# Soviets Report Lightning on Venus

On Dec. 21, only days after five U.S. probes had plumbed the atmosphere of Venus, the Soviet Venera 12 landing craft settled with a bump onto the haze-wrapped planet's sunlit side. Out of sight of earth and depending on a passing mothership for communications relay, it provided only 110 minutes of data after landing in the hellish environment, but the brief report was enough to set a new record for survival on Venus, eclipsing by three minutes the 1972 mark of Venera 8. Then, on Dec. 25, came the landing of Venera 11, which touched down about 800 kilometers from its twin and added another 95 minutes of data to the store.

Venus, of course, made its presence known as only it can. The first lander reported a surface pressure of 88 atmospheres and a temperature, "during the last minutes before touchdown," of 460°C (860°F), according to a Tass report. The second craft indicated an identical pressure, although the post-landing temperature, Tass said, was only 446°C (835°F). In addition to these and other measurements, however, the landers made another contribution, described by Soviet Intercosmos Council chairman Boris Petrov as "radically new data," and by several U.S. scientists contacted by SCIENCE NEWS as "exciting," "wonderful" and "fantastic": lightning — and, according to Soviet press accounts, a lot of it.

The instruments aboard the descending landers were reportedly activated about 62 km above the surface, a few kilometers lower than those aboard the U.S. Pioneer Venus probes. The action, however, was considerably farther down, beginning, according to the Novosti Press Agency report, when Venera 12 was about 10 km above the surface. "The descent," reported Tass, "took place in 'unclement weather.' The *groza* [thunderstorm] instrument recorded fairly frequent electrical discharges in the atmosphere during the descent. One weighty discharge made the surroundings resound for 15 minutes after the device had landed."

The existence of lightning on Venus is not entirely unexpected, according to several U.S. scientists. The source, however, is likely to raise considerable question. Data from past Veneras have indicated, for example, that the low-altitude winds are very slow, presumably inhibiting friction and similar effects. Dust particles rubbing together could build up charges, but the Pioneer Venus probes found the bottom 35 to 45 km of atmosphere to be almost totally free of particles. The sulfuric acid in the upper atmosphere would be a good candidate as an electrolyte — it is, after all, found in car batteries — but it too seems to be primarily confined to high altitudes.

"These electrical-storm discharges," said Petrov in an interview with a Soviet correspondent, "have been recorded both at very high frequencies and at relatively low ones. This indicates that the atmosphere of Venus is a dynamic and very complex formation, and which is alive and in which processes take place in a far more active way than [in] that of the earth."

Yet it was not precisely clear from early accounts just what the Veneras had found, particularly the reference to making "the surroundings resound for 15 minutes." The landers were said to carry both electric-field detectors and acoustic devices (suggesting something like microphones to listen for thunder), but what kind of electrical or acoustic effect would last that long on Venus? On earth, says James Warwick of Science Applications, Inc., the electromagnetic "whistlers" produced by lightning bolts last perhaps tens of seconds at the longest, as they "mirror" back and forth on the planet's strong magnetic field lines. But the magnetic field of Venus is extremely weak. Thunder reverberating for 15 minutes is a stunning concept, yet one might expect the dense Venusian atmosphere to dissipate acoustic energy more readily than does earth's. Whatever the answer, says Warwick, the existence of lightning on Venus would indicate that "the range of conditions under which lightning is expected to occur in nature is much greater than we have thought."

Scientists have also speculated on the possibility of lightning on Jupiter, and the U.S. Galileo orbiter-and-probe, to be launched in a few years, is planned to carry a lightning detector down into the Jovian atmosphere. As for Venus, further data will probably depend on Soviet spacecraft. The U.S. Pioneer Venus orbiter still circles the planet, but according to Frederic Scarf of TRW, Inc., symptoms of lightning are probably unable to get above the substantial ionosphere. In the works, however, is a Soviet-French mission in which balloons are to be deployed *in* the Venusian atmosphere for a few days of constant data-gathering.

Also significant could be the effect of lightning on the planet's bizarre atmospheric chemistry. "If you think of it as a quiescent atmosphere," says one U.S. researcher, "you could get very wrong results."

In addition to the lightning measurements, the landers measured the atmosphere's composition and structure, in many ways similarly to the studies by the Pioneer Venus probes. One significant finding by the Soviet craft supported a Pioneer Venus measurement that has been controversial because it conflicts with data from another sensor (SN: 12/16/78, p. 420): "The ratio of argon 36 to argon 40 on Venus," says a Tass report, "was 200 to 300 times higher than on earth," which could bear on differences in the primordial mixture from which the planets formed.

