The Space Congress® Proceedings

2003 (40th) Linking the Past to the Future - A Celebration of Space

May 1st, 1:30 PM - 4:30 PM

Paper Session II-B - 3,2,1...Liftoff: Building a Way Station to Space

Henry C. Dethloff
Professory Emeritus, Texas A&M University

3,2,1...Liftoff:

Building a Way Station to Space

Henry C. Dethloff
Professor Emeritus
Texas A&M University

40th Space Congress
Kennedy Space Center
Cape Canaveral Florida
May 1, 2003

==========

Cape Canaveral is a protrusion of land, sand, salt grass and thickly matted coastal vegetation jutting from the Florida peninsula into the Atlantic Ocean. First encountered by European explorers and identified on maps as early as 1502, the cape became a milepost and way station by which Western civilization came to the New World. Ponce de Leon, who explored the area around Cape Canaveral in 1513, and multitudes of aerospace engineers, scientists, technicians, administrators, businesses, and their associates throughout the old world and the new, through NASA, the National Aeronautics and Space Administration, share a common bond in the continuing exploration of the total human environment. By the close of the millennium Cape Canaveral's John F. Kennedy Space Center had become the base from which the civilizations of Earth were going into space and out to other worlds. Kennedy Space Center's first Director, Dr. Kurt H. Debus, perhaps reflecting on the common heritage of the New World explorers and the Other World explorers engaged in space and planetary exploration, observed that "**Space is not something new. It's part of the total environment, and we've been looking for the total environment ever since we looked out of caves at the stars."**[1]

==========

[1].*Congressional Record*, Extensions of Remarks (October 10, 1972), p. 6.

The Unique Origins of Kennedy Space Center

Cape Canaveral's role as a launch operations center began on July 24, 1950, when an Army rocket team working with General Electric engineers launched a long-range "Bumper" missile. The Bumper was a refined version of a German World War II-era V-2 combined with a second-stage American WAC (Without Any Control) liquid-fueled Corporal rocket. It flew from the Cape southeastward along a flight path that would become the Atlantic Missile Range. That flight derived, in part, because of the juxtaposition some remarkable historic events. The Army rocket team launching the Bumper had been transferred in April, 1950, from the Army's White Sands Proving Grounds in New Mexico to the just-established Ordnance Guided Missile Center at Redstone Arsenal in Huntsville, Alabama. The military commander of the new Missile Center was Major James Hamill. Dr. Wernher von Braun was the technical director of the Center. Kurt H. Debus was von Braun's special assistant.[2] **The three were key elements of a unique past and a remarkable future.**

Only five years earlier, during the closing days of the defeat of Nazi Germany, Major Hamill, working with Colonel H.N. Toftoy under the authority of a Joint Chiefs of Staff directive to "preserve...records, plans, documents, papers, files and scientific, industrial and other information and data belonging to ...German organizations engaged in military research," contacted a group of German scientists behind the crumbling military lines and extended them the option of coming to the United States, or being taken prisoner by Russian Army units rapidly approaching Peenemunde, Germany from the east. Wernher von Braun , who was technical director, with Kurt Debus and another 125 scientists and technicians of the Peenemunde Rocket Center, under very special arrangements identified as "Operation Paperclip," opted to go west to the United States with 300 boxcar loads of materials including plans, manuals, and documents and 100 V-2 rockets in various stages of assembly. Debus later attributed the successful transplantation of the German rocket scientists into the American rocket and space exploration program to Americans' basically friendly and tolerant, inviting attitude towards strangers and foreigners" who might become useful and productive citizens, in contrast to Europeans who tend to run a "'closed shop' and resent newcomers as unwelcome competitors for what they believe to be limited resources and crowded living space." [3]

In the midst of the rocket team's relocation to Huntsville, Alabama, on June 25, 1950, the United States entered the war against North Korea, adding new urgency to the Army's program to develop an arsenal of guided missiles. The Berlin Wall, Communist expansion throughout eastern Europe, the Balkans, and China; the Soviet explosion of an atomic warhead, and now the Korean War threatened the security of the United States and its western allies. The Cold War intensified. Intermediate and intercontinental ballistic missile warfare, and nuclear war, became a greater

---

[2].Stan Starr, The Bumper Corporal Story, unpublished manuscript, KSC Archives; David S. Akens, *Historical Origins of the George C. Marshall Space Flight Center,* MSFC Historical Monograph No. 1, MSFC, NASA, Huntsville, Alabama, December 1966, pp. 24-28; *Documents in the History of NASA: An Anthology*, 1975, p. 42; Memoir Paper by Kurt H. Debus, *From A-4 to Explorer I*, Seventh International History of Astronautics Symposium, 24th International Astronautical Congress, USSR, October 8, 1973, pp. 1-57, in Debus Papers, Kennedy Space Center Archives.

