASA, and the Supersonic-Hypersonic Frontier
Richard P. Hallion (National Air and Space Museum)

Session III: Human Spaceflight and Life Sciences

3:00 50 Years of Human Spaceflight: Problems and Achievements
John Logsdon (George Washington University)

3:30 From the Secret of Apollo to the Lessons of Failure: The Uses and Abuses of Systems Engineering at NASA
Stephen Johnson (University of Colorado and NASA)

Day 2 Wednesday, 29 October 2008

Session III (continued)

9:00 The "von Braun Paradigm" and NASA's Long-Term Planning for Human Spaceflight
Michael Neufeld (National Air and Space Museum)

9:30 Life Sciences and Human Spaceflight
Maura Mackowski

Session IV: Space Science

10:00 Keynote 3: Voyages to Mars
Laurence Bergreen

10:30 Transcendence and Meaning in the First 50 Years of Space Science
Roger Launius (National Air and Space Museum)

11:00 Space Science and Disciplinary Change
David DeVorkin (National Air and Space Museum)

11:30 Planetary Astronomy in the Inner Solar System
Joseph Tatarewicz (University of Maryland Baltimore County)

12:00 NASA's Grand Tours of the Outer Solar System
Michael Meltzer

12:30 Deep-Space Navigation, Astronomy, and Geodesy: A Symbiotic Relationship
Andrew Butrica

Session V: Earth Science and Applications

2:00 The Development of NASA's Earth Science Program, 1972–2006
Ed Goldstein (NASA)

2:30 Earth Observations from Space: Achievements, Challenges, and Realities
James Fleming (Colby College)

3:00 Planetary Science and Earth Science: A Symbiotic Relationship
Erik Conway (Jet Propulsion Laboratory)

3:30 Keynote 4: Exploration, Discovery, and Culture: NASA's Role in History
Steven Dick (NASA Chief Historian)

Forthcoming NASA History Publications

Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume VII, Human Spaceflight: Projects Mercury, Gemini, and Apollo (SP-2008-4407), edited by John M. Logsdon with Roger D. Launius. The civil space program of the United States was one of the most significant activities of the latter half of the 20th century. Even at this juncture, only a little more than generation after the first orbital flights, the compelling nature of space exploration and the activity that it has engendered on the part of many people and government organizations make the U.S. civil space program a significant area of investigation. This will be the seventh volume in an eight-volume series of reference books essential for anyone interested in the history of the U.S. civil space program and its development over time.

Rockets and People, Volume III: Hot Days of the Cold War (SP-2008-4110), by Boris Chertok. Much has been written in the West on the history of the Soviet space program, but few Westerners have read direct, first-hand accounts of the men and women who were behind the many Soviet accomplishments in exploring space. The memoir of Academician Boris Chertok, translated from the original Russian, fills that gap. In volume 1 of *Rockets and People*, Chertok described his early life as an aeronautical engineer and his adventures as a member of the Soviet team that searched postwar, occupied Germany for the remnants of the Nazi rocket program. Volume 2 gave an unprecedented view into the early days of the Soviet missile program and of the origins of the Baikonur Cosmodrome in Kazakhstan. In his latest volume, Chertok vividly outlines many of the events of the Soviet program leading up to Yuri Gagarin's death in 1968.

Remembering the Space Age: 50th Anniversary Conference Proceedings (SP-2008-4703), edited by Steven J. Dick and Roger D. Launius. Fifty years ago, events were building toward what some historians now recognize as a watershed in history—the beginning of the Space Age. The NASA History Division and the National Air and Space Museum History Division recently sponsored a conference on the 50th anniversary of the Space Age, held in Washington, DC, 22–23 October 2007. Entitled "Remembering the Space Age," the conference encompassed two main themes: the national and global dimensions of the Space Age and the remembrance and cultural representation of the Space Age. This upcoming publication contains the proceedings of the conference and will include papers, commentary, and reflections on the Space Age by 21 well-known authors.

Out-of-Print NASA History Books To Be Available Through Dover Publications, Inc.

The NASA History Division is pleased to announce that it has signed a nonreimbursable Space Act Agreement with Dover Publications, Inc., to reprint and sell certain out-of-print NASA History publications. This fall, Dover will be reprinting and selling three specific titles:

Constance McLaughlin Green and Milton Lomask. *Vanguard: A History*. NASA SP-4202, 1970; rep. ed. Smithsonian Institution Press, 1971.

Edward Clinton Ezell and Linda Neuman Ezell. *On Mars: Exploration of the Red Planet, 1958–1978*. NASA SP-4212, 1984.

Courtney G. Brooks, James M. Grimwood, and Loyd S. Swenson, Jr. *Chariots for Apollo: A History of Manned Lunar Spacecraft*. NASA SP-4205, 1979.

These attractive reprints will feature new introductions by Paul Dickson. For more information, see *http://www.doverpublications.com* or contact Steve Garber or Steve Dick (see contact information on the inside back cover of this newsletter).

Other New Aerospace History Publications

Compiled by Chris Gamble

SPACE Base Europe, 2nd English edition, by Giuseppe Reibaldi and Giovanni Caprara (ESA BR-270, 2007). This book covers the development of the International Space Station (ISS) from its beginnings with the U.S. *Skylab*, the Russian *Salyut* and *Mir*, and the European *Spacelab*, to the present-day European and Japanese elements. It describes how astronauts live and work in space, the benefits of research in "weightlessness," the role of Europe as a space power, and opportunities in space activities for young people. There are contributions by seven European astronauts, most of whom have firsthand experience of flying to the ISS.

It's ONLY Rocket Science: An Introduction in Plain English, by Lucy Rogers (Springer, March 2008). The author, herself a rocket scientist/engineer, describes, in everyday terms and entirely without complex math, just what is involved in launching something into space, from how to leave Earth—including the design of the rocket and vehicle, mission planning, navigation, and communication—to life in space and the effects of weightlessness.

Canada's Fifty Years in Space: The COSPAR Anniversary, by Gordon Shepherd and Agnes Kruchio (Apogee Books Space Series/Collector's Guide Publishing, Inc., April 2008). Detailing the last 50 years of the Canadian space science program, this extensive history explores everything from the aurora borealis studies of the late

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Other New Aerospace History Publications (continued)

1950s to the current Radarsat-1 and Canada's involvement with the NASA Phoenix mission. The people behind the country's spacecraft and programs, along with the long-overdue development of the Canadian Space Agency (CSA), are thoroughly discussed, as well as the parallel growth of the Canadian space program and the Committee on Space Research (COSPAR). Never-before-published information on the ISIS-II satellite is also included.

Titan Unveiled: Saturn's Mysterious Moon Explored, by Ralph Lorenz and Jacqueline Mitton (Princeton University Press, April 2008). In the early 1980s, when the two Voyager spacecraft skimmed past Titan, Saturn's largest moon, they transmitted back enticing images of a mysterious world concealed in a seemingly impenetrable orange haze. *Titan Unveiled* is one of the first general-interest books to reveal the startling new discoveries that have been made since the arrival of the Cassini-Huygens mission to Saturn and Titan. In this generously illustrated book with many stunning images, Ralph Lorenz gives an insider's account of the scientific community's first close encounter with an alien landscape of liquid methane seas and turbulent orange skies.

The Solar System Beyond Neptune, edited by M. A. Barucci, H. Boehnhardt, D. P. Cruikshank, and A. Morbidelli (University of Arizona Space Science Series, University of Arizona Press, April 2008). A new frontier in our solar system opened with the discovery of the Kuiper Belt and the extensive population of icy bodies orbiting beyond Neptune. Today the study of all of these bodies, collectively referred to as trans-Neptunian objects, reveals them to be frozen time capsules from the earliest epochs of solar system formation. This new volume in the Space Science Series, with 100 contributing authors, offers the most detailed and up-to-date picture of our solar system's farthest frontier.

