

Book Review

Mars Books in Brief

Several events last year focused the nation's and the aerospace community's attention once again on Mars. On Aug. 7, 1996, NASA announced that a meteorite found in Antarctica contained evidence that primitive life may have existed on Mars more than 3.6 billion years ago. The space agency's dramatic announcement sparked public interest in the search for extraterrestrial life and resurgent interest in future planetary and Mars missions. The first of three Mars missions for 1996, NASA's Mars Global Surveyor, was launched Nov. 7. It is expected to arrive at Mars on Sept. 11, 1997, and begin mapping the surface and studying the atmosphere. On Nov. 16, 1996, Russia's long-delayed, unmanned Mars 96 failed after liftoff due to a malfunction of the upper-stage launch vehicle. The failure received considerable media attention when there was uncertainty of the location of the spacecraft containing radioactive plutonium after it re-entered the Earth's atmosphere. On Dec. 4, 1996, NASA launched the Pathfinder mission to Mars, which landed a probe on the Martian surface on July 4, 1997. It deployed a science station and a small rover for the first successful surface exploration of Mars since the Viking 2 mission in September 1975.

Since the books of Percival Lowell around the turn of the century, a considerable Mars literature has developed. However, it has only been since the very successful Mariner and Viking missions of the 1960s and 1970s that we have begun to understand the true conditions on Mars that serve as motivation for the recent missions and the missions of the next century. Presented here is an annotated list of selected books on Mars that, with one exception, were written after the Viking missions. The list includes principally nonfiction books, but a few fiction books are included as well.

Nonfiction

Wernher von Braun, *The Mars Project* (German Edition, *Das Marsprojekt*, Bechtle Verlag, Esslingen, Germany, 1952), University of Illinois, Champaign, IL, 1953, reprinted 1962 and 1991, 91 pp., \$10.00 soft-cover.

This short book presents a Mars Mission of 10 space vehicles and 70 men as envisaged by von Braun in the early 1950s. It describes, in 47 steps, a sequence of engineering computations and data that quantify the feasibility of the mission. The book is mainly of historical interest; it shows the remarkable vision of von Braun. An excellent article, "Mars Mission Concepts: The Von Braun Era," by Frederick I. Ordway III in the

1996 volume *Strategies for Mars: A Guide to Human Exploration* describes von Braun's subsequent Mars activities.

Michael H. Carr, *The Surface of Mars*, Yale University Press, New Haven, CT, 1981. Out of Print.

The main focus of *The Surface of Mars* is the surface geology of the planet. Written by a Viking mission geologist, the book requires a working knowledge of physics and chemistry and a basic vocabulary of geology. The first three chapters give a historical perspective and describe the general characteristics of the surface and the atmosphere. Next, separate chapters describe impact craters, cratering statistics, and crater ages; the densely cratered terrain and plains; volcanoes, tectonics, and the Tharsis Bulge; canyons; channels; wind; the poles; surface chemistry; the distribution of volatiles; and the search for life on Mars, as well as on Phobos and Deimos. The geological features are illustrated with numerous black-and-white photographs taken by the Viking orbiters. Appendix A gives details on the Viking orbiter pictures and tells where the pictures may be obtained. Appendix B presents Mars maps prepared by the U.S. Geological Survey. An extensive bibliography includes over 600 references.

James E. Oberg, *Mission to Mars*, Stackpole Books, Harrisburg, PA, 1982, 221 pp. Out of Print.

Mission to Mars is based on the Case for Mars colloquium (see next items for the proceedings) held in 1981 at the University of Colorado, Boulder. In 13 chapters, the book describes plans and concepts for a manned mission and related issues as seen by participants in the conference. Mission planning is still under the influence of the Apollo model, although concepts such as aerobraking and in situ propellant production are introduced as offering potential for cost and weight savings. A chapter discussing costs considers a list of technology developments and space experiences that Mars enthusiasts in 1982 thought would be accomplished by 1999. There is also an interesting chapter on terraforming.

Penelope J. Boston (Ed.), *The Case For Mars I*, Vol. 57, Science and Technology Series, published for the American Astronautical Society by Univelt, San Diego, CA, 1984, 348 pp., \$45.00.