[3].*Ibid.*; Kurt H. Debus to Clarence G. Lasby, August 15, 1960, Debus Papers, Box 1, KSC Archives; and see, Walter A. McDougall, *...the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), pp. 42-46; and Henry C. Dethloff, *Suddenly...Tomorrow Came: A History of Johnson Space Center*, (NASA SP-4307), NASA: Lyndon B. Johnson Space Center, 1993, pp. 8-9.

reality. Following the successful launch of the WAC-Bumper from its Cape Canaveral launch pad, in July, 1950, the Army approved the development of a Redstone intermediate range (50-200 miles) missile capable of carrying a payload of 6,900 pounds, with twelve test launches to be completed by May 1953. The Redstone project would require frequent launch expeditions from Huntsville to Cape Canaveral. Kurt Debus advised Wernher von Braun at the Huntsville Guided Missile Center that the practice of sending missile firing teams (called the development groups) to Cape Canaveral with each proposed launch was terribly inefficient. There could be no planning, no scheduling, and no pre-launch preparation. He suggested that the Guided Missile Center should have a launch team permanently located at Canaveral to conduct the launches. Von Braun agreed, and responded, "Why don't you go ahead [and do that]."[4]

Explorer I: America Enters Space

Thus the seeds of what would become the John F. Kennedy Space Center were planted in Cape Canaveral soil. Debus and Dr. Hans Gruene drove to Cape Canaveral from Huntsville to locate and organize a Missile Firing Laboratory division, first headquartered in an old abandoned restaurant with nailed-up windows. Many of the fifty or so Marshall engineers and technicians, and their families, including Debus and Hans Gruene, moved into World War II "Wherry Housing" facilities at Patrick Air Force Base. By September 1957, the Missile Firing Laboratory, independently and in cooperation with the Army, Air Force, and Navy had conducted hundreds of launches including Redstone, Jupiter, Juno, Atlas, and Polaris rockets. Then, in October, 1957, the Soviet Union launched Sputnik, the first Earth-launched orbital vehicle. It was a particularly "sad day" for Missile Test Laboratory personnel, who knew "we could have been there first." Senator Lyndon B. Johnson commented that when "news of Sputnik flashed across the globe...a new era of history dawned over the world."[5] **He was right!**

Following a spectacular failure to launch a Navy Vanguard rocket into orbit in December 1957, the Army Ballistic Missile Agency was directed to conduct an orbital launch of a scientific satellite in celebration of the forthcoming International Geophysical Year. With Kurt Debus managing the launch, on January 31, 1958, the Army's Missile Firing Laboratory team lofted a reconfigured Redstone/Jupiter C (Juno I) rocket into orbit from Cape Canaveral. It carried a scientific package developed by Caltech's Jet Propulsion Laboratory and included a cosmic radiation experiment devised by Dr. James Van Allen of the State University of Iowa. The Secretary of Defense congratulated the ABMA team on the successful launch of America's first orbital satellite–to be called, he announced for the first time, "Explorer I." Meanwhile, Congress explored U.S. options in space.

NASA: The National Aeronautics and Space Administration

The Senate Preparedness Subcommittee of the Committee on Armed Services headed by Senator Lyndon B. Johnson conducted extensive hearings on "the missile gap." A study and report by President Dwight D. Eisenhower's special Science Advisory Committee envisioned "Human Lunar Exploration and Return," and later "Human Planetary Exploration." The result was Congressional passage and, in July 1958, Presidential approval of the National Aeronautics and Space Administration Act. The older

---

4. Kurt H. Debus to Clarence G. Lasby, August 15, 1960, Debus Papers, Box 1, KSC Archives; Memoir Paper by Kurt H. Debus, *From A-4 to Explorer I,* Seventh International History of Astronautics Symposium, 24th International Astronautical Congress, USSR, October 8, 1973, pp. 1-57, in Debus Papers, Kennedy Space Center Archives.

5. Lyndon Baines Johnson, *Vantage Point: Perspectives of the Presidency, 1963-1969* (New York: Holt, Rinehart and Winston, 1971), 272.