Fundamentals of Aerospace Medicine, 4th edition, edited by Jeffrey R. Davis, Robert Johnson, Jan Stepanek, and Jennifer A. Fogarty (Lippincott Williams & Wilkins, April 2008). This comprehensive text addresses all medical and public health issues involved in the care of crews, passengers, and support personnel of aircraft and space vehicles. Coverage includes human physiology under flight conditions, clinical medicine in the aerospace environment, and the impact of the aviation industry on global public health. This edition features new chapters on radiation, toxicology and microbiology, dental considerations in aerospace medicine, women's health issues, commercial human spaceflight, space exploration, and unique aircraft. Other highlights include significant new information on respiratory diseases, cardiovascular medicine, infectious disease transmission, and human response to acceleration.

Keep Watching the Skies!: The Story of Operation Moonwatch and the Dawn of the Space Age, by W. Patrick McCray (Princeton University Press, April 2008). When the Soviets launched Sputnik in 1957, thousands of ordinary people across the globe seized the opportunity to participate in the start of the Space Age. Known as the "Moonwatchers," these largely forgotten citizen-scientists helped professional astronomers by providing critical and otherwise unavailable information about the first satellites. In *Keep Watching the Skies!*, Patrick McCray tells the story of this network of pioneers who, fuelled by civic pride and exhilarated by space exploration, took part in the 20th century's biggest scientific endeavor. Drawing on previously unexamined letters, photos, scrapbooks, and interviews, *Keep Watching the Skies!* recreates a pivotal event from a perspective never before examined—that of ordinary people who leaped at a chance to take part in the excitement of space exploration.

Digital Apollo: Human, Machine, and Space, by David A. Mindell (MIT Press, May 2008). As Apollo 11's Lunar Module descended toward the Moon under automatic control, a program alarm in the guidance computer's software nearly caused a mission abort. Neil Armstrong responded by switching off the automatic mode and taking direct control. He stopped monitoring the computer and began flying the spacecraft, relying on skill to land it and earning praise for a triumph of human over machine. In *Digital Apollo*, engineer-historian David Mindell takes this famous moment as a starting point for an exploration of the relationship between humans and computers in the Apollo program. In each of the six Apollo lunar landings, the astronaut in command seized control from the computer and landed with his hand on the stick. Mindell recounts the story of astronauts' desire to control their spacecraft in parallel with the history of the Apollo Guidance Computer. From the early days of aviation through the birth of spaceflight, test pilots and astronauts sought to be more than "Spam in a can" despite the automatic controls, digital computers, and software developed by engineers. Drawing on transcripts and data telemetry from the flights, astronaut interviews, and NASA's extensive archives, *Digital Apollo* examines the design and execution of each of the six Apollo Moon landings.

Preludes to U.S. Space Launch Vehicle Technology: Goddard's Rockets to Minuteman III and *U.S. Space Launch Vehicle Technology: Viking to Space Shuttle*, by J. D. Hunley (University Press of Florida, April 2008). For nearly 50 years, a wide range of missiles and rockets have propelled U.S. satellites and spacecraft into the sky. J. D. Hunley's two-volume work traces the evolution of this technology, from Robert Goddard's research in the 1920s, through the development of the Titan missiles and launch vehicles in the 1960s, to the refinement of the Space Shuttle in the 1980s. With his first book devoted to military hardware and his second book devoted primarily to launch vehicle hardware, Hunley offers a sweeping overview of these impressive engineering innovations as well as insights into the dynamic personalities responsible for them. Together, the two volumes offer a unique, invaluable history of rocketry that should appeal to a wide range of scholars and space buffs.

Floating to Space: Opportunities in the Untapped Sky, by John M. Powell (Apogee Books Space Series/Collector's Guide Publishing, Inc., May 2008). Challenging the reader to consider what is possible, this book reveals an entirely new concept for getting into space—Airship to Orbit (ATO). Photographs and details are provided from the nearly 100 development flights conducted so far, along with new findings such as life 20 miles up and mile-high plasma volcanoes. The blueprints and economic details of hypersonic airships and cities floating at the edge of space are all included, bringing the subject out of scientific journals and fantasy pages and into the public eye.

The Universe in a Mirror: The Saga of the Hubble Space Telescope and the Visionaries Who Built It, by Robert Zimmerman (Princeton University Press, May 2008). *The Universe in a Mirror* tells the story of the Hubble Space Telescope and the visionaries responsible for its extraordinary accomplishments. Zimmerman shows how many of the telescope's advocates sacrificed careers and family to get it launched and how others devoted their lives to Hubble only to have their hopes and reputations shattered when its mirror was found to be flawed. This is the story of an idea that would not die—and of the dauntless human spirit. Illustrated with striking color images, *The Universe in a Mirror* describes the heated battles between scientists and bureaucrats, the perseverance of astronauts to repair and maintain the telescope, and much

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Other New Aerospace History Publications (continued)

more. Hubble, along with the men and women behind it, opened a rare window onto the universe, dazzling humanity with sights never before seen.

SpaceShipOne: An Illustrated History, by Dan Linehan, foreword by Arthur C. Clarke (Zenith Press, May 2008). This book chronicles the development of the world's first commercial crewed space program—a program that includes an airborne launcher (the White Knight), a spaceship (*SpaceShipOne*), rocket propulsion, avionics, a simulator, and full ground support. With ample illustrations, photographs, and behind-the-scenes information, *SpaceShipOne* provides a full picture of this project—from the conception and design, to the deals that brought together Scaled Composites' Burt Rutan and Virgin Airlines' Sir Richard Branson, to the plans for building a fleet of commercial suborbital spaceships and launch aircraft.

Jane's Space Recognition Guide, by Peter Bond (Collins, May 2008). This book contains a selection of over 500 satellites, spacecraft, and launch vehicles (rockets), with information on purpose, operations, specifications, and a brief type history. The entries (each with a color picture) are split into Historic Missions (to include Sputnik, Apollo, Mir, and Voyager), Historic Launchers, Space Organizations (to include NASA, the European Space Agency [ESA], and the Japan Aerospace Exploration Agency [JAXA]), Launchers, Current Spacecraft Programmers, Manned Spaceflight, and Futures. This is a most comprehensive guide and a stunning tribute to the exploration of space.

Salyut—The First Space Station: Triumph and Tragedy, by Grujica S. Ivanovich (Praxis, May 2008). This book offers a unique insight into the people involved in the development of the *Salyut* space station and the crews assigned to operate it. It describes the rotation between the crews, analyzes the decision to send the backup crew on Soyuz 11, and recounts the intrigues and difficult relationships between all the personalities involved: politicians, managers, designers, generals, and cosmonauts. Biographies of the Soyuz 11 cosmonauts are published for the first time in English. Grujica Ivanovich describes the longest piloted space mission of the time and then gives a unique summary of the most tragic day in the Soviet/Russian human space program. An investigation into the cause of the tragic deaths of the Soyuz 11 cosmonauts precedes a description of the post-*Salyut* era, showing how the legacy of the first space station has survived for decades.

Principles of Clinical Medicine for Space Flight, edited by Michael Barratt and Sam Pool (Springer, May 2008). Advances over the past decades in spaceflight technology have allowed U.S., Russian, and other space programs not only to increase the frequency of piloted spaceflights, but also to increase the duration of these flights. As such, a large body of knowledge has been developed regarding the ways in which spaceflight affects the health of the personnel involved. Now, for the first time, this body of clinical knowledge on how to diagnose and treat conditions that develop either during a mission or because of a mission has been compiled by Drs. Michael Barratt and Sam L. Pool of the NASA Johnson Space Center. Complete with detailed information on the physiological and psychological effects of spaceflight and on how to diagnose and treat health issues encountered during spaceflight, from dental concerns to decompression to dermatological problems, this text is a must-have for all those associated with aerospace medicine.

Italy in Space. Looking for a Strategy 1957–1975, by Michaelangelo De Maria and Lucia Orlandi (Paris: Beauchesne Editeur, 2008). Since the late 1950s, Italy

moved on toward the building of national space institutions and, at the same time, cooperated in the creation of the European space organizations while fostering bilateral cooperation with United States. The story of the development of the two major national programs, the San Marco project and the Satellite Italiano Ricerca Industriale Orientata (SIRIO) project, which were the hallmark of about two decades, the 1960s and the 1970s, is reconstructed, following the parallel growth of Italy's engagement in the scientific as well as institutional activities of European bodies. For the first time, the relations among science, military, politics, and economics are explored, in order to understand why the "Italy of records"—the nation that became the first country, following the United States and USSR, to put a national satellite into orbit, operated by an all-Italian team—betrayed this promising start.

