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SCIENCE, now combined with THE SCIENTIFIC MONTHLY, is published each Friday by the American Association for the Advancement of Science at National Publishing Company, Washington, D.C. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

Editorial correspondence should be addressed to SCIENCE, 1515 Massachusetts Ave., NW, Washington 5, D.C. Manuscripts should be typed with double spacing and submitted in triplicate. The AAAS assumes no responsibility for the safety of manuscripts. Opinions expressed by authors are their own and do not necessarily reflect the opinions of the AAAS or the institutions with which the authors are affiliated. For detailed suggestions on the preparation of manuscripts, see *Science* 138, 496 (26 Oct. 1962).

Advertising correspondence should be addressed to SCIENCE, Room 1740, 11 West 42 St., New York 36, N.Y.

Change of address notification should be sent to 1515 Massachusetts Ave., NW, Washington 5, D.C., 4 weeks in advance. Furnish an address label from a recent issue. Give both old and new addresses, including zone numbers.

Annual subscriptions: \$8.50; foreign postage, \$1.50; Canadian postage, 75¢. Single copies, 35¢. School year subscriptions: 9 months, \$7.00; 10 months, \$7.50. Cable address: *Advancesci*, Washington.

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The Venus Mission

Mariner II is already a record-breaking success. The pre-calculated flight trajectory has been followed, all interplanetary experiments have functioned, and many engineering data have been acquired. Though Mariner II is now more than 23 million miles away, data from 90,000 measurements a day are being received.

In this issue we are pleased to present scientific results obtained during the interplanetary phase of the mission. Our pleasure contrasts with corresponding sadness at five consecutive fiascos in the lunar program. The Venus shot is feasible for only a short period once every 584 days. Yet our first real lunar or interplanetary triumph has attended the more difficult mission.

The prerequisite for a successful space flight is functioning of all components. During launch phases, vibration and acceleration place unusual stresses on the vehicle. Even partial failure of one of hundreds of thousands of components can nullify the performance of all. After ascent to a circular parking orbit 115 miles from the earth, Mariner II was allowed to coast to a calculated point and was then boosted to escape velocity. During the next eight days the space craft was tracked to determine its path, and a slight corrective maneuver was made. The magnitude of the guidance problem can easily be seen. When Mariner II misses Venus by 21,000 miles on 14 December, it will be 26.3 million miles from Earth. The space craft will have traveled 182 million miles at highly variable speeds. Starting from rest with respect to Earth, the velocity rose quickly to 18,000 miles per hour. The vehicle was later accelerated to 25,503 mph, a speed in excess of escape velocity. After three days the velocity had decreased to 6874 mph. Then the space craft was moving about the sun 6874 mph slower than the earth's 66,000 mph, that is, about 59,400 mph. From that time the velocity of Mariner II increased as it moved toward the sun. The craft will attain a velocity of 84,000 mph and catch up with Venus, which moves about the sun at 78,300 mph. These figures make evident the complexity of calculating the trajectory and attaining it; this is only one facet of a successful flight.

The experimental and engineering data sensors must operate, and their information must be transmitted back to Earth. Hence the space craft must be positioned so that the solar batteries can operate and the antenna is directed toward Earth. Miraculously, all the components of Mariner II have functioned.

Prospects are excellent that worthwhile measurements will be made during planetary approach. At that time two additional instruments will be turned on, a microwave radiometer and an infrared radiometer. They should measure temperature distribution on Venus and tell whether there are discrete clouds with breaks. Previous measurements from Earth seem to indicate a surface temperature of 300°C, but this value is not universally accepted.

The magnetic field of the planet will also be measured. If it is comparable with that of Earth, the observation will be interpreted as indicating that Venus has a hot molten core. Other similarities of Venus and Earth such as a history of differentiation would also be inferred.

The striking success of Mariner II is reassuring. We now have grounds to hope that the Space Administration will ultimately shake down into an organization capable of sponsoring and carrying out solid scientific research.—P.H.A.

Science

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Science **138** (3545), 1069.
DOI: 10.1126/science.138.3545.1069

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