NACA (National Advisory Committee for Aeronautics) and its laboratories became a part of the new National Aeronautics and Space Agency. NASA began its work on October 1, 1958. Congress approved funding for the organization of a new Goddard Space Flight Center in Beltsville, Maryland in 1959, and in October, President Eisenhower announced the transfer of the Army Ballistic Missile Agency's Operations Division in Huntsville, Alabama–and its Missile Firing Laboratory at Cape Canaveral-- to NASA. The new NASA center at Huntsville was to be designated the George C. Marshall Space Flight Center. That transfer became effective July 1, 1960. Thus, the Army's Missile Firing Laboratory at Cape Canaveral became the NASA Marshall Space Flight Center's Launch Operations Directorate.[6] **As such, its mission shifted from the test and launch of weapons of war, to the test and launch of rockets and payloads devised for the exploration and scientific use of space. NASA devised a "manned satellite program" and by September 1959, had flight tested prototype space vehicles and launch systems that would soon carry Mercury and then Gemini astronauts into Earth orbital flights. Cape Canaveral, Marshall Space Flight Center, and its Launch Operations Directorate, were indeed on the threshold of a new era of history.**

President John F. Kennedy Announces the Lunar Landing Program

On April 12, 1961, the Soviet Union's Major Yuri Gagarin became the first human to "leave this planet, enter the void of space, and return." On May 25, 1961, President John F. Kennedy asked Congress to approve a national goal of landing an American on the Moon by the end of the decade, and in September NASA announced that Houston, Texas would be the location of a new spaceflight laboratory having primary responsibility for human space flight (later the Lyndon B. Johnson Space Center). Subsequently, on the recommendation of a study headed by Kurt H. Debus and General Leighton I. Davis for the Department of Defense, Cape Canaveral and adjoining Merritt Island were selected as the lunar launch sites.[7]

NASA then acquired title to somewhat more than 83,000 acres of private land and 55,000 acres of submerged state-owned land on Merritt Island, and began planning and construction of the proposed spaceport. A large portion of the property became the Merritt Island Wildlife Refuge–providing buffers both for the protection of wildlife and a safety zone for then distant populated areas. While construction of the NASA spaceport proceeded, NASA's Launch Operations teams completed over one-hundred launchings, including Redstones, Jupiter IRBMs, Jupiter–Cs, Juno II's, Pershings, Atlas Agenas, and Saturn test rockets using military launch facilities on Cape Canaveral.

The Air Force assigned three launch complexes on the Cape to the Launch Operations Directorate, with the use of associated electronic and optical tracking stations. These launch facilities included Complex 26 (two Redstone pads), 56 (two Jupiter-Juno pads) and 34, designed for Saturn I and IB launches. In addition, pads12 (Atlas Agena-B), and 36, constructed for the Centaur program, were used jointly by NASA and Air Force launch teams. Complex 37, containing

---

[6].Inquiry into Satellite and Missile Programs, Hearings before the Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Cong., 1st and 2nd Sess., Part I:1-2 (hereinafter cited Preparedness Subcommittee Hearings); NASA Act of 1958, 85th Congress, Second Sess. Report 2166, July 15, 1958; Staff Report of the Select Committee on Astronautics and Space Exploration, *The Next Ten Years in Space, 1959-1969*, 86th Cong., 1st Sess., House Doc. No. 115 (Washington D.C.: Government Printing Office 1959).

[7]. Aldo H. Bagnulo, Construction of the Spaceport, Speeches, Box 1, fol. 13; Bradley L. Maker, Development of Space Launch Facilities, Speeches, Box 1, fol. 18; Clarence Bidgood, Saturn V. Checkout Facilities at Merritt Island Launch Area, (March 18, 1963), Speeches, Box 1, fol. 21; NASA News Release, "NASA Launch Operations Directorate," undated [April 1963], KSC Archives.

two additional Saturn launch pads, and 36B (also designed for the Centaur rocket that was still under development), were under construction. In November 1960, NASA awarded a prime contract for the development of the Saturn lunar vehicle to North American Rockwell (later Rockwell International). North American then proceeded to sign on a broad spectrum of subcontractors, including Collins Radio, Honeywell, General Electric, Pratt and Whitney, AVCO and many others assigned to specific tasks or components of the complex Saturn vehicle. Subsequently, the Debus team conducted the first Saturn I (Block I/first stage) test launch in October 1961. In April 1962, a Saturn C-1 lifted off and climbed to an altitude of 135 miles in 115 seconds.[8] Saturn V lunar launches were still ye ars away, but work at KSC and throughout NASA Centers intensified.

The number of rocket launches rose sharply. Communications satellites, Earth-science study payloads, lunar surveillance, and piloted Mercury and soon Gemini launches required more personnel and more launch facilities at the Cape. Launch became the most critical and visible component of NASA's space programs. The obligations and responsibilities of Marshall Space Flight Center's Launch Operations Directorate grew rapidly as the products and projects of NASA's space centers became flight ready.

