

MARSBUGS:

The Electronic Exobiology Newsletter

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ARCHIVAL SITE NEEDED

By David Thomas and Julian Hiscox

At the end of last year, we, the editors, had an unfortunate mishap. Both of our archival disks were corrupted. This appears to be mere coincidence (no viruses were found), but it shows the need for some sort of archival system. We would like to be able to keep back issues of *Marsbugs* at a publicly accessible FTP site. If anyone knows of a possible site, please contact either of the editors.

Also, if anyone still has copies of back issues of *Marsbugs*, we would greatly appreciate it if you would send them to marsbugs@delphi.com.

MARS PROGRAM TO OVERSEE 10 YEARS OF MISSIONS From the *JPL Universe*

Request for proposals out to industry for design of 1998 mission to red planet.

NASA embarked on a decade-long program of Mars exploration in 1994, establishing at JPL a program office that will oversee all Mars missions planned for the next 10 years. The JPL Mars Exploration Office, established in July 1994, was put in place in response to NASA's initiative to scale back the cost and development time of spaceflight missions and to begin a sustained program of Mars exploration. Donna Shirley, manager of the Mars Pathfinder rover project, was named in August 1994 to manage the newly formed office.

The first two missions of the Mars Exploration Program got under way last year and will continue to play prominent roles for about 350 project personnel until they are launched in November 1996. The missions are the Mars Global Surveyor, an orbiter that will arrive at Mars in September 1997, and the Mars Pathfinder lander and rover, which will land on the planet and place the first robotic rover on the surface in July of the same year.

Mars Global Surveyor got off to a running start in July 1994, with the selection of Martin Marietta Technologies Inc. of Denver, Colo., to build the spacecraft. Development of the spacecraft is on a fast track schedule, with built-in performance measurement to assure on-time readiness for launch in just 28 months from the time the contractor was named last year. On average, the development of planetary spacecraft in the past has been about 66 months. The project has been capped at \$100 million per year. The Surveyor will be a polar-orbiting spacecraft designed to provide global maps of surface topography, distribution of minerals and monitoring of global weather. The spacecraft, which will be launched from a Delta II launch vehicle, will carry six of the eight scientific instruments carried aboard the Mars Observer spacecraft. The mission will rely on an aerobraking technique--developed during the final days of the Magellan mission--that will provide a means of minimizing the amount of fuel necessary to lower it into a low-altitude mapping orbit over Mars.

Mars Pathfinder received a fiscal year 1994 start by NASA's Office of Space Science, with a cost cap of \$150 million in fiscal year 1992 dollars. The project reported excellent progress in all aspects of development during 1994. Integration of prototype models of the rover, imager, flight system and ground- data system was accomplished. Conceptual testing of components of the innovative entry, descent and landing subsystems was also finished, including testing of air bag inflation and retraction mechanisms, testing of the heat shield material and testing of the rocket-assisted deceleration mechanism. Flight hardware and software will be completed this year and delivered to start the assembly and testing of the flight system in June.

In the meantime, a request for proposals has been issued to industry for design of the 1998 mission to Mars. Industry responses were expected to be returned by April 1. International participation, collaboration and coordination will be a cornerstone of all new missions to Mars, and each pair of spacecraft launched during the next decade will build on the experience of its predecessors. For instance, landers in future years--1998, 2001, 2003 and 2005--will capitalize on the experience of the Mars Pathfinder lander mission. By the same token, progressively smaller, streamlined orbiters will allow smaller and less expensive launch vehicles to be used as

NASA's armada of spacecraft is readied to explore and act as data relay stations for international missions of the future.

WELCOME TO MARS!

By Donna Shirley, Mars Exploration Program Manager
From *The Martian Chronicle*

NASA's Jet Propulsion Laboratory is going back to Mars for the first time since 1976 with a small "fleet" of missions: orbiters, landers, rovers, and maybe balloons and sample returns. And we are going in partnership with other countries like Russia, France, Germany, Italy, and Japan. Our plan is to fly at least two robotic missions to Mars every opportunity (that is about every two years) from 1996 through 2005.

Robot spacecraft from the United States and Russia have been flying to Mars since 1964. The last time we visited Mars with a fully successful mission was with the Viking, which flew two orbiters and two landers in 1975 and 1976. The orbiters took pictures of the surface that were sharp enough in some areas to see objects the size of a football field. The landers took close- up images of two spots on the surface and did experiments to search for life. While Viking did not find any life, the possibility that life once existed on Mars is still there. But we now know that finding evidence of life that exists now or in the past is harder than we thought. Missions to Mars have been attempted since Viking, but none have made all the scientific observations that were planned.

On top of that, all the Mars missions that have so far flown have not found out exactly what Mars is made out of. Do the rocks have carbon in them? Oxygen? How much iron and aluminum? Another key question is: Where did all the water go? Mars used to have a lot of surface water. We know that because the orbiter pictures show river valleys and channels. But it all disappeared a few billion years ago, except for a little bit frozen into the polar ice caps. If people are ever to live on Mars, we will need to find out if we can get water and other materials from the Martian soil, air, or underground.

And we will have to answer these kinds of questions with a program that costs much, much less than the previous Mars missions. For instance, Viking cost, if we were buying it today, almost \$4 billion. The first two of our new missions, an orbiter and a lander, will cost less than 10% of that. And every two missions after that (which will fly to Mars every two years) will cost less than 5% of the cost of Viking.

The Martian Chronicle will keep you posted on the work of the Mars Exploration Program. We will tell you about our missions, what we hope to find, and what we do find when we get there. And we will tell you what is going to be happening and ways for you to get involved as we build and fly our spacecraft. Other articles in the Chronicle will tell you about our plans for educational outreach and public involvement.

Please e-mail me at donna.shirley@jpl.nasa.gov with your ideas on how we can involve you and other people in exploring Mars. (The Martian Chronicle is also available on the World Wide Web at <http://www.jpl.nasa.gov/mars>.)

WHY SHOULD WE EXPLORE MARS?

