News & Notes

National Aeronautics and Space Administration

NASA HISTORY PROGRAM OFFICE
Office of Communications

Volume 29, Number 4

Fourth Quarter 2012

From the Chief Historian

Welcome to our annual thematic issue of the National Aeronautics and Space Administration's (NASA's) *News & Notes*. For 2012, our end-of-the-year issue is focused on planetary exploration. Fifty years ago this fall, the first successful planetary mission, Mariner 2, was under way. There were earlier efforts to send a robotic probe to a body beyond the Earth-Moon system. The Soviets made two attempts to reach Mars as early as the fall of 1960, although those efforts were largely unknown at the time. But Mariner 2's three-and-a-half-month journey and flyby of Venus were closely followed by the world. Its confirmation that Venus was uninhabitable by life as we know it radically changed the view of our nearest neighbors in the solar system. Our robotic partners in exploration have continued to challenge our assumptions and theories about the universe ever since.

Our annual history symposium this year was dedicated to examining this legacy and considering where it might lead us in the future. "Solar System Exploration @ 50" was cosponsored by the National Air and Space Museum, the NASA Science Mission Directorate, and the Jet Propulsion Laboratory and brought together scientists, engineers, managers, and historians at the Lockheed Martin Global Vision Center in nearby Crystal City for two fascinating days of discussions in late October. You'll see a full report in our next newsletter, and we'll be working on an edited volume of the papers that were presented. If you want more than that, follow the links at our Web site to find an archive of the symposium Webcast.

continued on next page

50 Years of Planetary Exploration

This newsletter features a special theme celebrating 50 years of planetary exploration at NASA. The following articles focus on how each NASA Center has contributed to this legacy.

Glenn Research Center (GRC)

By Bob Arrighi, Glenn History Office/Wyle Information Systems, LLC

The several hundred Lewis Research Center (now NASA Glenn) employees gathered in the cafeteria were just settling down after remotely watching the first Titan-Centaur (TC-1) lift off into the blue Florida sky when a voice on the public address system announced that the range safety officer had destroyed the launch vehicle 12 and a half minutes into the flight. The Pratt & Whitney RL-10 engines on Lewis's second-stage Centaur rocket had failed to ignite. The room became silent. The failed proof flight destroyed Lewis researcher Robert Lovell's Space Plasma High Voltage Interaction Experiment (SPHINX) and raised serious concerns with NASA management and researchers at the Jet Propulsion Laboratory (JPL) about the new launch vehicle. They were relying on Titan-Centaur to launch six major interplanetary missions within the next three and a half years, including the $1 billion Viking orbiters and landers.

At the time, Lewis was responsible for all of NASA's intermediate and large payload launches on expendable launch vehicles, including all missions to other planets. NASA's involvement with launch vehicles began in October 1962 with the acquisition of the Centaur Program. General Dynamics designed Centaur to be used with an Atlas booster to send the Surveyor

continued on next page

In This Issue:

From the Chief Historian (continued)

In the meantime, I hope you will join me in saying thanks to everyone who made the symposium a great success.

Godspeed,

William P. Barry
Chief Historian

---

50 Years of Planetary Exploration (continued)

spacecraft to the Moon in the mid-1960s to examine sites for the Apollo landings. Marshall managed Centaur initially, but the program was transferred to Lewis following the failure of its first attempted launch in May 1962. Centaur was the first space vehicle to use liquid hydrogen, and Lewis research in the 1950s had demonstrated liquid hydrogen's applicability to rockets. The Center was also currently correcting combustion instability in the RL-10 engines and resolving key issues regarding the pumping and handling of the cryogenic fluid.

Lewis's extensive work on Centaur in the early 1960s resolved issues with the pumping, electronics, shroud, and propellant storage systems. The massive effort paid off on 30 May 1966 with the launch of Surveyor 1. Three days later, Surveyor became the first U.S. spacecraft to land on another celestial body. Centaur rockets sent six additional Surveyors to the Moon over the next year and a half.

Lewis also acquired the Agena second-stage rocket program in late 1962. There were 28 Agena missions over the next six years, including Rangers 6 and 7 (1964–65); five Lunar Orbiter missions (1966–67); Mariner 4 (1964), which was the first successful flyby of Mars and produced the first photography of a planet from space; and the Mariner 5 (1967) flyby of Venus. The Agena missions were phased out as Centaur became available after its Surveyor assignments.

Lewis created its Launch Vehicle Division in 1969 to oversee the numerous launches planned for the coming years. The division was responsible for addressing all Atlas-Centaur problems, integrating the payload into the launch vehicle, establishing the correct flight trajectories, and preparing the vehicle for launch. The staff worked closely with the Kennedy Space Center launch operations, the exploration engineers at several NASA Centers, and eventually commercial and military organizations. The payload weight on nearly every mission increased during the spacecraft's development. The increases strained Centaur's capabilities, but subsequent negotiations brought the weight within range. Lewis was also responsible for testing the new shroud designs that were required for larger payloads.

Atlas-Centaur's initial interplanetary missions included the Mariner 6 and 7 (1969) flybys of Mars; Mariner 9 (1971) to Mars, which was the first spacecraft to orbit another planet; and Pioneer 10 (1972), which was the first spacecraft to visit Jupiter and the first to exit the solar system.

Meanwhile, Lewis worked with General Dynamics to update Centaur with a new computer system and an equipment module to attach the new electronics. In 1973, this new Centaur D-1A sent Pioneer 11 by Jupiter before it exited the solar system and launched Mariner 10, which was the first spacecraft to use the gravitation pull of a planet (Venus) to reach another (Mercury).

NASA planned even more complex missions for the mid-1970s that would require an even larger booster than the Atlas. The Air Force's three-stage Titan 3E was selected, and General Dynamics altered the Centaur D-1A to serve as the Titan's fourth stage. The most significant modification was the use of an entirely new shroud, which was wider than both the Centaur and Titan. This Centaur Standard Shroud underwent aerodynamic tests in the 8-by-6-foot Supersonic Wind Tunnel and full-scale separation and pressurization testing at Plum Brook Station.

There was tremendous disappointment following the loss of the first Titan-Centaur in 11 February 1974. Investigators determined that Centaur's liquid-oxygen boost pumps had failed to start. The boost pumps drew the oxidizer and propellant from their tanks to the engines. The NASA and General Dynamics engineers concluded that the issue was not unique to the Titan-Centaur and could have occurred on any of the previous Atlas-Centaur missions. All of the critical interface issues between Titan and Centaur had been demonstrated, so no additional test flight was required.

Tensions were relieved eight months later with Titan-Centaur's successful launch of the German spacecraft Helios 1, which made the closest pass to the Sun to date. The twin Viking launches were less than a year away, however. There was an additional layer of stress added by the requirement to launch both vehicles within 10 days of one another from the same pad. Lewis and Kennedy engineers prepared one vehicle for flight then removed it from the pad, then prepared the other vehicle with its payload. Once the first was launched, then the second vehicle was brought back, revalidated, and launched. It was a massive undertaking in a limited amount of time. The first Viking was launched on 20 August 1975. A delay with the second Viking spacecraft, however, pushed back its launch date until 9 September 1970. The Titan, Centaur, and Centaur Standard Shroud performed perfectly on both launches. The orbiters and landers arrived on Mars in July and September 1976, respectively. Although a fire severely damaged the launch pad during the second launch, there was relief that this had not occurred after the first.

The pad was quickly rebuilt, and Titan-Centaur sent Helios 2 toward the Sun in January 1976. Preparations for the two Voyager launches in August 1977 then began in earnest. Like Viking, these were to be launched from the same pad within 10 days. Voyager 1 departed Earth's atmosphere on 20 August 1977, and the launch team was able to get Voyager 2 up in 16 days. The Voyagers investigated Jupiter, Saturn (Voyager 2 also studied Uranus and Neptune), and 48 of their moons before leaving the solar system. In 1998, Voyager 1 surpassed Pioneer 10 as the farthest spacecraft from the solar system. Atlas-Centaurs launched Pioneers 12 and 13 toward Venus in 1978. The launches brought Centaur's whirlwind decade of inter-planetary planetary missions to a close.

continued on next page

50 Years of Planetary Exploration (continued)

Centaur maintained a busy schedule launching satellites in the 1970s and 1980s, but NASA had difficulty funding interplanetary missions. In the 1990s, NASA began partnering with the European Space Agency for new planetary spacecraft. The first, the Solar Heliospheric Observatory (SOHO), was launched on an Atlas-Centaur in December 1995 to conduct in-depth studies of the Sun. The Cassini-Huygens launch on 15 October 1997 was one of the Centaur Program's largest and most significant missions. The Cassini orbiter and Huygens probe arrived at Saturn in 2004. Huygens landed on Saturn's largest moon, Titan, in 2005 and became the first spacecraft to land on an object in the outer solar system.