NASA's John F. Kennedy Space Center

Indeed, the preparation, planning, design and construction of the launch facilities for the proposed Apollo/Saturn lunar landing program required a tremendous commitment of personnel and funding, and new and innovative technology. Contractors, NASA civil service employees including engineers, scientists, and managers, and others, came to Cape Canaveral to build the infrastructure on Earth that could create a sustained presence in space. As a part of this expanded initiative, on March 7, 1962, NASA reorganized the Launch Operations Directorate of Marshall Space Flight Center (MSFC), as a new, autonomous Launch Operations Center (LOC)--soon to be renamed the John F. Kennedy Space Center. In June, the Marshall Center and the Launch Operations Center completed a detailed "separation agreement," effective July 1, 1962. Launch Operations Center management team included Kurt H. Debus, Director; Hans F. Gruene, Deputy Director; Albert Zeiler, Assistant Director for Facilities (and Chief of the mechanical, Structural and Propulsion Office); Karl Sendler , Assistant Director for Instrumentation (and Chief of the Electronic Engineering, Measuring and Tracking Office), and C.C. Parker, Assistant Director for Administration and Services.[9] **That same month NASA selected the engineering design for the proposed Saturn/Apollo lunar launch complex.**

President John F. Kennedy initiated the lunar program and effectively instigated the founding of the Launch Operations Center. He committed the United States to: "landing a man on the Moon and returning him safely to Earth. No single space project in this period [he said] will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish." Thus, it could not have been more appropriate that in the wake of his tragic assassination in November 1963, President Lyndon B. Johnson directed that the Launch Operations Center be renamed the "John F. Kennedy Space Center, NASA." The change became effective December 20, 1963. While construction of the new launch facilities proceeded, Kennedy Space Center personnel completed 23 Little Joe (vehicle escape and landing system clusters) and Mercury launches, with six of the latter carrying astronauts. Flight distances ranged from one-third of a mile (MA-3) to 546,167 miles (MA-9). In April 1964, KSC teams launched the first of twelve two-person Gemini piloted space craft. Gemini flights provided an invaluable Apollo training experience and aroused considerable public interest. That was

---

8. *Ibid.*

9. *Ibid*; MSFC-LOC Separation Agreement, June 8, 1962, Debus Directives, 1956-1966, Box 46C.5 N, KSC Archives.

particularly true of the Gemini 7/6 mission in December 1966, when astronauts Frank Borman and James A. Lovell, Jr., flying in Gemini 7, completed a rendezvous in orbit with Wally Schirra and Tom Stafford aboard Gemini 6. Gemini closed in November 1966.[10] Apollo was about to take flight.

The Apollo/Saturn Lunar Program

By now, space, and most particularly the idea of putting humans on the Moon, had given flight to the imagination of the American people, and indeed fired the imagination of the world. By June 1965, KSC had logged its 50,000th Sunday (and holiday) Visitor. In addition, the Center hosted over 91,000 official visitors during 1965, including foreign leaders from Sweden, Germany, South Korea, Turkey, and Spain. Before the year ended, Kennedy Space Center had opened to the public for six hours on Saturdays and three hours on Sundays—and more than 100,000 public visitors had taken the "car tour."[11] **Launch operations had become a very public business, and Kennedy Space Center, unexpectedly, had become the focus of NASA space programs. Liftoff had become the most visible milestone in American exploration of space.**

And the Apollo lunar program had just begun. Following a number of successful lunar exploratory survey missions, NASA turned its attention to the planets. In August 1967, AS-202 left Canaveral for the first Saturn orbital flight, and in January 1967, AS-204 (Apollo 1), with astronauts Edward White, Virgil "Gus" Grissom, and Roger Chaffee aboard, stood on the launch pad ready for the first piloted Saturn flight. Shortly before liftoff a flash fire of pure oxygen swept through the command module. The three astronauts died of asphyxiation.[12] It was a very personal, and very public tragedy. Safety, quality assurance, testing and re-testing, already an intrinsic part of the KSC regimen, became a part of the culture. Public interest and empathy rose. The work, if anything, became more intense.

By July 1967, the Launch Control Center at Complex 39 was ready for the First Saturn V flight. KSC engineers and technicians began tests on Apollo flight hardware. On November 9, NASA completed the first flight test of the Saturn V three-stage rocket. Confidence and the commitment to reach the Moon within the decade were rejuvenated. Following the test launch of a lunar excursion module and a piloted command module aboard a Saturn IB (Apollo 7) in October 1968, and, almost two years after the 204 disaster, in December Apollo 8 achieved an historic first in placing American astronauts into orbit around the Moon. Somehow, despite the decade of social chaos at home that included race riots, the assassinations of John and Robert Kennedy, and Martin Luther King, mishaps at Cuba's Bay of Pigs, military losses incurred during the Tet Offensive, and political turbulence in Asia and the Baltics, the American psyche seemed salved by successes in space. The world focused on the subsequent Apollo liftoffs at Kennedy Space Center. There were eleven piloted Apollo missions. Nine of those went to the vicinity of the Moon. Six of those landed astronauts on the Moon. The Kennedy Space Center's role and mission in those endeavors had to do with assembling, testing, and validating the flight ready status of each of the diverse components

---

[10]. Memorandum, Albert F. Siepert, Acting Director, to All NASA Employees, December 23, 1963, Debus Directives, 46C.5 N, KSC Archives; Dethloff, *Suddenly? Tomorrow Came: A History of Johnson Space Center* (hereinafter styled, *History of Johnson Space Center*), pp. 69-95. KSC News Release, April 14, 27, 1965, KSC Archives.