Space Psychology and Psychiatry, 2nd edition, by N. Kanas and D. Manzey (Springer—Space Technology Library, May 2008). This book deals with psychological, psychiatric, and psychosocial issues that affect people who live and work in space, with an emphasis on the findings from psychological research conducted during actual space missions. What is presented in this readable text has previously been found only in scientific journal articles. Topics that are discussed include behavioral adaptation to space; human performance and cognitive effects; crewmember interactions; psychiatric responses; psychological countermeasures related to habitability factors, design, selection, training, and in-flight monitoring and support; and the impact of expeditionary missions to Mars and beyond.

From Laika with Love, by Duane Graveline, contribution by Fred Kelly (Duane Graveline MD MPH, May 2008). This book reveals the extraordinary life and achievements of Duane Graveline, M.D., M.P.H., a Vermont family doctor, aerospace medical research scientist, U.S. Air Force (USAF) flight surgeon, and former NASA scientist-astronaut (NASA Group 4—1965). In 1957, while Graveline was studying at Johns Hopkins University, the Soviet Union followed up its stunning earlier achievement of launching the first satellite into space by sending a research dog named Laika, monitored by instruments, into orbit aboard Sputnik II. Becoming a flight surgeon and conducting space medical research was almost an inevitable career path for Graveline, and he soon found himself in the super-secret USAF Foreign Technology Division as an analyst for Soviet bioastronautics. During this time, he was the flight surgeon who reviewed not only Laika's biotelemetry, but also, later, that of cosmonauts Yuri Gagarin and Gherman Titov. His analysis team broke out the secret biodata monitor that enabled the entire NASA tracking network to monitor the cosmonauts on *Voskhod 2*, at a time when the Soviets had amassed 292 crewed Earth orbits to 31 for the United States.

Space Policy and Exploration, edited by William N. Callmers (Nova Science Publishers, May 2008). This new book presents a wide spectrum of in-depth analyses detailing aspects of the U.S. space program including policy, the space stations, the Shuttles, and space exploration.

Science with the Atacama Large Millimeter Array: A New Era for Astrophysics, edited by Rafael Bachiller and José Cernicharo (Springer, June 2008). Currently under construction in the Andean Altiplano, northern Chile, the Atacama Large Millimeter Array (ALMA) is the most ambitious astronomy facility under construction. ALMA is a radio interferometer composed of 54 12-meter-diameter antennas and 12 7-meter antennas, with about 6,600 square meters of total collecting area. Initially covering the most interesting spectral wavelength ranges from 3 to 0.3 millimeters, ALMA

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Other New Aerospace History Publications (continued)

will be a revolutionary telescope aimed to unveil the details of star and planet formation and to provide astronomers with the first exhaustive view of the darkest and youngest objects of the universe. This book describes the enormous capabilities of ALMA, the state of the project, and, most notably, the scientific prospects of such a unique facility. The book includes comprehensive reviews and recent results on most hot topics of modern astronomy (the formation and evolution of galaxies, the physics and chemistry of the interstellar medium, and the processes of star and planet formation), along with possible revolutionary results to be obtained with ALMA. These topics, discussed with special emphasis on millimeter and submillimeter astronomy, are presented by scientists with worldwide reputations in their fields.

Small Satellites for Earth Observation, edited by Rainer Sandau, Hans-Peter Röser, and Arnoldo Valenzuela (Springer, June 2008). The material provided was collected from the 6th IAA Symposium on Small Satellites for Earth Observation, initiated by the International Academy of Astronautics (IAA) and hosted by DLR, the German Aerospace Center. The participation of scientists, engineers, and managers from 24 countries reflected the high interest in the use of small satellites for dedicated missions in Earth observation. As in the previous symposia, the contributions showed that dedicated Earth-observation missions cover a wide range of very different tasks. These missions provide increased opportunities for access to space and can be conducted relatively quickly and inexpensively. The spacecraft bus, the instruments, and the ground systems can be based either on optimized off-the-shelf systems with little or no requirements for new technology or on new high-technology designs.

Cosmos: An Illustrated History of Astronomy and Cosmology, revised edition, by John North (University of Chicago Press, July 2008). In *Cosmos*, the author offers a sweeping historical survey of the two sciences that help define our place in the universe: astronomy and cosmology. Organizing his history chronologically, North begins by examining Paleolithic cave drawings that clearly chart the phases of the Moon. He then investigates scientific practices in the early civilizations of Egypt, Greece, China, and the Americas (among others), whose inhabitants developed sophisticated methods to record the movements of the planets and stars. Trade routes and religious movements, North notes, brought these ancient styles of scientific thinking to the attention of later astronomers, whose own theories—such as Copernicus's planetary theory—led to the Scientific Revolution. The work of master astronomers, including Ptolemy, Galileo, Kepler, and Newton, is described in detail, as are modern-day developments in astrophysics, such as the advent of radio astronomy, the brilliant innovations of Einstein, and the many recent discoveries brought about with the help of the Hubble Space Telescope. This new edition brings North's seminal book right up to the present day, as North takes a closer look at last year's reclassification of Pluto as a "dwarf" planet and gives a thorough overview of current research.

New Online Resources

NASA History Web Sites

The NASA History Division is pleased to include the *A*stronautics and Aeronautics chronology series online in PDF format on the NASA History Series Publications Web site. The online availability of these publications is an invaluable resource as many of the Astronautics and Aeronautics chronologies are now out of print. The series relates the events in aeronautics, aviation, space science, and space exploration spanning the years 1915 to 1995. Links to the books are available at *http://history.nasa.gov/series95.html#chron*.

Also available online for this first time is T. A. Heppenheimer's *Facing the Heat Barrier: A History of Hypersonics* (NASA SP-2007-4232). Hypersonics is the study of flight at speeds where aerodynamic heating dominates the physics of atmospheric entry. It is an engineering science with close links to supersonics and engine design. Within this field, many of the most important results have been experimental. The principal facilities have been wind tunnels and related devices, which have produced flows with speeds of up to orbital velocity. This publication is now accessible through a three-part PDF at *http://history.nasa.gov/what.html#online*.

In addition, a number of past publications and monographs are now available online and are fully searchable (please note that the file size on some of the PDFs is rather large and they may take a couple of minutes to load):

Women in Flight Research at NASA Dryden Flight Research Center from 1946 to 1995, Monographs in Aerospace History, No. 6, 1997, by Sheryll Goecke Powers, at *http://history.nasa.gov/monograph6.pdf.*

Memoirs of an Aeronautical Engineer: Flight Tests at Ames Research Center: 1940–1970, Monographs in Aerospace History, No. 26, NASA SP-2002-4526, 2002, by Seth B. Anderson, at *http://history.nasa.gov/monograph26.pdf.*

Innovation in Flight: Research of the NASA Langley Research Center on Revolutionary Advanced Concepts for Aeronautics, Monographs in Aerospace History, No. 39, NASA SP-2005-4539, 2005, by Joseph R. Chambers, at *http://history.nasa.gov/monograph39/mon39_a.pdf.*

The Difficult Road to Mars: A Brief History of Mars Exploration in the Soviet Union, Monographs in Aerospace History, No. 15, 1999, by V. G. Perminov, at *http://www.hq.nasa.gov/office/pao/History/monograph15.pdf.* This monograph is also available in a two-part PDF:

http://history.nasa.gov/monograph15a.pdf
http://history.nasa.gov/monograph15b.pdf

NASA Historical Data Book, Vol. I: NASA Resources, 1958–1968, NASA SP-4012, 1976, rep. ed. 1988, by Jane Van Nimmen and Leonard C. Bruno, with Robert L. Rosholt, at *http://history.nasa.gov/SP-4012v1.pdf.*

NASA Historical Data Book, Vol. II: Programs and Projects, 1958–1968, NASA SP-4012, 1988, by Linda Neuman Ezell, at *http://history.nasa.gov/SP-4012v2.pdf.*

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New Online Resources (continued)