The Cassini launch brought an end to Glenn's management of NASA's interplanetary launches. NASA decided to consolidate Lewis/Glenn's and Goddard's launch vehicle programs with Kennedy's. During its 35 years in the business, Lewis/Glenn managed the launches of 17 interplanetary missions, 14 lunar vehicles, and scores of satellites.

Viking 2 (above) is launched on a Titan-Centaur on 9 September 1975. Viking 1 was launched on 20 August 1975, and both spacecraft reached Mars the following summer. (NASA/JPL).

Ames Research Center (ARC)

Preview of *Working on Mars: Voyages of Scientific Discovery with the Mars Exploration Rovers*

By William J. Clancey, NASA Ames Research Center and the Florida Institute for Human and Machine Cognition

The Massachusetts Institute of Technology Press, published 31 August 2012, hardcover with 24 color plates and 25 black-and-white illustrations

Excerpt from the Preface

The success of the Mars Exploration Rover (MER) missions begins to answer a question fundamental to space exploration: can people remotely conduct field science on another planet using a mobile, programmable laboratory? By virtue of its longevity—over eight years at this writing—and its complexity of organization and daily process, MER provides a wonderful and, in many ways, an unanticipated example for understanding and designing future planetary science missions. Through MER, a stable, sustainable enterprise has been developed and proven for reliably controlling two rovers with highly collaborative scientific and engineering teams. During these years, Spirit and Opportunity were driven a total of more than 40 kilometers (25 miles) and took hundreds of thousands of photographs with tens of thousands of Alpha Particle X-ray Spectrometer readings, Mini-Thermal Emission Spectrometer surveys, and microimages of more than 100 abraded surfaces.

We have come a long way from our first forays with robotic field science in the lunar Surveyor missions of the 1960s and joysticking Lunokhod 2 23 miles across the Moon. MER is not the first investigation on a nonterrestrial surface, the first to use a programmed laboratory with multiple instruments and cameras, or the first to demonstrate programmed mobility. But it is the first to combine these capabilities and thus make field science on Mars possible, and it did so in a multiyear mission. The story of MER is the story of a unique human-robotic enterprise, with new scientific and engineering collaborations, and a prolonged journey together on a largely unknown planetary surface.

In this book, I suggest that we view MER as an "exploration system" for doing field science. With this framing, I ask, what aspects of the design of the rover and how it is operated account for the quality of the scientists' work? In explicating the daily process of commanding the rover and comparing it to other missions, we find a variety of themes—"being the rover," methodical planning, personal and public concerns, aesthetic interests—that together reveal how the scientists actually manipulated the rover and why the programmable tools and analytic instruments worked so well for them. These complementary aspects are easily missed when we focus independently on the science team, the rover's design, science operations, or the scientific results.

The MER exploration system constitutes a blended scientific practice: *exploring scientifically*, engaging in *field and laboratory* work by interweaving *human and robotic* operations, using a textbook method (being *systematic*) yet stopping to

continued on next page

investigate interesting features (being *opportunistic*), and probing the landscape in a *kinesthetic, imagined experience.* Each part of these, such as using laboratory instruments in the field, poses a tension in the work; combined, they make this remote expedition an especially intriguing accomplishment.

Explicating the story of MER requires explaining the nature of field science on Earth (including, for example, undersea archaeology using submersibles and teleoperated robots), the nature of exploration as a cognitive activity (as opposed to a social-political motive or period of history), and the factual differences of other surface missions (Viking, Surveyor, Sojourner, etc.) and orbital/flyby missions (e.g., Cassini). Focusing on what the scientists are doing on Mars, I investigate questions such as "What is the relation of science and exploration?" and "How was controlling Viking's instruments different?" The answers reveal critical aspects of the MER exploration system that contributed to the expedition's success, and these are lessons we can build on for exploring the rest of the Red Planet, asteroids, and the moons of the gas giants that lie beyond.

A key purpose of this book is to reveal, by plain speaking about what people are accomplishing with MER as conveyed through their personal experiences, that the practical relation of people and robotic systems is quite different than is typically implied in discussions about "robot explorers" or "partners" and the poetic description of MER as a "robotic geologist." These inspirational descriptions have a place, but we must understand this new technology and articulate how it has worked so well if we are to know how to use and improve it. Understanding MER requires a theoretical foundation that includes the concepts of virtual presence and agency, an understanding that requires parting the curtain to see what lies behind tales of "Spirit's struggles" and "Opportunity's discoveries." In addition to journalists, computer scientists and program managers can benefit, too: the rovers are tools, but the relation of the scientists to a programmable laboratory is far more complex than how a geologist relates to a hammer or, for that matter, how a principal investigator relates to a "payload" (the aerospace engineering name for a spacecraft instrument). This book combines perspectives from computer science, anthropology, philosophy, and cognitive science to build on the scientists' stories, yielding a better understanding of why the rovers worked so well and the lessons for designing future missions.

NASA Headquarters

Historical Reference Collection (HRC)

By Jane H. Odom and Colin A. Fries

In keeping with the theme of this newsletter issue, the archivists want to point potential researchers to the "Spaceflight—Satellites and Probes" series in the HRC, which consists of 130 cubic feet of material from 1945 to the present. About half of this material documents dozens of missions pertaining to lunar and interplanetary flight (and exploration). Visitors will find a growing collection of files on the following missions: Cassini, Galileo, Lunar Orbiter, Magellan, Mars Observer, Mars Pathfinder, Mariner, Pioneer, Ranger, Surveyor, Viking, and Voyager, just to name a few. Within the files are materials on pre- and postlaunch activities, press kits (also available at *https://mira.hq.nasa.gov/history*, and many of them are also on our iTunes U site), canceled missions, extended missions, and costs, among others. These materials are arranged alphabetically by name of probe and therein are filed chronologically. Also available in the HRC are Lunar and Planetary Missions Board Official Minutes, 1967–70; Viking Cost Estimates, 1970–74; and Viking Project Monthly Financial Reports, 1969–77.

We have archival sources used for many of the books on planetary exploration published in the history series, including *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume V, Exploring the Cosmos,* NASA SP-4407, 2001, edited by John Logsdon; *William H. Pickering: America's Deep Space Pioneer,* NASA SP-2008-4113, 2008, by Douglas J. Mudgway; *On Mars: Exploration of the Red Planet, 1958–1978,* NASA SP-4212, 1984, by Edward Clinton Ezell and Linda Neuman Ezell; *Mission to Jupiter: A History of the Galileo Project,* NASA SP-2007-4231, 2007, by Michael Meltzer; *When Biospheres Collide: A History of NASA's Planetary Protection Programs,* NASA SP-2011-4234, 2011, by Michael Meltzer; *Humans to Mars: Fifty Years of Mission Planning, 1950–2000,* Monographs in Aerospace History, No. 21, NASA SP-2001-4521, 2001, by David S. F. Portree; and *Deep Space Chronicle: A Chronology of Deep Space and Planetary Probes 1958–2000,* Monographs in Aerospace History, No. 24, NASA SP-2002-4524, 2002, by Asif A. Siddiqi.

And lastly, the History Program Office is fortunate enough to house 1 of the 12 Voyager gold records originally manufactured. Two are in space: one on Voyager 1, the other on Voyager 2. Both missions were launched in 1977 and are now on their way out of the solar system into interstellar space.

Jet Propulsion Laboratory (JPL)

A Retrospective on Mariner 1962, the First Successful Planetary Mission

By Erik M. Conway

This year marks the 50th anniversary of the first successful planetary mission, JPL's Mariner 1962, also known as Mariner 2. Launched on 27 August 1962, Mariner 2 was a derivative of JPL's lunar impact spacecraft design, Ranger. Its twin, Mariner 1, was destroyed in a launch vehicle failure shortly before main stage separation.

The origins of the Mariners lay in the unavailability of the Centaur upper stage, for which JPL had devised a very different, heavier interplanetary vehicle called Mariner A. Centaur had been promised for planetary launches in late 1962, but by mid-1961, Centaur development was still immersed in serious technical problems. This threatened to make a Venus mission planned for late 1962 using the Mariner A impossible.

A JPL engineer named John Small organized a small design study to come up with a way to carry out a Venus mission using the Agena upper stage instead of Centaur. His group had proposed using the much lighter Ranger spacecraft instead. The Ranger, which used the already-flying Agena upper stage, could not carry much payload to Venus; in fact, JPL had to get Lockheed, the Agena's manufacturer,

continued on next page

to lighten the Agena by about 100 pounds (45 kilograms) so that this “Mariner R” spacecraft would have a payload at all. NASA’s Planetary Program Director, Oran Nicks, approved of the switch to the Mariner R mission in September 1961.

