ASTROPHYSICS

'X-Ray' of Moon Suggested

If the lunar crust can be used to transmit radio waves, astronauts might use the moon for communications

➤ "X-RAYS" of the moon should be made to determine whether its outer crust could be used to transmit radio waves, thus providing a system by which astronauts could communicate with each other when out of sight.

This ingenious proposal for determining the sub-surface structure of the moon using radio waves has been made by Dr. Winfield W. Salisbury of Harvard College Observatory and the Smithsonian Astrophysical Observatory, Cambridge, Mass.

Dr. Salisbury believes that the material of the moon itself can be used for communications when astronauts are separated by more than a mile, which is beyond the lunar horizon.

The moon's ability to transmit radio waves would also make it a large lens that would focus radiation from sources far out in space toward a lunar satellite.

The "X-rays" would show exactly how well the moon's matter transmits radio waves and how deep the "radio-transparent" layers go. This information could be gathered by a moon-circling satellite equipped to receive radio signals from earth. The satellite would act, in effect, as an X-ray machine.

Dr. Salisbury has calculated that a satellite orbiting between 50 and 300 miles above the lunar surface should be in the right position to receive radio signals sent from earth at radio wavelengths from 100 to thousands of meters. In this case the moon would focus the radio waves.

Such a small unmanned satellite would give not only a profile of the moon's internal structure but would show the feasibility of the miniature and simple system of translunar voice communication proposed by Dr. Salisbury. The cost would be quite small compared to the cost of a manned landing and would "contribute considerably to the safety and comfort of lunar explorers."

The moon is by far a larger focusing antenna than any object man could build on earth, Dr. Salisbury told SCIENCE SERVICE. He also said that using this method to find out how transparent the moon actually is to radio waves would require a satellite especially designed for such a project.

Neither Orbiter 1 nor Luna 11 could act as receivers for radio transmissions from earth. Since the moon does not have an atmosphere, radio waves cannot be bounced around there as they are from earth's atmosphere to make global communications possible.

As far as radio waves are concerned, the earth's effective horizon is about two and one-quarter miles away for communications between two men six feet tall, compared with one mile separation on the lunar surface.

Details of Dr. Salisbury's proposal to use lunar material for translunar radio communication are reported in Nature, 211:950, 1966. The radio waves would be transmitted through the moon's sub-surface layers much as earthquake shock waves are transmitted through different layers in earth's interior.

Dr. Salisbury suggested that astronauts could use trailing wire antennas for both sending and receiving their radio messages. He noted that combined storage cells and solar cells have shown by their performance for the Surveyor soft landing and picture transmissions that they can operate reliably under lunar conditions.

SPACE

Plants Ready for Space

➤ PEPPER PLANTS are next in line for space flight.

Now that men, monkeys, mice and other creatures have had their turn in space, scientists are preparing pepper plants, wheat seeds and pollen of the Tradescantia flower for a three-day trip in a special biosatellite late this year.

Leafy members of these first orbiting plants have been subjected to earth-bound laboratory tests simulating space conditions, said Dr. Theodore W. Tibbitts of the University of Wisconsin. He has been working with Dr. Sam P. Johnson of North American Aviation, Inc., under a National Aeronautics and Space Agency contract.

Using a machine called a clinostat which slowly rotates plants on a horizontal plane at right angles to gravity, the scientists simulated the weightless environment of space. Under "zero" gravity in the clinostat, leaves of the pepper plants curled downward. They recovered their natural position when turned upright again.

Space scientists feel the need to cultivate various plants for long periods of time on orbiting space stations or moon stations in order to provide food for human space travelers. By studying how plants react to space, scientists hope to understand optimum growing conditions for cultivating space plants and also how to grow better crops on earth.

In preparation for their first trip in space, five-week-old pepper plants will be sealed in plastic pots anchored in a small package with a mirror system so that a camera can take photographs of their behavior during flight.

The plants will be subjected to heavy noise vibrations and pressures eight times the force of gravity during the count-down and blast-off. When the satellite reaches its orbit 150 miles above earth, the gravity will drop to zero. Temperatures will be held to about 70 degrees F. Scientists will observe any physical changes in the astroplants as well as any chemical changes in carbohydrates and amino acids. The wheat seeds will be sprouting during the trip and the scientists will watch the orientation of their roots and shoots without the effect of gravity. They also will check for mutations that might occur in the microscopic pollen grains of the *Tradescantia* or wandering Jew plant. An identical group of plants will be kept on earth under similar conditions for comparisons with their space members.

The special satellite, to be launched by a Thor-Delta rocket, weights 1,160 pounds and will carry 200 pounds of payload inside the 12-cubit-foot capsule.

PHILIPS

SUPER MICROSCOPE—An electron microscope developed by Philips can be used with a television adapter to display either live or recorded images from the microscope on a screen before large numbers of people. Called the EM 300, the microscope is guaranteed to maintain a point resolution of five Angstroms for routine work.