CHAPTER ONE

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During the period between 1979 and 1988, NASA experienced many trials and triumphs. The Space Shuttle flew its first orbital mission in April 1981, suffered the *Challenger* accident in January 1986, and made a heroic return to flight in September 1988. The two Voyager space probes encountered both Jupiter and Saturn and sped outward to Uranus and Neptune. President Ronald Reagan, in his State of the Union address in 1984, announced that the United States would build a space station and set a goal of completing it within a decade.

Throughout this decade, moreover, the President increased funding for NASA. In response to new initiatives and the operational commitment to the Space Shuttle, the NASA budget rose from $4.96 billion in fiscal year 1979 to $9.06 in 1988. The increases allowed the agency not only to sustain the Space Shuttle program and to begin the construction of a space station, but also to bring to fruition a series of important science, aeronautics, and space applications programs.

Space Applications

In the area of space applications, there were several significant activities. For example, NASA began in the 1970s to build and launch Earth resource mapping satellites, the first of which was the Landsat series. Landsat 1, launched on July 23, 1972, as the Earth Resources Technology Satellite (ERTS) and later renamed, changed the way in which Americans looked at the planet. It provided data on vegetation, insect infestations, crop growth, and associated land-use information. Two more Landsat vehicles were launched in January 1975 and March 1978, performed their missions, and exited service in the 1980s. Landsat 4, launched on July 16, 1982, and Landsat 5, launched on March 1, 1984, were "second-generation" spacecraft, with greater capabilities to produce more detailed land-use data. The system enhanced the ability to develop a worldwide crop forecasting system. Moreover, Landsat imagery has been used to devise a strategy for deploying equipment to contain oil spills, to aid navigation, to monitor

pollution, to assist in water management, to site new power plants and pipelines, and to aid in agricultural development.[1]

Aeronautics and Space Research and Technology

From 1979 to 1988, NASA aeronautics and space research and development programs moved forward on a variety of fronts. The National Aeronautics and Space Act of 1958 gave NASA a broad mandate to "plan, direct, and conduct aeronautical and space activities," to involve the nation's scientific community in these activities, and to disseminate widely information about them. The most significant aeronautics endeavors of the era revolved around the effort to improve the efficiency of aircraft. For instance, in 1987, the NASA-industry advanced turboprop team at Lewis Research Center received the Robert J. Collier Trophy for the development of a new fuel-efficient turboprop propulsion system. The National Aeronautic Association has given this award every year since 1911 "for the greatest achievement in aeronautics and astronautics in America."[2]

Until 1970, NASA included basic aeronautics research as one of its major activities. The results of basic research added to the pool of knowledge and did not apply to any ongoing project. This effort was divided into four sections: fluid dynamics, electrophysics, materials, and applied mathematics. The aeronautics function also addressed the problems that vehicles might encounter during launch, ascent through the atmosphere, and atmospheric reentry. For instance, NASA conducted research in the areas of lifting-body research and planetary entry research. NASA also worked at improving the operational electronics systems, while reducing their size, weight, cost, and power requirements. Several NASA centers directed a variety of projects with this goal in mind. Especially important was work in aeronautical operating systems, aerodynamics research, aeronautical propulsion, and special efforts in short takeoff and landing (STOL) aircraft and experimental transport aircraft. The aeronautics effort also conducted projects in the areas of general aviation, environmental factors, vertical/STOL aircraft, supersonic/hypersonic aircraft, and military support.

Tracking and Data Acquisition/Space Operations

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[1]Roger D. Launius, *NASA: A History of the U.S. Civil Space Program* (Malabar, FL: Krieger Publishing Co., 1994), p. 104; Pamela E. Mack, *Viewing the Earth: The Social Construction of Landsat* (Cambridge, MA: MIT Press, 1990).

[2]Mark D. Bowles and Virginia P. Dawson, "The Advanced Turboprop Project: Radical Innovation in a Conservative Environment," in Pamela E. Mack, ed., *From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners* (Washington, DC: NASA Special Publication (SP)-4219, 1998), pp. 321–43.

Another central mission of the agency throughout this period was tracking and data acquisition. The Deep Space Network, charged with communication with space missions beyond Earth orbit, was rapidly changing. Its Mark III Data System implementation task had been completed. The new capabilities required for the Voyager Jupiter encounter were in operation throughout the Deep Space Network, and operations teams were trained in their use. The Viking mission had been "extended" through May 1978 and then further "continued" through February 1979. Both Pioneer Venus missions had been successfully completed in 1978, and both Voyager spacecraft were approaching Jupiter and expected to carry out a full program of science experiments and imaging sequences during their brief encounters with Jupiter in March and July 1979.