[11]. KSC News Release, June 4, August 21, October 3, 1963; January 22, March 3, 1964; April 15, June 16, November 12, December 27, 1965; KSC 215-65 [undated], KSC Archives.

[12]. Kurt H. Debus, Significant Highlights of USA-NASA Space Programs, A Progress Report to Hermann Oberth-Gesellschaft, Berlin, September 1, 1967; Dethloff, History of Johnson Space Center, 110-113.

of the Apollo systems: the three-stage rocket boosters, command module, service module, lunar module, communications systems, fuel systems, and the crew. As one of the engineers explained: "We had to take it all and put it together and make it work."[13] That is what Kennedy Space Center was all about.

The KSC-Apollo environment was an engineering "make it work" environment. It was also an increasingly public environment as American interest in space soared. Apollo 8 completed a lunar orbit on Christmas eve 1968; an earth-orbital test of the LEM was completed in March 1969. During the ten-day Easter holiday period in 1969, almost seventy thousand visitors toured Kennedy Space Center, double the number in the same period of the previous year–and more than 1-million visitors came to the center during the year. Apollo 10, launched on May 18, as scheduled, completed 31 lunar orbits, and, while in orbit about the Moon, performed a separation and rendezvous with the lunar module. Apollo/Saturn launches were an unparalleled KSC and NASA team effort–Debus insisted that liftoff only came to be only because of "team work."[14]

And then Apollo 11, "the greatest thing that ever happened," lifted off on July 16. Michael Collins flew the command module around the Moon, while Neil A. Armstrong and Edwin E. Aldrin, Jr. put the first human imprint on lunar soil. On the next flight, lightening struck the Apollo 12 spacecraft during launch, but systems checks and training enabled the NASA launch teams to put the lunar module Intrepid and its crew on the lunar surface and return them safely to Earth. During the flight of Apollo 13, in April 1970, an oxygen tank exploded in the service module. The mission control team returned the astronauts to Earth using the lunar module as a lifeboat. During the next four and final lunar missions (Apollo 14, 15, 16, and 17) American astronauts explored various sectors of the Moon (using on the final three landings a 4-wheeled electric roving vehicle) and achieved what none had ever done before.[15] But war, social programs, and economic problems began to displace the urgency of lunar exploration.

After Apollo—What's Next?

KSC's Director, Kurt Debus, created a new directorate, styled Center Planning and Future Programs, headed by G. Merritt Preston, to consider future programs that might supercede Apollo, such as a permanent space station, a smaller skylab, a Marinar-Mars exploratory vehicle, a nuclear shuttle, and a rocket-powered reusable orbital vehicle—tentatively designated a space shuttle. Following years of study, and before the final flight of Apollo in 1972, NASA announced the initiation of a Space Shuttle Program, delegating to Kennedy Space Center responsibility for the design of launch and recovery facilities. Debus then appointed Preston to head the new Shuttle Projects Office. Another milestone in Kennedy Space Center history occurred in 1974 when Dr. Kurt H. Debus announced his retirement from

---

[13]. Walter A. McDougall, *...the Heavens and the Earth: A Political History of the Space Age*, New York: Basic Books, 1985, 412-414; Dethloff, *History of Johnson Space Center*, 159-185; and see Courtney G. Brooks, James M. Grimwood, and Loyd S. Swenson, Jr., *Chariots for Apollo: A History of Manned Lunar Spacecraft* (NASA SP-4205), Washington D.C.: 1979; Interview, Dethloff and Snaples with I.A. "Ike" Rigell, KSC, June 18, 2001.

[14]. . KSC News Release(s) April, 30, 1969, May 14, 1969, Box 3, fols. 67-68, KSC Archives.

[15].

. Dethloff and Snaples, Interview with Alan J. Parrish, KSC, June 14, 2001; and see Courtney G. Brooks, James M. Grimwood, and Loyd S. Swenson, Jr., *Chariots for Apollo: A History of Manned Lunar Spacecraft* (NASA SP-4205), Washington D.C.: 1979; and Dethloff, History of Johnson Space Center, pp. 159-207.

