SPACE

Weightlessness Problems

The heart reflexes protecting a person from effects of gravity could be affected during weightlessness in which case an astronaut would be poorly prepared for re-entry.

See Front Cover

➤ THE EFFECTS of weightlessness and the heavy gravitational pull on Astronaut M. Scott Carpenter during reentry could be far greater than now believed. Astronaut John H. Glenn Jr. may already have provided some clues.

An Air Force physician, basing his ideas on studies on the ground and data from Glenn's flight, told SCIENCE SERVICE that the heart reflexes protecting a person from the effects of gravity decrease during a prolonged period of inactivity.

Dr. Michael McCally, flight surgeon of the Aerospace Medical Research Laboratories at Wright-Patterson Air Force Base, Dayton, Ohio, found this from studies of the heart during prolonged bed rest and immersion in water. Dr. McCally is seen on the front cover, standing to the right of the immersion tent.

He said even six hours of immersion in a water tank showed a deconditioning of the heart reflexes. Similar changes could be expected to take place in an astronaut during weightlessness. The astronaut would then be poorly prepared for the heavy g-forces (pull of the earth's gravity) on the way back to earth.

When Astronaut Glenn was pulled from his space capsule he stated that he was weak and not buoyant. The astronaut also said that he did not have the strength to pull himself out of the top of the capsule, the Air Force physician said.

The data from Glenn's flight suggest, said Dr. McCally, that there was a marked increase in pulse pressure during the orbital flight and that diuresis occurred. Diuresis is an increased rate of urine flow which may have been due to the weightless state.

Regarding the astronaut's fatigue, Dr. McCally said that the heat experienced by Glenn in the capsule was not as severe as he has undergone in trainers at Wright-Patterson Air Force Base without showing the same fatigue. However, any stress on the cardiovascular system (heart) might cause weakness and fatigue.

During long periods of bed rest or immersion in water (and similarly during weightlessness), the body fluids are redistributed in the body. While on earth these fluids, including the blood, are pulled toward the legs and lower part of the body by earth's gravity.

The diuresis Glenn experienced in space may have been caused by the redistribution of his body fluids while weightless. This, Dr. McCally sees, is a possibility as a result of experiments done at Wright-Patterson with volunteers subjected to prolonged bed rest and suspension in water.

A person immersed in water for seven days had significant diuresis during the first three days. The subject's tissues lost excessive amounts of water.

His urine volume increased 100% the first three days. The daily average is 1,000 cubic centimeters. Dr. McCally said that the person's blood volume increased shortly after immersion. The body then tried to eliminate the excess by diuresis—as fluid going out of the body through the urinary system. However, even after the blood volume became normal, it was found the diuresis continued and depleted the body tissues of fluid.

Dr. McCally said that through further studies he hopes to find out more about blood volume changes and their duration. He also aims to find out what can be done by using drugs and possibly pressure breathing when air is forced into the lungs by taking oxygen as in high-flying aircraft.

Techniques have been studied to protect the heart reflexes when blood suddenly rushes from one part of the body to another, as when a person gets out of bed after two weeks' inactivity or when gravity forces begin to pull an astronaut back to earth, Dr. McCally said.

Tourniquets on legs and arms are inflated on a subject during long bed rest or when immersed in water to simulate the effect of gravity. This method decreases the return of blood through the veins of legs and arms to the heart, increasing the pressure of the blood in the veins.

This offers complete protection of the heart reflex system, he said. The method has been used for persons staying in bed for prolonged periods and could be used in an astronaut's space suit, he suggested. Such a suit has not yet been made and tested.

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SPACE

Fishbowl Helmet for Astronauts on Moon

➤ A NEW FISHBOWL helmet that would be practical for astronauts working outside a spaceship or on the moon's surface has been developed.

The helmet allows the astronaut to move his head from side to side. The helmet now used by the Mercury astronauts allows no movement of the head, Robert F. Witte, project engineer of the Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Dayton, Ohio, told SCIENCE SERVICE.

Inside the new fishbowl experimental helmet, made of clear plastic, the astronaut would wear a skullcap for protection against injury. This is similar to a World War II summer flight helmet with pads of polyurethane.

A pressure-sensitive triggering device closes the helmet automatically when pressures become too low. A velvet strip mounted on the helmet wipes the visor clean as it closes.

The helmet is not expected to be used in aircraft because of the large size needed for the head and protective skullcap. The helmet is a sphere 14 inches in diameter. It has been subjected to temperatures up to 160 degrees Fahrenheit for one hour, and used in an altitude chamber to test the closing mechanism. It has also been tested in a simulated cabin environment with a man working controls while wearing the helmet.

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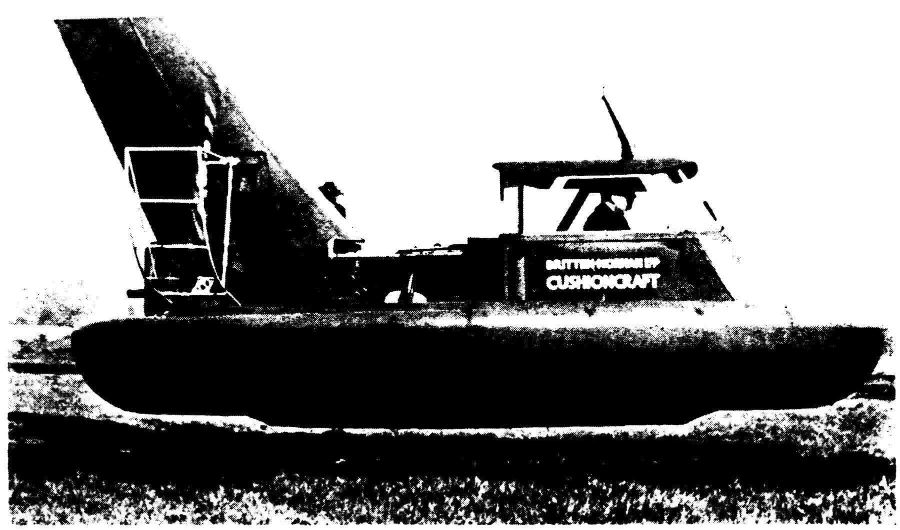

CUSHIONCRAFT PROTOTYPE—This version of a British hovercraft, powered by a sports car engine, travels 15 inches above land or water. A compressor around its circumference gives it lift through single jet nozzles.