An Administrative History of NASA, 1958–1963, NASA SP-4101, 1966, by Robert L. Rosholt, at *http://history.nasa.gov/SP-4101.pdf.*

From Runway to Orbit: Reflections of a NASA Engineer, NASA SP-2004-4109, 2004, by Kenneth W. Illiff and Curtis L. Peebles, at *http://history.nasa.gov/SP-4109.pdf.*

Shared Voyage: Learning and Unlearning from Remarkable Projects, NASA SP-2005-4111, 2005, by Alexander Laufer, Todd Post, and Edward Hoffman, at *http://history.nasa.gov/SP-4111.pdf.*

Venture into Space: Early Years of Goddard Space Flight Center, NASA SP-4301, 1985, by Alfred Rosenthal, at *http://history.nasa.gov/SP-4301.pdf.*

Flights of Discovery: An Illustrated History of the Dryden Flight Research Center, NASA SP-4309, 1996, by Lane E. Wallace. This book is a three-part PDF:

http://history.nasa.gov/SP-4309pt1.pdf
http://history.nasa.gov/SP-4309pt2.pdf
http://history.nasa.gov/SP-4309pt3.pdf

Crafting Flight: Aircraft Pioneers and the Contributions of the Men and Women of NASA Langley Research Center, NASA SP-2003-4316, 2003, by James Schultz, at *http://history.nasa.gov/SP-4316.pdf.*

Challenge to Apollo: The Soviet Union and the Space Race, 1945–1974, NASA SP-2000-4408, 2000, by Asif A. Siddiqi. This book is a two-part PDF:

http://history.nasa.gov/SP-4408pt1.pdf
http://history.nasa.gov/SP-4408pt2.pdf

The following publications are in HTML format:

A Spacefaring People: Perspectives on Early Spaceflight, NASA SP-4405, 1985, by Alex Roland, at *http://history.nasa.gov/SP-4405.pdf.*

To See the Unseen: A History of Planetary Radar Astronomy, NASA SP-4218, 1996, by Andrew J. Butrica, at *http://history.nasa.gov/SP-4218/sp4218.htm*.

Wingless Flight: The Lifting Body Story, NASA SP-4220, 1998, by Dale R. Reed, at *http://history.nasa.gov/SP-4220/sp4220.htm*.

Wallops Station and the Creation of an American Space Program, NASA SP-4311, 1997, by Harold D. Wallace, Jr., at *http://history.nasa.gov/SP-4311/sp4311.htm.*

Way Station to Space: A History of the John C. Stennis Space Center, NASA SP-4310, 1997, by Mack R. Herring, at *http://history.nasa.gov/SP-4310/sp4310.htm.*

"We Freeze to Please:" A History of NASA's Icing Research Tunnel and the Quest for Safety, NASA SP-2002-4226, 2002, by William M. Leary, at *http://history.nasa.gov/sp4226.pdf.*

Apollo 204 Review Board Report Appendices at *http://history.nasa.gov/Apollo204/content.html.*

Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume 1, Organizing for Exploration, NASA SP-4407, 1995, edited by John M. Logsdon with Linda J. Lear, Jannelle Warren Findley, Ray A. Williamson, and Dwayne A. Day, at *http://history.nasa.gov/SP-4407/vol1/intro.pdf.*

Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume 2, External Relationships, NASA SP-4407, 1996, edited by John M. Logsdon, Dwayne A. Day, and Roger D. Launius, at *http://history.nasa.gov/SP-4407/vol2/v2intro.pdf.*

NASA's National Historic Landmarks

The National Park Service (NPS) manages the National Register of Historic Places (NRHP): over 80,000 buildings, districts, structures and objects that are significant to America's history. Of these, approximately 2,900 are National Historic Landmarks (NHLs). Although NASA's accomplishments in aeronautical research, science, and space exploration are well documented, less is known about the historic buildings and structures that support and enable these accomplishments. This series provides an overview of NASA's 20 NHLs. This issue features NASA's 26-meter Pioneer Antenna located at the Goldstone Deep Space Communications Complex in California.

From Lunar Probe Tracking to Deep Space Communications: Pioneer Antenna

Goldstone Deep Space Communications Complex, California

By Tina Norwood

The 26-meter Pioneer Antenna is located at the Goldstone Deep Space Communications Complex (GDSCC), California. The complex is located at Fort Irwin and is managed by the Jet Propulsion Laboratory (JPL) for NASA. Initially part of the Deep Space Instrumentation Facility (designated DSIF 11) and later designated Deep Space Station 11 (DSS 11), the antenna is named after the program it first supported, the lunar probe program, Pioneer. It is still known today as the Pioneer Antenna. It was America's first deep space tracking antenna, first in NASA's Deep Space Network (DSN).

The DSN comprises communication stations currently located in Goldstone, California; Australia; and Spain. The DSN provides communications for all deep space missions, eliminating the need for each project to build its own communications network. It is well known that these ground stations are located approximately 120° latitude apart to enable continuous communications with spacecraft probing our solar system. Less is known about the 26-meter Pioneer Antenna and why it is a National Historic Landmark.

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Quarterly Series: NASA's National Historic Landmarks (continued)

In February 1958, the Advanced Research Projects Agency (ARPA) was established and charged with managing military and civilian space programs until Congress established a civilian space management agency. In March, the United States planned a lunar space program, Pioneer, as part of the International Geophysical Year (IGY) activities. ARPA directed the program, which entailed three launches by the U.S. Air Force, Pioneers 0, 1, and 2 (also known as Able 1, 2, and 3), and two by the U.S. Army, Pioneers 3 and 4. Under contract with the Army Ballistic Missile Agency (ABMA), JPL supported Pioneers 3 and 4. ABMA provided the launch vehicle, and JPL developed the upper stages and the satellites.

Accelerated and competitive design was fueled by the space race and benefited from the synergy generated by the success of America's first satellite, Explorer 1, launched 31 January 1958 from Cape Canaveral, Florida. There are many sources indicating that Goldstone played a role in tracking Explorer 1, supposedly by providing the first confirmation that the satellite was in orbit. This is not the case. Explorer 1 was tracked through a global network known as Microlock and supported by the British. Signals were received by stations in Florida, Singapore, Nigeria, and California. Services from the overseas stations were isolated and depended on "runners" to transport messages and tapes to the nearest telegraph office. Despite being primitive, these stations provided telemetry that enabled the orbit of Explorer 1 to be plotted by JPL.

Though the Explorer flights provided confirmation of the need for ground-based tracking systems, JPL knew Microlock was not suitable for tracking lunar probes. Under the leadership of JPL's communications chief, Eberhardt Rechtin, a steerable 26-meter-diameter parabolic dish antenna was selected as the best choice for the Pioneer lunar missions and the future planetary exploration program. The new tracking and telemetry system was designed to operate at 960 MHz, a much higher frequency than used to track the Explorers. With the goal of supporting Pioneer, ARPA purchased three 26-meter antennas. The priority was to connect one antenna in the United States with the other two to form what ARPA termed a "World Net." In addition to the Pioneer Antenna (DSIF 11) in California, the other two original 26-meter antennas were built in Woomera, Australia (DSIF 41), and South Africa (DSIF 51). DSIF 41 supported the DSN until December 1972, and DSIF 51 until June 1974.

The Pioneer Antenna under construction on 28 August 1958. (JPL File Photo JB1969B)

In his book, *Uplink-Downlink: A History of the Deep Space Network, 1957–1997* (NASA SP-2001-4227), Douglas J. Mudgway attributes the 26-meter antenna design to the emerging science of radio astronomy being developed by the Naval Research Laboratory with assistance from Carnegie Institute,

Associated Universities, and the Blaw-Knox Company. In the 1984 NHL nomination form for the Pioneer Antenna, the National Park Service cites the antenna as being patterned after radio astronomy antennas then in use by the Carnegie Institute in Washington and the University of Michigan. It also outlines significant differences in design, such as the incorporation of a closed-loop device to allow the antenna to provide automatic and continuous contact with spacecraft (see *http://www.nps.gov/history/history/online_books/butowsky4/index.htm*).