NASA as the first Director of Kennedy Space Center, effective October 9.[16]

Lee R. Scherer replaced Debus as Director on January 19, 1975. A 1942 Annapolis graduate, Scherer was a Navy fighter pilot and an Aeronautical engineer. In 1962, he accepted an assignment at NASA Headquarters as program manager for the Lunar Orbiter project–which provided data for the selection of Apollo landing sites, and following his retirement from the Navy in 1964, he remained in the NASA Office of Space Science as director of lunar programs.[17]

Thanks to the culture of discipline and engineering integrity, life and work at Kennedy Space Center were largely unaffected by the change in leadership. Things were, to be sure, more relaxed, in part because there were no launches carrying "precious human cargo," but also because the Debus style had been more formal and more structured. The Center passed a new milepost in space with the launch, in July 1975, of an American Apollo spacecraft carrying Thomas P. Stafford, Vance D. Brand, and Donald K. Slayton on a docking maneuver with a Soviet Soyuz spacecraft launched from the Baikonur spaceport in Russia.[18] The Apollo-Soyuz program denoted a significant thaw in the Cold War, and, in retrospect, the advent of a new era of international cooperation in space exploration.

KSC tentatively planned to conduct eighty-three launches during the period 1976 through 1980. Of these, seventy-two were to be expendable launch vehicles (ELVs). NASA planned to launch eleven Shuttle flights before the end of 1980. Three-fourths of the expendable vehicle launches were to be reimbursable, that is, NASA was to be paid for the cost of the launch vehicles and associated launch activities by private business, other Federal agencies, or other governments and international agencies. Indeed, an "international" presence became greater during these years in response to NASA's encouragement. Brazil, Canada, Japan, Indonesia, Italy, France, Germany, NATO, the Eurpean Space Agency, and the International Telecommunciations Organization began participating in space launch programs.[19]

Plans for Space Shuttle launches, however, failed to materialize on schedule. A hiatus followed. No piloted spacecraft lifted off from Kennedy Space Center for the next six years. Launch activity, while significant, was confined to expendable vehicle launches using Atlas and Titan rockets in combination with the new Centaur rocket, and the reliable Delta rocket series. Payloads included communications satellites (such as the Comsat General Corporations, Marisat-A, for maritime communications; and the RCA Satcom-B), weather stations, Earth science study payloads, and planetary probes and landers. The latter included several Pioneer Venus flights, a number of Mariner Mars and Mariner Venus missions, and a Mariner 10 launch to Mercury. Two Mariner Jupiter/Saturn launches completed in 1977 evolved over the next several years into the remarkable Voyager Grand Tour of the outer planets, an exploratory mission that continued well into the 21st Century beyond the limits of the Solar System.[20] But there were no Shuttle launches, and no American astronauts in space until April 1981.

The Space Shuttle: STS-1 to Challenger

---

[16]..KSC News Release, February 12, 1970; June 10, 1971; August 21, 1972; December 26, 1973; *Spaceport News*, November 1, 1974.

[17]..Lee R. Scherer, Director, Biographies, KSC Archives.

[18]..Interview, Dethloff and Snaples with John H. Straiton, KSC, June 19, 2001.

[19].. NASA Fact Sheet, John F. Kennedy Space Center, April 1, 1976.

[20].. NASA Fact Sheet, John F. Kennedy Space Center, April 1, 1976.

Nevertheless, the Space Shuttle was NASA's and Kennedy Space Center's primary business through most of the decade of the 1970s. KSC's job was to design and construct the necessary launch and landing facilities for the reusable Space Shuttle Orbiter, a vehicle that would be "launched like a rocket, operate in orbit like and spacecraft, and then land like an aircraft." KSC also had responsibility for testing and integrating payloads into the Shuttle launch systems.[21] **Redesign and conversion of the Saturn/Apollo launch facilities to Shuttle use proved to be a much more cost efficient and flight efficient option than the alternative of designing and building new systems. Thus, when the Shuttle was finally ready to launch, KSC launch facilities and teams, and the new Center Director, Richard G. Smith, who had joined the original rocket research and development team at Huntsville, Alabama in 1951 were ready. Smith knew intimately the inner-workings of Marshall and KSC, and rockets and rocket launchings, and he had experience and insight with Shuttle development.[22] The Shuttle was something new in rocketry and in aerospace engineering.**

When *Columbia*, the first Shuttle scheduled for launch, arrived at KSC, it looked to some like a "patch work quilt." Tiles were falling off, systems were not complete or integrated. Check-out was a tough and arduous business. "By the time Columbia fired its engines on the launch pad at Kennedy space Center in Florida, on April 12, 1981, the Space Shuttle already had experienced a long and difficult history. Simply being there, on the launch pad, was something of a triumph."[23] Over the next two decades NASA launched over one -hundred Space Shuttle missions, each originating from KSC's Launch Complex 39, and each extending our information and knowledge of Earth's environment, and extending the human presence in space.

