News
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****UT Southwestern researchers use parabolic flight for weightlessness

DALLAS -- Creating long-term weightlessness on Earth is impossible. So when researchers need to test the feasibility of space shuttle experiments, they create short-term weightlessness in a 707 that follows a path like a roller coaster's, called a "parabolic flight."

Researchers in the Space Medicine Lab at The University of Texas Southwestern Medical Center at Dallas needed weightlessness recently to answer a few questions: Is echocardiography possible in zero gravity? Will a special device that records images of the heart at different angles work in orbit? How can an astronaut use a stationary bike efficiently in outer space?

Answers to these questions are critical in understanding the changes on the cardiovascular system as a result of weightlessness. Dr. Gunnar Blomqvist, professor of internal medicine and space lab director, has been awarded a grant from the National Aeronautics and Space Agency to study those changes.

Dr. Drew Gaffney, associate professor of internal medicine at UT and space shuttle payload specialist, will use an echocardiograph on a special shuttle mission in 1990 to monitor blood volume in the heart. The echocardiograph produces an ultrasonic picture of the heart. The technique is used daily in hospitals all over the world. An echocardiograph operator simply presses a special transmitter to a patient's chest and an image of the heart appears on a monitor.

But the system isn't that simple in zero gravity. Researchers first had to address the possibility that the heart would shift in the chest because of weightlessness, said Lynda Lane, shuttle mission co-investigator. Then they had to develop a restraining system to prevent the separation of the echocardiograph operator and subject. Without gravity the patient is propelled in one direction and the operator in the other unless they are stabilized.

Through 40 25-second bouts of zero gravity, Gaffney and other space lab personnel found that the heart moves very little. They also found that echocardiography is possible with the addition of a subject support device and shoe modifications to anchor the operator and subject.

UT Southwestern's crew included Dr. Jay Buckey, assistant professor of internal medicine and physiology; Dr. Ben Levine, cardiology fellow; Willie Moore, research associate; Don Watenpaugh, physiology research fellow and Lane, clincial nurse specialist.

Gaffney will use a special device developed by Buckey called a tilt frame in conjunction with echocardiography. The tilt frame is placed on the echo transmitter and records pictures of the heart by photographing it in small segments. Each photographic slice will be analyzed, and the heart image reconstructed so volume changes can be studied. The tilt frame was also tested and pronounced feasible in zero gravity.

The team had 120 chances to test their methods of research during three days of flights involving forty parabolas each day. Each parabolic cycle, from the top of one curve to the top of the next, took about two minutes.

To create zero gravity, NASA flew the UT Southwestern crew and other researchers in a gutted, padded 707 to an altitude of 36,000 feet. The engines were "cut," and the plane fell to 24,000 feet where another parabola began.

(More)

As the plane flew over the top of the curve, it fell away from the researchers, which created weightlessness (0 G). As it flew along the sides and bottom of the parabolic curve, the gravitational pull became normal (1 G), and then increased to twice that felt on Earth (2 Gs).

"I had to sit down during the 2-G portions," Lane said. "I felt faint because all the blood was pushed from my head to my feet. It's also very common for some people to get sick at their stomachs. One way to prevent that is to keep your head still and focus your eyes straight ahead. NASA refers to the plane as the 'Vomit Comet.' The quick changes from 1 G to 0 G to 2 G are extremely irksome to the system that controls balance, which causes the nausea and vomiting."

Unfortunately one member of UT Southwestern crew did get sick on a flight. And worse, it was after the first parabola. He had to suffer through the remaining 39.

But the rest of the crew carried on with a second logistical task, which was to find a way to make cycling on a stationary bike possible in zero gravity. "One of the Skylab crews used a stationary bike to stay in shape," Lane said. "But they found they had to be held down when they pedaled, otherwise they would just fly away from the bike."

Although a new model tested in the parabolic flight has special pedal traps to hold cyclists' feet, exercisers still face the problem of lifting off every time they push down. "We found that the system worked very well when we pressed our heads against the top of the plane," she said. "Yes, we were standing up but at least we could pedal. NASA has designed a padded shoulder restraint for future flights."

The shuttle crew's performances on the bike will help predict fitness changes in prolonged weightlessness. Lane said that the in-flight fitness level of the Skylab crew didn't change. But when the astronauts returned home, it took them two weeks to a month to bring their aerobic capacity back to pre-flight levels. "We think the gravity-induced fluid shifts and subsequent loss of blood volume may be part of the problem," she said.

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Note: The University of Texas Southwestern Medical Center at Dallas comprises Southwestern Medical School, Southwestern Graduate School of Biomedical Sciences and Southwestern Allied Health Sciences School.