Technicians inspect Pioneer 3, the first probe the Pioneer Antenna tracked. (JPL File Photo 314-3944b)

The location selected for the first antenna was Fort Irwin, a military reservation located 45 miles northwest of Barstow, California. Located in the heart of the Mojave Desert near the Goldstone Dry Lake, ARPA's selection of government-owned land supported the funding and schedule restrictions while also meeting two principal stipulations: that the location be remote enough to provide isolation from humanmade electrical and commercial radio and television interference and that the terrain be a natural bowl shape. Construction of access roads and support facilities began in April 1958, and antenna components began arriving at the site in June.

The assembly of the antenna also followed an accelerated schedule, commencing in August. Before construction was completed in November, Executive Order (EO) 10783 established NASA effective 1 October 1958. Then, on 3 December, EO 10793 transferred the functions of JPL from the U.S. Army to NASA. Three days later, on 6 December 1958, Pioneer 3 was launched. This was the first mission the Pioneer Antenna supported, along with a mobile tracking station in Puerto Rico. The spacecraft contributed to the major scientific discovery of bands of radiation around Earth, the Van Allen Belts. Although the probe failed to reach the projected altitude, the new Goldstone antenna was successful, acquiring telemetry for the entire time the probe was above its horizon, tracking it 63,500 miles from Earth. In 1959, Dr. William Pickering, then Director of JPL, gave a presentation at the Seventh International Meeting of Communications Engineers in Italy entitled "Communications with a Lunar Rocket." He used the Pioneer space mission and new 26-meter antenna to emphasize that as rockets became available to launch spacecraft into deep space orbits, the communications engineers would play a key role in the success of missions.

The Pioneer Antenna remained in service until 1981. For 23 years, the Pioneer Antenna tracked a wide range of NASA missions, including Pioneer, Echo, Ranger, Lunar Orbiter, Surveyor, Apollo, Helios, Mariner, Viking, and Voyager. Although it was originally designed only to track probes as a receiver, upgrades enabled two-way communications including deep space command and navigation. According to Dr. Barry Geldzahler, DSN Program Executive, NASA Headquarters, the Pioneer

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Quarterly Series: NASA's National Historic Landmarks (continued)

Antenna was associated with numerous exploration milestones and complex communication capabilities. In 1959, the Pioneer Antenna successfully tracked Pioneer 4, the first United States spacecraft to leave Earth's orbit. In 1962, as part of the DSN, the Pioneer Antenna successfully commanded Mariner 2 to extend its solar panels and adjust its trajectory, thereby allowing it a close pass of Venus. It was heralded as the first time scientific data were received directly from the vicinity of another planet, earning the JPL/NASA team a visit to the White House in January 1963. In 1964, Ranger 7 impressed the world with spectacular images of the lunar surface as a JPL announcer relayed events directly from Goldstone. The construction of a 64-meter antenna at Goldstone began in late 1963 and was completed in 1966. This antenna was used as the primary video link for the Apollo missions, with all data routed through the Manned Space Flight Network Apollo station. The Pioneer Station had a "Manned Space Flight" wing added to allow the Pioneer Antenna to provide backup support during the Apollo missions. In 1978, the 26-meter Echo antenna was expanded to 34 meters with the addition of X-band capability. By 1986, Goldstone had the new 34-meter High Efficiency antenna and the DSN was using "real-time combining" to array the antennas to bring back data from the Voyager 2 spacecraft during the encounter at Uranus. By 1989, the 64-meter Mars antenna had been upgraded to 70 meters to support the Voyager 2 encounter at Neptune.

In 1978, NASA erected a plaque at the Pioneer Antenna in recognition of the important contributions the antenna made to the DSN and the people who operated the antenna. The NPS named the antenna a National Historic Landmark in October 1985 as part of the Man-in-Space NHL Theme Study. The nomination states,

> The Pioneer Station antenna represents the first generation of 26-meter antennas that enabled NASA to solve the technical problems of tracking deep space probes. Although it has now been superseded by newer and more efficient antennas it was the first, the prototype for the entire system. Features incorporated into the latest generation of 64-m antennas that enable NASA to track Pioneer and Voyager Spacecraft to the very edge of the Solar system and beyond were first developed and proven at the Pioneer Station.

The fate of the Pioneer Antenna is unknown. It has been permanently retired because it is not capable of supporting future DSN needs. All satellite communications equipment in the support buildings has been removed. The antenna remains on Army property, currently used for urban warfare training. The City of Barstow and the Barstow Community College have approached NASA about the possible relocation of the Pioneer Antenna. They are seeking a state bond to support a proposed Center for Science and Technology (COSAT) as a regional Smithsonian-affiliated center and museum. Relocated in the middle of the learning center and museum, the Pioneer Antenna would provide a visual beacon and testimony to the region's contribution to space exploration.

Peter Robles, NASA's Historic Preservation Officer (HPO) at JPL, states that if Barstow Community College receives state funding to construct COSAT, NASA would then initiate formal consultation as required under the National Historic Preservation Act to support the donation of this Pioneer Antenna to the college. According to Mr. Robles, "NASA continues to use many of our NHLs across the agency. However, the Pioneer Antenna is technologically obsolete and cannot be upgraded to support the agency's mission. I therefore support the donation of

the Pioneer Antenna to the Barstow Community College. It would make the NHL accessible to the public and support local tourism." The donation would also be consistent with the federal stewardship charge given by EO 13287, Preserve America. The EO places responsibility on the federal government to assist local communities in promoting the use of historic properties for heritage tourism and related economic development in a manner that contributes to the long-term preservation and productive use of those historic properties.

Information for this article was obtained from Uplink-Downlink: A History of the Deep Space Network, 1957–1997 *(NASA SP-2001-4227) and* William H. Pickering, America's Deep Space Pioneer *(NASA SP-2007-4113), both by Douglas J. Mudgway, as well as from NASA JPL personnel and publications. For additional information, contact Peter Robles, NASA's HPO at JPL, at* Peter.Robles@nasa.gov *or Tina Norwood, NASA Federal Preservation Officer, at* tnorwood@hq.nasa.gov.

The Pioneer Antenna operating at night during November 1964. (JPL Photo Number P4124A)

Annual NASA History Program Review

By Gail Langevin

Participants in NASA's History Program gathered at Langley Research Center from 29 April to 1 May to review activities of the past year and discuss mutual concerns. Historians from the Air Force's Air Combat Command and 1st Tactical Wing at Langley Air Force Base joined the conference, as well as folks from NASA's Historic Building team.

NASA Chief Historian Steven J. Dick addresses the group. (Source: NASA/Steven J. Dick)

Mark Shuart, Senior Advisor for Composite Materials, welcomed attendees and provided a brief overview of Langley Research Center, the nation's first civilian aeronautical laboratory. Steve Dick, NASA Chief Historian, then detailed the History Division budget and strategic plan. Included in the presentation were accomplishments associated with each of the History program's eight goals. It was noted that the NASA History Division's Web site (*http://history.nasa.gov)* had had a total of 77,574,617 hits in 2007 and that GRIN, the historic images Web site, had had 7,966,850 hits.

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Annual NASA History Program Review (continued)

Archivist Elaine Liston speaks on behalf of Kennedy Space Center. (Source: NASA/Steven J. Dick)

Jane Odom, Chief Archivist, reported that approximately 240 researchers had visited the NASA Headquarters Archives in the past year. These researchers included representatives from institutions like the Library of Congress, the Leichhardt Library in Australia, and the University of Cumbria in the United Kingdom. Thirty-five cubic feet of material was added to the archive, including an audio recording and transcript of an interview with Wernher von Braun. Over 100 cubic feet of material was processed by the History Division staff in order to make this material more accessible to staff and visitors. Digitization of all current news articles has been completed, and work is beginning on the speeches of NASA's senior leaders.

Approximately 44 manuscripts are in process in the History Division's various publication series. Series such as Exploring the Unknown and the Historical Data Book have long-awaited volumes near the end of the publication process. A new publication classification system was presented at the conference. The new system will make it easier for readers and researchers to locate materials.

Joel Levine discussed the scientific and engineering legacy of the Viking missions to Mars. The Viking spacecraft were the first and second to land successfully on Mars. The Orbiters imaged 97 percent of the Red Planet and sent back over 50,000 images.