By Dr. Matthew Golombek, Mars Pathfinder Project Scientist
From *The Martian Chronicle*

Mars is the most Earth-like of the five terrestrial planets and will be the first other planet humans will visit. Why? The Moon and Mercury are dry airless bodies. Venus has suffered a runaway greenhouse effect, developing a very dense carbon dioxide atmosphere that has resulted in the escape of all its water and uninhabitable surface temperatures of 750K. Mars, on the other hand, has everything necessary to support life, including an atmosphere with polar caps and large amounts of water. Mars is, in fact, the only other terrestrial planet with abundant water (and liquid water is absolutely required for life as we know it). So eventually humans will visit Mars not only because it is the only other planet with reasonable surface conditions, but for the potential of what it might become in the much more distant future--another home for people.

Mars is also the only other place where we can begin to address the question - "Are we alone in the universe?" Is life a cosmic accident or does life develop anywhere the proper environmental conditions are met? A number of studies have shown that the likelihood of humans hearing from possible advanced civilizations in other solar systems is extremely remote given the enormous distances (and long time delays) involved. Mars is our neighbor and, unlike any other planet in our solar system, substantial evidence indicates that early environmental conditions may have been similar to those on the young Earth. On Earth, evidence for life can be found in some of the oldest rocks, dating from the end of terminal bombardment around 4 billion years ago. Surfaces on Mars that are of this age show remains of ancient lakes, implying that liquid water was in equilibrium with the atmosphere at that time and that the climate was both wetter and substantially warmer. If this is true, then we can learn, through further exploration, whether life did develop on Mars, or if not why not. If life did develop on Mars what has happened to it, given that Viking found no evidence present-day life at the two landing sites? We could even begin to explore whether life that began early on could still survive in some specialized niches, such as hydrothermal systems near volcanoes.

Finally, exploring Mars provides a way of better understanding significant issues that face humankind in the future, namely the factors involved in natural changes in a planet's climate. On the Earth, one of the most important questions now being studied is whether or not humans are contributing to global warming (if it is occurring via industrial emissions). We do not know if we are, or if these changes could produce negative environmental changes such as sea level rise due to melting of the ice cap (most of the world's largest cities are at elevations very close to sea level). Mars, on the other hand, provides a natural laboratory for studying climatic changes on a variety of time scales. If Mars was warmer and wetter with a thicker atmosphere in the past, why did it change?

In addition, layered deposits near the martian polar caps suggest climatic fluctuations on a shorter time scale. If we can learn the important factors controlling climatic changes on another planet, we may be better capable of understanding the consequences of human-influenced changes on Earth. Lastly, Mars is an excellent laboratory to engage in such a study, given that its geologic activity has produced rocks on the surface of virtually all ages to study. Unlike the overactive Earth and Venus, where most of the surface is covered by young rocks, and the inactive Mercury and Moon, where only ancient rocks are present, Mars has had an intermediate level of geological activity, which has produced rocks on the surface that preserve

the entire history of the solar system. Sedimentary rocks preserved on the surface contain a record of the environmental conditions in which they formed and thus any climatic changes that have occurred through time.

LAB RESEARCHERS FIND IMPACT SITE LEADING TO DINOSAURS' DEMISE

By Karre Marino
From the *JPL Universe*

The Earth's dinosaurs may have been on the decline some 65 million years ago, but according to a team of JPL researchers, it was an asteroid that struck a geologically unique area in Mexico that ultimately did them in.

"We believe that an asteroid, 10 to 30 kilometers (about six to 18 miles) in diameter, impacted a sulfur-rich site in a region of the Yucatan Peninsula," according to Adriana Ocampo, planetary geologist in the Space and Earth Science Division 32.

A paper detailing the results of the researchers' findings was published this month in the journal *Earth and Planetary Sciences Letters* and was co-authored by Ocampo; Kevin Baines, also in Division 32; Kevin Pope of Geo Eco Arc Research in La Canada; and Boris Ivanov of Moscow's Russian Academy of Science.

"Several lines of evidence have prompted the scientific community to believe that this crater--called Chicxulub--(which means tail of the devil in Maya) caused the extinction of more than 50 percent of the Earth's species," Ocampo added.

That theory was first aired in 1980, when University of California, Berkeley, geology professor Walter Alvarez and his colleagues proposed that dinosaurs disappeared due to a large impact. The main evidence was the high concentration of iridium found in the clay layer in Italy in the Cretaceous/Tertiary boundary, which marks the time transition between these two geological periods. Iridium, an element rare on Earth, is found in high concentrations in asteroids and comets, and in rocks that date to the mass extinction.

The scientific community found this notion to be highly controversial, Ocampo explained. "It was hard for people to conceive that the Earth had been so catastrophically transformed by the impacts of an asteroid or comet," she said.

In order to be convinced, scientists had to find the actual impact site. It took them a decade to do so. In 1989, Pope and Charles Duller, of NASA's Ames Research Center, discovered a 170-kilometer-diameter (105-mile) semi-circle of sinkholes at Chicxulub, Mexico. After Ocampo studied the gravity, magnetic and stratigraphic data and correlated them with the sinkholes, she recognized that the area had the classic characteristics of an impact crater.

These results were published in 1991, the same year Ocampo and Pope discovered an unusual deposit of large boulders at the Cretaceous/Tertiary boundary in Belize in Central America, 360 kilometers (223 miles) south of the Chicxulub crater. The boulders, some the size of a Volkswagen bug, were spewed out of the crater upon impact, and flew 320 kilometers (200 miles) to land in Belize, she said. Fragments of glass, created by the melting of rock upon impact, were found with the boulders. Spherical fragments known as tektites, which were formed as the molten glass flew through the air and cooled, were also found.

"These tektites have been found in Haiti, Mexico, Texas and Alabama," Ocampo noted, "but the large boulders are only known in Belize, because it's so close to the crater."

Along with the tektites, spherical pieces of calcium carbonate, some with an unusual radial structure, were found. The formation of these "spherules" remains a mystery, but the scientists speculate that they may have formed from the residue of vaporized carbonates and sulfates.

Another important find in the boulder deposit was limestone with fossils dating to the early part of the Cretaceous, when the Yucatan platform first appeared. "Fossils of this age don't belong in northern Belize," Ocampo observed. "Early Cretaceous fossils are known from deep down in the platform, recorded in the drilling records of a Mexican petroleum company."

