

reaches the void beyond the pull of gravity.

The first rocket ship reaches the ionosphere and the motors are turned off. Momentum gone, the ship drifts in the vast, soundless void. The crew, which has survived the tremendous acceleration of take-off, is ready to make its observations. But bewilderment clouds their faces.

will fly out of the frying pan; all vegetables will be jumping beans, leaping from plates at the first opportunity; and liquids will splash in all directions.

The future space kitchen, then, will probably store precooked food or use an electronic range which cooks by short wave. All utensils will have to be



One is standing on the ceiling. Another is flailing helplessly in mid-air, his body twisting in grotesque contortions. The pilot has a death grip on the controls, his legs dangling aimlessly.

What's happened? Gravity has been almost literally pulled out from under them. They are now subject to an eerie reality of outer space: weightlessness. There is no up or down, nor even sideways. Everything just floats.

The problem—at first glance—is amusing, but scientists realize its urgency. Unless man finds a substitute for gravity, or learns to live without it, space may never be conquered. Here are the reasons:

—Weightlessness, or zero gravity, doesn't affect normal body functions like the blood, respiratory, and digestive systems, but some individuals are prone to motion sickness. In other words, man can exist in a weightless state, but some men will be too uncomfortable. Future space crews, therefore, must be chosen carefully.

—Even those who may find floating as much fun as a roller-coaster ride will be hampered by visual illusions and reduced coordination. Air Force tests show most men tend to overcontrol their movements while weightless, but improve with practice. This indicates that orientation will be necessary to adapt space crews to zero gravity.

—Equally important, but most comic, are the everyday problems of eating and sleeping. Space crews will probably be strapped to their seats or bunks for worktime or bedtime, and may wear magnetic shoes to walk about. But what of mealtime? Unless controlled, steaks

closed and locked in place. Food will be served between conveyor belts and eaten with tongs. Liquids will be kept in plastic bottles and drunk through straws or squeezed into the mouth.

Experiments to solve some of the problems of weightlessness are now under way. Monkeys and mice were shot aloft in rockets as high as 35 miles and showed no ill effects. The Air Force School of Aviation Medicine at Randolph Field, Tex., is also using a combination of kittens, scientists, and jets in further experiments.

The jets fly parabola flights—curved paths around the earth, flown at such velocity that the centrifugal force balances the pull of gravity—and the occupants, unless strapped down, become weightless for short periods. A kitten, most agile of animals, is suspended during these brief moments of zero gravity and his reactions observed. Without any visible means of support, his most consistent reaction is surprise.

Industry is also cooperating. Recently the Litton Industries of California announced completion of a million-dollar vacuum laboratory that will permit space-suit experiments at a simulated distance of 200 miles from earth.

The human factors involved in space travel have been less publicized than guided missiles and earth satellites, but they may ultimately determine the conquest of space. To the question whether space is worth conquering, the best answer came from Maj. Gen. Bernard A. Schriever, commander of the Air Research and Development Command: "Our future safety as a nation may depend on it."

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