ASTRONAUTICS

Moon Orbiting Satellite

Rocket guidance systems capable of directing a satellite along the right path, at the right speed, to its target is one of the chief problems facing U. S. scientists.

DROPPING a satellite into orbit around the moon will be a hard job for America's rocket experts.

It will challenge rocket guidance systems, because the United States does not yet have a rocket strong enough to carry the best guidance system. A guidance triumph, like Russia's around-the-moon feat with powerful Lunik III, will be hard to achieve.

In order to go into orbit around the moon, the satellite not only must be moving along the right path but also at the right speed.

The guidance system must calculate where the rocket is in space as it hurtles toward its destination, determine what corrections are needed, and cause "vernier" rockets, or a reverse thrust rocket, to fire just at the right time to bring the satellite in at the proper speed and angle.

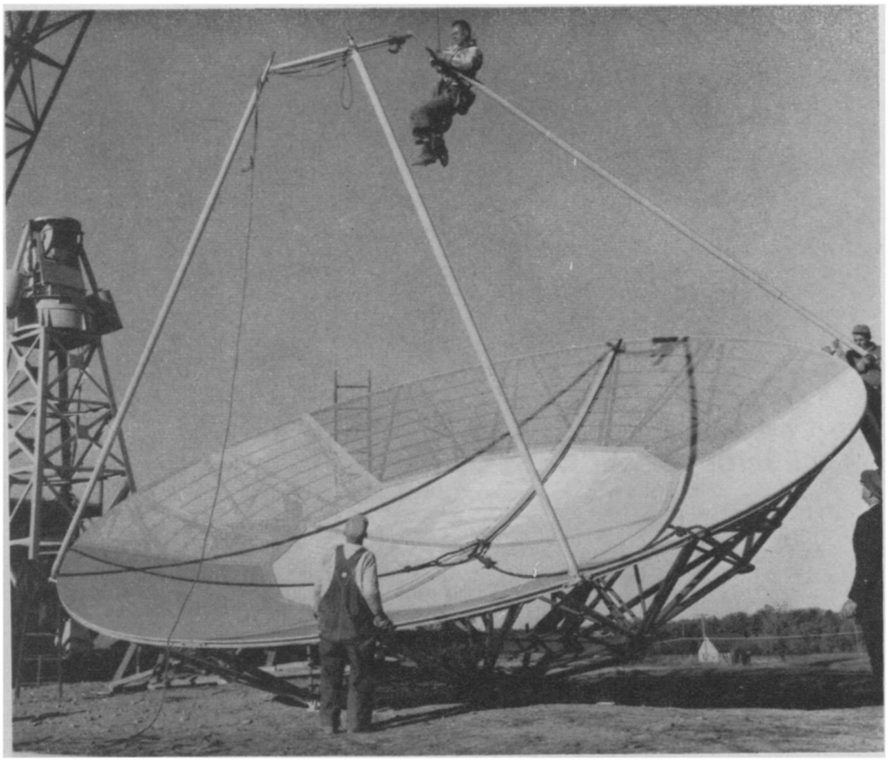
For tasks such as this, and for shots to Mars and Venus, terminal guidance systems will play a big role.

The moon, Mars and Venus all present moving targets for the satellite; however, distances to Mars, Venus and other planets are known to an accuracy of only 50,000 miles or so. Terminal guidance would therefore become a critical factor in the success of the mission.

Although military rockets are known to have terminal guidance for high accuracy no scientific space experiment has carried more than initial and mid-course guidance systems.

Pioneers I and II and Paddlewheel satellites all had mid-course guidance. But either these speed-adjusting vernier rockets failed to work, or, as in the case of Paddlewheel, they were not needed.

Paddlewheel's guidance was the most sophisticated. A radio beam was shot from earth to the rocket, where it was modified and transmitted back to earth. This enabled a big computer on earth to calculate Paddlewheel's precise position and orbit.



COMBINED TELESCOPE—Workmen assemble the antenna for the 28-foot-diameter radio telescope that will be part of the General Electric Company's radio-optical observatory, believed to be the first such combination in the world. The optical telescope is said to be capable of tracking objects almost half way to the moon. Described as the first observatory established by an American industrial enterprise as a regular function of its commercial operations, the observatory will consider automatic detection of missiles and satellites.

But the initial guidance system had done so well that no corrections were deemed necessary. Had corrections been needed, a combination of four pairs of vernier rockets could have been fired to make minor adjustments.

Ideally a space vehicle should be equipped with guidance in all of its stages, a National Aeronautics and Space Administration guidance expert said.

John R. Scull said the most accurate system would be in the first stage and would set the basic trajectory. Less accurate systems would be in the other stages. Just before each stage is jettisoned, its guidance system would "reset" the next guidance system scheduled to take over the flight at that point.

Two types of guidance systems have been tried. The first is a radio-inertial combination, in which radio signals from the earth are used to tell the rocket how to correct its course. The second is an all-inertial system, the heart of which is small gyroscope wheels made of a heavy alloy that spin 12,000 or 24,000 times a minute.

The radio system is lighter but vulnerable to jamming in war. In scientific applications, it has the further drawback that the ground transmitter must be able to "see" the space vehicle when time comes for a command. At such a time, however, the rockets might be on the opposite side of the earth and no corrections could be made.

Recent improvements in inertial systems have yielded accuracies equal to those of the radio systems. Inertial systems now appear to be preferred for space jobs deeper than 500 miles.

The big problem now awaiting a solution is the shrinking of guidance components so they will fit in small packages and not weigh too much. For deep space probes, such as to Mars or Venus, guidance systems must have a high reliability and be able to work 24 hours a day for periods up to a year.

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ASTRONOMY

Water Vapor Found in Atmosphere of Venus

EVIDENCE OF WATER VAPOR in the atmosphere of Venus has been found by scientists studying records of the planet made from a manned balloon flying 15 miles above the earth's surface.

The finding raised the possibility that some sort of life could exist on Venus. The balloonists were Cdr. Malcolm Ross of the Office of Naval Research and Dr. Charles Moore of Arthur D. Little, Inc., Cambridge, Mass.

The instruments carried in the balloon were designed by Dr. John Strong of Johns Hopkins University, Baltimore. The evidence of water vapor in the atmosphere of Venus is the first indication of water on the planet, which is already known to have a great deal of carbon dioxide in its atmosphere.

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