The scientists suggest that the limestone found in Belize was excavated by the impact, which probably blew a hole more than 15 kilometers (nine miles) deep in the Yucatan platform. Results of the Belize research by Ocampo, Pope and Alfred Fischer of the University of Southern California are scheduled to appear with other works in a special paper of the Geological Society of America, detailing recent research on major catastrophes in Earth's history.

Now that the crater had been found, "The real challenge was to show how it killed the dinosaurs," Pope said.

In studying the site and modeling the resulting changes in the biosphere, the scientists believed that what proved lethal to life on Earth was where the asteroid hit.

"The target area was rich in salts and sulfur, because the Gulf of Mexico was cut off from the sea for much of the Cretaceous. The evaporites produced by the evaporation of sea water were rich in sulfur," Ocampo explained.

Had the celestial body impacted somewhere else--in the Sierra Nevada, for instance--"The extinctions may not have occurred," she maintained.

"The impact created a melange of sulfuric acid, dust and soot that exploded from the crater to the highest levels of the atmosphere, distributing the materials worldwide," Ocampo added. "Initially, the Earth experienced a total blackout due to soot and debris wafting into the atmosphere as a result of the impact. Photosynthesis was shut down for approximately six months, after which the sky partially cleared."

From related work on the sulfuric-rich atmosphere of Venus and a sophisticated computer model of the impact, the team determined that "Sulfuric acid clouds, such as those that perpetually cover Venus, blanketed the Earth for more than a decade," Baines said. "The shielding effect of these high-altitude chemical hazes cooled the surface to near freezing across the face of the planet."

The researchers concluded that winter-like conditions lasted long enough to cool the ocean, as well as the atmosphere, even in formerly balmy tropical seas on the other side of the globe. The scientists speculate that after the sulfuric acid cloud precipitated, dousing the Earth with acid rain, a greenhouse effect may have taken over, caused by the carbon dioxide also released by the impact. Nevertheless, it was the duration and worldwide extent of the cold period that caused such devastating effects and ended the era of the dinosaurs.

This research was funded by the NASA Exobiology Program in the Solar System Exploration Division, and by the Planetary Society in Pasadena.

AGENCIES FORM JOINT PROGRAM IN PLANT BIOLOGY NASA release: 94-213

A joint government research program has been established which activities may result in the development of plants that can withstand drought, unseasonable temperatures, salinity in the soil, and other adverse growth conditions. Supported by NASA and the National Science Foundation, this collaborative program, called the Research Network on Plant Sensory Systems (RNPSS), will foster interactions among scientists that will increase human understanding of how plants sense and respond to various environmental signals, such as light, temperature and gravity.

The program includes the awarding of nine science grants totaling more than \$5 million over five years. The program also was selected as NASA's ninth Specialized Center of Research and Training (NSCORT), continuing a program dedicated to space life sciences begun in 1990.

Plants are vital to humankind's existence. From providing the oxygen we breathe to the foods we eat, plants are a renewable resource upon which our existence depends. The results of the research supported by this joint program will contribute to the long-term health of the environment and humans. Plants, unlike animals, have not developed specific organs that see, hear, and feel various environmental stimuli. Nor can they move to avoid adverse environmental conditions. Yet, plants respond to various environmental stimuli and survive significant fluctuations in environmental conditions. Many plant species have evolved to take advantage of specific environments they live in.

When the environment becomes extremely harsh, some plants shut down certain functions and preserve only the bare minimum set of functions to wait for a better growing condition. There are some indications that common mechanisms might be operating in plants' perception of and response to different environmental signals. How plants perceive and respond to the environmental signals is one of the major unanswered questions in biological sciences. Recent advances in biotechnology provide scientists an unprecedented opportunity to find answers to this long-standing question.

The nine research projects awarded grants were selected based on their scientific excellence from 35 applicants. All nine projects focus on the question of how plants perceive environmental signals and how those signals bring about growth and development of plants. An additional objective of the grants is to enhance opportunities for university students to receive research training in multidisciplinary and collaborative activities.

Awards under this program are exclusively for ground-based research. If research requires a microgravity environment for concept verification it will be considered for flight opportunities by NASA's Office of Life and Microgravity Sciences and Applications at a later date on a competitive basis.

FY 1994 List of Research Grant Recipients

Investigator/Institution

Sarah Assmann, Pennsylvania State University, University Park, PA
Ronald Davis, Stanford University, Stanford, CA
Michael Evans, Ohio State University, Columbus, OH
Jeffrey Harper, Scripps Research Institute, La Jolla, CA
Joseph J. Keiber, University of Illinois at Chicago, Chicago, IL
Barbara Pickard, Washington University, St. Louis, MO
Dieter Soll, Yale University, New Haven, CT
Edgar Spalding, University of Wisconsin, Madison, WI
Fedora Sutton, South Dakota State University, Brookings, SD

NEW SPACELAB SCIENCE MISSION TO FLY IN 1996 NASA release: 94-212

NASA has begun planning for a new multidisciplinary life and microgravity sciences Spacelab research mission to be flown on the Space Shuttle in mid-1996. The 16-day mission is scheduled for launch aboard the orbiter Columbia on Shuttle flight STS-78. The flight, carrying a crew of seven, will involve 21 investigations: fifteen in life sciences and six in microgravity sciences.

The life sciences experiments will continue studies probing the changes and adaptive mechanisms of living systems including plants, animals and humans under weightless conditions. Human and animal studies are focused on the effects of microgravity on the musculoskeletal system and on sleep and performance. Life sciences experiments will investigate changes in the musculoskeletal system (bone and muscle deterioration), neurovestibular system (balance disorders), cardiopulmonary (heart and lungs) and regulatory physiology (changes in body chemistry, fluid regulation and immune system).

The microgravity science investigations will focus on protein crystallization, fluid physics and materials science. In addition, vibration measurement instruments will support these experiments by characterizing in detail the microgravity environment aboard the Spacelab. Microgravity experiments will include protein crystal growth, electrohydrodynamics, fluids interface studies, high temperature directional solidification of multi-phase materials and solidification with particle pushing and engulfment.