Glenn Bugos presented a paper that examined NACA-style organizations with an eye toward recommending NACA business practices that may be helpful to current space industry entrepreneurs.

Lynn Heimerl presented an overview of the NASA Scientific and Technical Information program. The History Division has an agreement with the NASA Center for Aerospace Information to make history publications available to the public.

In addition to the presentations and discussion, the group took two tours. The Langley Research Center tour began at the historic and photograph archives. Stops included the historic 30-by-60-foot tunnel, built in the 1930s; the National Transonic Facility, NASA's newest large wind tunnel; the Landing and Impact Dynamics Facility, where Neil Armstrong practiced for his eventual landing on the Moon; and the Structures and Materials lab,

The NASA Langley Research Centver Landing and Impact Research Facility is where Neil Armstrong practiced for his future landing on the Moon. (Source: NASA/Steven J. Dick)

where visitors viewed a concept for a lunar habitat. A tour of the Jamestowne archaeological dig featured a stop at the Archaearium, which displays items uncovered by Dr. William Kelso and his team. Dr. Kelso rediscovered the site of the Jamestowne fort, where approximately 100 Englishmen settled in 1607. On display in the Archaearium is a 400-year-old metal shipping tag stamped "Yamestowne," rediscovered in an abandoned well at Jamestowne. The tag was flown on STS-117 and returned to the site after its 14-day spaceflight.

The next History Program review will be held at NASA Ames in the spring of 2009.

2008 NASA History Award: John W. Boyd

By Glenn Bugos

For his contributions to NASA history, Jack Boyd was awarded the 2008 NASA Headquarters History Division Award. Among his many jobs, Jack has served as the NASA Ames Research Center Senior Advisor for History since 2003. The award citation commends him for "Energetic outreach and promotion of NASA history and for making history relevant to NASA's present and future." NASA Chief Historian Steven Dick presented the award at the annual NASA History Program Review at NASA Langley Research Center. He commended Jack for his vigorous lecture and outreach schedule and his ability to describe NASA's present and its future in terms that showed that its past truly mattered. He noted how NASA benefits when those with institutional memory, like Jack's, participate so actively in conversations about shaping its vision.

In thanking the NASA history community for the award, Jack called it a pleasure to work for an agency that has taken its history seriously. He thanked them all for building a professional history and archive function within NASA that is consistently relevant, remains cutting-edge, and works to high academic standards. He paraphrased a favorite quote, saying that "historians never finish their work; for various reasons they simply abandon it." Jack also shared one instance of a brush with greatness when, as a young researcher, he presented his work at a 1950s NACA conference while Theodore von Karman sat in the front row. To him, this was a great example of how NASA and its predecessors have always enjoyed attention from great minds and of the power of personal contacts to share experience.

Jack Boyd, NASA Ames Senior Advisor for History (center), with the NASA Ames History Office staff, Glen Bugos (right) and April Gage (left). Boyd received the 2008 NASA Headquarters History Division Award. (NASA photo by Dominic Hart)

Jack has had a long and distinguished career of contributions to the Agency, beginning in 1947 and extending through

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2008 NASA History Award: John W. Boyd (continued)

today. He currently also serves as Senior Advisor to the Ames Center Director, where he helps guide those managers who do not have long experience with NASA. Also, as ombudsman, he helps solve problems that arise where the Ames corporate culture is broken and formal channels cannot fix it.

Over the past four years, Jack has delivered one or two formal presentations per week. Most often these lectures are Center overviews, and he always describes the Center's present and its future with excitement about the past. Sometimes the lectures are on special historical topics of interest to the audience, like a history of planetary probes or a history of education outreach at Ames. He is happy to discuss NASA history with any group—visiting dignitaries, professional societies, new employees, school groups. He is in demand because he does a great job. Furthermore, the slides he produces circulate widely around the Center, provoking comments and questions and making it easy for Ames people to start all of their own presentations with a history of their topic.

Since August 2003, Jack has helped establish, from nothing, a serious history and archive function at Ames. Most important, Jack has validated the importance of corporate memory in every meeting he has attended and in every conversation he has had with those coming to him for advice. Throughout NASA, he has been a very persistent and vocal advocate of the value of the past in planning for the future.

NASA Records Management Training

By Patti Stockman

For the first time ever, NASA is offering records management training on an Agency-wide basis.

Over the past five months, the NASA Records Management program, based in the Office of the Chief Information Officer, has made available 10 online NASA records management training modules to increase employee and contractor awareness of better record preservation methods. These records may, in turn, serve as good source material for historians documenting histories of NASA facilities, people, or programs. In addition, Agency records have reuse value to NASA scientists and engineers who work on new programs.

"Records Management for Everyone" is a required course for all NASA civil servants and optional for NASA contractors. It provides learners with an understanding of what constitutes a record, how to maintain it, and when it can be destroyed or archived, as well as where to go for additional help.

Seven optional training modules cover focused subject areas and teach the following skills:

- Understanding of the difference between records and nonrecords, why records matter, and the records management life-cycle.
- How to organize and file both paper and electronic records and how to create a finding aid that facilitates both easy filing and efficient reference.
- How to locate the online NASA Records Retention Schedule, understand how it is organized, understand its importance in the proper management of records, and use it to identify retention periods for records.
- Familiarity with terms associated with electronic records; basic understanding of relevant records theory and technology, as well as how to manage electronic records.
- How to store (retire) records that are no longer in active use but have not met their full retention period.
- How to retrieve records from storage and to authorize the disposition of records in storage that have met their full retention period.

Stockman believes that two brief training modules that may potentially have significant impact specifically on the preservation of program and project records are those providing overviews of actions to be taken for records at project startup and project closeout.

Recognizing his invaluable contribution to the NASA records management training program, Records Officer Patti Stockman presents National Archives and Records Administration (NARA) Great Lakes Region's Galen Wilson with a framed montage of NASA posters that announced the new records management training. He was the originator of the training modules, collaborated extensively with NASA in their refinement, and conceived promotional posters that use paintings by the masters with added records-related dialogue.

She highly recommends the "Project Startup" course and "Project Closeout" course to project management personnel who will be involved with organizing for project startup. Project personnel will learn how to prepare on the front end of a project for the systematic management of project records in order to facilitate easy record retrievability and disposition throughout the project. Personnel will learn, at a high level, how to determine which project records to save and which to destroy, how to protect selected records for potential use by future projects, and how to ensure that the project's existence and products are appropriately documented.

Other Aerospace History News

News from the National Air and Space Museum

On 14 June 2008, NASM opened its newest exhibition: "Space: A Journey to Our Future." Roger Launius, Margaret Weitekamp, and Jennifer Levasseur of the NASM Division of Space History led a broad effort to bring this traveling exhibition to NASM, where it will remain open until 11 January 2008. "Space: A Journey to Our Future" highlights past projects in space exploration—satellites, space telescopes, living in space—and provides a glimpse of the possibilities for future human space travel. The most advanced interactive displays and state-of-the-art projection and audio technology are used to bring the story to life. Highlights of the exhibition include a lunar habitat where visitors can experience what it might be like to live on the Moon; an up-close look at NASA's Constellation Program and a model of the Orion capsule, the spacecraft that will take human explorers back to the Moon; an illustrated timeline of NASA's 50 years of space exploration; and the 360-degree, multimedia "Future Theatre." "Space: A Journey to Our Future" is a traveling exhibit developed by Evergreen Exhibitions and presented at NASM courtesy of NASA on its 50th anniversary, General Motors, and Lockheed Martin, with additional support from ATK.

