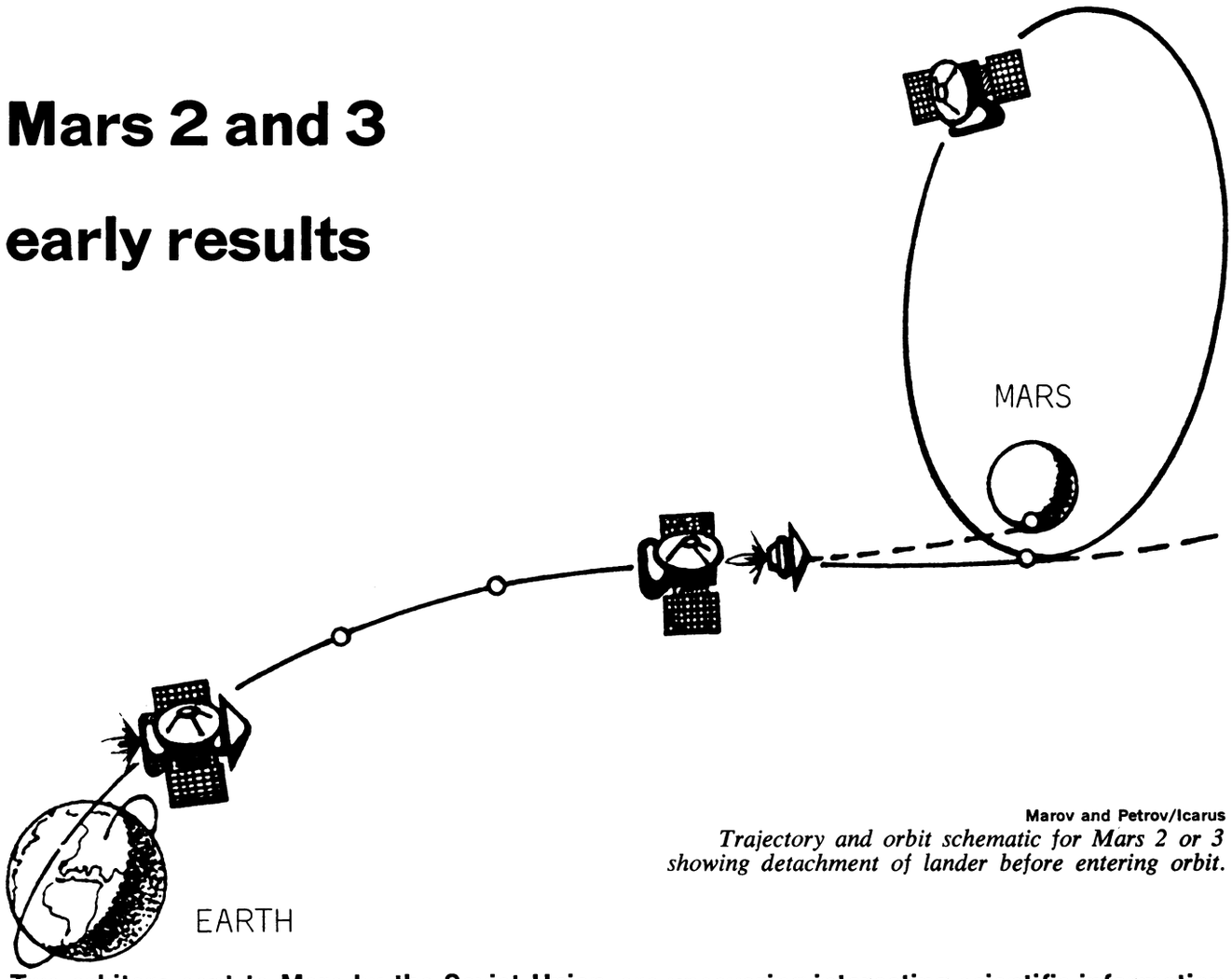
Mars 2 and 3 early results



Marov and Petrov/Icarus
Trajectory and orbit schematic for Mars 2 or 3 showing detachment of lander before entering orbit.

Two orbiters sent to Mars by the Soviet Union are uncovering interesting scientific information

by Dietrick E. Thomsen

At about the same time that the United States sent Mariners 8 and 9 to the planet Mars, the Soviet Union sent two spacecraft, Mars 2 and 3. In the American experiment Mariner 8 failed, and Mariner 9 survived to become an artificial satellite of Mars. Both Soviet craft successfully entered orbit around Mars. Now, in the June ICARUS, two Soviet space scientists, M. Ya. Marov of the Institute of Applied Mathematics in Moscow and G. I. Petrov of the Institute for Space Research in Moscow, report preliminary results of the investigations carried out by Mars 2 and 3.

