

## ASTRONAUTICS

# Remote-Controlled Robots

REMOTE-CONTROLLED robots that can repair each other as well as equipment will some day serve as crew members of vehicles exploring space, a scientist predicted.

Dr. Fred L. Whipple, director of the Smithsonian Institution's Astrophysical Observatory, Cambridge, Mass., said such robots could do anything a man can do "at far less expense, weight and emotional concern."

He told the House Committee on Science and Astronautics in Washington, D. C., that the robots could be supervised and guided from the earth by television. Since a major problem of space exploration is reliability of equipment, robots that repair each other and their equipment would be reliable, at least to the distance where communication by television is possible.

Dr. Whipple's forecast of robots as future space explorers was presented at the House Committee hearings as one example supporting his view that the Government should strengthen its programs for engineering and research in the space sciences.

He also pointed out that for many astronomical experiments balloons were superior to space satellites.

"Dollar for dollar," he said, adequately supported balloon experiments should "pay off at somewhere between 10 and 100 to

one over satellites in terms of space science results."

## Structure Unknown

Just at the time man is almost ready to leave the earth and go into space, he is becoming aware of how little he knows about the earth, Dr. Roger Revelle, director of Scripps Institution of Oceanography, La Jolla, Calif., told the House Committee. Dr. Revelle said he doubted very seriously if many of the usually accepted theories concerning the earth and its deep interior would stand up if more were known about conditions.

The plan to drill a hole through the earth's crust from an ocean platform, known as the "Mohole Project," would give answers to such questions as what kinds of rocks form the mantle, Dr. Revelle said. He urged a greatly expanded program of oceanographic research by the United States, citing the growth of Peru from a non-fishing nation to the second largest in the world as an example of practical benefits that could result from more knowledge about the ocean and its currents.

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## ENGINEERING

# Surveys of Mars Predicted

SPACE CRAFT with eight men aboard could make short survey flights to Mars and Venus by 1970 or 1971, Krafft Ehrlicke, program director for Convair Astronautics in San Diego, Calif., reported.

The flights depend on the United States developing nuclear heat exchange engines by 1965 and using them for trips to the moon from 1965 to 1970, Mr. Ehrlicke said.

He outlined a Venus flight plan in which men would travel 295 days, survey from their ship for 24 days and return in 223 days. Travel time to Mars would be less: 138 days to reach the planet and 175 days to return, he told the semi-annual meeting and aviation conference of the American Society of Mechanical Engineers in Dallas, Tex.

Mr. Ehrlicke predicted that the first surveyors would not land on the planets unless they had political reasons to do so. A landing, he said, would take extra personnel and would require rockets with double the payload capacity of those needed for surveys.

## Artificial Brain Predicted

Other scientists predicted the possibility, far in the future, of programming an electronic computer to simulate a human brain.

Ralph W. Stacey and Norman A. Coulter Jr., associate and assistant professors respectively at Ohio State University, reported

to the meeting and aviation conference of the American Society of Mechanical Engineers in Dallas, Tex., that electrical impulses have recently been used to simulate the behavior of artery pulses.

They said a doctor can feed data on a patient's arterial system into a computer and compare it with the normal artery data already fed the electronic machine. The doctor thus learns if his patient's system is normal.

"The ultimate step in the process of simulation would be the design of an artificial brain."

The professors said this was far beyond present knowledge but not really far fetched:

"We already have artificial organs which can take over the function of one part of the the brain, the respiratory center. Can we someday, when we understand the brain better, achieve what would amount to artificial metempsychosis—a transfer of human personality from a natural to an artificial brain?"

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## ASTRONOMY

## Newton's Theory Holds: Mass of Saturn Wrong

A SUGGESTION that Newton's theory of gravitation, used to predict the motions of

planets, might be wrong has itself been found to be wrong.

The fault is due to a small error in the value of the mass for Saturn, a neighboring planet whose attraction greatly influences the motion of Jupiter.

Drs. R. H. Krotkov and R. H. Dicke of Princeton University called attention in 1959 to a small difference between the observed and predicted motions of Jupiter. Sometimes this planet appeared to be ahead of where it should be, sometimes behind.

The difference changes regularly with time and goes through a complete cycle once every 12.4 years. The effect is small, since Jupiter never appears more than 600 miles from its predicted orbit.

The effect has now been explained by Dr. G. M. Clemence, director of the U. S. Naval Observatory's Nautical Almanac Office in Washington, D. C. He says it is due to a small error in the adopted value of Saturn's mass. The discrepancy is removed if Saturn's mass is taken as one over 3499.7 that of the sun, it is reported in *Sky and Telescope*, 19:472, 1960.

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## ASTRONOMY

## Shells Around Suns May Have Been Built

INTELLIGENT BEINGS in another solar system could have hidden their sun by knocking their planets apart and using the pieces to build a hollow ball around their sun.

Dr. Freeman J. Dyson of the Institute for Advanced Study, Princeton, N. J., says that other civilizations may be millions of years ahead of the earth. They may have rearranged their solar systems to meet the needs of their exploding populations.

A hollow ball built around the sun would solve the space and energy problems. It would also cut off the sun's light. To detect such an advanced civilization, earthlings would have to detect the invisible heat radiation from the hollow ball.

A search for such infrared radiation should be coordinated with Project Ozma, a program now underway for detecting artificial radio waves from nearby stars, Dr. Dyson reports in *Science*, 131:1667, 1960.

Using our own solar system as an example, Dr. Dyson calculates that it would take about 3,000 years for population and technology to expand one trillion times at the rate of one percent a year. Pressures of population and energy needs could be met only by trapping all of the sun's radiated energy.

To trap the energy, earthlings could knock apart the planet Jupiter and rearrange it as a hollow ball about 10 feet thick with a diameter twice the size of the earth's orbit. This would take all the energy given off by the sun in 800 years. Such a sphere would be "comfortably habitable."

Dr. Dyson states he is not suggesting that this is what will happen in the solar system, but only proposes what may have happened in other stellar systems.

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