The Life and Microgravity Spacelab (LMS) mission, as the flight has been designated, is being managed by the Marshall Space Flight Center in Huntsville, AL, for the Office of Life and Microgravity Sciences and Applications at NASA Headquarters, Washington, DC.

Mark Boudreaux of the Payload Projects Office at Marshall has been named mission manager and Dr. James P. Downey of the Center's Space Sciences Laboratory is the mission scientist. Principal investigators selected to date for the LMS mission include:

Dr. J. Barry Andrews, University of Alabama at Birmingham, AL.
Dr. Christopher Cann, University of Calif. at San Francisco, CA.
Dr. Paolo Cerretelli, Universite de Geneve, Centre Medical Universitaire, Geneve, Switzerland.
Professor Pietro E. di Prampero, Universita deglie Studi di Udine, Udine, Italy.
Dr. Y. Reggie Edgerton, U. of Calif. at Los Angeles, CA.

Dr. Robert Fitts, Marquette University, Milwaukee, WI.
Dr. Adrian LeBlanc, Baylor College of Medicine, Houston, TX.
Dr. Norman Lewis, Wisconsin State University, Pullman, WI.
Dr. Alexander McPherson, Jr., University of Calif. at Riverside, CA.
Timothy Monk, University of Pittsburgh, PA.
Dr. Shunji Nagaoka, National Space Development Agency of Japan.
Sam Schiflett, USAF Armstrong Laboratory, Brooks AFB, TX.
Dr. Doru M. Stefanescu, University of Alabama at Tuscaloosa, AL.
Dr. T. Peter Stein, U. of Medicine and Dentistry of New Jersey, Stratford, NJ.
Dr. Peter A. Tesch, Karolinska Institute, Stockholm, Sweden
Dr. Douglas Watt, McGill University, Montreal, Canada.
Dr. John B. West, University of California, La Jolla, CA.
Dr. Thomas J. Wronski, University of Florida, Gainesville, FL.

1995 ASTRONAUT CANDIDATES SELECTED NASA release: 94-205

Nineteen new astronaut candidates have been selected for the Space Shuttle program. The 1995 group consists of 10 pilots and 9 mission specialists, including 6 civilians and 13 military officers.

The candidates were chosen from among 2,962 applicants. NASA brought 122 of the applicants to the Johnson Space Center, Houston, for interviews and medical evaluations in June, July and August. The candidates will report to Johnson in March 1995 to begin a year of training and evaluation, followed by technical assignments within the Astronaut Office to further prepare them for assignment to Shuttle flight crews. The 1995 Astronaut Candidate class also will eventually include international participation. These international candidates will be announced at a later date.

A listing of the astronaut candidates and biographical data follows.

1995 Astronaut Candidates

Lt. Commander Scott D. Altman, U.S. Navy, Pilot
Major Michael P. Anderson, U.S. Air Force, Mission Specialist
Commander Jeffrey S. Ashby, U.S. Navy, Pilot
Major Michael J. Bloomfield, U.S. Air Force, Pilot
Kalpana Chawla, Ph.D., Civilian, Mission Specialist
Lt. Commander Robert L. Curbeam, Jr., U.S. Navy, Mission Specialist
Lt. Commander Joe F. Edwards, Jr., U.S. Navy, Pilot
Commander Dominic L. Gorie, U.S. Navy, Pilot
Kathryn P. Hire, Civilian, Mission Specialist
Major Rick D. Husband, U.S. Air Force, Pilot
Janet L. Kavandi, Ph.D., Civilian, Mission Specialist
Major Steven W. Lindsey, U.S. Air Force, Pilot
Edward T. Lu, Ph.D., Civilian, Mission Specialist
Major Pamela A. Melroy, U.S. Air Force, Pilot
Major Carlos I. Noriega, U.S. Marine Corp, Mission Specialist
James F. Reilly, Civilian, Mission Specialist
Stephen K. Robinson, Ph.D., Civilian, Mission Specialist
Lieutenant Susan L. Still, U.S. Navy, Pilot
Captain Frederick W. Sturckow, U.S. Marine Corps, Pilot

Biographical Data

NAME: Scott D. Altman, Lieutenant Commander, USN, Pilot
BIRTHDATE/PLACE: August 15, 1959 - Lincoln, IL
RESIDENCE: San Diego, CA
EDUCATION: Pekin Community High School, Pekin, IL 1977
B.S. Aeronautical/Astronautical Engineering, Univ. of Illinois
1981
M.S. Aeronautical Engineering, Naval Postgraduate School
1990 CURRENT POSITION: Operations Officer, Fighter
Squadron 31 NAS Miramar, San Diego, CA
PARENTS: Fred and Sharon Altman, Pekin, IL
MARITAL STATUS: Married to the former Jill Shannon
Loomer

NAME: Michael P. Anderson, Major, USAF, Mission Specialist
BIRTHDATE/PLACE: December 25, 1959 - Plattsburgh, NY
RESIDENCE: Plattsburgh, NY
EDUCATION: Cheney High School, Cheney, WA 1977 B.S.
Physics/Astronomy, University of Washington 1981 M.S.
Physics, Creighton University 1990
CURRENT POSITION: Tactics Officer, 380 Operations
Support Squadron, Plattsburgh AFB, NY
PARENTS: Bobbie and Barbara Anderson, Spokane, WA
MARITAL STATUS: Married to the former Sandra Lynn
Hawkins

NAME: Jeffrey S. Ashby, Commander, USN, Pilot
BIRTHDATE/PLACE: June 16, 1954 - Dallas, TX
RESIDENCE: Lemoore, CA
EDUCATION: Evergreen High School, Evergreen, CO 1972
B.S. Mechanical Engineering, University of Idaho 1976 M.S.
Aviation Systems, Univ. of Tennessee, Knoxville 1993
CURRENT POSITION: Commanding Officer, Strike Fighter
Squadron 94 NAS Lemoore, CA
PARENTS: Elizabeth Shears Ashby, Evergreen, CO, John
Benjamin Ashby, Pine Bluffs, WY
MARITAL STATUS: Married to the former Diana Christene
Merriweather