Roger Launius has published two articles in *Acta Astronautica* this year. "Underlying Assumptions of Human Spaceflight in the United States," *Acta Astronautica* 62 (March–April 2008): 341–356 suggests that Americans embraced human space exploration because of its potential for extending human dominion into space and for the promise of colonization and expansion, although that has usually been at best a subtext for the effort. When thinking about those human activities over the long term, moreover, it raises important and difficult questions about the evolution and survival of the species. "Space Stations for the United States: An Idea Whose Time Has Come—And Gone?" *Acta Astronautica* 62 (May–June 2008): 539–555 traces the evolution of the space station concept from its first expression in 1869 through the realization of the International Space Station (ISS) at the end of the 20th century. But even as the ISS became a reality, its role was made tenuous by the loss of the Space Shuttle *Columbia* on 1 February 2003 and by the grounding of the fleet. On 14 January 2004, moreover, President George W. Bush announced a reorientation of NASA's programs to emphasize a return to the Moon and a human expedition to Mars. In that context, he advocated the retirement of the Space Shuttle by 2010 and the ending of U.S. involvement in the ISS before 2020. Suddenly, the space station had become irrelevant to American efforts in space. The history of space stations and their development over time, and what it portends for the future of space policy, is the subject of this essay.

Roger Launius also organized and moderated a set of panel discussions, "Herman (Potočnik) Noordung's Work and Ideas" and "Possible Futures of Space Travel" at the Embassy of Slovenia, Washington, DC, 27 March 2008. Among those participating in this seminar was Michael J. Neufeld, Chair of Space History Division, who spoke on the probable influence of Noordung on von Braun's space station concepts.

Roger Launius and David DeVorkin were named as Goldfarb Visiting Fellows at Colby College, Waterville, Maine, during its Celebration of Research event,

28 April–2 May 2008. David DeVorkin has also been named the Smithsonian Distinguished Research Lecturer for 2008.

Michael Neufeld has won a Secretary's Research Prize at the Smithsonian Institution for *Von Braun: Dreamer of Space, Engineer of War* (2007). In addition, he recently published an article derived from the book: "Von Braun and the Lunar-Orbit Rendezvous Decision: Finding a Way to Go to the Moon," *Acta Astronautica* 63 (2008): 540–550.

Thomas Lassman is the new curator for rocketry after 1945 in the Division of Space History at the National Air and Space Museum, where he has succeeded the recently retired Frank Winter. (Michael Neufeld is curating all rocket artifacts up to 1945). He joined the division on 9 June after spending three years working on the Defense Acquisition History Project at the U.S. Army Center of Military History. He has a Ph.D. from the Johns Hopkins University in the history of science and technology and recently completed a monograph, *Sources of Weapon Systems Innovation in the Department of Defense: The Role of In-House Research and Development, 1945–2000,* which will be published this year. Dr. Lassman is currently outlining a new writing project on the history of weapons research and development in the U.S. Army's primary manufacturing arsenals from 1945 to 1962.

Ted Maxwell, the Associate Director for Collections and Research, has announced that he is stepping down and, with the NASM Director's blessing, returning to the Center for Earth and Planetary Studies (CEPS) at NASM as a Senior Scientist. By training, he is a geologist and planetary scientist. Peter Jakab, historian, longtime curator of early flight artifacts in the Aeronautics Division, and past chairman of that division, will assume the post, which is now the Associate Director for Collections and Curatorial Affairs. Five divisions report to him, as to Ted: Aeronautics, Space History, CEPS, Archives, and Collections. Peter intends to keep his early flight collection while simultaneously holding his new post.

Other Aerospace History Information Online

Stanford University Department of Aeronautics and Astronautics 50th Anniversary

In the months following the shock of Sputnik in October 1957, Stanford University established an independent department of aeronautics and astronautics. From 8 to 10 May 2008, the Stanford Aero/Astro department celebrated its anniversary with a series of tours and talks by eminent alumni, and NASA was well represented. Several speakers remarked that Aero/Astro was the first interdisciplinary department at Stanford and that this interdisciplinary mission focus remains a key part of the department's culture.

For more information on the Stanford University Department of Aeronautics and Astronautics, please visit *http://soe.stanford.edu/aeroastro50/index.html.*

Calls for Papers

Society for History in the Federal Government Online Journal

The Society seeks papers for its new, online, peer-reviewed history journal to be published in the fall of 2008. The journal will promote scholarship on all aspects of the history and workings of the federal government and of the developmental relationships between American society and the U.S. military or U.S. government from 1776 to the present. In addition, the journal will feature research articles on methodological developments in federal historical work, including the fields of history, archival science, historic preservation, public history, museum studies, Web-based history, memory studies, and other related areas. The manuscript must be fully documented and follow the submission standards posted at our Publications link at *http://www.shfg.org.* Send your manuscript, an abstract, brief biographical information, and information on available images to *editor-shfg-journal@shfg.org.* Deadline now extended to 31 August 2008.

Job Opportunity

Post-Doctoral Historian (Position 2008204): NASA Ames Research Center, Mountain View, California

An immediate postdoctoral opportunity is available in the History Office of the NASA Ames Research Center. The postdoc will support the NASA Ames Senior Advisor for History and the Ames Historian in the preparation of a history of Ames since 1958.

Minimum qualification is a Ph.D. in the history of recent technology or science. Because of the breadth of research done at Ames, historical expertise may be in such fields as aeronautics, astronautics, materials, space science, life sciences, or information technology. Experience with archival research in government records, oral history, and scholarly methods of citation is required. A record of peer-reviewed publications is preferred.

The position is based at the NASA Ames Research Center in Silicon Valley. The incumbent also is expected to spend time at the National Archives facility in San Bruno, California. The position is available now, and the appointment is for 12 months. Basic applications must be completed at *http://edassoc.arc.nasa.gov.* Curricula vitae may be sent by e-mail to *eaprogram@mail.arc.nasa.gov.* Please note "history postdoc" in the subject line for such submissions. For more information about the position, please contact Glen Bugos at *glenn.e.bugos@nasa.gov.*

Upcoming Meetings

25–27 September 2008, "John F. Kennedy: History, Memory, and Legacy: An Interdisciplinary Conference" will be held at the University of North Dakota in Grand Forks, North Dakota. President Kennedy's special counsel, adviser, and speechwriter, Theodore Sorenson, will be one of the keynote speakers for the conference. Please visit *http://www.und.edu/instruct/jfkconference/* for more information.

11–14 October 2008, The Society for the History of Technology (SHOT) will be hosting "SHOT @ 50: Looking Beyond" in Lisbon, Portugal. Please visit *http://www.shotlisbon2008.com/* for more information.

28–29 October 2008, "NASA's First 50 Years: A Historical Perspective" will be held in the NASA Headquarters Auditorium in Washington, DC. For more on this conference, see the article that appears earlier in this newsletter or visit *http://history.nasa.gov/50thannnasaconf/index.html.*

13–15 November 2008, "Aeronautical Culture: Artifacts, Imagination, and the Practice of Aeronautics, 18th–20th Century," organized by the Centre d'histoire des techniques et de l'environment (CDHTE/CNAM) and the Centre Alexandre Koyré—Centre de recherches en histoire des sciences et techniques (CAK-CRHST/CNRS), with the participation of the Aéro-Club de France, the Département d'histoire de l'armement (DGA/CHEAr), and the Musée de l'air et de l'espace, and supported by numerous institutions, will be held in Paris. Please see *http://www.shotnews.net/?p=419* for more information.

15–21 November 2008, "The 20th Anniversary of the Annual Supercomputing Conference," hosted by the Association of Computer Machinery and the Institute of Electrical and Electronics Engineers, will take place in Austin, Texas. The Twentieth Anniversary Initiative Committee is planning a number of activities to highlight the evolution of the conference, high-performance computing (HPC), and related fields. Please direct questions, comments, and suggestions to *20thanniversary@info.supercomputing.org* or visit *http://sc08.supercomputing.org/* for more information.

Obituaries

Dr. Robert C. Seamans, Jr., 89

Dr. Robert C. Seamans, Jr., former NASA Deputy Administrator and Secretary of the Air Force, died on 28 June 2008 of heart failure in his home in Beverly Farms, Massachusetts.

Dr. Seamans had a long history with NASA and its predecessor organization: from 1948 to 1958, he served on the technical committees for the National Advisory Committee for Aeronautics; in 1960, Dr. Seamans joined NASA as Associate Administrator, and in 1965, he became Deputy Administrator while retaining many of the duties of the Associate Administrator and also serving as Acting Administrator. Working closely with the Kennedy administration, he worked toward achieving the

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Obituaries (continued)

goal of a human lunar landing by the end of the decade and was instrumental in deciding, against many objections, to send Apollo 8 to the Moon.