Mariner R differed from Ranger in its adoption of several pieces and subsystems from the canceled Mariner A effort. The high-gain antenna came from Mariner A, as did larger solar panels and the electronics packaging methodology. Mariner R also debuted JPL’s first use of louvers on some of the electronics boxes as a means of thermal control.

Jack N. James, the Mariner R project manager, had been in charge of JPL’s launch operations at Cape Canaveral for the Explorer effort. He hired Daniel Schneiderman to be his spacecraft manager. The two planned to build three complete sets of spacecraft parts, two of which would be tested and prepared for launch. They ultimately decided to assemble and test all three, beginning what became a standard process at JPL for most of the next two decades: a “proof test model” that was identical to the flight spacecraft would be assembled and subjected to both design-level tests and environmental testing, while the “flight model” spacecraft would receive only the environmental testing.

The Mariner R schedule required the three spacecraft to be shipped to Florida for launch in May 1962, a little more than nine months from the start of the project. The design was frozen in January. The project was carried out under a “matrix” style of management, with a small project office led by James, set up independently of JPL’s technical divisions, providing leadership and project administration while the technical divisions did most of the engineering work. That too became JPL’s standard practice for spacecraft projects.

The three spacecraft went to the Atlantic Missile Range in May, and James’s crew made the first launch attempt one day late, on 22 July 1962. In his memoir, he expressed his disappointment at the launch vehicle’s destruction: “This had happened to me on the Sergeant, and I could not believe it was happening again.”

The Atlas had begun “fishtailing” after launch, a product of two interacting errors, and the Range Safety Officer blew it up. The second launch attempt had been scheduled for 21 days later, and that one nearly failed too. Mariner 2’s Atlas suffered a gyroscope failure, causing it to spin at 1 revolution per second. James called these “barrel rolls” and remembered 36 of them occurring before the gyroscope starting working again (the final report says 35). The Agena successfully corrected a velocity error resulting from the barrel rolls, and the rest of the injection onto the Venus trajectory and release of the spacecraft occurred properly.

Mariner 2’s flight to Venus was as eventful as its launch. The Earth sensor that provided attitude knowledge produced a signal that was too weak; at first the project engineers thought that it had locked onto the Moon but eventually realized that it had the right celestial body after all. It just was not producing the right signal level. The thermal predictions were also very low. Near Earth, the spacecraft ran up to 40°F hotter than expected. Near Venus, the exceedances were up to 70°F. (Beginning another longstanding JPL tradition, they had sufficient margin built in to survive even those errors). The midcourse correction appeared to occur perfectly but in fact had a large execution error (10 sigma, they calculated—they never did figure out why). One of the two solar panels shorted out on Halloween, somehow fixed itself a week later, and then failed again 14 November. Fortunately, by the time it failed again, Mariner 2 was close enough to Venus (and the Sun) that the lone solar panel could power all the instruments, so the mission scientists got all their data.

The Venus flyby occurred on 14 December, giving the United States its “first first” in the space race. And it got JPL’s Director, William Pickering, the honor of serving as Grand Marshall of the 1963 Rose Parade, for which JPL built a colorful float. Mariner 2 was also JPL’s first successful mission since 1959; the Ranger project continued to fail until 1964.

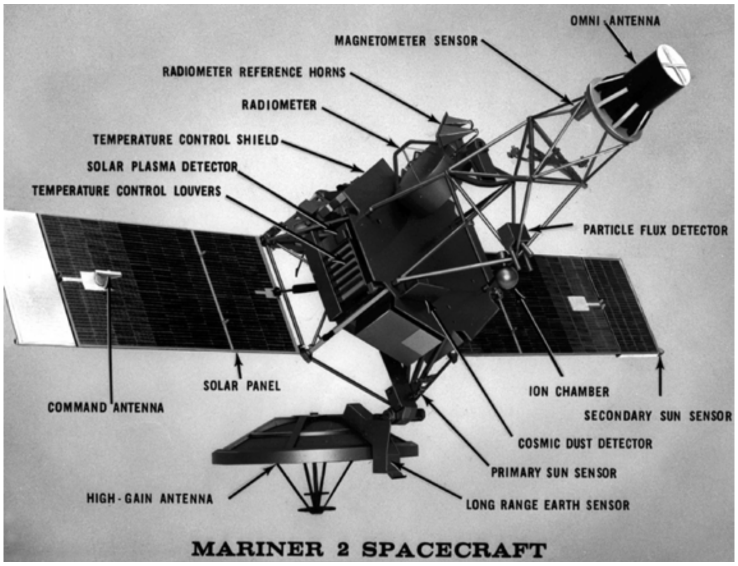
Mariner 2’s scientific results confirmed that Venus had a far hotter surface than most scientists expected. It had been possible to believe in a living, and livable, Venus in 1962, but not after Mariner 2’s short visit. The vehicle’s microwave radiometer reported a surface temperature of about 400 K, or 260°F. Later research would put the temperature even higher, well above what any known Earthlike life would tolerate.

After the Venus flyby, Jack James’s team began preparing a smaller, Agena-sized version of Mariner A. It was first called Mariner C and later renamed Mariner 4. This spacecraft flew past Mars in 1965, returning the first up-close images of the Red Planet and cementing JPL’s status as NASA’s leading planetary Center for the rest of the decade. It also solidified James’s reputation as JPL’s leading project manager of the era, the standard for others to emulate.

JPL’s 1963 Rose Parade float moving down Colorado Boulevard.

continued on next page

50 Years of Planetary Exploration (continued)



The Mariner 2 spacecraft. Note that the solar arrays are not the same size. The panel on the right side of the image is longer than that of the left; the white tip on the left panel was a cloth extension designed to even out the solar wind pressure on the spacecraft.

Mariner 2 under construction.

Presenting one of the first images of Mars, from the Mariner 4 flyby in 1965. From left, JPL Director William Pickering, Oran Nicks, Jack James, President Lyndon Johnson, and NASA Administrator James Webb.

Langley Research Center (LaRC)

By Dr. Joel S. Levine, Research Professor, Department of Applied Science, College of William and Mary

The Viking Project

In 1976, the United States had four active spacecraft (two orbiters and two landers) simultaneously operating in orbit and on the surface of Mars—all resulting from the twin Viking launches. Viking 1 was launched on 20 August 1975 and went into Mars orbit on 19 June 1976. The Viking 1 Lander soft-landed on the surface of Mars on 20 July 1976 in the Chryse Planitia (later renamed the Thomas Mutch Memorial Station in memory of the Brown University professor of planetary science and head of the Viking Surface Imaging Team). The Viking 1 Orbiter operated until 17 August 1980 (4 years, 1 month, 19 days, 1,485 orbits), and the Viking 1 Lander operated until 13 November 1982 (6 years, 3 months, 22 days). Viking 2 was launched on 9 September 1975 and went into Mars orbit on 7 August 1976. The Viking 2 Lander soft-landed on the surface of Mars on 3 September 1976 in Utopia Planitia (later renamed the Gerald Soffen Memorial Station in memory of the Viking Project Scientist at the NASA Langley Research Center). The Viking 2 Orbiter operated until 25 July 1978 (1 year, 11 months, 18 days, 706 orbits) and the Viking 2 Lander operated until 11 April 1980 (3 years, 7 months, 8 days).

The scientific objectives of the Viking Mission included 1) obtaining high-resolution images of Mars from the surface and from orbit, 2) characterizing the structure and composition of the atmosphere and surface of Mars, and 3) searching for evidence of life on Mars.

The Viking Orbiters carried cameras for photographing the surface of Mars from orbit, a radiometer for the thermal mapping of the surface to determine surface temperature, an infrared spectrometer to measure atmospheric water vapor, and a radio science experiment to investigate the atmosphere and ionosphere of Mars. During entry and descent through the atmosphere of Mars, a magnetic sector mass spectrometer and a retarding potential analyzer on the Viking aeroshell obtained in situ measurements of the chemical composition, temperature, pressure, and density of the atmosphere and ionosphere as a function of altitude. The Viking Landers carried cameras for surface photography; three instruments to search for biology on the surface of Mars (the three biology measurements were based on photosynthetic analysis, metabolic analysis, and respiration), conduct chemical analysis of the Mars soil and atmosphere using a gas chromatograph–mass spectrometer (GCMS), and perform elemental analysis of the Mars soil using an x-ray fluorescence spectrometer; a weather station to measure the weather on Mars (temperature, atmospheric pressure, and wind speed and direction); and instruments to measure the physical, magnetic, and seismic characteristics of Mars.

Some of the important scientific discoveries of Viking include 1) the first in situ measurements of the vertical distribution of atmospheric density, pressure, and temperature on Mars; 2) the first in situ measurements of the chemical composition of the atmosphere; 3) the discovery of nitrogen in the atmosphere; 4) the first evidence, based on the first nitrogen isotope measurements, that Mars lost the bulk of its atmosphere, which explains the geological evidence of past liquid water on Mars; 5) the discovery of the highly chemically reactive nature of the Mars surface; and 6) the lack of detection of organic material on the surface of Mars, which has been attributed to the highly chemically reactive nature of the Mars surface.

