

Lewis—but at a pricetag of \$1 million or more—that would have allowed it to communicate continuously with NASA's own tracking data and relay satellites without interfering with the Air Force mission.

The results of TRW's investigation will be passed on to the interagency panel looking into Lewis's demise, headed by Christine Anderson, space vehicle director at the Air Force Research Laboratory in Albuquerque, New Mexico. Anderson's group will look not just at technical details, but ask whether NASA's faster, cheaper, better philosophy is in part to blame—for example, by reducing NASA oversight of the contractor too dramatically. Anderson says the report should be ready by Christmas.

As the post-mortem gets started this week, NASA managers will be focusing on Clark, the surviving half of the satellite duo, which Venneri says is nearly 2 years behind schedule and at least \$7 million—about 13%—over its \$54 million original pricetag. Its launch date, planned for the summer of 1996, has slipped to May 1998.



Clark inquiry. Air Force's Anderson leads review.

Venneri cites late delivery of a camera designed to provide high-resolution pictures of Earth as a key setback. Officials at EarthWatch Inc. of Longmont, Colorado, which is responsible for the instrument, insist that it was only a couple of months behind schedule, less than many other components. "Venneri's flat-ass wrong," insists one peeved company source, adding, "Everyone failed to deliver." EarthWatch puts the blame on CTA Space Systems of McLean, Virginia—Clark's prime contractor—for failing to complete the satellite structure in time. NASA officials admit that they can't pinpoint exactly what went wrong and how, in part because they lack the detailed paper trail typical of the old NASA procurement process. But no matter how blame is apportioned, the situation is so bad that "this summer we were close to killing Clark," says Venneri.

What saved the program was the purchase of CTA's space business this summer by Orbital Sciences Corp., a larger aerospace company based in Fairfax, Virginia. "We made it very clear to the new management

[at Orbital] that they weren't dealing with the old NASA," Venneri says. "We told them we'd terminate the program" if it wasn't whipped back into shape. And it appears Orbital has succeeded. Venneri and Orbital managers say they are confident the revamped Clark program is back on track and will survive this week's review by NASA officials. "There was no smoking gun" to explain Clark's past troubles, adds Orbital spokesperson Barry Beneski. Many things "just all piled up." Venneri insists the program has not strayed over the 15% overrun limit set up by Goldin as a cause for automatic termination. "We're not at 15%," says Avant. "We've been able to operate in a cost environment that is extremely frugal."

NASA managers say the problems with Lewis and Clark are simply bugs that must be worked out of the system, but that the overall idea of the cheaper, faster, better approach is doubtless sound. "There's uniform agreement that we can cut costs dramatically," says Bill Townsend, acting chief of NASA's Mission to Planet Earth effort, which includes several small as well as large satellites. "It's a learning experience," says Townsend. "And we're not there yet."

—Andrew Lawler

PLANETARY SCIENCE

Tiny Comets' Spots Called Artifacts

At a geophysics meeting last spring, space physicist Louis Frank had the whole community seeing spots. He flashed stunning satellite images on the screen, showing dark spots silhouetted against the ultraviolet (UV) glow of Earth's upper atmosphere. Those spots, he said, restored to grace his discredited theory that Earth is pelted with fluffy, house-size snowballs 30,000 times a day. Frank had proposed these small comets back in 1986 (*Science*, 10 June 1988, p. 1403), but no one believed him because the idea conflicted with so much other evidence. The new images didn't win converts to small comets either, but they did persuade a number of researchers that something unusual is going on in Earth's upper atmosphere.

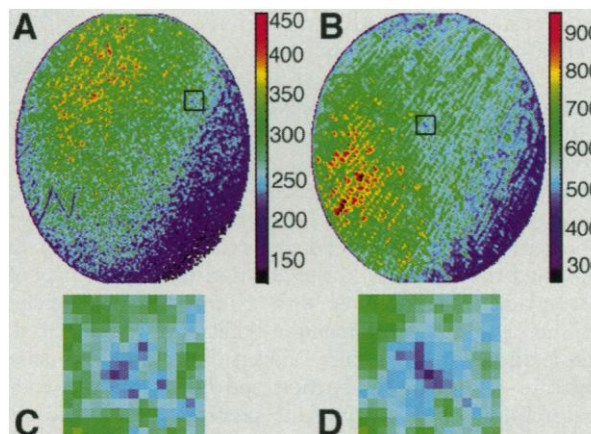
Now the tables have turned once more. An analysis of UV images from a similar camera on the same satellite suggests that the mysterious spots are nothing more than instrument artifacts. In a paper to appear in the 15 December issue of *Geophysical Research Letters* (GRL), space physicist George Parks of the University of Washington, Seattle, and his colleagues present analyses of their images from the Ultraviolet Imager (UVI) aboard the Polar satellite. They conclude that "there is no scientific evidence from UVI that snowballs pelt Earth." The spots are not clouds of water left from high-

