



National Aeronautics and Space Administration

**MARINER II**—The diagram to the left shows the infrared temperature study of the clouds of Venus and the one to the right, the microwave temperature study of the Venus atmosphere and surface.

SPACE

## Cold Clouds Over Venus

Findings of the Mariner II spacecraft indicated that the surface temperature of Venus is about 800 degrees Fahrenheit, too hot to support life like that found on earth.

➤ **VENUS** is covered by cold dense clouds in the upper atmosphere.

These thick clouds start at a height of 45 miles over Venus and extend about 15 miles up. They are composed of condensed hydrocarbons.

These are some of the findings of this country's Mariner II spacecraft reported by the National Aeronautics and Space Administration at Washington, D. C. The vehicle flew within 21,648 miles of Venus last December 14 after a 109.5 day voyage from earth.

Other conclusions reached were:

The surface temperature of 800 degrees Fahrenheit is too hot to support life as it is known on earth;

Solar gas continuously flows out from the sun at great speed;

Venus does not have the high density ionosphere that some scientists had expected;

The southern hemisphere of Venus has a cold spot;

Venus' atmosphere contains carbon dioxide but probably has little free oxygen or water vapor.

When Mariner II flew by Venus at a distance of about 21,000 miles, the planet was scanned with two special instruments for 35 minutes.

Three complete scans were made of the planet, one on the sunlit side, one on the dark side and one across the terminator, the line separating the sunlit side from the dark side.

That Venus does not have a super-ionosphere was proved by detecting the condition called limb darkening.

If the atmosphere above the surface on Venus gets colder and colder with height

and there is not a high electron density ionosphere around Venus, looking straight down on the planet, one would see the hot surface covered by thin, dark and cool clouds. Looking toward the edge one would be looking through a thicker concentration of cooler clouds and might not see any of the hot surface. The edge, or limb, would appear darker. This condition, limb darkening, was detected for the first time by Mariner as it flew by Venus.

Data obtained showed a cold spot on Venus, about 20 degrees Fahrenheit cooler than the rest of the cloud layer.

This means that the clouds in this region are higher, or more opaque, or both. An interesting possibility is that this cooler section of the cloud layer is associated with some hidden surface feature.

This cold spot was the only anomaly observed.

Temperatures in the cloud layer were the same on the dark side as on the light side. At the center of the planet, the temperature was measured at minus about 30 degrees Fahrenheit, but the certainty of this value must await further data evaluation.

The Mariner II flight resulted in accumulation of some 65 million bits of information with an accuracy of at least 1% and yet with the use of only three watts of radio frequency power.

A new technique for precise synchronization of telemetry and communication channels using pseudorandom codes successfully demonstrated that precise synchronization is possible using only very low powers.

• Science News Letter, 83:149 March 9, 1963

PHYSICS

## Frictionless Free-Fall Gyro Spins Indefinitely

➤ A **FRictionLESS**, free-fall gyroscope suspended in space within a vacuum inside a satellite is being designed by Stanford University physicists and engineers to test Einstein's general theory of relativity. The gyroscope would have neither bearings nor air to slow it down, and thus no friction.

Once in rotation it would continue to spin almost indefinitely. Its designers hope the gyro will be a million times more accurate than present ones.

The experiment, originally suggested in 1959 by Prof. Leonard I. Schiff, head of the Stanford physics department, requires observation of the extremely high precision gyroscope while it is in orbit in the satellite. Precise measurements would then be made of the barely perceptible motion, or "precession," of the gyro rotor's spin axis.

This precession would be caused by the earth's gravitational field, and is predictable with the use of Einstein's general theory. In the gyroscope the axis movement should be seven seconds of arc per year, or about one degree in 500 years. This is speeded up 15 or 16 times over the normal rate of precession because the satellite will orbit the earth that many times a day.

One possibility mentioned would be to launch the gyroscope in one of the Orbiting Astronomical Observatory satellites being planned by the National Aeronautics and Space Administration. NASA expects to orbit a number of OAO's in the next five years.

The apparatus would include an astronomical telescope to keep the satellite aimed at a fixed star. A long-lasting vacuum for the spinning rotor would present no great problems, and the zero-g environment of space would greatly simplify the task of keeping the rotor suspended.

In addition to testing gravitational aspects of Einstein's general theory, the zero-g satellite vehicle would have other uses.

• Science News Letter, 83:149 March 9, 1963