Proceedings of the first Case for Mars Conference held April 29–May 2, 1981, at the University of Colorado, Boulder. The volume is organized in six chapters: Introduction (three papers), Mission Strategy (three papers), Spacecraft Design (four papers), Life Support (five

papers), Surface Activities and Materials Processing (five papers), and Social and Political Aspects (six papers). Appendices present Ballistic Opportunities to Mars, A Short Guide to Mars, and The Future of Mars: A Hypothetical Chronology.

Christopher P. McKay (Ed.), *The Case For Mars II*, Vol. 62, Science and Technology Series, published for the American Astronautical Society by Univelt, San Diego, CA, 1985, 730 pp., \$60.00 hardcover, \$40.00 softcover.

Proceedings of the second Case for Mars Conference held July 10–14, 1984, at the University of Colorado, Boulder. The volume is organized into eight chapters: Introduction (two papers), National and International Aspects (five papers), Precursor Missions (nine papers), Science (three papers), Earth–Mars Delivery Systems (six papers), Mars Surface Technology (three papers), Utilizing Martian Resources (eight papers), and Human Factors (four papers). An appendix gives abstracts of eight additional papers.

Frank Miles and Nicholas Booth (General Eds.), *Race to Mars*, Harper and Row, New York, 1988, 192 pp., Out of Print.

The basic premise of the book—a race to Mars between the United States and the Soviet Union—no longer exists; however, the book's format and illustrations still make this an engaging publication. The format is like a glossy magazine with sidebars and color figures. The figures include a number of color drawings and illustrations. Many photographs are from the Apollo and the Viking missions. The Viking photographs are superb.

Duke B. Reiber (Ed.), *The NASA Mars Conference*, Vol. 71, Science and Technology Series, published for the American Astronautical Society by Univelt, San Diego, CA, 1988, 554 pp., \$70.00 hardcover, \$30.00 softcover.

Proceedings of the NASA Mars Conference held July 21–23, 1986, at the National Academy of Sciences, Washington, D.C. The volume is organized into three sections: Our Current Knowledge and Understanding of Mars (10 papers), The Present and Future Unmanned Exploration of Mars (8 papers), and Issues and Options for the Manned Exploration of Mars (8 papers). An Appendix contains color illustrations.

Carol Stoker (Ed.), *The Case For Mars III: Strategies for Exploration—General Interest and Overview*, Vol. 74, Science and Technology Series, published for the American Astronautical Society by Univelt, San Diego, CA, 1989, 727 pp., \$75.00 hardcover, \$55.00 softcover.

Proceedings of the third Case for Mars Conference held July 18–22, 1987, at the University of Colorado, Boulder. The volume is organized into five sections: Introduction (2 papers), Making the Political Case for Mars

(11 papers), Considerations for Sending Humans to Mars (13 papers), Technical Considerations for Getting to Mars (11 papers), and Living on Mars (14 papers).

Carol Stoker (Ed.), *The Case For Mars III: Strategies for Exploration—Technical*, Vol. 75, Science and Technology Series, published for the American Astronautical Society by Univelt, San Diego, CA, 1989, 646 pp., \$70.00 hardcover, \$50.00 softcover.

Proceedings of the third Case for Mars Conference held July 18–22, 1987, at the University of Colorado, Boulder. The volume is organized into four sections: Political and Social Issues (20 papers), Technical Issues for Getting to Mars (13 papers), Living on Mars (6 papers), and Surface Infrastructure and Technology (6 papers). The volume concludes with summaries of six papers presented in a workshop.

William Sheehan, *Planets & Perception—Telescopic Views and Interpretations, 1609–1909*, University of Arizona Press, Tucson, AZ, 1988, \$43.50.

Planets & Perception presents a history of lunar and planetary astronomy. The book gives an interesting historical view of early astronomers and how they interpreted the images they saw. There is a psychological theme throughout the book that is expressed early on by the author, noting that an observer sees not with the eye but with the mind. There is a thorough treatment of the history of the Mars “canals” identified by Schiaparelli in 1877 and the steadfast advocacy of the canals by Percival Lowell—in spite of evidence to the contrary—until his death in 1916. Written from a scholarly viewpoint, the book has 30 pages of endnotes.

Eric Burgess, *Return to the Red Planet*, Columbia University Press, New York, 1990, 222 pp. Out of Print.

