SCIENCE NEWS of the week

Another Solar System?

The U.S.-Dutch-British Infrared Astronomy Satellite (IRAS) has discovered what the project's scientists believe to be "the first direct evidence that solid objects of substantial size exist around a star other than the sun." This could mean that the star—Vega, fifth brightest in the sky—has its own asteroid belt, or perhaps even a family of larger planets.

IRAS was being aimed at Vega because the extremely stable and well-studied star is often used as calibration standard for brightness and spectral observations. Instead of finding the expected IR emissions for a star of Vega's type and temperature, however, Harmut H. Aumann of Jet Propulsion Laboratory (JPL) in Pasadena and Fred Gillett of Kitt Peak National Observatory found them to be considerably stronger. When the satellite was carefully scanned back and forth, the source of the emissions turned out to be a region extending about 7.4 billion miles from the star, making it about twice the size of our solar system. The emissions indicated a temperature of about 88 kelvin (−301°F), presumably representing energy re-radiated by a "shell" of solid particles that had been ejected and heated by Vega itself.

If the material were mere tiny dust motes, says Charles Beichman of JPL, it would have been blown away by pressure of the star's radiation; slightly larger particles would have spiraled in to destruction in the star itself. The IRAS team's conclusion, then, is that they are larger still — perhaps a few millimeters or more in size. Models of how our own solar system formed suggest that enough such particles to produce what IRAS saw would also be accompanied by smaller numbers of larger particles. If the relative numbers of different-sized particles resemble the distribution in our system, there could well be much smaller numbers (thousands instead of trillions) of much larger particles —from buckshot to asteroids. The overall mass of the "Vega system," in fact, would be similar to that of ours.

Other infrared telescopes are likely to add their own observations in the very near future. *—J. Eberhart*

The troubles of Landsat: Second-guessing an endgame

On Aug. 7, a complex satellite sent aloft more than four months ago to relay messages between other satellites and ground facilities finally did its job for the first time. The Tracking and Data Relay Satellite (TDRS-1), deployed April 4 from the space shuttle, had taken 12 weeks to reach its assigned orbit after an attached booster rocket malfunctioned (SN: 7/9/83, p. 22), and further delays have been encountered in checking it out now that it is in position. Last Sunday, TDRS-1 at last received its first signals from another satellite, passed them on to a ground station and sent others back. The test, said officials of the National Aeronautics and Space Administration (NASA), was a success.

The satellite with which it was communicating, however, has proved anything but successful. The status of Landsat 4, in fact, has deteriorated to a matter of waiting for the end.

It was launched on June 16, 1982, designed for a three-year lifetime of providing images of the earth's surface from a pair of multi-spectral scanners, one tried-and-true, the other an advanced, higher-resolution version receiving its first orbital test. But a few months ago, two of the satellite's four solar panels began to operate intermittently, then quit altogether, leaving the satellite on half-power. This meant that only one of the imaging devices could be operated at a time. But there was more to the problem. The advanced scanner, called the Thematic Mapper (TM) and capable of providing thermal infrared data as well as nearly three times the spatial resolution of its established companion, had to transmit its data at a particularly high rate. This was made possible by a transmitter operating in the "x-band" of the electromagnetic spectrum, but that, too, had failed. It was also possible to transmit on the "k-band," but it had to be done through the TDRS-1 satellite, which was not yet available.

As a result, only three countries (the United States, Canada and Italy), whose ground facilities were sufficiently far along in their development, have ever received any data from the TM. Brazil "just missed it," says John H. McElroy, the National Oceanic and Atmospheric Administration's (NOAA) acting administrator for Environmental Satellite Data and Information Services; Sweden, India and Japan had the work underway but now can only bide their time.

By comparison, about a dozen countries have been receiving data from Landsat 4's conventional multispectral scanner, which had already flown three times before. But it now appears likely that the whole satellite will soon simply expire.

The failure of the two solar panels had been traced to the breaking of the wires that had carried their power to the satellite, caused by the thermal expansion and contraction of a plastic insulation material as it was exposed alternately to sunlight and shadow. Before the panels had even begun to intermit, however, Landsat 4 controllers had noted intermittent behavior from a group of other components, which were connected by similarly insulated but thinner wires. These thinner, more easily broken wires thus turned out to have been a precursor of the panel failure—and the remaining solar panels are now showing the same precursor. If a third panel does quit, says McElroy, "I've lost the spacecraft." Even if it merely starts intermitting, he adds, it will be "just a matter of time." He speculates that the end could come by October, but says this is merely "a wet-finger-in-the-wind-type guess."

Officials of both NOAA (which manages the satellite) and NASA want very much to maintain the continuity of Landsat data. There is one more Landsat in existence, called Landsat D′, or "D-prime," and NOAA is now planning to advance its launch from January 1985 to March of next year. (The problems with Landsat 4 are being corrected in the new one.) NOAA also hopes to be able to win funding for one more in the series — a Landsat D″ — but it might take an estimated 54 months to build, so that even if Landsat D′ lasts its full three years, there could be a significant data gap before D″ is launched.

There is another possibility, however. Landsat D (like D′) is based on a modular satellite designed so that faulty components can be removed and replaced by astronauts from the space shuttle. (The same basic spacecraft is at the core of the Solar Maximum Mission satellite, for which a repair mission by a shuttle crew is to be attempted next spring.) The problem is that Landsat D′'s orbit is both too high for the shuttle to reach and steeply inclined so that it passes nearly over earth's poles, which will be inaccessible to the shuttle until the opening of a launch facility at Vandenburg Air Force Base in California, late in 1985 at best. The satellite can be directed to a lower orbit by ground commands — but not if its failing solar panels kill it off first. And it is difficult to estimate, says McElroy, just how much warning the solar panels will give by intermitting before they finally stop providing power completely. Another factor is that a "dead" Landsat could start to tumble, due to atmospheric and solar drag on those same solar panels, so that "uncontrolled shadowing" on some of its components and materials might cause them to freeze. This could damage the satellite beyond the capabilities of an in-orbit repair mission, so that the problem would become one of evaluating the worth of bringing it back to earth and relaunching it.

And added to Landsat 4's technical problems is the matter of the growing opposition to President Reagan's plan for turning the whole earth-resources satellite program over to the private sector. *—J. Eberhart*