The Viking Landers successfully accomplished the first soft landings on Mars. On 5 August 2012, at 10:32 p.m. PDT, when the Mars Science Laboratory (MSL) Curiosity successfully soft-landed in the Gale Crater on the surface of Mars, the entry, descent, and landing (EDL) technology developed for the first two successful Mars soft landings by the Viking Landers in 1976 was clearly in evidence. The Viking technology employed in the MSL EDL included 1) the Viking-derived disk-gap band supersonic parachute, 2) the Viking-derived aeroshell, and 3) the Viking-derived throttleable hydrazine propulsion system for controlled descent and landing for a precision guided entry through the atmosphere.

The Viking Project was managed at the NASA Langley Research Center. LaRC also had responsibility for the development and management of the Viking Landers and the entry and lander science and instrumentation. The Viking Orbiters were designed and built by the Jet Propulsion Laboratory. JPL also has responsibility for the orbiter science and instrumentation. The Viking Lander capsules were developed and built by Martin Marietta. Lewis Research Center (now the Glenn Research Center) managed the Viking launch vehicle, a two-stage Titan III with two additional solid-propellant rockets (solid rocket motors, or SRMs) attached with a Centaur upper stage. The NASA Kennedy Space Center was responsible for the launch of Vikings 1 and 2.

Marshall Space Flight Center (MSFC)

By Mike Wright

Juno II Served as Explorer Satellite Launcher

Before solar system exploration began in earnest in the United States, America had to develop and launch its own satellites and spacecraft.

The Soviet Union opened the space race with America on 4 October 1957 when the Soviets orbited their Sputnik satellite. As a result, America's leadership quickly realized that the Soviets had beaten the United States into space and, among other responses, directed the U.S. Army in Huntsville to modify an existing 1,500-mile-range Jupiter missile and use it to launch a satellite. As later described by Wernher von Braun (who later served as Director of the Marshall Space Flight Center from 1960 through 1970), the configuration for the satellite and the launch vehicle was designed simply by adding a single solid rocket motor as a fourth stage, then attaching a scientific payload provided at its forward end.

Launched from Florida on 31 January 1958, the rocket lifted the Explorer 1 satellite into space, an event celebrated ever since as the first major milestone in the U.S. space program. The 18-pound satellite discovered the first of the natural radiation belts of Earth, identified by Dr. James A. Van Allen of Iowa State University.

Space experts referred to Explorer's modified launch vehicle as Jupiter C or Juno I. The Explorer 1 launch in January brought success. Unfortunately, Explorer 2 failed to orbit on 5 March 1958 because the last stage failed to ignite. However, on 26 March, a Juno I rocket successfully launched Explorer 3, which yielded more data about the Van Allen radiation belt and on micrometeorite impacts and temperatures. Other Explorer launches using the Jupiter C came on 26 July (the successful Explorer 4) and on 24 August (the unsuccessful Explorer 5). The Explorer 5 mission failed when it did not achieve orbit because of a collision between parts of the booster and instrument compartment.

Development of the Juno II variant began in the spring of 1958 under the Army in Huntsville. After NASA was created on 1 October 1958, the Army conducted the satellite launchings on behalf of the new space agency. On 1 July 1960, NASA created the George C. Marshall Space Flight Center in Huntsville, which involved transferring about 4,000 Army personnel in Huntsville to NASA. As a result, NASA moved its responsibility for Juno II to Marshall.

Unfortunately, other events during the late 1950s and early 1960s have obscured historical interest in Juno II. For example, the significance of Explorer 1 has often overshadowed any focus on the satellite launchings that later depended on Juno II. In addition, historical interest in Marshall's role in the Mercury Redstone program and in the Saturn moon rocket program has clouded interest in the Center's work regarding Juno II.

"One Juno II innovation was a shroud covering the upper-stage cluster assembly. This shroud was necessary to protect the payload and upper stages from aerodynamic heating during ascent," von Braun wrote, adding, "Although the Juno II was not an optimum vehicle, it provided a quick and economical way to launch a payload over three times as heavy as that lifted by its Redstone predecessor, the Juno I. And like many other things in this early era of space achievements, it was available for minimum expenditure of time and money."[1] Writing in the journal *Technology and Culture* in 1963, von Braun traced the history of the Juno II satellite program.

He noted, for example, that Pioneer III, launched by a Juno II on 6 December 1958, attained a 24,000-mile-per-hour velocity and discovered 24 radiation belts around Earth. Also on 3 March 1959, a Juno II launched Pioneer IV, the first U.S. satellite to orbit the Sun.

To end Juno II's space adventures, it launched the Explorer 7, 8, and 9 satellites carrying more sophisticated space science experiments and weighing about 90 pounds on 13 October 1959, 3 November 1960, and 27 April 1961. Explorer 7 provided significant data on magnetic fields, magnetic storms, solar flare activity, and radiation belts; Explorer 8 carried eight experiments and transmitted information on electron density and temperature, positive-ion mass and density, and micrometeorite distribution; and Explorer 9 returned valuable data on gamma rays.

---

1. Wernher von Braun, "The Redstone, Jupiter, and Juno," *Technology and Culture* 4, no. 4 (autumn 1963): 462–463.

50 Years of Planetary Exploration (continued)

Juno III–V

The successes of Junos I and II were projected to generate several other Juno configurations at Redstone Arsenal in the 1956–58 period. While the Juno III and Juno IV concepts never reached the hardware stage, the design and study of Juno V led directly to the giant Saturn.

Juno III studies began in 1956. These considered a vehicle based on the standard Jupiter booster, with a 500- to 600-pound orbital payload capability. The upper stages were to consist of solid rockets somewhat larger than the scaled Sergeants of the earlier Junos, and the second-stage cluster would have had 12 motors instead of 11. However, the heavier cluster presented design problems, so the proposal was abandoned and the Juno series of rockets gave way to the well-known Saturn series.

News from Headquarters and the Centers

Headquarters

History Program Office

By Bill Barry

What a busy fall for all of us in the History Program Office at Headquarters. Like this issue of the newsletter, much of our focus recently has been on planetary exploration, but we've also been busy with many other things. Of course, the big event for the fall was our annual history symposium, "Solar System Exploration @ 50." (As I write this, the symposium is still a couple of weeks away, so expect a full report in the next newsletter.) Preparation for the symposium has been a significant team effort on the part of our cosponsors (the National Air and Space Museum, the Science Mission Directorate, and the Jet Propulsion Laboratory) and the history staff at Headquarters. As usual, we've depended heavily on Nadine Andreassen to make the seemingly impossible happen. We've also had some great support from our fall interns, Kelly Victor-French and Marshall Bennett. (You may remember from their introduction in the last newsletter that they are both graduate students at Georgetown and will be with us through the end of November.)

Speaking of interns, I should mention that the final parting gift from summer interns Jessica Brodsky and Joey Meyer was an item they produced themselves for our iTunes U site. If you haven't seen their dozen-minute video, "Making NASA History," you should make the time to do so. (Start at *http://go.nasa.gov/ROuL7D.*) The video aims to give middle school kids an introduction to NACA/NASA history, but most adults have enjoyed it too. During the summer, Jessica and Joey loaded a lot of other content on our new iTunes U site, including tons of material on the Apollo program. This was in particularly high demand following the death of Neil Armstrong this past August. Given the effectiveness of using iTunes U as a supplemental source of history material, our fall intern Kelly Victor-French has been uploading material about historic planetary missions in advance of the fall symposium.

Also in the science theme this fall, we had our third History Program Quarterly Brownbag Lunch speaker of the year in early October. This time, we were joined by the legendary Nancy Grace Roman for a discussion of the origins of astronomy research at NASA. She was both very informative and witty, keeping the capacity crowd of fans (including Associate Administrator John Grunsfeld) enthralled with her tales of a time before bureaucratic rigidity set in at NASA. We filmed the presentation and hope to have it available soon for you to view online.

On the publications front, Bob Arrighi's Propulsion Systems Laboratory monograph came back from the printer in late August and has been a significant success. An e-book version of the book is now available (*http://www.nasa.gov/connect/ebooks/pursuit_power_detail.html*). I was particularly pleased that our Headquarters colleagues responsible for printing managed to find some funding that allowed us to put the second volume of the Shuttle bibliography into print. (We had originally been expecting that this might only be available as a PDF online.) Also due out before you get this newsletter is the set of oral histories done with NASA leadership in 2008 (to mark the 50th anniversary of NASA). *NASA at 50: Interviews with NASA's Senior Leadership* was edited by Rebecca Wright, Sandra Johnson (both of Johnson Space Center), and Steve Dick (our former Chief Historian). The book provides a valuable snapshot of NASA in a time of transition. The next major publication in line for production is *NASA's First A*, by Rob Ferguson. This is an overview of the first five decades of aeronautics research at NASA. It should be in print this winter.

