Jet Propulsion Lab Looks to Life After Voyager

Jet Propulsion Laboratory, Pasadena, California

Gone is the anxiety so evident here at JPL during the Voyager 2 flyby of Saturn in 1981, when the laboratory's staff had been slashed by 10% and the incoming Reagan Administration seemed ready to cancel NASA's planetary program entirely. Gone is the grief and frustration that shadowed the spacecraft's flyby of Uranus in 1986, when the explosion of Challenger threw NASA's already much-delayed launch schedule into chaos.

Today, in the aftermath of Voyager's exhilarating encounter with Neptune, the laboratory that sent it forth more than a dozen years ago is moving on a high-energy trajectory of its own. "We're getting started again," proclaims one young engineer.

Indeed they are. The new Magellan spacecraft is already en route to Venus. The Galileo mission to Jupiter is on the launch pad at Cape Canaveral. Other spacecraft are on their way down the production line, including the Mars Observer satellite and the Ulysses mission to the polar regions of the sun. And JPL as a whole is so busy that it is literally running out of places to put people.

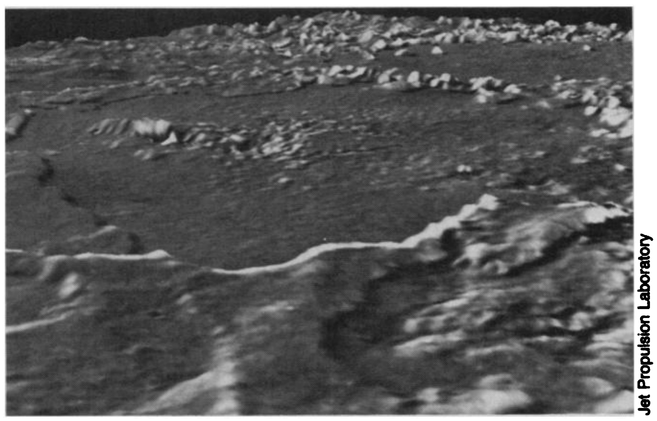
Internally, moreover, JPL also seems much healthier than it was. Having spent the 1980s diversifying into such areas as advanced microelectronics, supercomputer development, and Earth observations, JPL is no longer the one-dimensional institution it was in the 1970s when it was utterly at the mercy of Washington's erratic enthusiasm for planetary missions.

"The laboratory is robust," declares director Lew Allen. Given the funding uncertainties inherent in the federal deficit, he told *Science*, JPL always has to be concerned about the future. "But our diversity, together with the strengthening of our science and technology base, gives us the ability to meet an uncertain future."

Discovering the virtue of diversity was a hard lesson, notes JPL chief scientist Moustafa Chahine. "We started the decade of the 1980s in despair for new starts in planetary exploration," he says. So to help keep the laboratory intact, Allen's predecessor, California Institute of Technology planetologist Bruce Murray, began to seek out nonclassified Defense Department work in technologies related to planetary exploration. After Allen arrived in October 1982, he continued and expanded that commitment, says Chahine. Although it was becoming clear by then that planetary spacecraft were not quite the endangered species people had thought, it was also becoming clear that NASA's overall neglect of advanced technology development was going to stifle any new generations of spacecraft unless the laboratory took steps itself.

JPL's defense technology work now involves some 20% of the total research hours there, says Chahine, and is focused in two main areas. One is advanced microelectronics, with emphasis on such developments as radiation-resistant semiconductors suitable for the space environment. The other is the hypercube computer, in which dozens or even hundreds of PC-scale processors are harnessed in parallel to provide supercomputer power at minicomputer cost. As a demonstration experiment, one small hypercube with eight processors was used to process some of Voyager's Neptune images—at about ten times the speed of conventional computers.

Meanwhile, says Chahine, since many of the laboratory's planetary scientists had been left at loose ends in the mid-1980s for lack of any near-term missions, he and Allen started encouraging them to the study of Earth as a planet. "They had a great enthusiasm," he said. "Planetary scientists had always felt that the relevance of what they do is not obvious. But here the relevance *is* obvious." That enthusiasm recently bore fruit in the planning for NASA's Earth Observing System, a set of polar-orbiting remote sensing platforms scheduled for launch in the mid-1990s. JPL researchers will be principal investigators on 11 out of the mission's 16 instruments. Earth observations now constitute about 30% of the total research hours at JPL.



Triton in perspective. *Using information from shadows, JPL's hypercube generated this panorama within hours after receiving Voyager's images.*

Because of this diversification, says Chahine, JPL's core mission of planetary science now occupies only about 50% of the laboratory's effort. On the other hand, it still accounts for a much larger percentage of JPL's uncertainty about the future. The most immediate question is whether Congress will approve CRAF/Cassini, a dual mission that would send one spacecraft to rendezvous with a comet and another to orbit Saturn. The current indications from Capitol Hill are that the mission will be approved. But if not, JPL would be left with no spacecraft to develop in house, something the laboratory has always tried to do to keep its technical skills sharp. JPL would also be left with few new jobs to offer the Voyager engineers, most of whom will otherwise find themselves at loose ends once the spacecraft has been reprogrammed to take particles and fields measurements on its way out of the solar system. That job is scheduled to be completed within about 12 to 18 months, whereupon the Voyager staff will shrink from the current 220 to about 60.

Another major uncertainty is the role JPL will play in President Bush's recently announced initiative to establish human outposts on the moon and Mars—assuming that the initiative is funded. The laboratory's most obvious role would be to develop robotic precursors to a human Mars expedition: autonomous, artificially intelligent rovers that would wander the surface of the planet and pick up samples for return to Earth. A less obvious mission would be to develop astronomical observatories for deployment on the moon. That concept has recently begun to excite the interest of conventional astronomers who see the moon as an extremely quiet and stable platform for telescopes. But JPL has an additional motivation all its own: Researchers there believe that a high-resolution infrared telescope erected on the lunar surface might be able to image Earth-like planets around other stars. ■ **M. Mitchell Waldrop**