altitude impacts of small comets, they say, but simply artifacts produced inside the camera—so much snow on a UV television.

"Parks's paper is absolutely devastating," says longtime small-comet critic Alexander

saga of small comets, Parks removed his name from a paper with Frank, and other researchers are grumbling that Frank is keeping his raw data to himself. With Frank once again the only person who can see dark spots, even his newfound supporters are taking a cautious tack. "It would take some independent person to try to referee this," says Robert Meier of the Naval Research Laboratory in Washington, D.C., who spoke up for spots at the spring meeting. "That's probably the only way to resolve it."

Frank's spring announcement—billed as a triumphant vindication in the popular press—was largely based on data from his UV camera aboard Polar. Although they rejected small comets, some space physicists were convinced that the spots, at least, were real (*Science*, 30 May, p. 1333), in part because the same specks apparently turned up in Parks's UVI. That cam-



Signal or noise? Ultraviolet images of Earth (a) and a lab calibration test (b) show similar dark spots (c and d).

Dessler, a space physicist at the University of Arizona, Tucson. But Frank, of the University of Iowa in Iowa City, counters that the problem lies with Parks's analytical methods, which he says dismiss real spots as mere mirage. Meanwhile, echoing past chapters in the

era records UV images in much the same way Frank's does, just in a narrower part of the UV spectrum.

Bolstering the case even more, Frank said that water from some of the same spots could also be seen in images from the vis-

ible-light camera (VIS) on Polar. The VIS, which Frank also runs, picks up the glow of a water fragment called hydroxyl. Indeed, he and his Iowa colleague John Sigwarth found that the VIS and Parks's UVI captured the same spot in five cases. (The two groups exchanged data, making Parks one of the few outside Frank's Polar team who has his raw image data.) A preprint of a paper on those simultaneous detections—with both Frank and Parks as co-authors—was circulated last spring and helped persuade other researchers that the spots were real. That paper, together with several others on Polar observations and small comets, appears in the 1 October GRL.

But Parks is no longer a co-author. He grew uneasy with Frank's methods of analysis and calibration, especially after discovering that the UVI had also recorded dark spots during calibration tests in the laboratory, when the only thing it was looking at was a UV light. A dark spot of a given size—as detected by a computerized detection scheme—was as likely to show up in a calibration image as in an image made from orbit. Parks doesn't know exactly what causes the spots, but he believes they must be inherent to the UV camera. "If you're going to try to understand your instrument," he says, "you had better look at it in the lab."

Frank agrees that there is plenty of noise in the images, but he says he can distinguish spots from artifacts by comparing UV and visible images. When he finds a spot in the same place at the same time in both images, he assumes it's real: "What I use to verify [spots] is that there has to be simultaneous events in the VIS camera." He also looks for a distinctive effect caused by the Polar spacecraft's slight, unintended wobbling, which makes any camera recording a real object "see double" and produce a pair of spots.

That approach has not convinced Parks that the cameras were both imaging a true spot. He has not yet completed his own correlation of the UV and visible data sets, but "my preliminary analysis suggests there's no simultaneity. It's just an accidental coincidence." In other words, both cameras happened to show noise at the same place at the same time. "I asked him to remove my name," he says, "because I didn't agree with his interpretation and the way he was doing the analysis."

Parks also did a computerized search for doubled spots in his UV images. He found plenty, but he also found that close pairs of spots are oriented at random, rather than in the direction the wobble would give them. That suggests that these doubled spots are also just an accident. "There's no scientific justification for anybody looking at these data and extracting the kind of information Lou [Frank] is," Parks says. "Ours is a standard technique; this is what experimental

physics is about. He's just looking at an image and picking out an event."