Mars 2 was launched on May 19, 1971; Mars 3, nine days later. On Nov. 27, 1971, Mars 2 went into orbit around the planet; Mars 3 was put into orbit on Dec. 2, 1971. In addition to the orbiters the expedition contained two landers, a capsule released from Mars 2 and a lander with automatic survey instruments released from Mars 3. Both reached the surface of the planet.

The Mars 3 lander carried equipment for measuring temperature, atmospheric pressure, chemical composition of the atmosphere, wind velocity and chemical composition and physical and mechanical properties of the surface layer. It also had television cameras for panoramic viewing of the surface.

Unfortunately, about 20 seconds after transmission began, signals from the lander were cut off. The reason is unknown, but Marov and Petrov suggest that it may have been due to terrain characteristics of the landing site, which was between the Martian features Electris and Phaethontis, or to the dust storm which was under way at the time. "The sudden break in signals from the lander unfortunately prevented our obtaining information about the operation of the scientific equipment," Marov and Petrov write. ". . . The very fact, however, that a soft landing was successfully effected on Mars opens wide the prospects for the investigation of this planet by direct methods in the not too distant future."

The United States has plans for a lander, which will carry experiments to look for life on Mars, in July 1976 (SN: 11/4/72, p. 300). Whether the Soviet Union has plans for any more Mars landers, Marov and Petrov don't say, but American scientists believe it is likely.

Mars 2 and Mars 3 went into quite different orbits, as would have been the case with the American spacecraft had Mariner 8 survived. Mars 2 ranges from a near point of 1,380 kilometers to a far point of 25,000 kilometers; Mars 3, from 1,530 kilometers to 214,500 kilometers. The Mars 2 orbit is inclined 49 degrees to the equatorial plane of Mars; the orbit of Mars 3 is inclined 60 degrees. Mars 2 completes an orbit every 18 hours; Mars 3 takes 12 days and 16 hours to go around once.

One of the most striking discoveries is that the upper atmosphere of Mars ends in a region of ions that forms a kind of bow wave like that of the earth. This is interpreted as a shock front caused by the interaction of the Martian atmosphere and the solar wind.

It is possible, according to Marov and Petrov, to interpret the data obtained about the magnetic field and upper atmosphere of Mars in terms similar to those used for the earth: shock front, magnetospheric boundary and magnetosphere. The magnetic field strength at the Martian equator is about 60 gamma, or 500 times less than that on the earth.

Ultraviolet photometers aboard the two satellites gave some information about the distribution of gases in the upper atmosphere. At 400 to 500 kilometers from the surface, hydrogen is very rare. There are only about 6,000 hydrogen atoms per cubic centimeter. Atomic oxygen is practically absent above 1,600 kilometers.

Like Mariner 9 the Soviet orbiters found "hotspots" on the surface of Mars, areas where the temperature is 10 to 15 degrees K. higher than in the surrounding areas. The reason for the temperature difference is probably that the surface at these hotspots is made of particles of different size and porosity from the neighboring areas. Or the hotspots may mark locations where rock formations emerge.

There are also temperature differences over larger regions. The dark and bright regions ("seas" and "continents") differed by about 10 degrees both during the dust storm and after it. This probably is due to differences in the amount of sunlight reflected by the different regions. The storm caused a general depression of surface temperatures. At middle latitudes the decline was about 20 to 30 degrees. At latitude 60 degrees south the temperature around midday did not exceed 245 degrees K. After the storm it rose to 270 degrees K.

During the storm photometric measurements of carbon dioxide showed its emissions much weakened. This was probably due to obscuration by the dust. It probably indicates that the tops of the dust clouds were very high, between 8 and 10 kilometers above flat terrain and somewhat less above mountainous terrain. The contrast in brightness between seas and continents was considerably less than in clear weather. The numerical difference led V. Moroz and Z. Ksanfomaliti to conclude that the mean radius of the dust particles (assuming that they are made of silicates) is between one-half and one micron.

In conclusion Marov and Petrov remind the reader that they are summarizing the results of a large number of investigators, whose work continues and from whom further reports may be expected. What has been found so far by the Soviet orbiters and by Mariner 9 whets the appetite for future Mars orbiters and landers. □

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