TITAN 3C (U.S.) June 18—The Air Force's super-workhorse, carrying a 21,000-pound dummy payload, made a virtually flawless first flight, giving hope to scientists working on the Manned Orbiting Laboratory (MOL), which will probably be the 3C's first major payload. Two 85-foot strap-on boosters brought the total thrust of the vehicle to 2.4 million pounds, the greatest of any rocket—U.S. or Soviet—known to have left earth's surface. The payload went into a 100-mile circular orbit, with a period of 88.1 minutes.

TIROS 10 (U.S.) July 1—This one brought the total number of working TIROS satellites (Television Infra-Red Observation Satellite) to four, since numbers 7, 8 and 9 are still functioning. TIROS 10 is in a sun-synchronous, nearly solar orbit, with both cameras operating. 458–517 miles, 100.6 minutes.

MARINER 4 (U.S.) July 15—Although it had been transmitting data back to earth since its launch last Nov. 28, Mariner 4 did its most spectacular trick in July, when it passed within 5,700 miles of Mars and sent 21 pictures of the surprisingly moon-like planetary surface to California Institute of Technology's Jet Propulsion Laboratory. The eagerly awaited photographs and the data are still being analyzed by a large number of scientists.

ZOND 3 (USSR) July 18—Repeating the 1959 feat of Lunik 3, Zond 3 photographed parts of the lunar surface never seen from earth. Because the moon revolves around the earth in about the same time it takes to rotate once on its axis, the same side always faces the earth. Zond took its pictures from about the same distance—Mariner 4 was from Mars.

PEGASUS 3 (U.S.) July 30—This meteoroid detection satellite, like Ranger 9, was the object of some disfavor as an unnecessary expense, despite NASA's explanation that the detection panels would be made removable so that some future astronaut might bring one back to earth. The flight marked the 10th success, out of 10 attempts, for the Saturn 1 booster. 323–336 miles, 95.2 minutes.

ATLAS-CENTAUR 6 (U.S.) Aug. 11—NASA officials breathed a sigh of relief when AC-6, the booster assigned to the long and critical Surveyor unmanned lunar landing program, successfully hit an imaginary "dummy" moon 240,000 miles out in space. AC-5, launched earlier this year, exploded when one of the first stage engines cut off prematurely, letting the rocket crash back on the pad.

GEMINI 5 (U.S.) Aug. 21—Old-timer Gordon Cooper and his co-pilot Charles Conrad set all kinds of records, not the least of which was their eight days in orbit. The only problem was a malfunction in the fuel cells, threatening to use up fuel too quickly. The astronauts, therefore, elected to spend two days tumbling in space without corrective maneuvers although it later turned out that the fuel would have been adequate. 100–219 miles, 90.1 minutes.

MOL (U.S.) Aug. 25—This date marks only a contract decision, but it was so large, and so long in coming, that it is included. The Air Force's Manned Orbiting Laboratory is planned to keep two men in space for a month late in 1968, and will cost $1.5 billion.

COSMOS (USSR)—The Soviet Union's secret, all-purpose satellite series grew by leaps and bounds in 1965, reaching number 79 by mid-September. A number of multiple launches were included, with as many as five satellites carried aloft by a single booster.

DISCOVERER, SAMOS, MIDAS, VELA HOTEL (U.S.)—The U.S. Department of Defense added, with as little fanfare as humanly possible, to its series of spy satellites, which are quietly watching for nuclear explosions, rocket launches and no one is telling what else.

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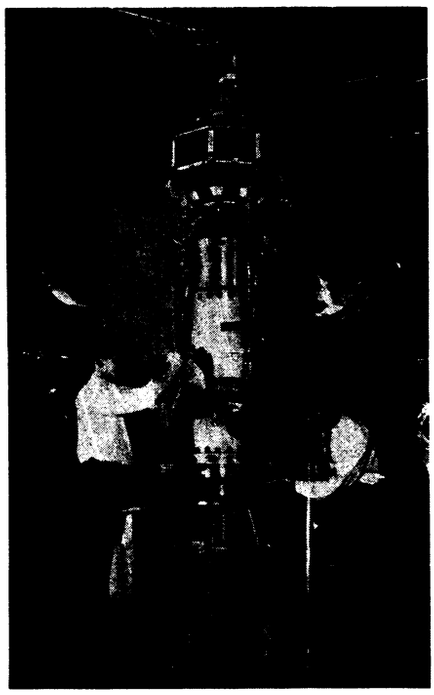

NASA

FRENCH BUILT—A prototype model of French-built FR-1 scientific satellite, a simulated fourth-stage Scout rocket motor and a separation unit are prepared for testing at the National Aeronautics and Space Administration's Goddard Space Flight Center, Greenbelt, Md. The FR-1 is designed to study very low frequency radio wave propagation and the distribution of the ionosphere.

SPACE

Men in Space Exercise

➤A DEVICE that has already been used by submarine crews and Olympic athletes to keep in shape is now intended for men exposed to long periods of weightlessness, such as aboard space stations or interplanetary spacecraft.

Called the Exer-Genie, the apparatus resembles a jump rope with wooden handles at each end, passing through a metal cylinder about the size of a flashlight. A hook at one end of the cylinder enables the exerciser to be fastened to the floor.

The cylinder can be adjusted for the amount of force, up to 400 pounds, required to pull the rope through it. Lockheed Missiles and Space Co., Sunnyvale, Calif., is currently experimenting with it.

The Exer-Genie was originally developed by Dean D. Miller, who was then track coach and an associate professor at San Jose, Calif. It is based on both isotonic and isometric exercises (with and without movement of the muscles, respectively).

One submarine crew using the device reportedly lost an average of five pounds each and gained an average of two inches around each arm.

One likely candidate for the Exer-Genie is the Air Force's Manned Orbiting Laboratory (MOL), scheduled for a one-month stay in orbit late in 1968. The cramped quarters and limited movement will make some sort of exercise necessary to preserve muscle tone.

A more elaborate solution to body conditioning is zero-gravity, and one that has received serious consideration for use on larger, more sophisticated space missions, is a centrifuge. Many advanced project ideas, both from the Government and from industry, have included one- or two-man centrifuges as means of providing temporary, artificial gravity.

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PHYSICS

Moon's Surface Seen Sintered by Radiation

➤RADIATION from the sun sinters the moon's surface into a relatively rigid but porous structure.

Sintering involves a limited amount of heating without melting, resulting in material that is stiff but not dense. Radiation sintering of lunar dust plays an important role in determining the properties of the lunar surface, Dr. R. Smoluchowski of Princeton University reported.

Protons in the solar wind, displacing atoms in the grains of lunar dust, cause the sintering of the lunar surface, Dr. Smoluchowski reported in Science 150:1025, 1965.

He did not venture a suggestion as to the strength of the lunar surface, or whether it would support a manned landing vehicle. Instead, Dr. Smoluchowski called for "much careful and experimental work" as a requisite to understanding the structure of the lunar dust layer.

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