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SPACE MEDICINE BRANCH REPORT

Extended Duration Orbiter Medical Project

This article is the second in a series on Space Medicine, and was written by Dr. Sam Pool at the Johnson Space Center

The Space Shuttle was configured originally to remain in Earth orbit for a maximum of approximately 10 days. In 1989, NASA elected to develop an Extended Duration Orbiter (EDO) capable of remaining on orbit approximately 1 month. The first phase of developing an EDO explores the safety of extending duration of orbital flight to approximately 16 days.

It may come as a surprise to some that there exist significant medical concerns that must be addressed in order to safely extend the duration of manned orbit beyond 10 days. Because the U.S. and U.S.S.R. have both held orbital flights of much longer duration than 30 days, it is reasoned, why is extending Shuttle flight to 16 days of medical concern?

One major difference is that g forces acting on seated Shuttle crews are different from those forces acting on crews from U.S.S.R. and earlier U.S. programs. The latter crews returned to Earth in the prone

position, with g forces along the x-axis (front-to-back). Shuttle crews, by contrast, are exposed to approximately 1.5 g along the z-axis (head-to-toe).

The goals of the EDO program include ensuring that crewmembers are capable of performing essential functions during entry, landing, and egress after flights of 16 days. Operational countermeasures are being developed toward this end; however, specific decision criteria are required in order to accurately assess the risk involved in extending flight duration. Missions have been scheduled between now and 1994 that increase the duration of stay on orbit in increments, from three 10-day missions, to three 13-day missions, after which begin 16-day missions.

The principal medical concerns are related to crew performance during entry, landing, and egress from the Orbiter in both normal and emergency situations. Maintaining normal orthostatic function while sitting or standing in an acceleration field during entry or immediately after landing is a primary concern. Approximately 5% of Shuttle crewmembers have had syncopal or presyncopal episodes prior to egress from the Orbiter

when they attempted to stand shortly after landing. Another 5% have exhibited presyncopal symptoms during a provocative orthostatic stand test after egress. While sitting is somewhat protective of orthostatic functions, NASA is employing two countermeasures during reentry in order to further protect orthostatic tolerance; an inflatable anti-suit and drinking of a fluid-and-salt solution.

Other concerns include maintaining the crews' physical capacity to maneuver on board the spacecraft while wearing crew equipment that weighs from 50 to 75 pounds. Exercise capacity, muscle strength, and motor coordination are all factors in this activity. Some evidence exists that coordination may be altered when returning from spaceflight. These factors must be taken into account when considering the extension of stay on orbit.

While the focus of the medical program and support of extending the duration of the Orbiter is somewhat limited, the medical program will provide information of benefit to NASA, both in determining the early effects of long-term spaceflight on human beings, and in supporting longer missions such as those planned for Space Station.

Meetings Calendar 1990

July 9-12, 1990, Williamsburg, VA. 20th Annual Intersociety Conference on Environmental Systems of the Society of Automotive Engineers cosponsored by the AsMA and several other organizations. Information on the AsMA's part of the program: Dr. Don Reid, Chairman, AsMA-ICES Committee, Boeing Aerospace and Electronics, M/S 84-15, PO Box 3999, Seattle, WA 98124.

July 9-13, New London, NH. Gordon Research Conference: Effects of Gravity on Biosystems. Colby-Sawyer College, New London, NH. Contact: Dr. Cruickshank (401) 783-4011 at the Gordon Research Conference Center, RI or Dr. Eva Ray, Conference Chair, 1222 Prospect Hill Rd., Villanova, PA 19085.

August 11-18, 1990, Amsterdam, The Netherlands. World Congress on Diving and Hyperbaric Medicine, a joint meeting of the International Congress on Hyperbaric Medicine, the Undersea and Hyperbaric Medical Society, and the European Undersea Biomedical Society. Info: Congress Secretariat, Mrs. L. Schipmolder-de Bruyn, Academic Medical Centre, G4-111, Meibergdreef 9, 1105 AZ Amsterdam, The Netherlands.

Aug. 26-28, 1990, Old Westbury, Long Island, N.Y. East Coast Conference on Biomechanics. Info: Prof. H. S. Ranu, Department of Biomechanics, New York College of Osteopathic Medicine, New York Insti-

tute of Technology, Old Westbury, NY 11568.

Sept. 10-13, 1990, Paris, France. 38th International Congress of Aviation and Space Medicine of the International Academy of Aviation and Space Medicine. Hotel Meridien Montparnasse. Info: 38th International Congress, Air France Medical Service, 1 square Max Hymans, 75757 Paris Cedex 15, France.

September 20-23, 1990, Auckland, New Zealand. Scientific Meeting of the Aviation Medical Society of Australia and New Zealand. Info: Dr. L. J. Thompson, Principal Medical Officer, Air New Zealand, Private Bag, Auckland 1, New Zealand.

October 1-4, 1990, Long Beach, CA. SAE AEROTECH '90, Aerospace Technology Conference and Exposition, sponsored by SAE. Long Beach Convention Center, Long Beach, CA. Info: Alison Frederick, SAE World Headquarters, Dept. 935, 400 Commonwealth Dr., Warrendale, PA 15096.

Oct. 1-5, 1990, Austin, TX. 4th International Conference on Environmental Ergonomics. Four Seasons Hotel. Sponsors: University of Texas at Austin and USAF Office of Scientific Research. Info: Dr. Eugene Wissler, Department of Chemical Engineering, University of Texas at Austin, Austin, TX 78712-1062.

Oct. 8-11, 1990, Madrid, Spain. International Symposium of Aviation and Environmental Medicine by the Spanish Air Force Institute of Aerospace Medicine (CIMA). Info: International Symposium of Aviation and Environmental Medicine (CIMA), Arturo Soria 82, 28027 Madrid, Spain.

Oct. 8-12, 1990, Orlando, FL. 34th Annual Meeting of the Human Factors Society. Stouffer Orlando Resort. Info: Human Factors Society Central Office, P.O. Box 1369, Santa Monica, CA 90406.

Oct. 10-14, 1990, San Diego, CA. 24th Meeting of the Civil Aviation Medical Association. Doubletree Hotel, San Diego, CA. Info: Dr. Stephen V. Blizzard, 378 Viewmount Dr., Nepean, Ont. K2E 7P6, Canada.

November 2-5, 1990, Louisville, KY. Sixth Annual Meeting of the American Society for Gravitational and Space Biology. Info: Donald Beam, American Institute for Biological Sciences, Special Science Programs, 730 11th St., NW, Washington, DC 20001.

ASMA FUTURE MEETINGS

May 5-9, 1991
Cincinnati Convention Center
Cincinnati, OH

May 10-14, 1992
Fontainebleau Hilton
Miami Beach, FL

May 23-27, 1993
Sheraton Centre Hotel
Toronto, Ont., Canada

May 8-12, 1994
Convention Center
San Antonio, TX