NAME: Michael J. Bloomfield, Major, USAF, Pilot
BIRTHDATE/PLACE: March 16, 1959 - Flint, MI
RESIDENCE: Edwards Air Force Base, CA
EDUCATION: Lake Fenton High School, Fenton, MI 1977
B.S. Engineering Mechanics, U.S. Air Force Academy 1981
M.S. Engineering Management, Old Dominion Univ. 1993
CURRENT POSITION: Flight Commander, 416th Flight Test
Squadron Edwards Air Force Base, CA
PARENTS: Roger & Maxine Bloomfield, Linden, MI MARITAL
STATUS: Married to the former Lori Ann Miller

NAME: Kalpana Chawla, Ph.D., Mission Specialist
BIRTHDATE/PLACE: July 1, 1961 - Karnal, India
RESIDENCE: Sunnyvale, CA
EDUCATION: Tagore School, Karnal, India, 1976
B.S. Aeronautical Engineering, Punjab Engineering College
1982 M.S. Aerospace Engineering, University of Texas 1984
Ph.D. Aerospace Engineering, University of Colorado 1988
CURRENT POSITION: Research Scientist/Vice President
Overset Methods, Inc. Los Altos, CA
PARENTS: Syongita and Banarsi Lal Chawla, New Delhi,
India MARITAL STATUS: Married to Jean-Pierre Harrison

NAME: Robert L. Curbeam, Jr., Lt Commander, USN, Mission
Specialist
BIRTHDATE/PLACE: March 5, 1962 - Baltimore, MD
RESIDENCE: Annapolis, MD

EDUCATION: Woodlawn High School, Baltimore County, MD
1980 B.S. Aerospace Engineering, United States Naval
Academy 1984 M.S. Aeronautical Engineering, Naval
Postgraduate School 1990 Degree of Aeronautical &
Astronautical Engineering, Naval Postgraduate School 1991
CURRENT POSITION: Instructor United States Naval
Academy Annapolis, MD
PARENTS: Robert and Yvonne Curbeam, Quinton, VA
MARITAL STATUS: Married to the former Julie Dawn Lein

NAME: Joe F. Edwards, Jr., Lieutenant Commander, USN,
Pilot BIRTHDATE/PLACE: February 3, 1958 - Richmond, VA
RESIDENCE: Fairfax, VA
EDUCATION: Lineville High School, Lineville, AL 1976 B.S.
Aerospace Engineering, United States Naval Academy 1980
M.S. Aviation Systems, Univ. of Tennessee, Knoxville 1994
CURRENT POSITION: Operations Officer, The Joint Staff,
The Pentagon, Washington, D.C.
PARENTS: Joe and Jane Edwards, Roanoke, AL
MARITAL STATUS: Married to the former Janet Leigh Ragan

NAME: Dominic L. Gorie, Commander, USN, Pilot
BIRTHDATE/PLACE: May 2, 1957 - Lake Charles, LA
RESIDENCE: Orange Park, FL
EDUCATION: Miami Palmetto High School, Miami, FL 1975
B.S. Ocean Engineering, United States Naval Academy 1979
M.S. Aviation Systems, Univ. of Tennessee, Knoxville 1990
CURRENT POSITION: F/A-18 Pilot, Strike Fighter Squadron
106 NAS Cecil Field, FL
PARENTS: The late Paul Louis Pudwill (father), Shirley
Pudwill, Casselberry, FL William Gorie, Palm City, FL
(stepfather) MARITAL STATUS: Married to the former Wendy
Lu Williams

NAME: Kathryn P. Hire, Mission Specialist
BIRTHDATE/PLACE: August 26, 1959 - Mobile, AL
RESIDENCE: Merritt Island, FL
EDUCATION: Murphy High School, Mobile, AL 1977 B.S.
Engineering Management, U.S. Naval Academy 1981 M.S.
Space Technology, Florida Institute of Tech. 1991 CURRENT
POSITION: Supervisor, Orbit Mechanisms and Swing Arms,
Lockheed Space Operations Company, Kennedy Space
Center, FL PARENTS: Robert and Kathryn Hire, Orange
Beach, AL MARITAL STATUS: Unmarried

NAME: Rick D. Husband, Major, USAF, Pilot
BIRTHDATE/PLACE: July 12, 1957 - Amarillo, TX
RESIDENCE: Amesbury, England
EDUCATION: Amarillo High School, Amarillo, TX 1975 B.S.
Mechanical Engineering, Texas Tech University 1980 M.S.
Mechanical Engineering, California State Univ. 1990
CURRENT POSITION: Chief of Flight Test, Tornado GR1
Exchange Program with Royal Air Force, Boscombe Down,
England PARENTS: The late Doug Husband, Jane Husband,
Amarillo, TX MARITAL STATUS: Married to the former Evelyn
Neely

NAME: Janet L. Kavandi, Ph.D., Mission Specialist
BIRTHDATE/PLACE: July 17, 1959 - Springfield, MO
RESIDENCE: Renton, WA
EDUCATION: Carthage Senior High School, Carthage, MO
1977 B.S. Chemistry, Missouri Southern State College, 1980
Ph.D. Chemistry, University of Washington 1990
CURRENT POSITION: Principal Engineer, Energy Storage,
Boeing Defense and Space Group, Seattle, WA.
PARENTS: The late William and Ruth Sellers Niece of
Edward and Mary England (Guardians) Carthage, MO
MARITAL STATUS: Married to John Kavandi

NAME: Steven W. Lindsey, Major, USAF, Pilot
BIRTHDATE/PLACE: August 24, 1960 - Arcadia, CA
RESIDENCE: Niceville, FL
EDUCATION: Temple City High School, Temple City, CA
1978 B.S. Engineering Sciences, U.S. Air Force Academy
1982 M.S. Aero Engineering, Air Force Institute of Tech. 1990
CURRENT POSITION: Test Pilot, Air Force Seek Eagle
Office, Eglin Air Force Base, FL
PARENTS: Arden & Lois Lindsey, Arcadia, CA
MARITAL STATUS: Married to the former Diane Renee
Trujillo

NAME: Edward T. Lu, Ph.D., Mission Specialist
BIRTHDATE/PLACE: July 1, 1963 - Springfield, MA
RESIDENCE: Honolulu, HI
EDUCATION: R.L. Thomas High School, Webster, NY 1980
B.S. Electrical Engineering, Cornell University 1984 Ph.D.
Applied Physics, Stanford University 1989 CURRENT
POSITION: Postdoctoral Fellow, Institute for Astronomy,
University of Hawaii-Manoa, Honolulu, HI PARENTS: Charlie
and Snowily Lu, Fremont, CA MARITAL STATUS: Unmarried

NAME: Pamela A. Melroy, Major, USAF, Pilot
BIRTHDATE/PLACE: September, 17, 1961 - Palo Alto, CA
RESIDENCE: Edwards, CA
EDUCATION: Bishop Kearney High School, Rochester, NY
1979 B.A. Physics and Astronomy, Wellesley College 1983
M.S. Earth & Planetary Sciences, MIT 1984
CURRENT POSITION: C-17A Developmental Test Pilot,
Edwards Air Force Base, CA
PARENTS: David and Helen Melroy, Pittsford, NY MARITAL
STATUS: Married to Christopher Wallace Wank

NAME: Carlos I. Noriega, Major, USMC, Mission Specialist
BIRTHDATE/PLACE: October 8, 1959 - Lima, Peru
RESIDENCE: Camp Foster, Okinawa, Japan
EDUCATION: Wilcox High School, Santa Clara, CA 1977
B.S. Computer Science, Univ. of Southern California 1981
M.S. Computer Science, Naval Postgraduate School 1990
M.S. Space Systems Operations, Naval Postgraduate School
1990 CURRENT POSITION: G1 Operations Officer, 1st
Marine Aircraft Wing, Camp Butler, Okinawa, Japan
PARENTS: Rodolfo and Nora Noriega, Gilbert, AZ
MARITAL STATUS: Married to the former Wendy Louise
Thatcher

NAME: James F. Reilly, Mission Specialist
BIRTHDATE/PLACE: March 18, 1954 - Mountain Home AFB,
ID
RESIDENCE: Mesquite, TX
EDUCATION: Lake Highlands High School, Dallas, TX 1972
B.S. Geosciences, University of Texas-Dallas 1977 M.S.
Geosciences, University of Texas-Dallas 1987 Ph.D.
Geosciences, Univ. of Texas-Dallas 1995 (expected)
CURRENT POSITION: Chief Geologist-Offshore Enserch
Exploration, Inc., Dallas, TX
PARENTS: Ken and Billie Reuthers, Tyler, TX James Francis
Reilly, Rockwall, TX
MARITAL STATUS: Married to the former Jo Ann Strange

NAME: Stephen K. Robinson, Ph.D., Mission Specialist
BIRTHDATE/PLACE: October 26, 1955 - Sacramento, CA
RESIDENCE: Grafton, VA
EDUCATION: Campolindo High School, Moraga, CA 1973
B.S. Mechanical/Aeronautical Engineering, University of
California 1978
M.S. Mechanical Engineering, Stanford University 1985 Ph.D.
Mechanical Engineering, Stanford University 1991 CURRENT
POSITION: Research Scientist, Fluid Dynamics & Acoustics

Division, NASA Langley Research Center Hampton, VA
PARENTS: William & Joyce Robinson, Moraga, CA
MARITAL STATUS: Unmarried

NAME: Susan L. Still, Lieutenant, USN, Pilot
BIRTHDATE/PLACE: October, 24, 1961 - Augusta, GA
RESIDENCE: Virginia Beach, VA
EDUCATION: Walnut Hill High School, Natick, MA 1979 B.S.
Aeronautical Engineering, Embry-Riddle Univ. 1982 M.S.
Aerospace Engineering, Georgia Institute of Technology 1985
CURRENT POSITION: F-14 Pilot, Fighter Squadron 101,
NAS Oceana, Virginia Beach, VA
PARENTS: The late Jean Ann Batho Still, Joseph and Sue
Still, Martinez, GA
MARITAL STATUS: Unmarried

NAME: Frederick W. Sturckow, Captain, USMC, Pilot
BIRTHDATE/PLACE: August 11, 1961 - La Mesa, CA
RESIDENCE: Leonardtown, MD
EDUCATION: Grossmont High School, La Mesa, CA 1978
B.S. Mechanical Engineering, California Polytechnic State
University 1984
CURRENT POSITION: F/A-18 E/F Project Pilot, Naval Air
Test Center, Patuxent River, MD
PARENTS: Janette Sturckow, La Mesa, CA Karl H. Sturckow,
Lakeside, CA
MARITAL STATUS: Married to the former Michele A. Street

NASA COMPLETES SHIPMENT OF FIRST STATION
HARDWARE TO RUSSIA
NASA release: 94-217

NASA has completed the second of two shipments of solar
panel modules, marking delivery of the first U.S. Space Station
flight hardware for NASA's cooperative space endeavors with
Russia. The hardware shipments each consisted of 45 solar
panel modules that were developed for the Mir cooperative
solar array project, an effort that brings together NASA's
advanced photovoltaic technology with Russia's proven
structures and mechanisms. The second set of solar panel
modules left Lockheed Missiles and Space Company's
manufacturing facility in Sunnyvale, CA, on Dec. 16. The first
shipment was sent in mid-November. Prototypes of the arrays
were shipped to Russia in May for verification of the design and
assembly procedures.

Each panel module consists of 80 solar cells. One panel
measures approximately 51 inches long by 17 inches wide, and
is capable of generating about 80 watts. Eighty-four of the
modules will be integrated with Russian-made frames in 42
hinged pairs. After the modules are installed in the frames, the
completed array will be shipped back to the U.S. to be readied
for launch. The complete six kilowatt joint array will be taken to
the Mir Space Station on the Space Shuttle Atlantis STS-74
mission, scheduled for October 1995.

The program objective is to augment Mir's power by replacing
an existing degraded array with the new, jointly- developed
array. The power from the new array, and a second all-
Russian array, is needed to extend the lifetime of the Mir Space
Station and support experiments conducted at the Station by
the U.S. The Mir cooperative solar array project is managed by
NASA's Lewis Research Center, Cleveland, OH, for the Space
Station Program Office, Houston. Team members include
Lockheed; Rockwell International, Rocketdyne Division,
Canoga Park, CA; and RSC- Energia, Kaliningrad, Russia.

