

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.

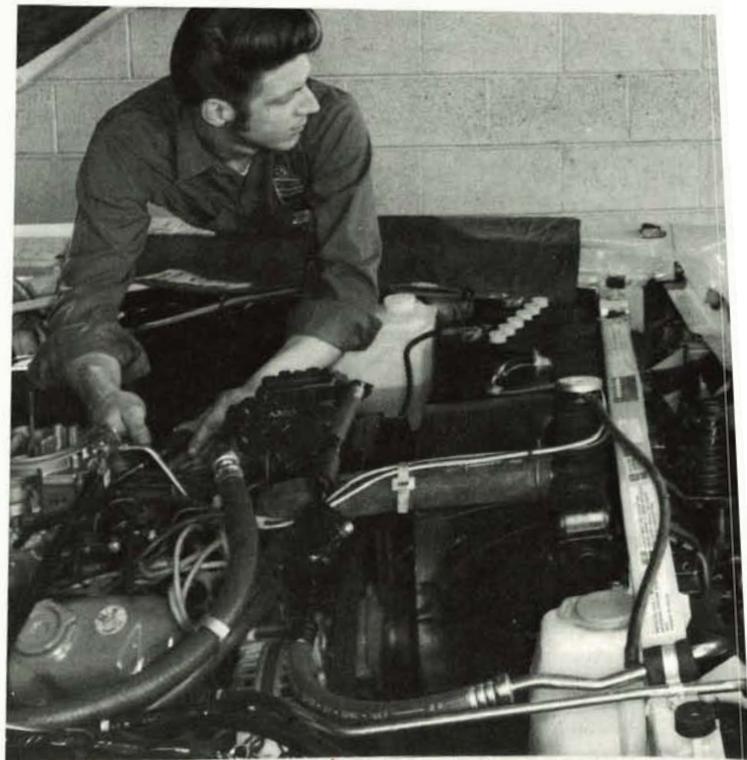


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In the sixties, Chrysler was NASA's prime contractor for the Saturn I and IB test launch vehicles. The company installed and operated at Huntsville what was known as the Saturn I/IB Development Breadboard Facility. "Breadboard," means an array of electrical and electronic equipment for performing a variety of development and test functions. This work gave Chrysler a broad capability in computerized testing to assure quality control in development of solid-state electronic systems.

Today that division is manufacturing many products not destined for NASA, most of them being associated with the company's automotive line. A major project is production and quality-control testing of the "lean-burn" engine, one that has a built-in computer to control emission timing, and allow the engine to run on a leaner mixture of fuel and air.

Other environment-related products include vehicle emission analyzers. The newest of the line is an accurate, portable solid state instrument for testing auto exhaust gases. The exhaust analyzers, now being produced for company dealers and for service



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stations, are expected to find broad application in state and municipal auto inspection programs.

Similar technology is employed in production of other exhaust analyzers, including systems to check out new engines in laboratory tests and units for testing new car emissions to assure that they meet Environmental Protection Agency standards. The Automated System for Emission Testing (ASET) can coordinate as many as seven vehicle exhaust analyzers at one time. The Automotive Pre-Check Corp. of Los Angeles uses ASET to test about 3,000 new cars each year, to comply with California air pollution laws which require that a two-percent sample of all new cars sold in the state be exhaust-analyzed.

This Jacksonville, Florida, apartment complex has a wastewater treatment system which clears the water, removes harmful microorganisms and reduces solid residue to ash. It is a spinoff from spacecraft waste management and environmental control technology.

Packaged Waste Treatment

As NASA contractor on the biosatellite program several years ago, General Electric Co. acquired experience in waste management and associated spacecraft environmental technology. The company has spun off this experience into packaged waste treatment systems for both sea and land applications.

GE's initial effort was a "shipboard waste treatment system," which used physical and chemical processes to clear wastewater, settle the solid matter, and remove harmful microorganisms. The solid residue is reduced to a small amount of ash by the system. GE built and installed these sludge incinerator systems on an Army dredge, a Navy destroyer escort and three Great Lakes steel ore carriers.

Shortly thereafter, passage of the 1972 Clean Water Act prohibited ships from dumping treated or untreated wastewater. Thus, demand turned from shipboard treatment systems to shipboard holding tanks and shore-based treatment systems.

Using the same technology, GE then built and tested a trial land-based system. This experiment evolved into an advanced 50,000-gallon-a-day "packaged waste treatment system," installed in Jacksonville, Fla. by Demetree Builders of that city. The system now serves about 600 units in the Villa del Rio and Ortega Arms apartment complexes.

Two environment-related automotive products are Chrysler's "lean-burn" engine and an auto exhaust emission analyzer. These and other products now being built at the Electronics Division trace their lineage to technology acquired when it was a key test and development center for the space program.

