

all the bacteria aboard a given vehicle are dead. Instead, they are gamblers trying to predict the odds that any microorganisms will be left alive after such-and-such a treatment. NASA has a full-time Special Assistant for Planetary Quarantine, despite the fact that scarcely a handful of U.S. spacecraft have actually touched down on another world.

An extreme example of the possible effects of planetary contamination is man. In fact, several authorities believe that all life on earth could be descended from a single spore that landed after years of floating through space, rather than from a freak combination of chemicals and environmental conditions. This theory was first suggested in 1908 by the Swedish chemist, Svante Arrhenius, who called it "pan-spermia." Imagine the effect of a few uninhibited bacteria turned loose on another planet after a flight aboard a contaminated spaceship.

When the Soviet spacecraft Venus 2 crashed on Venus this year, a cry of "Contamination!" rose until the Russians belatedly announced that they had sterilized the vehicle. Scientists were concerned despite estimates that the surface temperature of Venus reaches 800 degrees F.

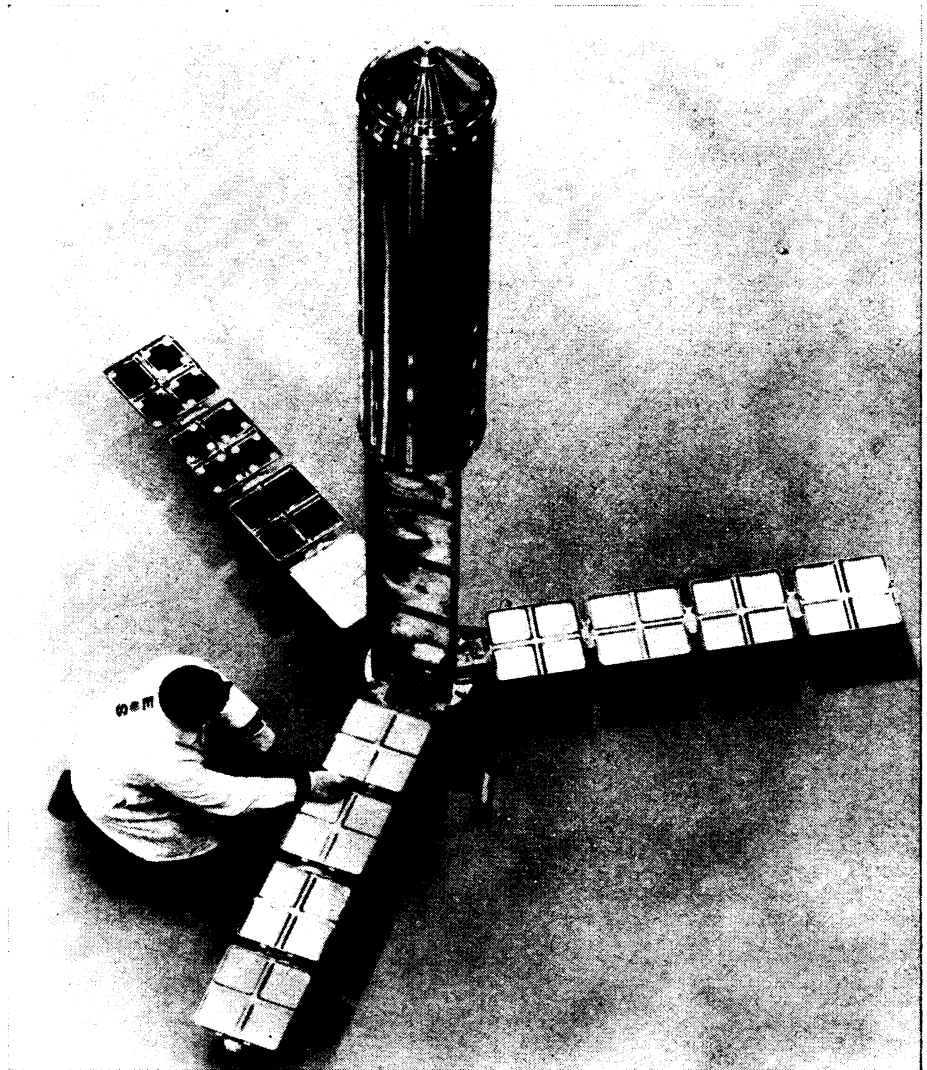
Several experimenters, including some at Union Carbide Corporation, have succeeded in growing not just bacteria, but full-fledged plants under a wide range of unusual conditions. At Union Carbide, for example, winter rye, corn and several other cereals were grown from seed despite temperature variations from 65 degrees F. to four degrees below zero. In addition, the grains had to withstand a lava-like substance called Perlite instead of soil, as well as an atmosphere containing 97% oxygen and 3% carbon dioxide. Most plants are accustomed to an atmosphere that is about four-fifths nitrogen.

Other plants — succulents, some high-altitude conifers such as black pine and others—have endured similarly unfriendly environments for as long as 300 days, even when their initial growth was in normal terrestrial surroundings. Onions have prospered in an atmosphere primarily of methane, a major component of Jupiter's "air."

A plant is the product of generations of ancestors, each one more specialized than the one before. Many microorganisms, however, are very primitive, and therefore unspecialized. If an ordinary onion can adapt to methane, there surely must be a bacterium which, given half a chance, can adapt to anything.

Other planets are not the only ones in danger. What about strange micro-creatures brought back on returning spacecraft and turned loose in a strange but tolerable environment?

Many bacteria have a reproduction time of less than 12 hours. One proposed round-trip Mars flight calls for a spacecraft to spend 40 days on the surface, enough time for some 80 gen-



Electro-Optical Systems, Inc.

PROSPECTING "LUSTER"—"Luster" is the name of a prospecting space probe launched into space last year by an Aerobee 500 rocket. Built by Electro-Optical Systems, Inc., Pasadena, Calif., Luster automatically uncovered the sealed containers on its three arms and gathered valuable samples of microscopic space dust. The samples returned to earth with Luster and are being chemically analyzed.

erations of such bacteria—each larger than the last—to evolve into a variation which just might be able to live both on Mars and on earth.

As the Space Age progresses, sterilization will become ever more important, but, perhaps, more difficult. When orbiting space stations make it practical to construct larger spacecraft in orbit instead of on earth, individual parts will have to be sterilized before they are sent up to be assembled. To maintain their "purity," the construction tools, already in orbit, will have to be treated too. And so on back to the space stations themselves, even though they were never intended to leave their orbits.

The problem is a vast one. Even the customs officials who carefully inspect every plant or animal brought from one country into another have an easy job, compared to the men who have found themselves entrusted with guarding the very planets.

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TECHNOLOGY

Industrial 'Kidney' Cleans Pulp Water

► AN "INDUSTRIAL KIDNEY" that can clean up spent liquor from pulp mills and other wastes from industrial processes is being developed at the Sulphite Pulp Manufacturers' Research League, Appleton, Wis.

The pollution of streams by pulp and paper mills has long been a problem, and for many years manufacturers have been conducting research on methods to reduce it.

The new process involves the use of a synthetic membrane that removes wastes from water in much the same way as do living kidney membranes.

The process shows great promise, said Loren V. Forman, League president and also vice president of the Scott Paper Company.

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