SPACE

Men, Pictures Told Space Story

The astronauts came thick and fast, with a pair of cosmonauts thrown in, as the race for the moon really got off the ground.

By JONATHAN EBERHART

Eight men and 21 photographs told the biggest stories of 1965. First the two Russians, Leonov and Belyayev, orbited the earth in March, and Leonov became the first man ever to step unprotected (except by a spacesuit) into space.

The Gemini program, however, has been going full speed, and at press time three two-man flights have taken place: Grissom-Young (Gemini-Titan 3), McDivitt-White (GT-4), and Cooper-Conrad (GT-5). During GT-4, Edward White repeated Leonov's space walk, and spent twice as long in space doing it. In August, Gordon Cooper and Charles Conrad set new records for man-hours in space, spacecraft-hours and total hours for one country.

Two more flights, GT-6 and 7, were scheduled for early this month, the first one to be launched for a two-week trip, and the second to be sent up during that time for a not-quite-touching rendezvous in space. Old-timer Walter Schirra and rookie astronaut Thomas P. Stafford will man GT-6, while newcomers Frank Borman and James Lowell, the scheduled GT-7 crew, could bring the number of 1965 American spacemen to 10.

Previously, the record for sheer volume of human space-traffic was set way back in 1962, when three Americans (Glenn, Carpenter and Schirra) and two Russians (Nikolayev and Popovich) orbited the earth a total of 124 times. Gemini 5 alone this year accounted for 120 orbits.

As the Gemini program swung into high gear, and other projects were delayed for lack of funds, the cry arose that the Government was so committed to getting to the moon first that it had no plans for the future.

The future looked bigger than ever, however, as the National Aeronautics and Space Administration expanded its scientist-astronaut program, awarded contracts for studies of probes to the outer planets, and expanded its research into electric and ionic drive engines that would provide small, but steady, thrust during long duration flights.

In addition, a contractor was finally selected to build the Air Force's $1.5 billion Manned Orbiting Laboratory (MOL), which will provide a month's continuous orbital space flight for two men in late 1968.

The outer space art gallery grows and grows. Mariner 4 sent 21 photos of Mars back to earth, where they answered a few questions and raised a bushel. The pictures were not Mariner's only contribution, however. The spacecraft was transmitting data throughout its seven-month flight. Several teams of scientists are still busy decoding and analyzing the reams of information.

More pictures came from Russia's Zond 3, which became the second spacecraft—the first was the Soviet Lunik 3 in 1959—to photograph the side of the moon never seen from earth.

1965 Space Calendar

The following are the principal satellites and probes launched in 1965 up to Sept. 15. When available, orbital distance closest to (perigee) and farthest from (apogee) earth are shown in miles. The times represent the durations of the orbits. Unsuccessful launches are not listed.

TIROS 9 (U.S.) Jan. 22—The first "cartwheel" Tiros "rolls" around its orbit, which is elliptical rather than circular as intended, taking pictures with the one of its two cameras that is operational. 435–1602 miles, 119.2 minutes.

OSO 2 (U.S.) Feb. 3—The second Orbiting Solar Observatory was placed in orbit with six of its eight experiments working, including solar X-ray, gamma ray and ultraviolet radiation monitors. 343–393 miles, 96.5 minutes.

PEGASUS 1 (U.S.) Feb. 16—Huge, 96-foot "wings" which give the satellite its name, are the sensors for this micrometeoroid detection station, which orbits still attached to its Saturn S-IV second stage booster. 308–462 miles, 97.0 minutes.

RANGER 8 (U.S.) Feb. 17—The second consecutive success for the moon-camera program crashed on the moon in the Sea of Tranquility after transmitting 7,137 photos of the lunar surface back to earth.

VOSKHOD 2 (USSR) March 18—Soviet Cosmonaut Alexei Leonov spent 10 minutes outsde his spacecraft, the first time any man had ever actually stepped into space. After 17 orbits, he and pilot Pavel Belyayev landed on solid ground. 107–308 miles, 90.9 minutes.

RANGER 9 (U.S.) March 21—The preceding two lunar probes were so successful that some scientists branded this one a waste of money. Nevertheless, it transmitted 5,814 pictures, crashed in Alphonsus Crater.

GEMINI 3 (U.S.) March 23—Astronauts Virgil Grissom and newcomer John Young flew the first manned Gemini spacecraft, nicknamed the "Molly Brown," up, down and sideways, landing in the Atlantic after three orbits. 100–140 miles (approx.), 88.2 minutes.

EARLY BIRD (U.S.) April 6—The first commercial communications satellite was placed into an elliptical orbit, from which it fired a rocket and pushed itself out into a circular orbit, 22,300 miles above the earth. The Communications Satellite Corporation (ComSat), the satellite's owner, is still thrashing out the unbelievable web of legal problems that clings to an international enterprise, but Early Bird has already proved its worth, carrying phone calls, television, teletype and other kinds of communications on a "rent-a-satellite" basis. Since it remains stationary over one spot on the earth, Early Bird has the same orbital period as a point on earth's surface: 24 hours.

SATURN S-1C (U.S.) April 16—Although nothing was actually launched, the biggest booster America has yet produced (and the first stage-to-be for the Apollo lunar flight) was successfully fired for the first time. For six and one-half seconds of burn-time, the S-1C's five F-1 engines produced a total of 160 million horsepower.

LUNA 5 (USSR) May 9—The craft failed as the world's first attempt to soft-land on the lunar surface although it reached the moon. Luna's retrorockets apparently fired about five minutes too soon, so the probe ran out of fuel ahead of schedule and crashed.

PEGASUS 2 (U.S.) May 25—The National Aeronautics and Space Administration correlating data from Pegasus 2 and a virtually identical preceding satellite, concluded that meteoroids "probably will not be unduly hazardous" to spacemen. 314—466 miles, 97.3 minutes.

GEMINI 4 (U.S.) June 3—While pilot James McDivitt flew the spacecraft, co-pilot Edward White took the first American "space walk," maneuvered himself around in space with a compressed air gun, and only reluctantly came back inside after 20 minutes instead of a scheduled 12. 101–178 miles, 94.7 minutes.

LUNA 6 (USSR) June 8—This was apparently another unsuccessful lunar soft-landing attempt, although again it did get to the moon. Luna 6 was the first known space vehicle to be launched not from earth, but from orbit—its booster first circled the earth before firing the payload moonward.

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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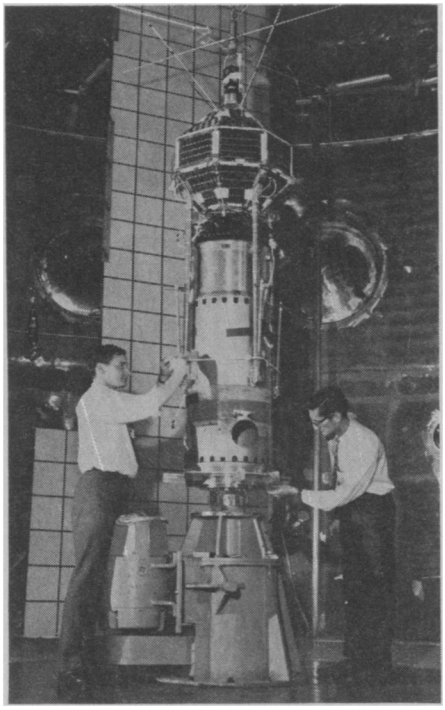

NASA

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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