The first chapter of *Return to the Red Planet* discusses the history of man's interest in Mars from antiquity through the Viking missions. The next two chapters give good descriptions of the Martian world as learned from Mariner and Viking, with many black-and-white photographs. Later chapters discuss planned Soviet and U.S. missions as of 1989. The coverage of the Soviet Union's mission plans for Mars exploration is outdated, since it was written shortly before the U.S.S.R.'s economic collapse and dissociation into separate states. The description of the U.S. mission plans covers the period up to President Bush's announcement of the Space Exploration Initiative in July 1989. A final chapter describes possibilities for future manned missions, as well as possible Mars bases and settlements.

Michael Collins, *Mission to Mars*, Grove Weidenfeld, New York, 1990, 307 pp. Out of Print.

Michael Collins, the Apollo 11 astronaut, presents his view of our future in space by designing a manned mission to Mars for early in the next century. The book was published for a popular audience shortly after President

Bush, on July 20, 1989, called for a U.S. Mars landing by the 50th anniversary of Apollo 11 in 2019. Collins proposes a U.S. and Soviet international mission with four husband-and-wife teams of astronauts. Each nation would assemble an Earth–Mars spacecraft at a space station in low Earth orbit. The vehicles are massive; the U.S. vehicle would require 10 launches of 200,000 lb each to the space station. The aeroshell would be 100 ft in diameter. After departing their space stations, the spacecraft would rendezvous and dock for the long trans-Earth–Mars trajectory. The strongest part of the book is the narrative description of the mission from the astronauts' perspective. There are no references or endnotes. The November 1988 issue of *National Geographic* magazine has an abbreviated version of the book with numerous color illustrations.

John N. Wilford, *Mars Beckons*, Alfred A. Knopf, New York, 1990, 244 pp., hardcover out of print; softcover available from Vintage Books, New York, \$12.00.

Mars Beckons is similar to *Return to the Red Planet*, although it is less technical and oriented more toward popular readers. The book is very well written, and it provides a clear, objective view of "the mysteries, the challenges, the expectations of our next great adventure in space." There is a very good chapter on Percival Lowell and his influence on perceptions of Mars early in this century. Later chapters describe the moons of Mars, Phobos and Deimos, and findings from the Mariner and Viking missions. There are about a dozen color photographs of the Martian surface from these missions. Later chapters discuss future Mars missions; as with *Return to the Red Planet*, these chapters are now outdated. An appendix provides a concise summary of missions to Mars from 1960 through 1989.

Peter Cattermole, *Mars—The Story of the Red Planet*, Chapman & Hall, London, 1992, 224 pp. Out of Print.

Peter Cattermole, a geologist, presents an account of the atmosphere and geology of the planet. The first four chapters discuss concisely general characteristics of Mars, spacecraft exploration, the atmosphere, and weather. The next eight chapters describe the geology, including the interior of the planet, the ancient cratered terrain, the central volcanoes, the plains, the equatorial canyons, the channels and chaotic terrain, the polar winds and volatile activity, and the geological history. The last chapter gives 11 objectives for future Mars exploration. The book has numerous black-and-white photographs of surface details and eight pages of large color images of the surface. An extensive bibliography includes over 250 references.

H. H. Kieffer, B. M. Jakosky, C. W. Snyder, and M. S. Matthews (Eds.), *Mars*, University of Arizona Press, Tucson, AZ, 1992, 1498 pp., \$92.00.

At nearly 1500 pages with 114 collaborative authors, *Mars* is the superheavyweight of Mars books. The objec-

tive of the book is to provide a summary of what is known about Mars, and it is meant to be a source book on all aspects of Mars. The book is organized into seven parts: Introduction, Solid Body Geophysics, Bedrock Geology and Geological Units, Surface Properties and Processes, Current Atmospheres, Biology, and Satellites of Mars. There are 38 invited articles spread over these topical areas; the articles were written in 1989 and 1990. An appendix gives the origin and use of Martian nomenclature, and a glossary provides about 4000 definitions normally applied to Mars or used in planetary science. An introductory article gives an annotated list of about 50 books on Mars, and an extensive bibliography at the end of the book provides about 2500 references. The book concludes with 18 color plates.

E. Brian Pritchard (Ed.), *Mars: Past, Present, and Future*, Vol. 145, Progress in Astronautics and Aeronautics, AIAA, Washington, DC, 1992, 332 pp., AIAA members \$49.95, nonmembers \$69.95.

This AIAA volume is a collection of 28 papers presented at a conference in Williamsburg, Virginia, in July 1991. Written in the heyday of the Space Exploration Initiative (SEI), the papers represent an excellent account of the state of knowledge of Mars mission technology and mission planning at that time. The papers are organized in six sections: Overview, Prior Missions, Future Missions: Rationale and Benefits, Future Missions: System Concepts and Operations, and Future Missions: Technology. A paper by Marcia Smith of the Congressional Research Service gives a remarkably prescient view of the SEI: "...the majority of Congress supports the goal of returning humans to the Moon and eventually going on to Mars, but believes that today is not the time to begin an ambitious costly space program. ...unless taxpayers are willing to pay more in taxes or accept cuts in entitlement programs, there is little hope for the sizable increases in NASA's funding that would be required to pursue SEI in an expeditious manner." In March 1993, NASA Administrator Daniel S. Goldin closed the office in charge of human space exploration.

Michael H. Carr, *Water on Mars*, Oxford University Press, New York, 1996, 229 pp., \$70.00.

In Chapter 9 of this scholarly book, Michael Carr, author of the 1981 book *The Surface of Mars* (see above), states that the scientific goals of Mars exploration are to determine the present state of the planet, how it formed and evolved to that state, and how that evolutionary history compares with those of other planets, including the Earth. Scientists have been analyzing the data from the Mariner and Viking missions for over 20 years with these goals in mind. After an introductory chapter gives a concise summary of current knowledge of Mars, the next seven chapters discuss the role played by water in Mars evolution. The next-to-last chapter discusses future Mars exploration, and the last chapter provides a summary and conclusions. The book is aimed primarily at scientists, although many chapters have introductions and concluding

summaries that are clear to the general reader. The general conclusion is that water played a prominent role in the evolution of the planet but that "...uncertainties remain about almost every aspect of the water story." Many of these uncertainties concern how much water is near the surface today and where it is located. More than 12 pages of references document the book's sources.

William Sheehan, *The Planet Mars—A History of Observation & Discovery*, University of Arizona Press, Tucson, AZ, 1996, 270 pp., \$45.00 hardcover, \$19.95 softcover.

The Planet Mars—A History of Observation & Discovery is a thorough history of man's study of Mars, although there is some duplication of coverage from the author's 1988 book *Planets & Perception—Telescopic Views and Interpretations* (see above). The first 10 chapters of *The Planet Mars* describe the earliest observations of Mars from the 1600s through the first half of this century. The next three chapters describe the spacecraft missions and the discoveries of the Mariners and Vikings. The last chapter tells how an amateur astronomer might best view and document Mars. Four appendices give essential facts about Mars. Twenty-six pages of notes as well as a short bibliography document the sources. Written from an amateur astronomer's viewpoint for the general public, it is nevertheless a fine work of scholarship.

Jack Shuster, *Bold Endeavors—Lessons from Polar and Space Exploration*, Naval Institute Press, Annapolis, MD, 1996, 377 pp., \$32.95.

The preface of *Bold Endeavors* states that the purpose of the book is to present recommendations to facilitate human adjustment and performance within isolated and confined environments. The recommendations are aimed at the design of spacecraft and the operation of long-duration space expeditions including Mars missions. Part 1 of the book describes the research conducted, including the sources. The book is based on expeditions of early polar explorers, extended Antarctic habitations, long-duration Soviet space missions, and other terrestrial isolated or confined experiences. Part 2, the heart of the book, consists of 15 chapters devoted to the research results. These include human factor issues such as sleep, clothing, exercise, workload, leadership, medical and psychological support, personal hygiene, food, and many others. These chapters are made interesting by reference to past experiences, particularly the arduous polar expeditions. Each chapter ends with a list of specific recommendations. There are some 200 recommendations in the 15 categories of human behavior. Part 3 concludes the book with a useful discussion of some implications for the future. A conclusion of the book is that humans are fully capable of enduring the isolation and confinement of long-duration space missions if proper preparations are made. The conclusion is supported strongly by the author's engaging accounts of early polar explorers' heroic endeavors.