One of the secrets of our success in getting all of these publications into your hands is Yvette Smith. Since starting her yearlong detail with us in August, Yvette's editorial skills have proven invaluable in pushing a number of manuscripts to completion. Her Web savvy has also proven invaluable as we have provided more content to the NASA Web team. If you haven't visited *http://www.nasa.gov/history* lately, you might want to take a look at how Yvette has transformed that page into a news site for both NASA generally and the History Program Office. As you will read below, our archival teammates have also been incredibly productive this fall. I continue to be awed by the talent and commitment of the history team here at Headquarters and across the Agency. We have some great history to make ahead of us.

Historical Reference Collection

By Jane H. Odom and Colin A. Fries

In the Headquarters archives, the staff continues to stay busy with reference services and processing projects. During the last quarter, we hosted an average of a dozen people per month who came in person to the History Program Office to conduct research. We had research visits by NASA staff as well as visitors from the National Air and Space Museum, the National Research Council, the Naval Research Laboratory, George Washington University, American University, the

News from Headquarters and the Centers (continued)

University of Maryland, Carnegie Mellon University, the University of Oklahoma, Brown University, Texas A&M, the Massachusetts Institute of Technology, and the University of British Columbia.

A number of archive projects either are under way or have been completed recently that researchers will find of interest. The processing (arrangement, description, and preservation) of a large audiovisual collection, circa 1960–2011, is complete. The collection includes over 45 cubic feet of material in numerous formats.

Of the 300-plus audio reel-to-reel recordings identified in this recently processed collection, 15 more have been selected for digitization, bringing to nearly 90 the total that have been converted to WAV and MP3 formats. The latest batch to be digitized includes interviews, speeches, press conferences, and testimony, dated 1960–73, of Headquarters and Center officials (Homer Newell, Thomas Paine, James Fletcher, Arnold Frutkin, George Low, and Wernher von Braun), astronauts (Alan Shepard and Pete Conrad), and life sciences experts (Clark Randt, Orr Reynolds, and Sherman Vinograd).

The review of boxes on loan from the Federal Records Center continues unabated, with material recently being added to the HRC from boxes containing Lunar Roving Vehicle documentation, 1969–72. Additionally, an effort has begun to capture born-digital press kits for NASA missions. These will be uploaded to our internal database and will also be made available externally for research use at *https://mira.hq.nasa.gov/history/.*

More than 1,500 archivists attended the Society of American Archivists Annual Meeting in August in San Diego. Participants had more than six dozen sessions, numerous networking opportunities, and a dozen local repository tours and open houses from which to choose. Pictured above in the exhibit hall are, left to right, Tracy Grimm, Archivist for Flight and Space Exploration at Purdue University; Jane Odom, Chief Archivist at NASA Headquarters; and April Gage, Archivist, and Ratana Ngaotheppitak, Life Science Data Archivist, both from Ames Research Center.

Ames Research Center (ARC)

By Glenn Bugos

Jack Boyd and Hans Mark joined Ed Hoffman of the NASA Academy of Program/Project & Engineering Leadership (APPEL) for a Masters with Masters interview on 13 August. They reviewed lessons learned over their decades of leadership in America's aerospace efforts and offered advice for those looking to become leaders within NASA. Video of the discussion is on the NASA APPEL Web site (*http://www.nasa.gov/offices/oce/appel/knowledge/multimedia/index.html*).

Jack Boyd and Glenn Bugos presented a paper at "AIAA Space 2012" in Pasadena entitled "Mars Exploration: Contributions of NASA Ames Research Center." They reviewed the role of Ames in the ecosystem of NASA planetary exploration and focused on the Ames legacy of achievement in entry systems, Mars atmospheric science, exobiology and astrobiology, telepresence and robotic science operations, and mineralogy and in situ resource utilization. Glenn Bugos completed a redraft of *Atmosphere of Freedom* to publish it as a pictorial history and highlight the Center's rich legacy of visual imagery.

In other history news from around the Center, economic historian Alex Macdonald presented his work on the long Space Age with a space history panel at the U.S. House of Representatives on 15 June (*http://www.c-spanvideo.org/program/306613-1*). Stephanie Langhoff, reflecting on her legacy as Ames Chief Scientist, compiled a history of the Director's Colloquia at Ames since 1999 and a history of the H. Julian Allen Award for the most groundbreaking research paper. The staff of Code TS reviewed and documented the 3.5-foot hypersonic wind tunnel, anticipating its planned demolition. Historian Megan Prelinger returned to research the history of Moffett Field's interaction with San Francisco Bay, to prepare an exhibit for a new exhibition at the Exploratorium on an atlas of the Bay.

Bill Clancey, chief scientist in the Ames human-centered computing division, published an important new book, *Working on Mars: Voyages of Scientific Discovery with the Mars Exploration Rovers* (MIT Press). Clancey explores how the missions of the Mars Exploration Rovers (MERs) combined the functional perspective of engineering with a social and psychological perspective so that humans, machines, and the environment interacted to make possible the first overland geological expedition on another planet. This work was funded in part by the NASA Science Mission Directorate as part of the History of the Scientific Exploration of Earth and Space (HSEES) research grants that were administered in conjunction with the NASA History Program.

April Gage overhauled a facilities tour brochure, which has proven very useful in introducing the many Ames partners to the diverse capabilities of our Center (*http://historicproperties.arc.nasa.gov/tour_arc_rschfacility/tour_arc_rschfacility.html*). She also processed and rehoused 36 scrapbooks in our collection. Published in the Ames *Astrogram* is an article April wrote on test pilot George Cooper receiving the medal of the Legion of Honor of France at the French consulate.

Jack Doran joined us as an intern from the San Jose State University School of Library and Information Science. Jack will process photographs and digitize documents on the Planetary Atmosphere Experiments Test (PAET), a precursor to all the planetary probe missions from which NASA learned much about the structure of the atmospheres of Venus, Mars, Jupiter, and Titan.

As a gift to the NASA Langley Research Center on the 95th anniversary of its founding, and recognizing Langley's role in the birthing of NASA Ames, our History Office presented to the Langley history office a finding aid for the Langley records at the National Archives facility in Philadelphia. We digitized the extant finding aids and overhauled them to the current archival standard (called DACS), reformatted a container list, wrote the introductory material, supplemented it with five other finding aids, and marked it up in Encoded Archival Description. It is now available, alongside the records of Ames, at the Online Archive of California (*http://www.oac.cdlib.org/findaid/ark:/13030/c8st7njm/*). We hope that other finding aids from the National Advisory Committee for Aeronautics (NACA) years of other NASA Centers might also be digitized, posted online, and available to researchers in time to mark the 100th anniversary of the NACA.

Dryden Flight Research Center (DFRC)

By Christian Gelzer

Peter Merlin was asked to attend the annual Society of Experimental Test Pilots gathering and staff a table to provide copies of *Breaking the Mishap Chain* to those in attendance. One of the other authors, flight surgeon Dwight Holland, will also be on hand.

Pete just wrapped up his most recent manuscript, *A New Twist in Flight Research: The F-18 Active Aeroelastic Wing Project*, which will be going to peer review shortly. From his introduction: "In the early part of the 21st century, advances in materials and adaptive control technologies allowed aeronautical researchers to revisit the wing warping control technique pioneered by the Wright brothers, and take a small step toward development of wings with a bird-like ability to change shape for optimized efficiency. This new concept, called Active Aeroelastic Wing or AAW, is a synergistic technology that integrates air vehicle aerodynamics, active controls, and structures to maximize aircraft performance. The concept turns aeroelastic flexibility—once a liability—into a net benefit."

Curtis Peebles was the driving force behind the idea of naming minor planets, sometimes called asteroids, after the X-15 pilots. Dryden's petition to the International Astronomical Union (IAU) was accepted in February of 2012, and we issued the first citation publicly to Joe Engle on 2 August, when he came to Dryden in conjunction with a talk he gave at the Center. We have issued a citation to Bill Dana and are in the process of doing so to family members of the other pilots. The IAU citations, which are in sequence, are similar to Engle's: "Air Force test pilot Joe Engle (b. 1932) was the eighth pilot to fly the X-15 and made a total of 16 flights. He received Air Force astronaut wings for a flight that took him to

85[,]500 meters. Engle also flew the Space Shuttle, becoming the only person who reached space before being selected as an astronaut."

On a sad note, the funding for Curtis's position has been lost; consequently, as of 30 September, he completed his work with the history program.

