

# Photo Mission Finished

Russian spacecraft Luna 11, weighing 3,616 pounds, joined U.S. Orbiter 1 traveling around the moon on an information gathering mission

## See Front Cover

► LUNAR Orbiter 1, an 850-pound spacecraft launched Aug. 10 to take photographs of possible moon landing sites, completed its photographic survey on Aug. 29. Apparently it did not shoot a picture of Surveyor I, which landed gently in the Sea of Storms early last June.

One of Orbiter's missions was to amplify and extend the coverage of the lunar surface provided by Surveyor. However, one of its two cameras, a high resolution device capable of photographing objects as small as a card table, did not perform properly.

There was, therefore, little hope that Surveyor would appear in any of Orbiter's photographs, the last of which will not be transmitted to earth until mid-September.

The historic picture of earth shown on the cover was taken by Orbiter in a completely unrehearsed move. The spacecraft flipped over on its back and snapped the earth from a distance of 240,000 miles, giving a good picture of the terminator—the division of the sunlit and shadowed areas of our planet.

Changes in Orbiter's path around the moon confirmed that the moon is slightly pear-shaped, as is earth, and also that the moon's gravitational pull is about one-sixth that of earth's. The moon's gravitational pull was found to be reasonably uniform, offering no unaccountable dangers to close-up maneuvers by spacecraft.

The final path of Lunar Orbiter 1 around the moon took it from 25 miles above the surface out to some 1,159 miles.

A preliminary report on the first scientific findings from Orbiter 1 appear in *Science*, 153:1102, 1966. The report was made by William H. Michael Jr., Robert H. Tolson and John P. Gapcynski of the National Aeronautics and Space Administration's Langley Research Center, Hampton, Va., which managed the Orbiter project.

On Aug. 28, the Russians reported that Luna 11 satellite, launched Aug. 24, had joined lunar Orbiter 1 and a sister Soviet Sputnik in orbit around the moon.

The 3,616-pound spacecraft was equipped with cameras to take pictures of possible sites for manned lunar landings, and started transmitting photographs within hours after Orbiter had snapped its final picture.

Luna 11 was reported to be sweeping around the moon every two hours

and 58 minutes in an egg-shaped orbit from a low point of 99.2 miles above the lunar surface to a high point of 744 miles. Luna 10, which on April 3 became the first spaceship to orbit the moon, did not send any lunar pictures back to earth.

The Soviet Union announced it had launched its 128th unmanned satellite in the Cosmos series on Aug. 27.

An attempt by the United States to simultaneously orbit eight military communications satellites ended in a fiery failure when the nose cone of a Titan 3C rocket ripped apart 75 seconds after launch on Aug. 26.

The sudden loss of streamlining sent the Titan into a violent nose-down flip that ended in a violent explosion five seconds later. Loss of the eight satellites, each of which cost \$1.5 million, stalled Department of Defense plans to double its spaceborne network of radio relay stations.

Eight more of the 100-pound switchboard satellites have been built and could be launched within two months, but U.S. Air Force officials have not yet set a date for the next launch.

The National Aeronautics and Space Administration announced plans for Apollo astronauts to study the sun during the period of maximum solar activity expected to start in 1968. The mission will require development of an Apollo Telescope Mount, or ATM, and instruments for observing the sun, at a cost of about \$35 million to be spent during a three-year period.

The purpose of the flight will be to obtain highly detailed measurements and observations of the structure and behavior of the sun from a position above the earth's obscuring atmosphere. The flight will also test man's capability for conducting astronomical observations in space.

A parachute system designed to lower spacecraft onto planetary surfaces was successfully tested by descent to the desert floor from 23 miles above New Mexico on Aug. 30. The 800-foot-tall balloon was launched from Walker Air Force Base near Roswell.

The balloon, taller than the Washington Monument, dropped a dummy Voyager capsule in a simulated test of entry into the Martian atmosphere. The parachute descent took about 70 minutes.

The balloon, billed by the Air Force as the largest ever launched in the U.S., carried the 1,600-pound Voyager parachute system to an altitude of 120,000 to 125,000 feet during the flight.

(Cover photograph from NASA.)

# Fusion of Uranium Atoms Seen Possible in Future

► URANIUM atoms could release even more energy by joining together than they do when splitting apart in a reactor or in an atomic bomb.

Atom smashing machines now in use to test the possibility of producing nuclear reactions between heavy atoms would need only some six times their present energy to cause the fusion of individual uranium atoms.

Such a fusion would result in the release of some one billion electron volts per atom, about five times as much as when a uranium atom splits apart in a fission reaction. However, there is no known possibility of a chain reaction in the fusion of uranium atoms as occurs when uranium or plutonium fissions.

The "exciting possibilities" that could be investigated when two heavy atoms, such as uranium, are joined together were reported to a joint meeting of the American Physical Society, the Mexican Physical Society and the Canadian Association of Physicists in Mexico City, by Dr. R. J. Van de Graaff, chief scientist for High Voltage Engineering Corporation, Burlington, Mass. Dr. Van de Graaff invented in 1931 the high voltage atomic accelerator that is still important in the study of high energy nuclear physics.

Two Van de Graaff accelerators working in tandem have been able to speed uranium atoms to energies in excess of 200 million electron volts. The beams of high-speed heavy particles from such an accelerator can be used for various new areas of nuclear research, Dr. Van de Graaff said.

He reported that a new design for tandem accelerators will allow investigation of nuclear structure with beams of particles having energies of hundreds of millions of electron volts.

"One exciting possibility is the fusion of two uranium nuclei, which would be a new type of exothermic nuclear reaction greatly exceeding uranium fission in the energy released per fused nucleus," Dr. Van de Graaff concluded.

## GEOPHYSICS

# Heavy Meteorite Found In Northern Argentina

A HEAVY meteorite, weighing between three and four tons, has been discovered on the northern Argentine Chaco by a scientific expedition headed by a Columbia University professor.

The mixed Argentine-United States expedition is under the direction of William Cassidy and composed of scientists from Argentine Universities in Buenos Aires, La Plata and Santa Fe.

The meteorite was said to be part of a much larger one that fell about 6,000 years ago.