Born on 30 October 1918 in Salem, Massachusetts, Dr. Seamans earned his bachelor's of science from Harvard University and his master's and doctorate in instrumentation from the Massachusetts Institute of Technology (MIT). In the 1940s and 1950s, Dr. Seamans served as a professor and researcher in the field of aeronautics at MIT.

After his initial time at MIT, Dr. Seamans joined the Radio Corporation of America (RCA) in 1955, and in 1958, he became Chief Engineer of the Missile Electronics and Controls Division in Burlington, Massachusetts. While with NACA and NASA, he also served as a consultant to the Scientific Advisory Board of the United States Air Force from 1957 to 1959, as a member of the Board from 1959 to 1962, and as an Associate Advisor from 1962 to 1967. He was also a National Delegate, Advisory Group for Aerospace Research and Development, North Atlantic Treaty Organization (NATO) from 1966 to 1969.

Dr. Seamans remained a consultant to NASA after his retirement in 1968 and became a visiting professor at MIT. He served as Secretary of the Air Force from 1969 to 1973 and was named as administrator of the Energy, Research and Development Administration by President Carter in 1974. In 1977, Dr. Seamans returned once again to MIT to become dean of its School of Engineering and continued to teach freshman seminars even after his retirement in 1984.

His memoir, *Aiming at Targets*, was published by the NASA History Division in 1996.

Dr. Seamans is survived by his wife, Eugenia; his 3 sons, Joseph, Robert III, and Daniel; his 2 daughters, Katharine and May; 12 grandchildren; and 2 great-grandchildren.

To learn more about Dr. Robert C. Seamans, Jr., please visit *http://history.nasa.gov/Biographies/seamans.html*. From this link, you can also access the HTML version of his memoir, *Aiming at Targets* (NASA SP-4106, 1996), and his monograph on the Apollo program, *Project Apollo: The Tough Decisions* (NASA SP-2005-4537).

To sign Dr. Seamans's online guestbook, please visit *http://www.legacy.com/bostonglobe/GB/GuestbookView.aspx?PersonId=112538627*.

Dr. Ernst Stuhlinger, 94

Dr. Ernst Stuhlinger, one of the last surviving members of the 126 German rocket scientists brought over to the United States after World War II, died on 25 May 2008 at his home in Huntsville, Alabama, of "complications of old age," according to Robert Petroff, his friend and neighbor.

Born on 19 December 1913 in Niederrimbach, Germany, Dr. Stuhlinger earned his Ph.D. in physics at the age of 23 and began to work for the German Atomic Energy Program in 1939. He became a member of Wernher von Braun's team working on guidance systems in 1943 in Peenemünde. After World War II, Dr. Stuhlinger immigrated to the United States as part of Operation Paperclip and became a naturalized U.S. citizen on 14 April 1955.

In the 1950s, Stuhlinger developed designs for solar-powered spacecraft at Redstone Arsenal in Alabama. Later, Stuhlinger served as director of the space science lab at NASA's Marshall Space Flight Center in Huntsville from 1960 to 1968, and then as the associate director from 1968 to 1975. Retiring in 1975, Dr. Stuhlinger became an adjunct professor and senior research scientist at the University of Alabama in Huntsville.

Dr. Stuhlinger was one of the key inventors of ion propulsion, a common technology that has recently been implemented by the American and Russian space programs in order to conserve fuel and extend the life of spacecraft. In the 1970s, the Space Electric Rocket Test (SERT) was the first mission to use this technology, and in 1998, NASA's Deep Space 1 spacecraft depended on ion propulsion for its missions. As far back as 1970, Dr. Stuhlinger and von Braun were convinced that ion propulsion would be a key part of interplanetary exploration.

Dr. Stuhlinger is survived by his wife, two sons, and a daughter.

Mr. Harry Lange, 77

Harry Lange, former illustrator for NASA and cinematic art director, died on 22 May 2008.

During his time at NASA, Mr. Lange worked closely with Wernher von Braun's team as section head of the future projects staff of illustrators working on interplanetary and deep space projects. He was later commissioned to illustrate several books on space travel, including von Braun's *History of Rocketry and Space Travel.*

Mr. Lange was born on 7 December 1930 in Eisenach, Germany. He planned to pursue studies in classical archaeology. The end of World War II and the subsequent annexation of his hometown as part of the Russian Occupied Zone (East Germany), however, made it difficult for him to pursue his archaeological ambitions. Leaving East Germany in 1949, Mr. Lange studied art in Hamburg and Munich and, upon graduation, took a job as an advertising designer in New York City. Later, working for Craig Air Force Base and the Army Ballistic Missile Agency, Mr. Lange prepared a number of air and space illustrations.

After Mr. Lange left NASA, Arthur C. Clarke introduced him to Stanley Kubrick, who chose him as an art director for *2001: A Space Odyssey* because of his experiences at NASA. His work on the film earned him the British Academy Award and an Oscar nomination.

After working on several other films, including three *Star Wars* films (1977, 1980, 1983); *Moonraker* (1979); and the last Monty Python film, *The Meaning of Life* (1983), Mr. Lange pursued his original ambitions and became a staff member of the University of Arizona's expedition to design and supervise the construction of the Mirobriga Room in a Portuguese archaeological museum.

Mr. Lange is survived by his wife Daisy and his two sons.

For more information on Harry Lange and his artwork, please visit *http://www.harry-lange.org.uk/index.html*.

Images in Space History

On 27 June 2008, NASA Chief Historian Steven J. Dick, Chief Archivist Jane Odom, and Johnson Space Center History Coordinator Rebecca Wright visited with Dr. Eilene Galloway, who served as Special Consultant to the Senate Special Committee on Space and Astronautics in 1958 and partook in the legislative process that produced the National Aeronautics and Space Act of 1958.

Dr. Eilene Galloway (left) with NASA Chief Historian Steven J. Dick (right).

Dr. Eilene Galloway (center) with NASA Chief Archivist Jane Odom (left) and Johnson Space Center History Coordinator Rebecca Wright (right).

During 25–29 June 2008 and 2–6 July 2008, NASA, along with the country of Bhutan and the state of Texas, played an integral part in the Smithsonian Institution's annual Folklife Festival on the National Mall. Representatives from Headquarters and every Center shared their knowledge and experiences with the curious crowd.

Goddard Space Flight Center Chief Scientist Dr. Jim Garvin (left), National Air and Space Museum Curator Dr. Roger Launius (center), and NASA Chief Historian Dr. Steve Dick (right) discuss NASA's rich history and the exciting future of human and robotic exploration. (Source: NASA/Ed Goldstein)

Alison Kilpatrick conducts exciting scientific experiments during her presentation on "Mad Science." (Source: NASA/Ed Goldstein)

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Images in Space History (continued)

A beautiful view of the length of the Smithsonian's Folklife Festival on the National Mall.
(Source: NASA/Bill Ingalls)

NASA Chief Historian Steven J. Dick speaks during a panel entitled "Why We Explore."
(Source: NASA/Ed Goldstein)

The Prince of Bhutan looks on while NASA Deputy Administrator Shana Dale delivers her speech introducing the NASA program of the Folklife Festival during the opening ceremony on 25 June 2008. (Source: NASA/Bill Ingalls)

The Prince of Bhutan test-drives one of the winning Great Moonbuggy Race entries. (Source: NASA/Ed Goldstein)

continued on next page

Images in Space History (continued)

NASA Aeronautics representatives (from left to right) David Nils Larson, James Ross, and Jim Sokolik discuss the Next Generation Air Transportation System (NGATS), with a special "appearance" by NASA's High Altitude Pressure Suit. (Source: NASA/Ed Goldstein)

Festival-goers learn about the differences and similarities between Space Shuttle main engines and the J-2 engines that will be used to propel the Ares rockets to the Moon. (Source: NASA/Bill Ingalls)

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We also welcome comments about the content and format of this newsletter. Please send comments to Steve Garber, newsletter editor, at *stephen.j.garber@nasa.gov*.

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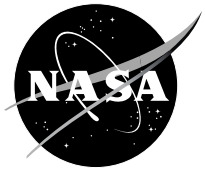

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