For their success, each of the Voyager encounters depended not only on operable spacecraft, but also on ever-greater significant enhancement of the uplink and downlink Deep Space Network capabilities. At the same time, a heavy expenditure of Deep Space Network operational resources in personnel, training, and facilities was required simply to maintain a viable science data return from existing missions. Toward the end of the Voyager era, a truly international cooperative mission made its appearance. The Venus-Balloon mission in mid-1985 involved the Soviet, French, and North American space agencies. Although of very short duration, it presented a complex engineering and operational challenge for the Deep Space Network. Its successful completion established a basis for future relationships between these agencies in the area of tracking and data acquisition support for deep space missions.[3]

Commercial Programs

Very early in the 1980s, the United States developed an official policy to apply the resources of the nation to preserve the role of the country as a leader in space science and technology and their applications. Brought on by the emergence of the Space Transportation System (STS) as a space vehicle, many people began to believe that the dawn of an era of widespread commercial activities in space was at hand. Ensuring that national leadership would require the support and expansion of commer-

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[3]William R. Corliss, "A History of the Deep Space Network," NASA CR-151915, 1976, NASA Historical Reference Collection, NASA History Office, NASA Headquarters, Washington, DC; N.A. Renzetti, *et al.*, "A History of the Deep Space Network from Inception to January 1, 1969," Technical Report 32-1533, Volume 1, Jet Propulsion Laboratory, September 1971. A more detailed account of many of these topics are contained in the unfinished and unpublished notes on the early (prior to 1962) history of the Deep Space Network compiled by Craig Waff at the Jet Propulsion Laboratory in 1993. The Waff notes are held in the Jet Propulsion Laboratory's Archives, Pasadena, CA.

cial space activities.[4]

The President's National Space Policy of July 4, 1982, directed NASA to expand U.S. private-sector investment and involvement in civil space and space-related activities. In light of this directive and because substantial portions of the U.S. technological base and motivation reside in the U.S. private sector, NASA will invigorate its efforts to take necessary and proper actions to promote a climate conducive to expanded private-sector investment and involvement in space by U.S. domestic concerns.[5] To more effectively encourage and facilitate private-sector involvement and investment in civil space and space-related activities, beginning in the early 1980s, NASA directed a portion of its space research and development activities toward supporting the research, development, and demonstration of space technologies with commercial application. To further support this objective, NASA would directly involve the private sector in initiatives that are consistent with NASA program objectives and that support commercial space activity.[6] Those initiatives included:

- Engaging in joint arrangements with U.S. domestic concerns to operate on a commercial basis facilities or services that relieve NASA of an operational responsibility
- Engaging in joint arrangements with U.S. domestic concerns to develop facilities or hardware to be used in conjunction with the STS or other aspects of the U.S. space program
- Entering into transactions with U.S. concerns designed to encourage the commercial exploitation of space

In addition to making available the results of NASA research, principal NASA incentives included:

- Providing flight time on the STS on appropriate terms and conditions as determined by the NASA Administrator
- Providing technical advice, consultation, data, equipment, and facilities to participating organizations
- Entering into joint research and demonstration programs in which each party funds its own participation

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[4]W.D. Kay, "Space Policy Redefined: The Reagan Administration and the Commercialization of Space," *Business and Economic History* 27 (Fall 1998): 237–47.

[5]"Remarks at Edwards Air Force Base, California, on Completion of the Fourth Mission of the Space Shuttle *Columbia*," July 4, 1982, in *Public Papers of the Presidents, Ronald Reagan, 1982* (Washington, DC: U.S. Government Printing Office, 1983), p. 892.

[6]"NASA Policy to Enhance Commercial Investment in Space," September 13, 1983, NASA Historical Reference Collection.

In making the necessary determination to proceed under this policy, the NASA Administrator will consider the need for NASA-funded support or other NASA action to commercial endeavors and the relative benefits to be obtained from such endeavors. The primary emphasis of these joint arrangements will be to provide support to ventures that result in or facilitate industrial activity in space when such activity would otherwise be unlikely to occur because of high technological or financial risk. Other ventures involving new commercial activities in space will also be supported. In either case, private capital must be at risk. The major areas that NASA pursued emphasized:

- Effect of the private-sector activity on NASA programs
- Enhanced exploitation of NASA capabilities, such as the STS
- Contribution to the maintenance of U.S. technological superiority
- Amount of proprietary data or background information to be furnished by the concern
- Rights to be granted the concern in consideration of its contribution
- Impact of NASA sponsorship on a given industry
- Provision for a form of exclusivity in special cases when needed to promote innovation
- Recoupment of the contribution under appropriate circumstances
- Support of socioeconomic objectives of the government
- The willingness and ability of the proposer to market any resulting products and services

Facilities and Resources

During the ten years between 1979 and 1988, NASA's facilities and resources underwent significant alterations. Personnel, budgets, finances, procurement, and many other resource issues rose in response to the increased emphasis placed on spaceflight and NASA during the decade. This volume concludes with a discussion of these issues.