Were there any photos from the latest landers? They carried cameras, and U.S. scientists this week were still trying to find out. But one Tass report, sent several hours after the second lander had ceased functioning, said: "Three years ago, owing to the two first, *and so far only* [emphasis added] telepanoramas received from Soviet automatic probes, the planet for the first time revealed details of its surface." □

# A rapid test for Legionnaires' disease

Because Legionnaires' disease, a newly discovered and often fatal bacterial pneumonia, keeps on popping up, and because the antibiotic erythromycin can dramatically help Legionnaires' disease victims, physicians are eager to procure a test that can rapidly, safely, specifically and sensitively diagnose the disease. A technique that meets three of these requirements, and possibly the fourth as well with some refinement, is reported in the January ANNALS OF INTERNAL MEDICINE by Claire V. Broome of the Center for Disease Control in Atlanta and her colleagues.

Ever since Legionnaires' disease first made headlines in 1976, medical scientists have been exploring different ways of diagnosing it, but none of them has proved satisfactory. The bacterium that causes the disease, for instance, is virtually impossible to culture. What's more, while this bacterium is a Gram-stain organism, it stains poorly or not at all with a Gram stain in tissues or tissue exudates. And as for immunofluorescent staining of blood samples suspected of containing the bacterium, antibodies directed against it and labeled with fluorescent dye only reveal it three weeks after onset of the disease. By then it may be too late to save a patients's life with erythromycin.

Recently, though, immunofluorescent staining was shown to reveal rapidly and accurately the Legionnaires' disease bacterium in lung tissue taken from victims of the disease. Collecting sputum samples from patients, however, is less hazardous than collecting lung tissue samples from them. So Broome and her colleagues hypothesized that immunofluorescent staining of sputum samples also reveals the Legionnaires' disease bacterium quickly and accurately. Such staining might thus prove to be the best diagnostic test yet for

the elusive killer, since it would be not only rapid and accurate but safe.

To test their hypothesis retrospectively, Broome and her team obtained sputum samples that had been collected from 21 Legionnaires' disease victims some months before and stored. They also procured sputum samples that had been taken from 47 control subjects some months before and stored in the same way. These subjects had had other kinds of bacterial pneumonia than Legionnaires' disease or other bacterial infections.

Sputum smears from both Legionnaires' disease patients and controls were then fixed with formalin, because satisfactory immunofluorescent staining of the Legionnaires' disease bacterium has been observed in formalin-fixed tissues and because formalin would ensure sterilization of the smears. Antibodies manufactured in rabbits against the Legionnaires' disease bacterium were then extracted and labeled with fluorescent dye. Each smear was then stained with the fluorescent antibodies and examined under the microscope by investigators who didn't know which smears were from Legionnaires' disease patients and which were from controls. This way complete objectivity was assured as the investigators determined whether the antibodies on each smear were reacting with bacteria structurally typical of the Legionnaires' disease bacterium.

Smears from five of the 21 Legionnaires' disease patients were found to contain Legionnaires' disease bacteria, whereas none of the smears from the 47 control subjects did, showing that immunofluorescent staining of sputum is specific; that is, it is capable of diagnosing Legionnaires' disease to the exclusion of other bacterial diseases. What's more, four of the five Legionnaires' disease patients with positive smears had died from the disease, whereas only five of the 16 Legionnaires' disease patients with negative smears had, further underscoring the staining technique's specificity for the Legionnaires' disease bacterium. Finally, both positive and negative sputum smears had been taken from Legionnaires' disease patients only one to seven days after the onset of illness, whereas immunofluorescent staining of blood samples takes three weeks to reveal Legionnaires' disease, strongly implying that immunofluorescent staining of sputum is a rapid test for the disease.

Thus, immunofluorescent staining of sputum is a safe, specific and quick method for diagnosing Legionnaires' disease, Broome and her co-workers conclude. Still to be answered, however, is how sensitive it is, since it only detected one-fourth of the cases of Legionnaires' disease in the study. Its sensitivity might well improve if sputum samples are immediately stained and examined, not first stored for months at room temperature or in a frozen state, as was the case in the study. □

# NASA '79: A busy year in space

At the beginning of 1978, the National Aeronautics and Space Administration announced plans to launch as many as 25 payloads into space during the year. As it turned out, the final total was only 20, and the 1979 list is even shorter. Yet the space agency faces one of its busiest years ever, with launchings scheduled for up to 15 satellites, studies underway or due at Venus, Mars, Jupiter and Saturn, and the long-delayed first orbital flight of the space shuttle.

Much of the work, of course, will come from the planetary spacecraft. The three operating Viking craft at Mars will finish their labors this year, and the Pioneer Venus orbiter is already on station around its own target planet. In March, Voyager 1 will fly past Jupiter and its moons, followed four months later by Voyager 2. And early in September, five and a half years after being launched on what was to have been a mission only to Jupiter, the doughty Pioneer 11 probe will become the first spacecraft to provide close-up images of Saturn.

The agency's biggest event of the year in terms of time, money, personnel, suspense and public relations will be the first trip into orbit by the space shuttle, to be crewed by veteran astronaut John Young and rookie Robert Crippen. The oft-delayed event is now officially scheduled for Sept. 28, although many NASA officials have said that it could take place as late as mid-December. Last week, one of the shuttle's main engines sustained heavy damage from a fire due to a valve failure during developmental testing, and delay is now likelier than ever. (One agency source thinks it possible from some reading between the lines that the flight may in fact be pushed as far as February of 1980.)

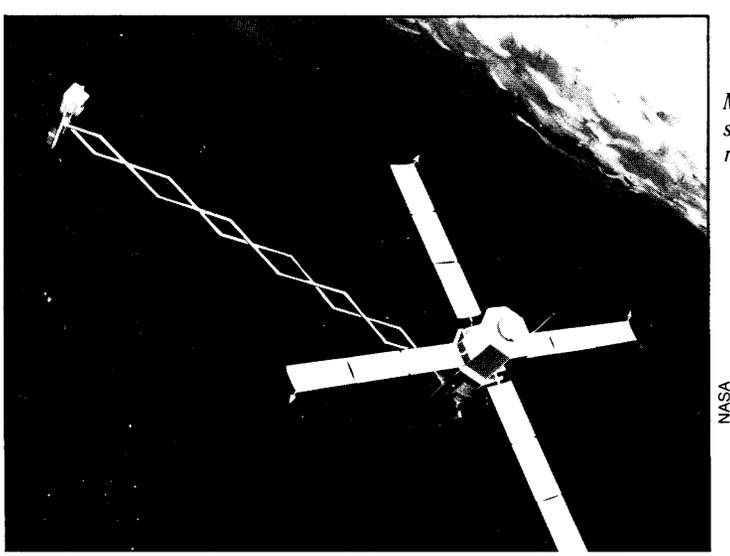
Out of the 15 satellites on the schedule, only four are NASA's own, with the agency serving merely as a launching service for the rest and being reimbursed for its role. Both of the scheduled weather satellites — NOAA-A and -B — are for the National Oceanic and Atmospheric Administration, and a pair of Transit navigational satellites (one a backup if necessary for a previously launched edition) are to be flown for the U.S. Navy. There are five communications satellites on the calendar, and all are for non-NASA customers: The Navy/USAF FleetSatCom-B, Westar-C (again only if needed) for Western Union, RCA-C for RCA Corp., and the first and second of the new-generation Intelsat V's for the International Telecommunciations Satellite Consortium.

NASA's own probes all have science in mind. The third and final High Energy Astronomy Observatory will survey gamma-ray and cosmic-ray sources in the sky, while the Stratospheric Aerosol and Gas Experiment will look down on pollutant problems in earth's upper atmosphere. Magsat-A will study the planet's magnetic field in detail, while the Solar Maximum Mission will monitor the sun from earth orbit during the upcoming high-activity portion of the solar cycle. Great Britain's science-oriented UK-6 is also on the schedule (held over from last year), as is SCATHA, a Defense Department satellite instrumented to study

**1979 NASA Schedule**

| Date | Mission | Description |
|---|---|---|
| Jan. 25 | SCATHA | Spacecraft Charging At High Altitudes (DOD) |
| Jan. 25 | SAGE-A | Stratospheric Aerosol and Gas Experiment |
| Mar. 5 | Voyager 1 | Jupiter encounter (launched 9/1/77) |
| April | NOAA-A | weather satellite (NOAA) |
| April | Transit* | navigation (DOD) |
| May | FLTSATCOM-B | communications (USN/USAF) |
| June | UK-6 | scientific satellite (UK) |
| July 9 | Voyager 2 | Jupiter encounter (launched 8/20/77) |
| July | Westar C* | communications (Western Union) |
| August | Intelsat V-A | communications (Intelsat) |
| Sept. 1 | Pioneer 11 | Saturn encounter (launched 4/5/73) |
| Sept. | HEAO-C | High Energy Astronomy Observatory |
| Sept. | Magsat A | geomagnetic field measurements |
| Sept. 28 | shuttle | first orbital flight |
| Oct. | SMM-A | Solar Maximum Mission |
| Oct. | Transit | navigation (DOD) |
| Nov. | Intelsat V-B | communications (Intelsat) |
| Dec. | NOAA-B | weather satellite (NOAA) |
| Dec. | RCA-C | communications (RCA) |

*Optional if needed



NASA

*Magsat A will study earth's magnetic field.*