There were, to be sure, some missions that we re more notable and memorable than others. STS-7, which left Kennedy on June 18, 1983, carried Sally Ride, the first American woman in space. STS 41-C performed the first space satellite repair. The first seven-member crew flew in October 1984. The Shuttle enabled the delivery of more communications satellites into orbit, and more space walks became the norm. The Shuttle began a series of Spacelab flights in 1983, focusing on the conduct of multi-disciplinary Earth-science experiments by scientists and payload specialists from the United States, Great Britain, and Germany. The frequency of Shuttle flights rose. And then, on January 28, 1986, after twenty-four safe and successful Shuttle launches, Challenger exploded seventy-three seconds after liftoff. The entire crew, including Francis R. Scobee, Michael J. Smith, Ellison S. Onizuka, Judith A. Resnik, Ronald E. McNair, Gregory Jarvis, and Christa McAuliffe died. It was one of Kennedy Space Center's, NASA's, and the nation's "worst days." Throughout the organizaton there were studies, investigations, and reviews. KSC began a rebuilding, and a restoration. The Center reconstituted its tests and check-points to improve already tough quality controls, and to provide greater assurance and safety.[24] Challenger was both an agonizing, and a learning experience.

The Return to Flight

During the hiatus in Shuttle launches, in October 1986, General Forrest McCartney replaced Richard Smith as Director of KSC. On "detail" from the Air Force, until his retirement from the Armed Services in 1987, McCartney headed the Air Force Space Division before coming to Kennedy. He began

---

[21] *Ibid.*

[22] *Richard G. Smith, Biography, KSC Archives.*

[23] Dethloff and Snaples, Interview with Alan J. Parish, KSC, June 13, 2001; Interview with Isom A. "Ike" Rigell, June 18, 2001; Interview with John Straiton, June 19, 2001, KSC Archives; and see Henry C. Dethloff, "The Space Shuttle's First Flight: STS-1," in Pamela E. Mack, ed., *From Engineering Science to Big Science, The NACA and NASA Collier Trophy Research Project Winners* (Washington D.C.: NASA, 1998), NASA SP-4219, pp. 277-297.

[24] Interview, Dethloff and Snaples with Alan Parrish, June 13, 2001, KSC Archives.

to rebuild KSC personnel levels which had slumped to some 13,000, and to replace the numerous 'temporary housing' facilities with permanent offices and laboratories. "The space program at KSC is not a temporary effort," he said. The 300,000 square-foot Launch Complex 39 Operations Support Building, dedicated in March 1990, seemed to verify that sentiment. His insistence on an "exacting review requiring a massive effort," and his "open-door, hands-on" approach to management and operations helped Kennedy and NASA successfully "return to flight."[25]

Now, almost three years after the Challenger explosion, on September 29, 1988, the twenty-sixth Shuttle flight, now appropriately designated STS-26, left the Cape on a mission to prove the safety of the redesigned Solid Rocket Boosters, and to launch a TDRS (Tracking and Data Relay) satellite. The American public, and the world watched carefully this "return to flight." Over 2,000 media representatives were on hand for the launch, as compared to the 2-300 who had been present for the Challenger launch.[26] NASA's focus, and that of the media and the public, remained on the Shuttle and on Kennedy Space Center.

There were two Shuttle flights in 1988, five in 1989, and six each in 1990, and in 1991. Three of the 1989 missions carried science payloads and experiments. There were experiments on plant and crystal growth, and the resilience of the human body in the vacuum of space. There were to study Earth's planetary environment, and to explore Venus and Jupiter. There were missions related to national defense, and to Earth and planetary sciences. Columbia retrieved a "Long Duration Exposure Facility" which had been in an Earth orbit for six years. The study helped in the engineering design of a permanent space station which had been on NASA "drawing boards" for some time. One of the most intriguing and promising science projects involved the launch of the Hubble Space Telescope, in April 1990. It was science's first opportunity to begin to observe our own planetary system, and more distant galaxies from the vantage point of space. And in the following flight in October, NASA sent the Ulysses spacecraft to explore the polar regions of the Sun, and followed that with a flight devoted to astronomical studies of comets and quasars, and x-ray and ultraviolet wavelengths in the unique laboratory provided by space.[27] All of this was very consistent with Kurt Debus's premise that humankind were meant to explore their "total environment."

