Send information for publication on this page to: Melchor J. Antunano, M.D., M.S.
3309 Crosstimber Drive
Edmond, OK 73034
(405) 954-6206
melchor_j_antunano@mmacmail.jccbi.gov

SPACE MEDICINE BRANCH REPORT

Supporting the Exploration of Space

The exploration and commercialization of space continues to be an important goal for the U.S. and several other countries around the world. The following are some examples of accomplishments and developments (political, economical, scientific) that support this goal:

• The January 2001 report of the Commission to assess the U.S. National Security Authorization Act of 2000, indicated that it is in the U.S. national interest to shape the domestic and international legal and regulatory environments for space to ensure U.S. National Security, enhance competitiveness of commercial sector, and increase the effectiveness of the civil space sector. This report also indicated the need to train military and civilian space professionals, and to make investments in both people and facilities to expand U.S. capabilities.

• Executives from nine commercial U.S.-based launch sites in Alabama, Nevada, New Mexico, Oklahoma, Utah, Virginia, Washington, Texas, and Minnesota formed the National Coalition of Spaceport States to have a voice in national commercial space transportation legislation. They are interested in issues such as flight safety, standards, FAA regulations, and the impact of privatizing national launch ranges.

• The U.S. Department of Commerce and the Space Transportation Association organized a workshop on emerging space markets entitled "Market Opportunities in Space: The Near-Term Roadmap." The main goal of this workshop was to discuss potential future space markets and the necessary conditions for market growth in areas such as biotechnology, pharmaceuticals, media, power generation, cargo delivery, and passenger travel.

• Amsterdam-based MirCorp signed an agreement with the Russian Space Agency Rosaviakosmos and Russian spacecraft builder RSC Energia for the design, development, launch, and operation of a private space station capable of supporting three visitors for up to 20 days at a time. The price tag for MirCorp's Mini Station 1 is approximately $100 million dollars. Operations could begin as early as 2004.

• NASA's Deputy Associate Administrator for Space Station discussed the agency's position on commercial space tourism before the U.S. House of Representatives Subcommittee on Space and Aeronautics. He stated that as long as safety is not compromised, NASA will continue to support policies and technology development to enable commercial space tourism. In the near-term, clarification is needed regarding the proper use of ISS and the degree to which this international resource should accommodate commercial opportunities in general and space tourism in particular.

• The FAA Office of Commercial Space Transportation produced a report entitled "Concept of Operations for Commercial Space Transportation in the National Airspace System" in 2005 and beyond. This report describes an evolutionary expansion of the U.S. air traffic management system to encompass the people, infrastructure, policies, procedures, rules, and regulations necessary to fully integrate space and aviation operations under a single infrastructure.

• The FAA 2001 Commercial Space Transportation Forecast Report indicates that the expected worldwide demand for commercial launch services for the 10-year period 2001 to 2010, will average 32 commercial launches per year.

• NASA awarded contracts valued at $767 million dollars to 22 contractors to develop concepts and technologies needed to produce space vehicles that are at least 10 times safer (100% better crew survivability) and at one-tenth of today's cost.

• NASA selected the 10 most promising Mars mission concepts (out of 43 proposals) to receive funding (up to $150,000 each) for 6 months as a means for jump-starting the identification of new Mars Scout missions that will compete for a possible launch in 2007.

• NASA selected a contractor to build the Mars Reconnaissance Orbiter, a spacecraft scheduled for launch in August 2005 to return the highest resolution images yet of the Red Planet. The goal of this orbiter is to understand the history of water on Mars by observing the planet's atmosphere, surface and subsurface. This mission will identify the best sites for a new generation of landed vehicles to explore, by virtue of its ability to find local evidence of the chemical and geological 'fingerprints' of water and other critical processes.

• NASA selected 10 researchers to receive grants to develop advanced technologies needed to produce food, recycle water and air, and monitor spacecraft environments required for long-term human space exploration. The grants, totaling approximately $5.4 million over 3 years, will create a knowledge base in these important areas. These grants will lead to technologies that can be used in low Earth orbit, on the International Space Station and for future human exploration of the solar system.

• 51 U.S. Teachers of the Year including 22 educators from other countries participated in simulated Space Shuttle and International Space Station missions and other space camp activities to learn innovative approaches to teach students about the space program. The goal is to give teachers the tools to motivate and inspire young students to pursue careers in math, science, and engineering.

• 208 students were selected to participate in hands-on research at several NASA facilities through the Summer High School Apprenticeship Research Program. Since its inception in 1980, about 3,114 students have participated in this science and engineering program.

• 8 high school student teams and their teacher advisors had their experiments chosen for space flight through the NASA Student Involvement Program (NSIP) that links students directly with NASA's diverse missions of research, exploration, and discovery.

• An international team of astronomers discovered 8 new extrasolar planets, bringing to nearly 80 the number of planets found orbiting nearby stars. The latest discoveries, supported by NASA and the National Science Foundation (NSF), uncovered more evidence of what the astronomers are calling a new class of planets. These planets have circular orbits similar to the orbits of planets in our solar system. Over the last 10 years more than 50 stars have been found to contain large planets in orbit, but their composition has remained unknown. Observations with the Submillimeter Wave Astronomy Satellite (SWAS) have revealed the first evidence of water in some of these worlds.