Christian Gelzer finished his two Shuttle-related books, but they have both slipped into peer-review limbo. He has been working on two other projects, however, so his disappointment was brief. Both flight projects involve new technology seed money and university student interns, and he plans on making both projects into publications. And he, like everyone else in his office, spent the better part of three days escorting and accommodating media of various kinds before, during, and after Endeavour's visit en route to the California Science Center.

Susan Edwards finished cataloging her father's (John Edwards's) material. She came by recently to drop off the material, which now occupies 2.5 shelves of a Lektriever. The collection is cataloged, if not yet loaded electronically into our database. April Gage, at Ames, has been key to this, and we are indebted to her as well as Susan, whose generosity of gift and time we now benefit from.

Johnson Space Center (JSC)

By Rebecca Wright

The NASA Commercial Orbital Transportation Services (COTS) began operating in 2006, working with two industry partners that have developed and demonstrated their capability to serve the U.S. government. Housed at Johnson Space Center (JSC), the small COTS workforce has supported the efforts with the private sector while building a methodology and model for future partnerships. The JSC History Office will be working with the COTS group to "tell the story" of their brief history. This project will include lessons learned, details of the model, challenges encountered, and processes developed to ensure smooth and productive partnerships.

Joining the History Office staff to serve as the lead on this effort is Rebecca Hackler, who is a native Houstonian who grew up in the backyard of NASA's Johnson Space Center. After graduating summa cum laude with a B.A. in history from Texas Lutheran University, she pursued her diverse interests by teaching English at an elementary school in Spain and completing her M.A. in Central and Eastern European history at the Jagiellonian University in Poland. Most recently, Rebecca completed her M.S. in museum studies at the University of Glasgow in Scotland, where she also volunteered for Glasgow Museums and taught ballet classes at Dance Glasgow.

For several years, Rebecca worked as a researcher with the NASA JSC History Office, supporting multiple oral history projects by researching interviewees, editing and indexing transcripts, operating recording equipment, and converting obsolete media to digital files. Other highlights from her experience include her work on *The First 50 Years*, a pictorial history of JSC, and the *Goosebumps: The Science of Fear* exhibit for Space Center Houston.

In 2011, Rebecca was honored with the Universities Space Research Association Student of Year Award for her work with the JSC History Collection, where she processed the archival collection of astronaut Robert A. R. Parker and organized an exhibit on early Space Shuttle design that was featured at the "Celebrating Shuttle: An American Icon" event at the University of Houston–Clear Lake.

This joint project between the JSC History Office and the COTS office will be ongoing during FY 2013.

Stennis Space Center (SSC)

By Katie Wallace

The Mars Science Laboratory's successful landing on Mars early on 6 August was a huge engineering accomplishment! Years of research, planning, collaboration, and dedication came down to 7 minutes. Seven minutes determined success or failure. The successful landing and immediate operation of Curiosity compares to earning Olympic gold.

As an engineer and an educator, I was excited to hear that a key theme to the Curiosity landing was STEM (science, technology, engineering, and mathematics) education. Everyone on the Curiosity team discussed the importance of science and technology to our country and the world's future. Recent studies cite the need for STEM education to be a national priority. Indicators show the United States is losing its technological edge. Indicators include 1) math and science middle school test scores that rank in the lower half among industrialized countries, 2) declining enrollment in engineering and technical science majors, and 3) decreased funding for research in physical sciences.[1]

NASA is in a unique position to excite and inspire students about STEM education and to help grow our technical workforce. The Stennis Office of Education has focused on that goal through specific STEM activities, including teacher professional development and student engagement. Studies show that an effective way to reach students is to provide training for teachers who will share knowledge with hundreds of students per year. At Stennis, we provide free, credit-bearing workshops to teachers across Mississippi and Louisiana. We are collaborating with Louisiana to provide STEM instruction for their Math Science Partnership. Over the past three summers, just in the months of June and July, we have reached 848 preservice and inservice teachers. This fiscal year, we have reached 706 teachers and over 8,000 students and parents. Our workshops have a satisfaction rating of 99 percent.

In addition, we focus on student activities that enrich the school curriculum. We completed 24 years of Astro Camp this summer and changed the curriculum to include a science lab and other larger-scale activities. This year, 476 students, ages 7–15, participated in weeklong sessions. We included military families by hosting a camp at Keesler Air Force Base.

---

1. *Rising Above the Gathering Storm* (Washington, DC: National Academies Press, 2007).

We also reached students through the Summer of Innovation initiative requested by NASA Administrator Charles Bolden to offer summer enrichment activities to underserved and underrepresented students. Stennis partnered with the 4-H Club, the Boys and Girls Clubs of America, and robotics teams to offer STEM camps. Programs were held in 28 Mississippi counties, reaching 650 students. There also were special programs at Columbus and Keesler Air Force bases. Summer activities ended with a surprise visit from former astronaut and NASA Associate Administrator for Education Leland Melvin, who spoke to 4-H campers about living and working in space.

It has been a busy and successful summer for the Stennis Office of Education. As we continue to inspire the next generation, we hope one of those students may be the next engineer or Mars rover designer. Without everyone's support and engagement, the office could not be successful. To learn more about Stennis and NASA education, visit *http://education.ssc.nasa.gov*.

Summer Astro Campers launch Estes Rockets they constructed during a weeklong camp at Stennis Space Center.

Other Aerospace History News

National Air and Space Museum (NASM)

By Roger Launius

In fall 2012, Palgrave Macmillan will publish *Exploring the Solar System: The History and Science of Planetary Exploration.* From the beginning of the Space Age, the United States and the Soviet Union, followed soon by other nations, began an impressive effort to learn about the planets of the solar system. The data collected and analyzed by scientists revolutionized our understanding of our neighbors. These efforts also captured the imagination of people from all backgrounds like nothing else except the Apollo lunar missions. As a result, the cause of planetary exploration had little difficulty in capturing and holding widespread public support. The significance of this project is twofold: 1) it will capture in one place a set of broad studies of the history of robotic solar system exploration, and 2) it will open opportunities for greater involvement of social scientists, historians, and scientific and technical academics in considering a topic that has not attracted them heretofore. There is no question but that the greatest share of historical work has been on human spaceflight, and that story is very much in the public consciousness. This book is intended to be a work that will provide important insights about themes that might be productively explored by others in the future and an opportunity to energize scholars to pursue this important topic. The chapters are listed below:

Introduction, Roger D. Launius, Smithsonian Institution

Part I: Managing Planetary Science

1. “Homer Newell and the Origins of Planetary Science in the United States,” John D. Ruley, Modesto, California

2. “The Survival Crisis of the U.S. Solar System Exploration Program in the 1980s,” John M. Logsdon, George Washington University

3. “Faster, Better, Cheaper: A Sociotechnical Perspective on Programmatic Choice, Success, and Failure in NASA’s Solar System Exploration Program,” Amy Paige Kaminski, Virginia Polytechnic Institute and State University

Part II: Developing New Approaches to Planetary Exploration

4. “Redefining Celestial Mechanics in the Space Age: Astronomy, Astrodynamics, Deep-Space Navigation, and the Pursuit of Accuracy,” Andrew J. Butrica, Washington, DC

5. “Big Science in Space: Viking, Cassini, and the Hubble Space Telescope,” W. Henry Lambright, Syracuse University

6. “Visual Imagery in Solar System Exploration,” Peter J. Westwick, University of Southern California

7. “Returning Scientific Data to Earth: The Parallel but Unequal Careers of Genesis and Stardust and the Problem of Sample Return to Earth,” Roger D. Launius, Smithsonian Institution

Part III: Exploring the Terrestrial Planets

8. “Planetary Science and the ‘Discovery’ of Global Warming,” Erik M. Conway, Jet Propulsion Laboratory

9. “Exploring Planet Earth: The Development of Satellite Remote Sensing for Earth Science,” Andrew K. Johnston, Smithsonian Institution

10. “Venus-Earth-Mars: Comparative Climatology and the Search for Life in the Solar System,” Roger D. Launius, Smithsonian Institution

11. “Missions to Mars: Reimagining the Red Planet in the Age of Spaceflight,” Robert Markley, University of Illinois

Part IV: Unveiling the Outer Solar System

12. “Parachuting onto Another World: The European Space Agency’s Huygens Mission to Titan,” Arturo Russo, University of Palermo, Italy

13. “Pluto: The Problem Planet and Its Scientists,” David H. DeVorkin, Smithsonian Institution

14. “Transcendence and Meaning in Solar System Exploration,” William E. Burrows, New York University

Recent Publications and Online Resources

NASA Publications

Celebrating 30 Years of the Space Shuttle Program, designed by Adam Chen and edited by William Wallack and George Gonzalez (NASA NP-2012-01-838-83). This book includes details and color photographs about each mission from STS-1 to STS-135. Available in print through the Government Printing Office Bookstore (*http://bookstore.gpo.gov/actions/GetPublication.do?stocknumber=033-000-01355-8*) or download as a PDF at *http://www.nasa.gov/connect/ebooks/shuttle_retrospect_detail.html.*

Dressing for Altitude: U.S. Aviation Pressure Suits—Wiley Post to Space Shuttle, by Dennis R. Jenkins (NASA SP-2011-595). This e-book discusses the development and details in the pressure suits worn during the Space Shuttle Program. Available online in various e-book formats for download at *http://www.nasa.gov/connect/ebooks/dress_for_altitude_detail.html.*

On 28 June 2012, the Headquarters History Lunchtime Quarterly Speakers Program featured Professor Harry Lambright giving a talk called "The Politics of Mars: Robotic Exploration from Mariner to MSL." His presentation is available online at *http://history.nasa.gov/Politics%20of%20Mars.pdf*.

