

A unique device for surveying forest lands highlights a number of spinoff developments benefitting environmental protection and resources management.

technology and the environment

The Forest Service has 187 million acres of land in 44 states and Puerto Rico. Accurately marking the boundaries of such extensive property is obviously a monumental task. The Forest Service once estimated that, with conventional surveying techniques, it would take 24 years and cost \$100 million. But a NASA-developed system would enable the Forest Service to do the job in 10 years at considerable savings.

New emphasis on border-marking our national forests became necessary in recent years because of increasing use of nearby land by private owners, whose enterprises range from timber harvesting to resort development. A large percentage of forest land is not well enough located and marked to allow landowners to manage their properties with confidence that they are not trespassing.

The survey was originally estimated as a 24-year job because mountains, trees and thick bushes often

block direct sighting between two points, the conventional method of surveying. Thus it was necessary to hack sighting paths through the forests by machete and bulldozer, a costly and time-consuming process.

Forest Service officials consulted NASA and found a solution in the application of laser technology originally developed for satellites. NASA-Goddard built a system called a "laser range pole," a portable battery operated back-packed device that allows direct sightings no matter how rough the intervening terrain or how thick the forest.

The equipment consists of a laser transmitter and a receiver. From a given property marker, the transmitter pulses a laser beam vertically, several thousand feet in some cases. At a second surveying point about a mile away, the receiver detects the laser pulse high above the trees, and locks in on the exact direction. Thus provided a bearing between the two points, a

A major problem in surveying 187,000,000 acres of Forest Service property is that trees and mountains block direct sightings. This NASA-developed "laser range pole" provided a solution. The receiver at left detects a vertically-fired laser beam (right) to get an accurate bearing between two points not visible to each other. Non-exclusive license to manufacture this device is available from NASA-Goddard.



ground crew can extend the border line back to the sending point by conventional surveying techniques.

After NASA developed the laser pole, a joint NASA-Department of Agriculture contract was awarded RCA Corp., Burlington, Mass., to produce an operational version. The Forest Service now has several in use. So does the Department of the Interior's Bureau of Land Management for surveying large areas such as those in Alaska.

Educational Packages

An environmental spinoff for educational purposes broadens the availability of remote sensing imagery.

Through manned space missions, Landsat, and in aircraft remote sensing programs, NASA is acquiring

This and similar audio-visual presentations are being used by educational institutions for teaching how remote sensing can be applied to resource problems, or for adding perspective to existing courses in ecology, geography, geology and urban planning. Other users include artists, environmental centers, and consulting firms engaged in the preparation of environmental impact statements. The NASA Center in Albuquerque sold the production rights to a commercial firm, Pilot Rock Inc. of Arcata, Cal., which now offers 76 different educational packages.

Educational packages developed by NASA's industrial application center at the University of New Mexico provide instruction on remote sensing and its value in environmental disciplines. Now commercially available, the packages combine aerospace imagery with instructional narration. Sample subject: how satellite imagery can aid in crop management.



thousands of photographs of Earth which, properly packaged, can be useful in a variety of ways. In 1974, the NASA Industrial Applications Center at the University of New Mexico in Albuquerque, undertook the production of educational packages, which combine these photos with instructional narration. A sample: *Food Watch by Satellite*, a tape-slide presentation on the potential of satellite systems for crop management, includes 51 slides, a cassette recording of the narration, a printed copy of the text, and a bibliography of agricultural remote sensing literature. Produced in conjunction with the Audio-Visual Institute, also of Albuquerque, the package now sells for \$90.

'Breadboard' Facility

Environmental control of automobile emissions is enhanced by new electronic systems devised during the Apollo program by a NASA contractor. Many interesting technology transfers involve not merely a specific product, but rather a whole facility, its equipment, and the experience of the people who operate it. Chrysler Corp.'s Huntsville Ala. facility provides a good example. Once a key test and development center for the space program, the Electronics division there is now engaged in similar but non-NASA work for the parent company.