• The Microwave Anisotropy Probe will help determine the content, shape, history, and the ultimate fate of the universe, by constructing a full-sky picture of the afterglow light from the Big Bang. This is the first time a spacecraft will be in orbit around the second Lagrange (L2) point, which is four times further than the moon in the direction away from the Sun and requires very little fuel to maintain orbit.

• A record superflare with it's associated coronal mass ejection (CME) was produced by the Sun at 21:51 p.m. on Monday, April 2, 2001. This was the largest solar flare on record and fortunately it was not aimed towards earth. In the past, smaller flares than this have caused major power failures and disrupted communications on Earth.

• Satellite data show the area of this year's Antarctic ozone hole peaked at about 26 million square kilometers (roughly the size of North America) making the hole similar in size to those of the past three years, according to scientists from NASA and the National Oceanic and Atmospheric Administration (NOAA). Researchers have observed a leveling-off of the hole size and predict a slow recovery. Over the past several years the annual ozone hole over Antarctica has remained about the same in both its size and in the thickness of the ozone layer. This is consistent with human-produced chlorine compounds that destroy ozone reaching their peak concentrations in the atmosphere, leveling off, and now beginning a very slow decline.

Space Medicine Research

A better understanding of the effects of human exposure to space environments is extremely important and will determine our future ability to engage in long-term beyond-Earth space missions, including the potential colonization (temporary and permanent) of the moon, mars, and other objects in our solar system.

• The National Research Council's Committee on Space Biology and Medicine produced a report entitled "A Strategy for Research in Space Biology and Medicine into the Next Century." This report provides a

(See SPACE MEDICINE, p. 1158.)

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broad direction for future space medicine research. The committee described areas of fundamental scientific investigation in space biology and medicine that are important to pursue and developed the foundation of knowledge and understanding that will make long-term manned space habitation and/or exploration feasible. The report produced by this committee discussed: 1) A review of the disciplines of biology and medicine that can be studied in the space environment including sciences that study plant, animal, and human systems at the molecular, cellular, system, and whole-organism levels, 2) The fundamental research issues and questions within these disciplines, 3) Identification of the most promising experimental challenges and opportunities within each discipline, 4) Evaluation of the potential for space research to provide advances within each discipline, and 5) Prioritization of research topics to the extent feasible.

• The National Space Biomedical Research Institute (NSBRI) is a consortium of 12 institutions working to prevent or solve health problems related to long-duration space travel and prolonged exposure to microgravity. The group's primary mission objective is to ensure safe and productive human exploration and development of space beyond Earth orbit. NSBRI discoveries and research will lead to countermeasures to the harmful effects of microgravity and space radiation, while bringing discoveries and products of clinical benefit to mankind on Earth enhancing treatments for conditions such as osteoporosis, muscle wasting, shift-related sleep disorders and radiation-related conditions. The Institute also is researching ways to deliver medical care on these missions through new technologies and remote-treatment advances.

• NASA selected 325 research proposals for negotiation of contract awards for its 2001 Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs. SBIR and STTR goals are to stimulate technological innovation; increase the use of small business, including women-owned and disadvantaged firms, in meeting federal research-and-development needs; and increase private sector commercialization of results of federally funded research.

• NASA researchers have uncovered evidence that gravity, or the lack thereof, may play an important role in the development and evolution of life. The study suggests fertilization is gravity-sensitive and works differently in the near-weightless environment of space than it does on Earth. Studies conducted during space shuttle missions showed changes in cell proteins, which stimulated and increased the activity of the sperm cells. However, by spinning the cells in a slow-speed centrifuge to increase gravity, sperm activity was decreased, suggesting fertilization may be inhibited by exposure to increased levels of gravity.

• NASA selected 43 biotechnology researchers to receive $27 million in grants over the next your years to conduct Earth and space-based research in tissue engineering, gene expression, and biosensor technology.

• NASA's Strategic Plan identifies five Strategic Enterprises through which the NASA mission is implemented. One of these, the Human Exploration and Development of Space Enterprise, or HEDS, provides the framework for management and implementation of the life sciences. Its goals are to: 1) Increase knowledge of nature's processes using the space environment, 2) Explore and settle the solar system, 3) Achieve routine space travel, and 4) Enrich life on Earth through people living and working in space

Other News

• Space Shuttle Endeavor Mission STS-108 will carry into orbit nearly 6,000 American flags to honor the victims of the September 11 terrorist attacks in New York, Washington, DC, and Pennsylvania. The flags will be returned to Earth at the end of STS-108, mounted on specially designed memorial certificates, and presented to the survivors and families of the victims.

• After nearly 10 years as the head of America's space program, NASA's longest-serving Administrator, Daniel S. Goldin, announced his resignation, effective November 17, 2001.

I invite you and encourage you to become personally involved in the activities of the SMB by participating on the SMB committees and subcommittees. Please feel free to contact me if you have any ideas, suggestions, proposals, etc. to support our SMB mission, or to improve the scope of services available to our membership. You can also contact our SMB Secretary/Treasurer at 3701 Olde Willow Drive, Beavercreek, OH 45431, or phone 937-255-5742, or e-mail Lloyd.Tripp@wpafb.af.mil