The NASA History Program Office iTunes U site contains free multimedia downloads for important moments, activities, and figures in NASA history. New items include Voyager, Mariner, and Viking materials. Search for "NASA History Program Office" in iTunes or use the following link: *http://go.nasa.gov/ROuL7D.*

NASA Publications Reprinted by Dover Publications

Suddenly, Tomorrow Came: The NASA History of the Johnson Space Center, by Henry C. Dethloff (Dover Publications, September 2012). This illustrated volume traces the Johnson Space Center's history, starting with its origins at the beginning of the space race in the late 1950s. Thrilling, authoritative accounts explain the development and achievements of the early space voyages; the lunar landing; the Mercury, Gemini, and Apollo programs; and the Space Shuttles and International Space Station. Reprint of NASA's 1993 edition.

Commercially Published Works

Compiled by Chris Gamble

Emigrating Beyond Earth: Human Adaptation and Space Colonization, by Cameron M. Smith and Evan T. Davies (Springer-Praxis, June 2012). Humankind has been actively expanding geographically and in doing so has adapted to a wide variety of hostile environments. Now we are looking toward the ultimate adaptation—the colonization of space. Based on the most current understanding of our universe, human adaptation, and evolution, the authors explain why space colonization must be planned as an adaptation to, rather than the conquest of, space. The authors argue that space colonization is an insurance policy for our species and that it isn't about rockets and robots but instead about humans doing what we've been doing for four million years: finding new places and new ways to live.

X-planes of Europe: Secret Research Aircraft from the Golden Age 1947–1967, by Tony Buttler and Jean-Louis Delezenne (Hikoki Publications, May 2012). Although much has been written about the legendary American "X-planes" of this era, far less is known about many of the secret and exotic research aircraft designed and built in Europe. Now, these once highly classified aircraft are brought together in detail for the first time. With many unpublished photographs, previously classified drawings, and detailed appendices, the stories of these remarkable aircraft combine to produce an in-depth record that gives these rare and exotic flying machines their proper place in aviation and military history.

Rocketing Into the Future: The History and Technology of Rocket Planes, by Michel van Pelt (Springer-Praxis, May 2012). *Rocketing Into the Future* journeys into the exciting world of rocket planes, examining the exotic concepts and actual flying vehicles that have been devised over the last 100 years. The book then looks at the possibilities for the future. The technological and economic challenges of the Space Shuttle were a major handicap, and thus the program was unable to fulfill its promise of low-cost access to space. However, the burgeoning market of suborbital space tourism may yet give the necessary boost to the development of a truly reusable space plane.

NASA Space Shuttle Crew Escape Systems Handbook, by United Space Alliance (Periscope Film, LLC, May 2012). Prepared for NASA by contractor United Space Alliance in 2005, this *Space Shuttle Crew Escape System Handbook* details the equipment, systems, and procedures that would have been used in the event of an emergency during launch. Designed for use by astronauts, instructors, and ground personnel, the text describes and explains the crew-worn equipment and orbiter hardware, emergency escape modes, and crew duties and responses during egress.

NASA Space Shuttle Main Engine Design Features, by Rocketdyne Division Rockwell International (Periscope Film, LLC, May 2012). This informative booklet provides an overview of the design, components, and physical characteristics of the Space Shuttle main engines originally created by NASA prime contractor Rockwell International in 1973 during the development of the Space Shuttle main engines.

Saturn IB/Saturn V Rocket Payload Planner's Guide, by Douglas Aircraft (Periscope Film, LLC, June 2012). Originally prepared by the Missile and Space Systems Division of NASA contractor Douglas Aircraft, this book was created to acquaint payload planners with the capabilities of the Saturn IB and Saturn V rockets. It shows methods by which Saturn vehicles can accommodate payloads of various weights and volumes for different missions and methods by which they might be modified to allow even greater performance.

continued on next page

Recent Publications and Online Resources (continued)

History of Rocketry and Astronautics, edited by Marsha Freeman, American Astronautical Society (AAS) History Series, vol. 37, International Academy of Astronautics (IAA) History Symposia, vol. 26 (AAS/Univelt, Inc., 2012). These are the proceedings of the 40th History Symposium of the International Academy of Astronautics, Valencia, Spain, 2006.

Down to Earth: Satellite Technologies, Industries, and Cultures, edited by Lisa Parks and James Schwoch (Rutgers University Press, May 2012). This book presents the first comprehensive overview of the geopolitical maneuvers, financial investments, technological innovations, and ideological struggles that take place behind the scenes of the satellite industry. This collection takes readers on a voyage through a truly global industry, from the sites where satellites are launched to the corporate clean rooms where they are designed, and along the orbits and paths that satellites traverse.

Meta-Geopolitics of Outer Space: An Analysis of Space Power, Security and Governance, by Nayef R. F. Al-Rodhan (Palgrave Macmillan, June 2012). Al-Rodhan sheds new light on the debate about the geopolitics of outer space, going beyond applying traditional international relations approaches to space power and security by introducing a multidimensional spatial framework. The metageopolitics framework includes space and expands classical power considerations to cover seven state capacities.

Artificial Satellites and How to Observe Them, by Richard Schmude, Jr. (Springer, July 2012). The book describes all of the different satellites that can be observed, including communication, scientific, and spy satellites, as well as the International Space Station. Schmude describes how to recognize them and even how to predict their orbits. The book tells how to observe artificial satellites with the unaided eye, with binoculars, and with telescopes. Many images of artificial satellites taken from Earth are included.

Landsat and Its Valuable Role in Satellite Imagery of Earth, edited by Ryan K. McHale (Nova Science Publishers, Inc., September 2012). The U.S. Landsat mission has collected remotely sensed imagery of Earth's surface for more than 35 years. At present, two satellites, Landsat 5 and Landsat 7, are in orbit and continuing to supply images and data for the many users of the information, but they are operating beyond their designed life and may fail at any time. Landsat has been used in a wide variety of applications, including climate research, natural resources management, commercial and municipal land development, public safety, homeland security, and natural disaster management. This book presents information on Landsat and its valuable role in satellite imagery of Earth.

Tragedy and Triumph in Orbit: The Eighties and Early Nineties, by Ben Evans (Springer-Praxis, June 2012). To commemorate the 50th anniversary of Yuri Gagarin's pioneering journey into space, Springer-Praxis is producing a short series of books that reveals how humanity's knowledge of flying, working, and living in space has grown in the last half century. *Tragedy and Triumph in Orbit*, the fourth book in the series, explores the tumultuous events of the 1980s and the beginning of the 1990s, a time when a reinvigorated Cold War between the United States and the Soviet Union bred further distrust and intense competition between the two old foes.

Space Policy in Developing Countries: Security and Development on the Final Frontier, by Robert C. Harding (Routledge, June 2012). This book analyzes the rationale and history of space programs in countries of the developing world. Rather than merely describing the programs and their technical details, the book places these programs within the context of international relations theory and foreign policy analysis.

Robotic Exploration of the Solar System, Part 3: The Modern Era 1997–2009, by Paolo Ulivi and David M. Harland (Springer-Praxis, August 2012). In this book, the authors provide a comprehensive account of the design and management of deep space missions, the spacecraft involved (some flown, others not), their instruments, and their scientific results. This third volume in the series covers launches in the period 1997–2003.

Doing the Impossible: George E. Mueller and the Management of NASA's Human Spaceflight Program, by Arthur L. Slotkin (Springer-Praxis, July 2012). This account describes for the first time how George E. Mueller, the system manager of the human spaceflight program of the 1960s, applied the Department of Defense's system program office (SPO) methodology and other special considerations, resulting in the success of the Apollo program. While Apollo remained Mueller's top priority, from his earliest days at the Agency he promoted a robust post-Apollo program, which culminated in Skylab, the Space Shuttle, and the International Space Station. As a result of these efforts, Mueller earned the sobriquet "the father of the Space Shuttle."