Robert L. Crippen, a former astronaut who assumed the directorship of Kennedy Space Center on January 1, 1992, re-affirmed the imperative of space exploration. During his three-year tenure KSC launched twenty-two Shuttle flights, and a large number of expendable vehicles. Most of the missions, as in the recent past, had to do with scientific studies of Earth's space environment, including atmospheric and microgravity studies, the deployment of an Italian-built Tethered Satellite and later a Laser Geodynamic Satellite, and on yet another mission the delivery of a Japanese spacelab into orbit. Jay Honeycutt, who had a long and close working technical and management experience with spacecraft processing, and with Shuttle launch and flight operations became Director of KSC in January 1995.[28] While there was some increasing activity in expendable launch operations, the Shuttle continued to be in the forefront of NASA and Kennedy Space Center programs.

Thus in June 1995, NASA celebrated the 100th U.S. human space flight with the launch of Atlantis (STS-71). More significantly, Atlantis docked for five days with the Russian space station

---

[25] *Spaceport News*, November 8, 1981; September 25, 1987; March 23, 1990; Forrest S. McCartney, Biographical, February 1996, KSC Archives.

[26]. Interview, Dethloff and Snaples with Lisa A. Malone, June 21, 2001, KSC Archives.

[27]. See Rumerman and Garber, *Chronology of Space Shuttle Flights, 1981-2000.*

[28]. KSC Spaceport News, December 21, 1994.

Mir, marking the advent of a number of Shuttle-Mir linkups and the exchange of American, Russian, Canadian and European astronauts on the Shuttle and aboard Mir. Mir, NASA's Spacelab, a commercially owned and operated SPACEHAB module, and Hubble, all provided an important experience in extending the stay of humans in space.[29] NASA and the international science and space community anticipated yet a more permanent presence in space with an orbiting space station.

An International Space Station and a Roadmap to Space for the New Millennium

The advent of an international space station come to be in the midst of NASA budget and personnel reductions, and in the milieu of international diplomacy and negotiation. A critical component of NASA's restructuring involved transferring management responsibility for Space Shuttle operations to private contractors. That began with the award of a contract to United Space Alliance, a joint Rockwell International and Lockheed Martin venture. NASA proposed to do more, better, with less, by extending its contractual partnerships.[30]

In March 1997, the new Director, Roy D. Bridges, Jr., the seventh in succession since the appointment of Kurt H. Debus in 1962, initiated an intensive study and evaluation of Kennedy Space Center's role and mission in the changing environment of the American space flight program. Expendable launch vehicles and their payloads, the Space Shuttle and shuttle payloads, International Space Station hardware and launches, Earth-science, and planetary science programs all came through the laboratories and onto the launch pads of the Kennedy Space Center. A careful study and review by the Director and his Senior Management Council, with broad-based advice and consultation from the Center's workforce, customers, and suppliers, resulted in a Roadmap to the year 2025—and a plan as to how to implement policies and procedures required to achieve the revised goals and missions of the Center.[31] **It was the morning of the Millennium.**

Paramount among the continuing and new initiatives of Kennedy Space Center, in addition to its continuing and historic role as NASA's center for launch operations, announced Director Bridges, was to effect the transition of flight operations management to the United Space Alliance, the deployment of the International Space Station, to increase the efficiency of Shuttle and payload processing–and to reconfirm through a series of programs and projects an emphasis on safety, health, and public outreach.[32]

Meanwhile, the Shuttle completed its 100th flight mission, and the first elements of the new International Space Station arrived at KSC. Work began on payload processing, launch planning, and integration of U.S. and Russian assembly processes. The delivery of space station components into orbit was to be a joint effort with alternating launches from Russia and from Florida with the first launch scheduled from Russia in June 1998, and alternating with U.S. Shuttle deliveries and space walks for assembly through 1999. While there were delays, assembly began with the delivery of a 20-ton Russian Zarya module, followed by the STS-88 delivery in December of a Unity connecting module to which future space station components would be tied. [33]

---

[29] ..*Ibid.,* June 16, 1995.

[30] .. *Ibid.,* November 17, 1995.

[31] ..*Ibid.,* June 5, 1998; September 3, 1999; Kennedy Space Center Roadmap, KDP-KSC-S-2001, Rev. B 7/00, pp. 1-6.

[32] *Ibid.*

[33] ..*Ibid.,* January 31, 1997, March 14, June 6, July 4, 1997; August 14, 1998..

Concurrently, NASA and private industry increased the utilization of expendable launch vehicles, assigning Kennedy Space Center lead center responsibility for the acquisition of payloads and management of launch services. Well before the close of the millennium and beginning of what promised to be a new era in the exploration and discovery of the total human environment, new policies, programs, procedures, and organizations were being developed by NASA and Kennedy Space Center. In addition, Kennedy Space Center planners proposed to complement that initiative by further facilitating KSC's technology transfer to the community through the development of an associated Spaceport Technology Center. Thus, Kennedy Space Center entered the new millennium with an expanded role as a launch operations and emerging technology center, and a roadmap and implementation plan to further facilitate the exploration of space.

Endnotes: