Send information for publication on this page
to: Jeffrey R. Davis, M.D.
801 E. NASA Rd. 1, 3214
Webster, TX 77598

SPACE MEDICINE BRANCH REPORT

Space Exploration Initiative

This article is the third in a series on Space Medicine, and was written by Douglas O'Handley, Ph.D.

When Space Station Freedom achieves permanent manned capability in the late 1990's, the United States will forever change the relationship of man in space from visitor to resident. The Space Station Freedom is an essential step in the future human exploration of the Moon and Mars. We will learn to assemble large space structures while constructing the facility. Upon completion, it will provide a laboratory in which to study, for example, the effects of long duration exposure of humans to microgravity.

President Bush, on July 20, 1989, stated, "Space is the inescapable challenge to all advanced nations of the Earth. And there is little question that in the 21st century, humans will again leave their home planet for voyages of discovery and exploration . . ."

The next significant step after permanent manned presence on Space Station Freedom is a lunar outpost around the turn of the century. The Moon is Earth's closest neighbor in our solar system. The Moon is measured by a distance of a 3-day trip time, and communications are measured by a couple of seconds delay.

Permanent habitation on another planetary body presents considerable challenges, both technical and of a physiological nature, which cannot be thoroughly anticipated. Placing an outpost on the Moon allows us to gain planetary surface experience; humans would learn how to live and work on another body. Scientists and technicians could test hardware and systems in the harsh environment of the Moon, and have access to simulate a manned Mars mission using the microgravity of Space Station Freedom and the partial gravity of the Moon.

Science opportunities on the Moon will expand our knowledge of the history and relationship of the Moon and Earth. The Moon represents an untouched 4-billion year record of solar activity and we will gain an insight into the nature of cyclic impacts on the surface of the Moon. As a research environment, the Moon provides a superior observation base to view the Sun and the stars. It will allow astronomers to gain orders of magnitude improvement in space-based astronomy. The lunar outpost will also provide an environment to validate remote life support and health care which are required for the later missions to Mars.

The Mars missions necessitates a long-term program. The planet Mars requires a 2-year round-trip voyage and communication relays are measured by 40 minutes. However, this planet represents a further clue to the origins of the Earth and that of our solar system.

The fact that Mars is the most similar of all the planets to Earth makes it a desirable target for indepth exploration. A variety of geologic processes have occurred on Mars to produce landscapes that are barren and yet familiar. There are features such as volcanoes which are taller than natural creations on Earth, a great canyon that would stretch from New York to Los Angeles, and seas of sand dunes that girdle the entire north polar region. Mars can offer us a natural laboratory for studying the various geologic forces that shaped the planets in our solar system, making it a natural laboratory for studying pristine geologic features. The combined human and robotic exploration of the surface will contribute to a greater understanding of early planetary formation.

Mars has aroused scientific curiosity and stimulated the imagination of people since men and women first looked out to the stars. In 1971, Mariner 9 imaged Mars and revealed a fascinating, diverse world with similar features found on Earth. Mars may also have once harbored life. The dry river valleys and sedimentary deposits viewed in orbiter photography indicate a warmer, wetter past which might have encouraged primitive life forms to develop. These organisms might be found in fossil deposits in river beds or might even live today in underground habitats protected from the harsh Martian radiation and tenuous, lethal atmosphere.

We revisited Mars in 1976 with the landings of two unmanned Viking spacecraft. Viking found no traces of life at their respective landing sites, but added to our knowledge, and gave a rise to many new questions. There are still conflicting views that life may exist or has existed in the past.

The human exploration of Mars will first involve robotic precursor missions to be followed by the piloted voyages. Robotic expeditions will be necessary to conduct advanced research on the safety requirements for humans living and walking on the surface, to survey scientifically interesting sites, map and characterize the landing site on the planet. Following a series of robotic missions, the piloted expeditions would be conducted in order to establish an outpost. This would ultimately be followed by the establishment of a base operation.

There are numerous reasons for establishing a human presence on Mars. Direct human intervention, interpretation, and involvement would facilitate detailed studies of the Martian geology, environment, and resources. The human exploration of Mars itself is a source of untold benefits: it would increase our understanding of our own solar system and specifically, our planet; it would lead to technological developments, economic growth, academic maturation, and so on. It would push the frontier of human presence beyond Earth's boundaries as stated in our space policy. It would also provide an exciting focus for creativity, motivation, and pride of the American people and the world.

In summary, the establishment of an outpost on the Moon or Mars allows us to build on our past experience of Mercury, Gemini, Apollo, Skylab, and Space Shuttle. The plans for extending human presence beyond the limits of Earth into space are: in the 1990's, to establish a permanent presence on the Space Station Freedom; in the first decade of the 21st century, to establish an outpost on the lunar surface, and to follow that in the second decade with an expedition to the surface of Mars. Beyond that are the permanent bases established on both the Moon and Mars, the study of asteroids and the Martian moons and beyond.

SPACE MEDICINE BRANCH AWARDS—(Top photo) Hubertus Strughold Award of excellence was presented to Dr. Joan Vernikos-Danellis by Dr. Paul Buchanan. (Bottom photo) The Best Paper by a Young Investigator Award was presented to Andrew J. Seter, M.D. for his paper "The Determination of Human Strength Characteristics in a Simulated Zero G Environment" (abstract #382). Making the presentation is James Logan, M.D., President of the Space Medicine Branch. There were two runners-up in this award category: Barbara Shukitt-Hale for abstract #177, and Lisa Gilmour-Stallsworth for abstract #233.