THE SNOWS OF OLYMPUS: A GARDEN ON MARS.

By Arthur C. Clarke.

120 pp., Victor Gollancz, London, 1994.

BOOK REVIEW

By Martyn J. Fogg.

The advice I would give to anybody about to read this book is not to judge it by the blurb on its cover which boldly states: "Arthur C. Clarke's unique vision, accompanied by stunning computer-generated images, shows how the planet Mars could be made habitable for humanity."

The concept of terraforming Mars, to suit it for terrestrial life, is not a "unique" vision at all; this book hardly discusses anything worthwhile about the "how" of terraforming; and--yes, I'm sorry--I just didn't find those garish computer pictures at all "stunning".

The publisher's hyperbolae aside, I did enjoy perusing "The Snows of Olympus". A truer description would be to say that the book illustrates the terraforming of a virtual reality Mars created by the Vistapro software running on Arthur's Amiga personal computer. This is at once more and less impressive than it sounds. The computer is acting solely as an art generator and is not simulating any of the physical processes relevant to the transformation being shown. However where Arthur comes close to being "unique" is that he is presaging the time when virtual reality paint programs become so powerful that authors of coffee table books can do all their own artwork and dispense with artists completely (although perhaps the coffee table book itself might become obsolete too). This said, I must admit that I much preferred the more traditional airbrush-rendered pictures that were also included. Computer-aided amateur illustration has evidently still a long way to go before it catches up with professional quality.

The text, whilst sparse and superficial, is highly readable. At a cracking pace, Arthur covers the history of Mars in fact and fiction; the politics of space exploration; how to travel to Mars; how to live there; and even a few words on what the book is ostensibly about--terraforming. Clarke's skills as a writer are still light years ahead of his new found talent of computerised landscape painting. There are a few quite hilarious passages well worth waiting for, such as where he jokes about the believers of the 'face on Mars': "... there is a face on Earth too--and not just any old face. Some years ago a Canadian air survey photographed a formation which was, quite unmistakably, a profile of George Bernard Shaw--which was promptly named after him. It has been well asked: 'What strange powers did the Ancients possess, which enabled them

to erect this monument to a famous playwright--thousands of years before he was born?'"

The book contains so many pictures, that their captions run like a parallel text that seems curiously unconnected with the main text. Future historical dates appear in the captions which seem arbitrary. They are not provided by Vistapro (which knows nothing of what it is illustrating save its files of digital elevation data and what its algorithms say looks "pretty") and yet also are clearly unrelated to any technically-based model of the terraforming process. Some infelicities are quite striking due to Vistapro's ignorance of absolute, rather than relative scale, and its imperative to produce attractive images. Thus we see trees the size of megaton mushroom clouds drawn on features of the Martian landscape that are shrunk into banality by comparison. Equally bizarre are a picture of Olympus Mons with a sea lapping around its basal escarpment--which means that most of the planet would be underwater! Or several pictures of a lake flooding the caldera of Olympus Mons, surrounded by temperate vegetation, which implies that if it is this hot 20 km above the planet's mean radius, then down at "sea level" the seas would be near boiling!

Pictures and captions together therefore illustrate the main problem I have with "The Snows of Olympus": we have plenty of pictures illustrating a scenario of terraforming, but very little discussion--and certainly no detailed reasoning--that such a scenario is possible. However, Clarke does provide an escape route for readers whose appetite has been whetted. In his "Further Reading" section, three technical papers on terraforming are cited--not many compared to the number now published--but enough when accessing their reference lists to open up the technical study of terraforming to anybody who might be interested.

So this is the purpose behind "The Snows of Olympus": a generally accessible, Walt Disney style, tour of a future Mars. Don't expect to be edified, but you will be entertained.

MID-CONTINENT SPACE DEVELOPMENT CONFERENCE

The Mid-Continent Space Development Conference will be held February 17 & 18, 1995 in Ames, Iowa. This is the fourth annual MCSDC; it is produced by college students for the benefit of students, educators and the general public.

Our current speakers list includes, but will not be limited to:

<u>Speaker</u>	<u>Representing</u>	<u>Topic</u>
Dr. William Gaubatz	McDonnell-Douglas	Delta Clipper
Dr. Robert Zubrin	Martin-Marietta	
Dr. Robert Forward	Forward Unlimited	Advanced Propulsion
Dr. Seth Shostak	SETI Institute	SETI
?	Jet Propulsion Laboratory	
Dr. Robert Zuppero	Idaho Nat. Energy Lab	Space/Water Resources
Thomas Kessler	International Space Enterprises	
Seth Potter	New York University	Solar Power Sattelites
?	NASA Lewis	?
Frank Hughes	NASA-Johnson	Astronaut Training

We will eventually have 15 speakers.

A WWW/Mosaic site for the MCSDC has been set up; it contains further information, including maps, hotel information and our registration form. More will be added as it becomes available. <http://www.public.iastate.edu/~selowthe/mcsdc.html>

Prices

Adults

one day: \$18
both days: \$30

Children, K-12

one day: \$9
both days: \$15

College students and educators

one day: \$13
both days: \$22

For more information, contact:
Jeanette Ramsey: (515)292-2619
Tomas Gonzalez: (515)296-3096
mcsdc@iastate.edu

THE NATIONAL SPACE SOCIETY'S 14TH ANNUAL INTERNATIONAL SPACE DEVELOPMENT CONFERENCE

Cleveland, Ohio May 18-21, 1995 Holiday Inn Independence Held one week earlier than Memorial weekend.

