information that already exists and to use the data to tabulate rates of deforestation over a period of time. Singh plans to fill in the gaps in global coverage by ordering more data from satellites, but he concedes that this is an expensive undertaking. Singh says the project should be complete in the early 1990s and will cost a total of about $3 million.

Tucker and his colleagues say that the United States could begin monitoring deforestation immediately and that the entire job would cost no more than $5 million a year. Their plan calls for using a pair of NOAA weather satellites to gather relatively crude data over very large areas, and then to use the more expensive but more detailed images of the Landsat satellites to focus on certain hot spots. Random ground checks could corroborate the data and provide information about the forces driving deforestation, providing countries in the tropics can be encouraged to participate.

Though the NOAA weather satellites were designed with meteorologists in mind, the remote sensing community discovered that the sensors aboard the polar-orbiting satellites could be used to distinguish forest from nonforest. On one channel in the mid-infrared region, forests appear cooler and clearings warmer. This was very fortuitous. The NOAA satellites pass over the entire globe every single day. They can cover a huge swath of a continent on a single orbit. Such frequent coverage over such a large land area is particularly attractive if one is interested in monitoring fires or deforestation in the tropical world, which is often shrouded in clouds for weeks at a time. Frequent coverage gives one a better chance of at least getting one cloud-free image every few weeks.

The information from the weather satellites could be backed by the Landsat images, which provide highly detailed images with a resolution of 30 meters, as opposed to the NOAA weather satellites with a resolution of more than 1 kilometer. The problem with Landsat is that for global monitoring it almost produces too much data. At $3600 a "scene," it is also expensive. One would have to purchase more than 200 Landsat scenes just to survey the Amazon Basin. Tucker says the best approach is to combine NOAA and Landsat images.

"It's fine to talk about going to Mars with the Russians, but we're becoming more and more aware that we've got problems right here on Earth that we should be addressing," says Barrett Rock of the University of New Hampshire. "We ought to be using our space program to look down rather than up."

■ WILLIAM BOOTH

Landsat Wins a Reprieve

Vice President Dan Quayle, chairman of the National Space Council, stepped in last week to rescue the Landsat earth imaging satellites from an early demise.

Until Quayle's intervention on 6 March, the government had planned to turn off both Landsats 4 and 5 this month and also shut down archival data services (*Science* 24 February, p. 999).

Landsat's patron, the National Oceanic and Atmospheric Administration (NOAA), received no funding in the 1989 budget to run the system after 31 March and did not want to sacrifice other programs in its account just to keep these popular satellites going. Although many congressmen like Landsat, they failed to provide a full year's funding because the satellites had already outlived their expected lifetime. But the company that manages the system says it can keep them working until 1991.

The Vice President stepped in last week, promising to keep the Landsats alive at least for several months while his staff undertakes a review of the situation. It will be the fourth such review in less than a year. At Congress' behest, NOAA has spent $2 million for other studies on the prospects for "commercializing" Landsat. The studies were finished in August but have been kept under wraps by the Office of Management and Budget, which may not like their conclusion that Landsat is a healthy but immature enterprise that will require federal subsidies for the rest of this century.

As Landsat's savior, Quayle may find he has taken on a bigger challenge than he expected. The rescue announcement has not been followed as yet by any funding details, and NOAA officials still do not know where the money will come from to keep the system running after the end of the month. They have agreed not to pull the plug. But there are reports that the Vice President has secured pledges from only two agencies—the Department of Defense and the National Aeronautics and Space Administration—each of which agreed to contribute $2 million toward this year's $9.4 million funding gap.

The rescue announcement came just a day before an emergency hearing on the subject in Congress, called by Representative James Scheuer (D–NY), chairman of the House science subcommittee on natural resources. Scheuer and several other senior members—including Representatives Robert Roe (D–NJ) and George Brown (D–CA)—politely flogged the NOAA spokesman for the "damn nonsense," as Roe said, that pervades U.S. space policy. Brown collected the signatures of 100 congressmen on a letter appealing to the Vice President to defend "one of the greatest triumphs of the nation's civilian space effort." Scheuer said it was a "disastrous, aberrational decision" to throw away $1.5 billion worth of Landsat equipment to save $9 million in operating costs.

Thomas Pyke, Jr., assistant administrator of NOAA for satellite and information services, promised to keep Landsat going but conceded that the "details of the interim funding plan are not available." Meanwhile, NOAA is seeking emergency financial help from the Earth Observation Satellite Company (EOSAT), the firm that won an exclusive right to commercialize the Landsat data and has profited from it since 1984. EOSAT's president, Charles Williams, responded that before investing any further in the system, he wanted an assurance from the government that it would reimburse the company.

Scheuer gibed: "The government and you are acting like a bunch of rug traders when there are real national interests at stake." Representative Dave McCurdy (D–OK) said he thought federal agencies were "playing a pretty expensive game of chicken" over Landsat, and that a decision to shut the system down for 2 years would be "devastating" to the plan to convert it into a commercial enterprise, which was the proclaimed reason for moving it out of NASA in the first place.

As Landsat sponsors continue the debate over who will pay the bills, competitors are moving aggressively into the earth surveillance business. Ray Cline, a former intelligence official now at Georgetown University, testified at the hearing that there may be as many as 24 nations or multinational organizations operating satellites in space by the year 2000, and even the Soviet Union is now peddling satellite photos to the public. "If we turn off Landsats 4 and 5," he concluded, "we could be setting ourselves up for a major strategic disaster." ■ ELIOT MARSHALL