Frank has rebuttals for all these concerns. First, he says that lab calibrations aren't as good as those done in flight: "We have lab calibration images, but we feel it's much more favorable to calibrate them in flight." Unfortunately, dark spots won't show up against the black of space—so the space calibrations can't be used as a control for dark spots. Frank also insists that Parks's statistical analysis isn't up to the job. Using the same approach as Parks, "I never got anything out of my images either," Frank says. "There's just so much noise in the data that [Parks's] approach didn't tell me whether they were there or not."

To observers, the whole debate may create a sense of déjà vu, because this is not the first time Frank has seen a signal where others, including the originators of the data being analyzed, saw noise. Back in 1987, Frank's original dark spots, seen in images taken by the Dynamics Explorer satellite, were put down as artifacts by a team led by Bruce Cragin, now at CES Network Services in Farmers Branch, Texas. They noted, among other things, that the spots were

the same size in the images no matter how far away the actual events would have been. Then in 1989, Frank and his colleagues reported dark spots in UV images from the Viking satellite. But John Murphree of the University of Calgary in Canada, the principal investigator for the Viking imager, found similar spots in lab calibration images—and removed his name from the preprint being circulated. Now, in the wake of Parks's withdrawal, even Meier says he's "trying to disengage a little bit."

Given this history, it may not be easy to resolve what the dark spots really are. The solution will only come, many researchers say, if outsiders are free to analyze the raw data, but Frank has a reputation "for being slow to distribute his data," as one close colleague puts it. Other than Parks, no one has seen more than a smattering of the visible-light camera data, which are now vital to Frank's argument. Parks has a proposition: "Let's get this raw data out on the Internet and let the scientific community be the judge." Frank responds that anyone who wants data should just ask. Then, perhaps, more researchers will be able to see spots—or not.

—Richard A. Kerr

SCIENCE BUDGET

Last-Minute Deal Gives NIH 7.1% Raise

Congress agreed months ago that it wanted to give biomedical research a large raise in 1998, but it was not until this week that members actually passed the appropriation—providing a 7.1% increase for the National Institutes of Health (NIH) in 1998.

It was a "long, tortuous process," said Representative John Porter (R-IL), chair of the House appropriations subcommittee that drafted the bill. Porter had initially proposed a 6% increase for NIH, and his Senate counterpart, Arlen Specter (R-PA), had pushed through a bill promising 7.5%. The legislation, which covers the Departments of Labor, Health and Human Services, and Education, then got tied up for months, Porter said during House debate on 7 November, with "an unprecedented number of amendments ... that have nothing to do with" agency budgets. They included issues such as abortion and birth control, workplace safety, AIDS prevention, and—the hottest topic this year—a White House plan for national educational testing. The final sticking point was removed on 5 November, when negotiators reached an agreement that allows the Administration to develop an educational test, but not to implement it until 2000 or later.

These deals made it possible for NIH to get its promised fiscal year 1998 boost—although it arrives 6 weeks late. The bill gives NIH a budget of \$13.6 billion and provides hefty raises

for nearly all its divisions except the director's office, which will be held to a 3.6% increase. Most institutes will get 6% to 7% more than last year, and the fast-growing National Institute of Human Genome Research will receive a whopping 15.2% increase, giving it a total budget of \$217.7 million.

Legislators also added some special bonuses for particular areas of research they favor. For example, one section authorizes—but does not order—the NIH to create 10 centers for Parkinson's disease research and spend up to \$100 million on the disease. Parkinson's advocates, who had lobbied hard for special budgetary treatment, read this as a big improvement over \$34 million in direct current support. In nods to other groups, the bill says that Congress expects NIH to spend \$22 million on studies of neurodegenerative diseases and \$38.5 million on pediatric research. Senator Tom Harkin (D-IA), a strong backer of unorthodox therapies, also helped push through a section that raises funding for NIH's Office of Alternative Medicine from \$13 million to \$20 million. The AIDS research program receives an extra \$17 million as downpayment on a \$26 million vaccine center.

After clearing the Senate on 8 November, the bill went to the White House this week, where the president was expected to sign it.

—Eliot Marshall



BUDGET '98