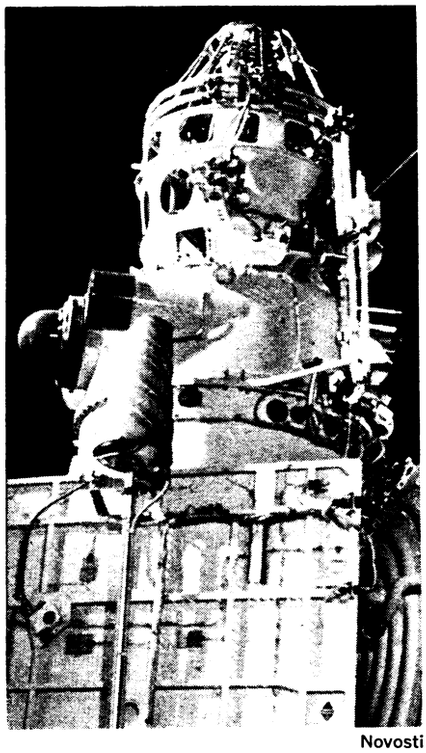
300 degrees warmer than the Soviet data indicated.

This possibility has come to light as a result of new radar measurements of the planet made from earth, combined with analysis of the trajectory of the U.S. Mariner 5 spacecraft as it curved around behind Venus two days after the Russian probe's arrival.

The analysis of Mariner's path, affected by Venus' gravitational attraction, revealed the distance to the planet's center of mass, and the last data from the Russian probe, fitted onto the imaginary line between the mass center and Mariner, presumably indicated the



Novosti

Venus 4: but for an altimeter. . . .

surface of the planet. Judging by the distance from the last Russian data to the mass center, the radius of Venus seemed to be 6,078 kilometers.

But previous studies, by both U.S. and Soviet researchers, had indicated that the planet's radius was only 6,056 km.—somebody was wrong. Because the earlier, smaller figure resulted from seven years of painstaking radar measurement from earth without any spacecraft for correlation, and because the complex equations offered such possibility for error, some scientists tended to favor the new number. But the question was open.

Now it seems to have been closed, for the time, in favor of the old.

While Mariner 5 was in the vicinity of Venus, Dr. Von R. Eshleman of Stanford University in Palo Alto, Calif., together with colleagues from Stanford, the University of California's Jet Propulsion Laboratory and the 1,000-foot radio telescope at Arecibo, Puerto Rico, used the giant telescope to bounce radar waves from the surface of Venus. By comparing Arecibo's distance with Mariner's distance from the planet's center of mass, the scientists were able to confirm precisely (and confidently), the earlier, smaller radar estimates of Venus' radius.

According to that calculation, the pressure and temperature data from both spacecraft were wrong, since the figures were assumed to be for altitudes some 24 km. higher than now appears to be the case. The data from the two spacecraft did overlap, however ("It fit very well indeed," Dr. Eshleman says), so determining the new surface estimates was only a matter of extrapolation.

The "new Venus," therefore, has an estimated surface temperature of 800 degrees F. and an atmospheric pressure 100 times greater than that of earth. The original Russian spacecraft data indicated a cooler, but still uncomfortable, 536 degrees, and a somewhat less crushing 22 atmospheres of pressure.

But why the error? What made the Soviet probe misjudge its height by 24 km.?

When the instrument package was released, its altimeter indicated that it was about 24 km. above the surface. However, says Dr. Eshleman, some kinds of altimeters give the same signal at multiples of a given height. If the spacecraft was really 48 km. up when it dropped its instrument package, the mystery is solved. All the data fit consistently together if that one, simple correction is made.

There is other evidence as well that the instruments failed while still descending through Venus' atmosphere. Their batteries were reportedly designed to operate for 100 minutes (the signals actually stopped after 94). This, Dr. Eshleman says, would have been just about enough time for the package to float from a level of 0.7 atmospheres—the first reading from the instruments—down to where the pressure would be about 20. It would have taken several times the maximum battery lifetime to fall to the newly estimated surface pressure level. Thus, according to the scientist, they must have died in mid-air.

MIRV

Overkilling negotiations

Lockheed

Dwarfing its Polaris A3 predecessor, a multi-warhead Poseidon missile.

When the Soviet Union began in late 1966 to deploy antimissile defenses around Moscow, the immediate response of the United States was to develop multiple warheads for its key missile deterrents: the Poseidon being developed for launching from submarines, and the Minuteman III, latest generation of the silo-based ICBM.

The logic, according to then-Secretary of Defense Robert S. McNamara was that the Soviet ABM threatened the ability of the U.S. to deter attack through the effective threat of instant retaliation.

To build an American version of the ABM, McNamara argued, would simply accelerate the arms race. He opted for MIRV—the multiple, independently targeted reentry vehicle—designed to flood an enemy defensive system with more warheads than it could handle, thereby reestablishing the deterrent and the stalemate.

It was with McNamara's reluctant accord that Congress trumped the Secretary's ace by opting for an American ABM—upsetting the balance once more.

In this perspective, the Defense Department late last week moved into the

first operational tests of MIRV aboard both Poseidon and Minuteman III missiles at Cape Kennedy.

The new imbalance in the balance of armaments created by the test series seemed last week to threaten the success of a round of disarmament negotiations toward which the U.S. and U.S.S.R. had been moving.

And by the time the balance has been reestablished, through development and deployment of a Soviet MIRV—expected to take about two years—the number of nuclear warheads in the world's arsenals will have grown about 20 times.

The problem is further compounded:

A major barrier to disarmament negotiations during the last decade has been the problem of inspection to ensure that armament reduction promises are being kept. Recent advances in satellite-borne intelligence-gathering technology, represented by the U.S. Samos and Soviet Cosmos satellite series, promised to eliminate the need for on-sight inspections and, in fact, made a treaty look possible.

But they depend for their effectiveness on what can be detected. A missile can, and an ABM installation can, from satellite heights.

But it is impossible at this time to tell whether a missile has one or many warheads without actual on-sight inspection—a luxury that is unlikely to find its way into any U.S.-Soviet pact in the near future.

"Unless you were capable of physically taking a screwdriver and opening the damn thing up," says physicist Dr. Ralph Lapp, "you couldn't tell." Even then, he adds, there would be no way to keep the missile's owners from simply switching warheads after the inspector was gone.

The only glimmer of hope for talks in 1970 or beyond is that there are finite limits as to how many nuclear warheads a given missile can carry. The present capacity of the U.S. Poseidon missile has been estimated as high as 20, while Russia's more powerful SS-9 may carry 35.

Thus, at least theoretically, once both countries have multiple warheads, negotiators could agree on non-proliferation to begin at some point of equal warhead numbers and delivery capability. In other words, "balanced overkill."

The overkill level, in fact, might well be reached more quickly with MIRVs than with single-warheaded missiles. Not only would the cluster's spray of warheads be more difficult to defend against, but a single MIRV-equipped missile could cover the largest cities, whereas many single-bomb missiles might be required for the same area. MIRV, at least, reduces overkill costs.