TECHNOLOGY

Keep Satellites on Path

➤ SATELLITES in exact orbits around the earth will be kept in their narrow paths by nudges of ionized cesium atoms if development plans are successful.

The National Aeronautics and Space Administration has given Hughes Aircraft Company a research contract to design an ion engine system.

The multi-engined system will use ionized cesium atoms to provide a "gentle" thrust of about one one-thousandth of a pound. The system can be used to precisely adjust the attitudes and orbits of advanced communications satellites, weather surveillance satellites, or space-probe relay stations for periods of three or more years.

"Perhaps as many as 50 different satellites requiring extremely accurate synchronous positioning and orientation may be launched within the next ten years. These will have a direct beneficial effect on human affairs, in such ways as providing global communications links, weather warning information or lunar relay stations," Dr. Malcolm R. Currie, associate director of the Hughes Laboratories, said. "We anticipate the Hughes ion engine system will play a key part in keeping the U. S. first in this important peaceful use of space, a use which provides the first application of electrical propulsion engines developed by NASA over the past several years."

As a satellite orbits around the earth, its "attitude," or the "face" it presents to ground stations, is affected by solar radiation, micrometeorites, and the torque caused by moving parts in the satellite. The path it follows in orbit is affected in the north-south direction by the gravitational attraction of the sun and moon, and in the east-west direction by the unsymmetrical shape of the earth.

The proposed system will counteract these forces tending to move a satellite off its course by applying the thrust from two or more ion engines for short periods of time at command from the satellite or a ground station.

When used to control a typical 500 pound satellite, the system would operate this way: The station-keeping engines would thrust about 10 minutes each day for the east-west orbit correction and a total of about one and a half hours for the north-south correction. The attitude control engines will operate only a few seconds approximately every quarter hour.

As the satellite weights increase and the time in orbit becomes longer, the weight advantage of the ion system becomes greater. For example, a typical gas positioning jet would require a minimum of 150 pounds of fuel to keep a typical synchronous satellite positioned for three years, whereas an ion engine will require only about 2.25 pounds of cesium fuel.

The ion engine is considered the "ultimate" long-range propulsion system for large scale exploration of our solar system.

Thrust for ion engines is obtained by heating and vaporizing the rare metal, cesium. The atoms are ionized and accelerated to product thrust. The ejected cesium particles have a very high velocity which makes this engine ideal for long-space propulsion since less fuel is needed.

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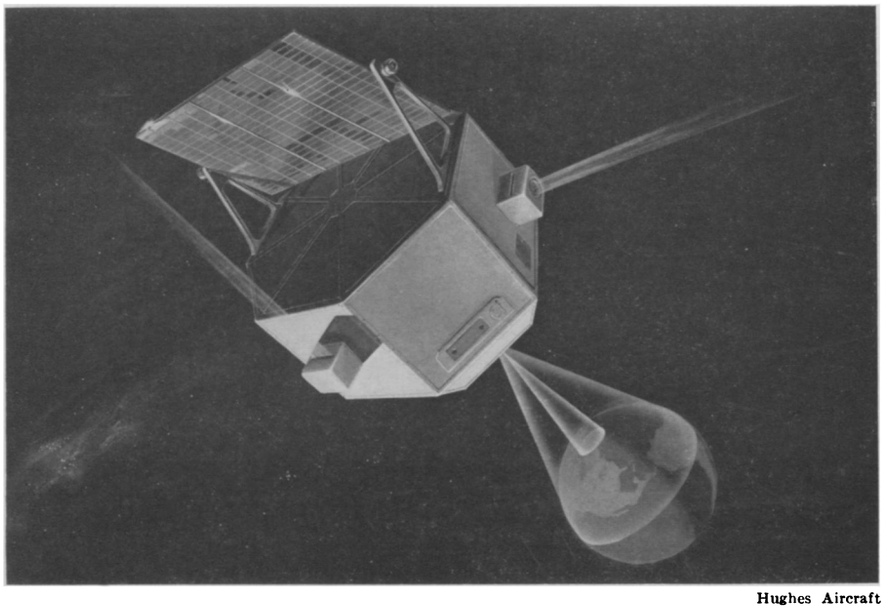

Hughes Aircraft

"LOCKED" IN POSITION—The periodic thrust of ion engines, contained in the small boxes on the side of the satellite, will keep a "stationary" satellite parked in a "locked" position in space relative to the earth, as is the simulated one shown in this artist's concept.

SPACE

Oxygen for Space May Be Produced on Moon

➤ THE OXYGEN needed for men to survive on the moon and to propel their spacecraft during the return flight may be obtained from the moon itself.

This prediction was reported by Dr. Eugene B. Konecci, director of biotechnology and human research for the National Aeronautics and Space Administration. He told the Manufacturing Chemists' Association meeting in New York that the lunar processing plant is expected to produce 4,000 pounds of liquid oxygen a month from rocks.

The lunar chemical plant would be unmanned. Officials at Aerojet-General Corporation, Azusa, Calif., propose to take molten lunar rock and methane gas to produce oxygen in a cyclic process.

Four basic sub-systems are envisioned—mirror and furnace, conversion, electrolysis, and condensation and storage. Processing 45 pounds of lunar rock each hour is expected to yield nearly 12 pounds of oxygen.

Since a man consumes about two pounds of oxygen a day, the 4,000 pounds obtained each month would keep a large number of lunar astronauts alive.

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SPACE

Route to Moon Is Via Barge on Mississippi

➤ THE WAY to the moon from the United States is via a slow barge ride on the Mississippi River.

This was the only way the massive S-1 (Stage 1) of the Saturn booster, developed by the National Aeronautics and Space Administration for manned lunar flight, could get to the launch pad at Cape Canaveral, Fla., from the Marshall Space Flight Center in Huntsville, Ala., where it was assembled. Its tremendous size (162 feet high) and bulk prohibited transportation by rail, truck or air shipment.

A first stage of Saturn, SA-3, was successfully flight-tested, shooting skyward at 4,000 miles per hour. This is the third flight trial of the eight H-1 engines that make up the Saturn's first stage. Fueled by nine tanks with kerosene fuel and liquid oxygen, the H-1 cluster provides 1.3 million pounds of thrust.

During this test, the second and third stages of the SA-3 were ballasted with 95 tons of water to simulate the propellant weight. This water was released at an altitude of 104 miles, 295 seconds after liftoff when the vehicle had traveled about 130 miles down the Atlantic Missile Range from Cape Canaveral. After this release of water, the vehicle was deliberately destroyed. A large cloud was formed that disappeared in seconds.

Scientists anticipate important knowledge about the atmospheric processes from observing the effects of the water release.

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