Becoming Spacefarers, by James A. Vedda (Xlibris Corp., June 2012). In this book, the author offers a no-nonsense account of the current doldrums of spaceflight in the United States and how the nation might deal with it. He makes clear that we are in a crisis, that business as usual will not enable us to overcome it, and that it is not sufficient to rest on past successes or to accept the present partisanship and parochialism. In addition to diagnosing the problems, Vedda also offers useful and, in some cases, provocative prescriptions for how Americans might untie the Gordian knot of current approaches to spaceflight.

Commercial Spaceflight: Assessments, Challenges and Trends, edited by Nathaniel J. Clements and Edison G. Hahn (Nova Science Publishers, Inc., June 2012). This book examines the commercial spaceflight industry with a focus on space tourism and commercial space transportation of NASA crews and cargo.

This Is Redstone Missile Weapon System, by Chrysler Corporation Missile Division (Periscope Film, LLC, May 2012). While Redstone's role as a weapon system was brief, it had a major impact on America's early space program. In January of 1958, just four months before the U.S. Army activated the Redstone in Germany, a modified version designated Jupiter-C put Explorer, America's first satellite, into orbit. In 1961, the Mercury-Redstone Launch Vehicle lifted Alan Shepard into space. *This Is Redstone* provides a detailed overview of this historic weapons system, originally

continued on next page

created in 1959 by prime contractor Chrysler Corporation, which built 101 of the 128 missiles produced. It includes chapters about the missile's structure, operation, propulsion and propellant systems, ground support equipment, guidance and controls, firing site operations, and more.

Reaching for the Stars: The Inspiring Story of a Migrant Farmworker Turned Astronaut, by José M. Hernández (Center Street, September 2012). Born into a family of migrant workers, toiling in the fields by the age of six, José M. Hernández dreamed of traveling through the night skies on a rocket ship. This is the inspiring story of how he realized that dream, becoming the first Mexican American astronaut. Turned down by NASA 11 times on his long journey to donning that famous orange spacesuit (on STS-128), Hernández's message of hard work, education, perseverance, and "reaching for the stars" makes this a classic American autobiography.

European Identity through Space: Space Activities and Programmes as a Tool to Reinvigorate the European Identity, edited by Christophe Venet and Blandina Baranes (Springer, August 2012). This publication investigates the effect space activities have already had on building a European "spirit" (e.g., through European missions or European astronauts). The book's intention is to identify creative ways and means for how to further use space for shaping the European identity. For this purpose, the focus is not only on policy analysis but also on expertise from the fields of cultural science and the arts to tap their creative potential and also their theoretical approaches to the topic.

Forever Young: A Life of Adventure in Air and Space, by John W. Young with James R. Hansen (University Press of Florida, September 2012). Enthusiasts of space exploration have long waited for John Young to tell the story of his two Gemini flights, his two Apollo missions, the first-ever Space Shuttle flight, and the first Spacelab mission. This book delivers all that and more: Young's personal journey from engineering graduate to fighter pilot, to test pilot, to astronaut, to high NASA official, to clear-headed predictor of the fate of planet Earth.

Working on Mars: Voyages of Scientific Discovery with the Mars Exploration Rovers, by William J. Clancey (The MIT Press, August 2012). Beginning in 2004, a team of geologists and other planetary scientists did field science in a dark room in Pasadena, exploring Mars from NASA's Jet Propulsion Laboratory (JPL) by means of the remotely operated Mars Exploration Rovers (MERs). Drawing on his extensive observations of scientists in the field and at JPL, Clancey investigates how the design of the rover mission enabled field science on Mars, explaining how the scientists and rover engineers manipulated the vehicle and why the programmable tools and analytic instruments worked so well for them. He shows how the scientists felt not as if they were issuing commands to a machine but rather as if they were working on the Red Planet, riding together in the rover on a voyage of discovery.

The History Program Office gives sincere thanks to volunteer Chris Gamble, who compiles this section for us every quarter. Please note that the descriptions have been derived by Chris from promotional material and do not represent an endorsement by NASA.

Upcoming Meetings

The 127th annual meeting of the American Historical Association will be held **3–6 January 2013** in New Orleans, Louisiana. Please see *http://www.historians.org/annual/2013/index.cfm* for more details.

The 221st meeting for the American Astronomical Society will be held **6–10 January 2013** in Long Beach, California. Please see *http://aas.org/meetings* for more details.

The 51st AIAA Aerospace Science Meeting, including the New Horizons Forum and Aerospace Exposition, will be held **7–10 January 2013** in Grapevine, Texas. Please see *https://www.aiaa.org/asm2013/* for more details.

The midwinter meeting of the American Library Association will be held **25–29 January 2013** in Seattle, Washington. Please see *http://www.ala.org/ala/conferencesevents/upcoming/index.cfm* for more details.

The 19th Annual Space Exploration Educators Conference will take place on **7–9 February 2013** at Space Center Houston in Houston, Texas. Please see *http://www.spacecenter.org/TeachersSEEC.html* for more details.

The 17th Annual International Space University Symposium will be held **5–7 March 2013** in Strasbourg, France. Please see *http://www.isunet.edu/annualsymposium* for more details.

The 44th Lunar and Planetary Science Conference will be held **18–22 March 2013** at The Woodlands, Texas. Please see *http://www.lpi.usra.edu/meetings/lpsc2013/* for more details.

The 51st Robert H. Goddard Memorial Symposium will be held **19–21 March 2013** in Greenbelt, Maryland. Please see *http://www.astronautical.org/goddard* for more details.

The 29th National Space Symposium will be held **8–11 April 2013** in Colorado Springs, Colorado. Please see *http://www.nationalspacesymposium.org/* for more details.

The annual meeting for the Organization of American Historians will be held **11–14 April 2013** in San Francisco, California. Please see *http://annualmeeting.oah.org/* for more details.

The Humans to Mars Summit will be held **6–8 May 2013** in Washington, DC. Please see *http://www.exploremars.org/h2m* for more details.

Image in Aerospace History

The Mars rovers in a family photo: Mars Science Laboratory's Curiosity rover (right), Mars Exploration Rovers (MERs) Spirit and Opportunity (left, only one pictured), and Mars Pathfinder's Sojourner (center). The rovers have increased in size to carry more scientific instrumentation and travel longer distances. (NASA/JPL-Caltech)

The NASA History Program Office, under the Office of Communications, NASA Headquarters, Washington, DC 20546, publishes *News and Notes* quarterly.

To receive *News and Notes* via e-mail, send a message to *history-request@hq.nasa.gov*. In the text portion, simply type "subscribe" without the quotation marks. You will receive confirmation that your account has been added to the list for the newsletter and for receiving other announcements. For more information about our LISTSERV, please see *http://history.nasa.gov/listserv.html* on the Web. We also post the latest issue of this newsletter at *http://history.nasa.gov/nltrc.html* on the Web.

Do you have more questions about NASA history in general? Please check out our NASA History Program Office Home Page at *http://history.nasa.gov* on the Web. For information about doing research in the NASA History Program Office, please e-mail us at *histinfo@hq.nasa.gov* or call 202-358-0384.

The NASA History Program Office is also online on Twitter! Get short, timely messages and stay updated on a wide variety of topics by following @NASAhistory.

We also welcome comments about the content and format of this newsletter. Please send your comments, as well as any changes to your mailing address or requests to stop receiving *News and Notes* in the mail, to Giny Cheong, newsletter editor, at *giny.cheong@nasa.gov.*

NASA Headquarters History Program Office Staff Contact Information:

William Barry, Chief Historian	*bill.barry@nasa.gov* 202-358-0383
Nadine Andreassen, Program Support Specialist	*nadine.j.andreassen@nasa.gov* 202-358-0087
Colin Fries, Archivist	*cfries@mail.hq.nasa.gov* 202-358-0388
Stephen Garber, Historian	*stephen.j.garber@nasa.gov* 202-358-0385
John Hargenrader, Archivist	*jhargenr@mail.hq.nasa.gov* 202-358-0387
Jane Odom, Chief Archivist	*jane.h.odom@nasa.gov* 202-358-0386
Yvette Smith, Editor	*yvette.smith-1@nasa.gov* 202-358-5196
Elizabeth Suckow, Archivist	*elizabeth.suckow-1@nasa.gov* 202-358-0375

Created and produced by the following:
Giny Cheong, Newsletter Editor
Kevin Harris, Editor, NASA Headquarters Communications Support Services Center (CSSC)
Janine Wise, Publication Specialist/Graphic Designer, NASA Headquarters CSSC
Tun Hla, Printing Specialist, NASA Headquarters CSSC
Trenita Williams, Mail Coordinator, NASA Headquarters Mail Room
Carl Paul, Distribution, NASA Headquarters CSSC

National Aeronautics and Space Administration

NASA Headquarters
300 E Street SW
Washington, DC 20546

www.nasa.gov