Carol R. Stoker and Carter Emmart (Eds.), *Strategies for Mars: A Guide to Human Exploration*, Vol. 86, Science and Technology Series, Univelt, San Diego, CA, 1996, 644 pp., \$70.00 hardcover, \$45.00 softcover.

Strategies for Mars: A Guide to Human Exploration is intended to provide a broad background on the wide range of topics relevant to human exploration of Mars. Twenty-six chapters give a review of Mars exploration strategies. The prolog "Steps to Mars" is by NASA Administrator Daniel Goldin. Chapter 25, by the late Thomas O. Paine, former NASA Administrator, is a forecast of the next 100 years of Martian history.

Robert Zubrin with Richard Wagner, *The Case for Mars—The Plan to Settle the Red Planet and Why We Must*, The Free Press, New York, 1996, 328 pp., \$25.00.

Robert Zubrin's *The Case for Mars* strongly advocates manned missions to Mars. Zubrin, a former engineer at Martin Marietta Astronautics, has been active in Mars mission planning for several years, and he has synthesized his past research and the research of others to present a provocative case for human exploration of the Red Planet. The first five chapters of the book describe a mission plan that he advocates called Mars Direct. He argues that, using today's technology, a mission with a crew of four can be sent to Mars within the next 10 years for \$20 billion to \$30 billion. The next four chapters thoroughly discuss exploring Mars, building a base, colonizing, and terraforming. The final chapter discusses funding plans, and an epilog gives further motivation for developing Mars as a new frontier. Although he states that the book is written in a layman's terms, it is best suited for readers with an engineering or a scientific orientation. However, his basic arguments for Mars manned missions are clear, stimulating, and written in a colorful style. There is a helpful glossary but only a very brief list of references.

Thomas R. Meyer (Ed.), *The Case for Mars IV: The International Exploration of Mars—Mission Strategy and Architectures*, Vol. 89, Science and Technology Series, Univelt, San Diego, CA, 1997, 760 pp., \$80.00 hardcover, \$55.00 softcover.

Proceedings of the fourth Case for Mars Conference held June 4–8, 1990, at the University of Colorado, Boulder. The prolog by the late Thomas O. Paine, former NASA Administrator, describes the rationale for Mars and lessons from Apollo. The volume is organized into three parts: Making the International Case for Mars (21 papers), Mission Strategy (30 papers), and Technical Considerations for Getting to Mars (57 papers).

Thomas R. Meyer (Ed.), *The Case for Mars IV: The International Exploration of Mars—Considerations for Sending Humans*, Vol. 90, Science and Technology Series, Univelt, San Diego, CA, 1997, 502 pp., \$70.00 hardcover, \$45.00 softcover.

Proceedings of the fourth Case for Mars Conference held June 4–8, 1990, at the University of Colorado, Boulder. The volume is organized into three parts: Considerations for Sending Humans (10 papers), Living on Mars (33 papers), and Social Perspectives (19 papers).

Fiction

Stephen Baxter, *Voyage*, Harper Collins, New York, 1996, 511 pp., \$23.00.

The premise of *Voyage* is that President Nixon directs NASA to pursue a manned Mars mission instead of building the Space Shuttle. Using enhanced Apollo technology, three astronauts land on Mars in 1986. The continuity of the narrative is disrupted by frequent shifts backward and forward in time.

Ben Bova, *Mars*, Bantam Books, New York, 1993, 549 pp., \$5.99.

Mars is an account of a first expedition to Mars early in the next century. An international team of 25 astronauts and scientists travels to Mars and explores the sur-

face. The technology and events are interesting as well as plausible.

Kim Stanley Robinson, *Red Mars*, Bantam Books, New York, 1992, 572 pp., \$5.99.

Kim Stanley Robinson, *Green Mars*, Bantam Books, New York, 1994, 535 pp., \$12.95.

Kim Stanley Robinson, *Blue Mars*, Bantam Books, New York, 1996, 609 pp., \$22.95 hardcover.

The first of the trilogy, *Red Mars*, begins with a voyage to Mars by 100 international colonists in 2026. Using advanced technology, the colonists begin developments on the Martian surface and the Martian moon Phobos. Expansive in scope, the book describes the growth of a Martian civilization over several decades. Major political and environmental conflicts among the settlers over issues such as terraforming are developed and continued in succeeding volumes. The trilogy has received laudatory critical reviews.

Earl A. Thornton
University of Virginia