

TOPSI (U.S.) Aug. 25, 1964—Actually Explorer 20, it is named for its role as a Topside Sounder. The satellite is providing upper-atmospheric data by the unusual method of bouncing signals off the ionosphere from above, then relaying them back to earth. 540-634 miles. 103.9 minutes.

NIMBUS 1 (U.S.) Aug. 28, 1964—The most remarkable weather satellite yet took the first photographs ever of the earth's nighttime cloud cover, using special, infrared cameras. It missed its intended circular orbit, but the resulting close-ups were an unexpected pleasure. 263-579 miles. 103 minutes.

OGO-1 (U.S.) Sept. 4, 1964—The first Orbiting Geophysical Observatory carried 20 experiments into orbit, with 17 working despite a major mechanical failure. It showed that almost any combination of experiments can be put together in one satellite, despite their need for "special treatment." 175-92,827 miles. 63.59 hours.

SATURN 7 (U.S.) Sep. 18, 1964—Another test of Apollo's ride-to-the-moon, with nothing to speak of different from the previous flight, except for a new guidance system, which worked perfectly, as did everything else. 112-145 miles. 88.6 minutes.

BEACON EXPLORER-B (U.S.) Oct. 9, 1964—22nd in the Explorer series, the satellite carries a honeycomb of tiny mirrors designed to reflect an earth-based laser beam directly to its source. Exact measurements of the time between transmission and reception of the beam give a super-accurate picture of the satellite's orbit. 546-674 miles. 104.7 minutes.

VOSKHOD (USSR) Oct. 12, 1964—The event of the year. Three men—an astronaut, a doctor, and a scientist—went around the world 16 times without spacesuits, the only spacemen of 1964. 112.5-255.6 miles. 90.1 minutes.

MARINER 3 (U.S.) Nov. 5, 1964—Sent on a 325-million-mile journey to fly close to the planet Mars and take photographs, the probe was lost when its shroud failed to eject clear of the spacecraft.

MARINER 4 (U.S.) Nov. 28, 1964—After some early trouble, the 575-pound probe finally locked its electronic "eye" on the star Canopus and sped toward its rendezvous with Mars about July 14, 1965. It is designed to take 22 TV photographs of Mars, make scientific observations and then go in orbit around the sun. On this week's cover the Mariner is shown on the launch pad at Cape Kennedy.

ZOND 2 (USSR) Nov. 30, 1964—Believed to weigh about 2,000 pounds, this Mars probe was reported to have suffered a failure in half of its power supply shortly after launch.

COSMOS (USSR)—The Soviet Union doubled the size of its unmanned, unpublicized, unidentified space probe series, launching numbers 25 through 50 in 1964.

DISCOVERER (U.S.)—Discoverer launches were so secret that even the number is not known. Usually for scientific/military purposes, more than 60 were launched in 1963, probably more than that this year.

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SPACE

Atlas Missile Has A Variety of Missions

► THE MIGHTY ATLAS missile, used to launch the Mariner Mars probes, has a variety of other assignments in National Aeronautics and Space Administration programs.

These include:

1. RANGER—A lunar research program, with television cameras transmitting close-up pictures of the surface of the moon during the last few minutes of flight as the Ranger spacecraft descends toward a hard landing.

2. OGO (Orbiting Geophysical Observatory)—A standardized spacecraft designed to accommodate a variety of geophysical experiments to be launched into an eccentric orbit.

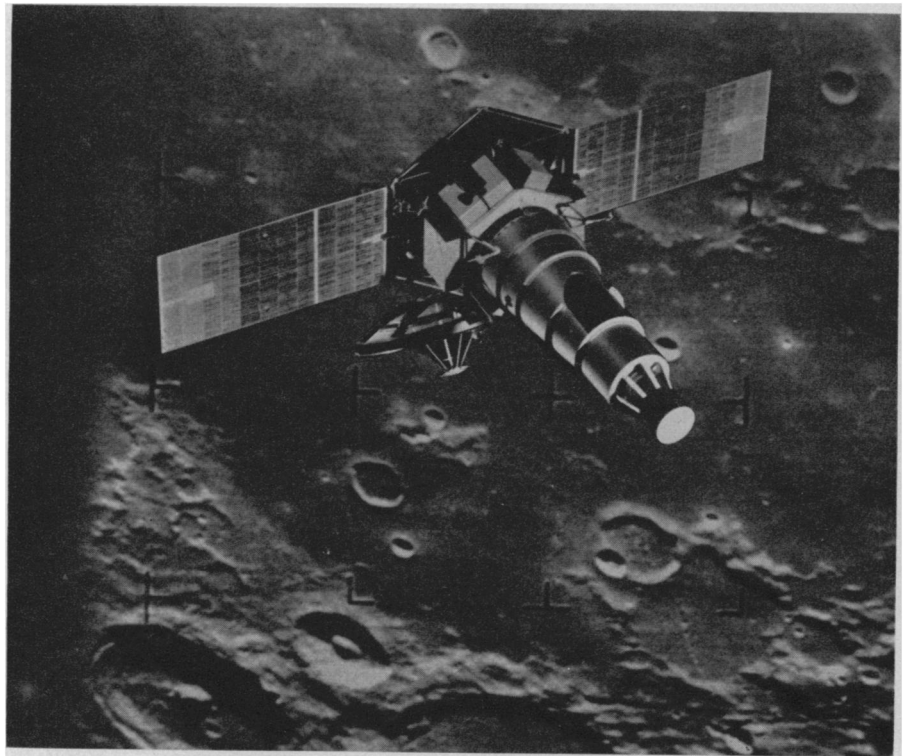
3. OAO (Orbiting Astronomical Observatory)—A scientific satellite to make telescopic observations of ultraviolet, infrared, and X-ray ranges from a precisely stabilized orbiting platform above the obscuring effects of the earth's atmosphere.

4. CENTAUR — Launching high-energy liquid hydrogen-powered Centaur upper stages (under development by the Astronautics division) for Surveyor and other missions.

Surveyor is designed for soft landings on the moon to provide: lunar data in support of Project Apollo; techniques of control, guidance, communication, and landing for manned expeditions, and to obtain basic scientific data about the moon.

5. FIRE—Testing of vehicles and systems during atmosphere re-entry at high velocities.

6. GEMINI TARGET—The second U.S. manned space flight program to provide experience in rendezvous and docking, perform earth-orbital flights up to 14 days, and



Composite of NASA photos by Fremont Davis

AMERICA'S BIG MOMENT—Biggest space news from the United States this year was the Ranger 7 spacecraft, which took 4,316 razor-sharp pictures of the moon's surface. The pictures started a flurry of nature-of-the-moon theories that is still raging today. Here Ranger 7 is shown before a background of one of its own photographs.

demonstrate controlled re-entry and landings. The Air Force will launch Agena vehicles with Atlas to serve as rendezvous targets for the two-man Gemini spacecraft.

7. LUNAR ORBITER—Launch of spacecraft to orbit the moon, take close up pic-

tures of the lunar surface and transmit them to earth. Lunar orbiter spacecraft will secure topographic data for the selection and confirmation of landing sites for Project Apollo manned lunar landing missions.

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