PROPOSED SPEAKERS

Dr. Guion Bluford
Dr. R. Lynn Bondurant
Michael Ciancone
Charles Walker
Dr. Michael Fulda
Mae Jemison
Gordon Woodcock
Dr. David Webb
Dr. Robert Zubrin

WORKSHOPS

Astronomy
Rocketry
Space Frontier Foundation
Space Materials

SPECIAL EVENTS

NASA Tours
Music of the Heavens Concert
Cleveland Metroparks Zoo Rainforest
Exhibits

FEATURED TOPICS

Student Robotic Lunar Rover Contest
Apollo/Soyuz (Then & Now)
NASA's Space Art Program
Teachers' Seminar
Lunar & Mars Settlements
High School Student Day
Space Law
Star Gazing Party
Nano Technology
Art Exhibit & Auction
Astronaut Training Environment
Simulated Trip to the Moon
Space Medicine
Out of the Foundry into the Frontier
Privitization of Space Program
Many Roads to Space

SESSION SPONSORS

Cuyahoga Valley Space Society; EXITUS, Inc.; Midwest Space Development Corporation; NASA Lewis Research Center

CO-SPONSORS

AlliedSignal Aerospace; Cleveland Aerospace Professional Representatives Association; Ohio Wing of the Civil Air Patrol; Cleveland Museum of Natural History; Great Lakes Industrial Technology Center; Institute for the Social Science Study of Space; Middleburg Hts. Chamber of Commerce; Parma Philharmonic Orchestra; Tal-Cut Company

Hotel Reservations

Please call Holiday Inn Independence at 1-800-465-4329 (1-800- HOLIDAY) or locally at 216-524-8050 to reserve your room at the special rate of \$82.00 (US) . This is a flat rate, specially arranged by ISDC '95.

Air Travel

Special discount air fares are available from American Airlines - the official ISDC-95 airline. Call 1-800-433-1790 and reference Star Number 0655 LN. Door to door air cargo service also available.

ISDC '95

Join the excitement of the NATIONAL SPACE SOCIETY'S 14th Annual International Space Development Conference (ISDC '95) to be held in Cleveland, Ohio on May 18, 19, 20 & 21, 1995 (One weekend before the Memorial Day weekend).

Tentative Program as of 11 th December 1994 (subject to change without notice):

.....THURSDAY May 18th:.....

There will be two tracks running including such topics as NASA Spinoffs, Solar Dynamic Power, Advanced Propulsion Systems, High Speed Research, the Apollo Program and more. We will have tours to NASA Lewis Research Center (LeRC) and the Cleveland Metro Parks Rain Forest Exhibit.

.....FRIDAY MAY 19TH:.....

There will be three tracks running including a Children's Seminar presented by NASA LeRC, Space Craft in Action Now, Galileo, Russian Launch Vehicles, Warp Drive, the Environment, Candles in Space and more. We will repeat the tours from Thursday and have workshops on Chapter's Assembly and the Foundry. At 8:00 PM there will be the first space concert presented by the Parma Philharmonic Orchestra.

.....SATURDAY MAY 20TH:.....

Topics will include Moon Treaty, Space Law, SSI, Russian Space Program, A Visit to the Moon, The European Space Program, Space Medicine, the Canadian Space Program and more. Workshops on Astronomy, Rocket Engines and Space Materials. Many Roads to Space a session where anyone who wants to make a presentation can have fifteen minutes to talk on a subject of their choice. There will be a Star Gazing Party at Baldwin Wallace College later in the evening.

.....SUNDAY MAY 21ST:.....

Topics include Lunar/Mars Settlements, Big Ear Radio Astronomy, Space Debris, Apollo/Soyuz, Space Cause, Reduced Launch Costs, EXITUS-Lunar Settlement, Chapter Activities and more. Workshops on Civil Air Patrol and Astronomy. The Experimental Spacecraft Society will also have a session.

Please call the Holiday Inn Independence at 1-800-465-4329 to reserve your room at a flat fee of \$82.00 US per night.
PLEASE CIRCLE YOUR CHOICE BELOW

Registration is \$60.00 until April 15, 1995 \$70.00 until May 17, 1995 \$90.00 at the door; Students \$25.00

Meals: Thursday Lunch \$11.00 Thursday Dinner \$19.00
Friday Lunch \$10.00 Friday Dinner \$19.00 Saturday Lunch \$12.00 Saturday Banquet \$35.00 Sunday Lunch \$12.00
ALL MEALS \$118.00

ISDC '95 Registration

NAME (please print)_____

ADDRESS_____

CITY_____STATE_____ZIP_____

HOME PHONE_____WORK PHONE_____

AMOUNT INCLUDED: \$_____

(Please make checks/money orders payable to: MSDC) Mail to:
MSDC, 6167 Oakwood Circle, North Ridgeville, OH
44039-2663 Phone: (216) 826-0330 - Fax (216)-826-0333 For
further information email to either: charles@tranquest.com or
ff212@cleveland.freenet.edu

YOU, TOO, CAN SPEAK AT THE ISDC 1995

If you have unique perspectives, experiences or ideas on any
matter relating to space science, technology, development,
promotional techniques and space policy, but have not had a
forum in which to pass them on to, or get feedback from, other
space advocates -- you do NOW!

The Opportunity. National Space Society's 1995 ISDC in
Cleveland, Ohio, May 18-21, will create a special track of
programming throughout the conference--under the title "Many
Roads To Space"--whereby individual registrants may make a
15- minute presentation on any of such matters of special
importance to them and of potential interest to others.

These mini-presentations should help spread the diversity of
ideas and experiences that abound, which is one of the main
purposes of an ISDC, where registrants are always seeking
new ideas and new directions to follow in pushing for
accelerated space development. A similar track was well
attended at the ISDC '89 in Chicago and was introduced again
at ISDC '94 in Toronto.

Selection of Speakers. Only ISDC registrants will be allowed
an opportunity to make such a presentation, and the
Conference Committee will give preferences in the order of
registration. To apply, a registrant should submit a request in
substantially the following form, and submit it as soon as
possible (and, if you have not yet registered, enclose a check
for the appropriate amount payable to MSDC):

NAME (Print)_____Have you registered yet?_____

ADDRESS_____

PHONE
(Home)_____(Other)_____

At ISDC: Likely arrival (Day/time)_____
Likely departure_____

Title of Proposed Presentation:

Summary of Presentation (for Program Book) (about 75 word maximum; you may -- in addition -- submit an Abstract of up to two 8-1/2" x 11" pages, in case the Conference publishes them):

Information about Speaker (for Program Book) (75 word maximum):

MAIL TO: Many Roads to Space - ISDC '95, c/o Rick Wills, 7179 Claybeck Dr., Huber Hts., OH 45424

For further information email to: charles@tranquest.com or ff212@cleveland.freenet.edu

End *Marsbugs* Vol. 2, No. 1.