ACCELERATING COMMERCIAL REMOTE SENSING

Among environment-related technology transfers is a NASA/ private sector partnership effort to expand commercial use of remotely sensed data

Remote sensing technology offers a broad spectrum of opportunities that could lead to new commercial products or processes of benefit to the nation as a whole and to individual companies. However, although sales of remote sensing data are on the rise, the government is still the principal market for such data; industry has been slow to grasp the potential.

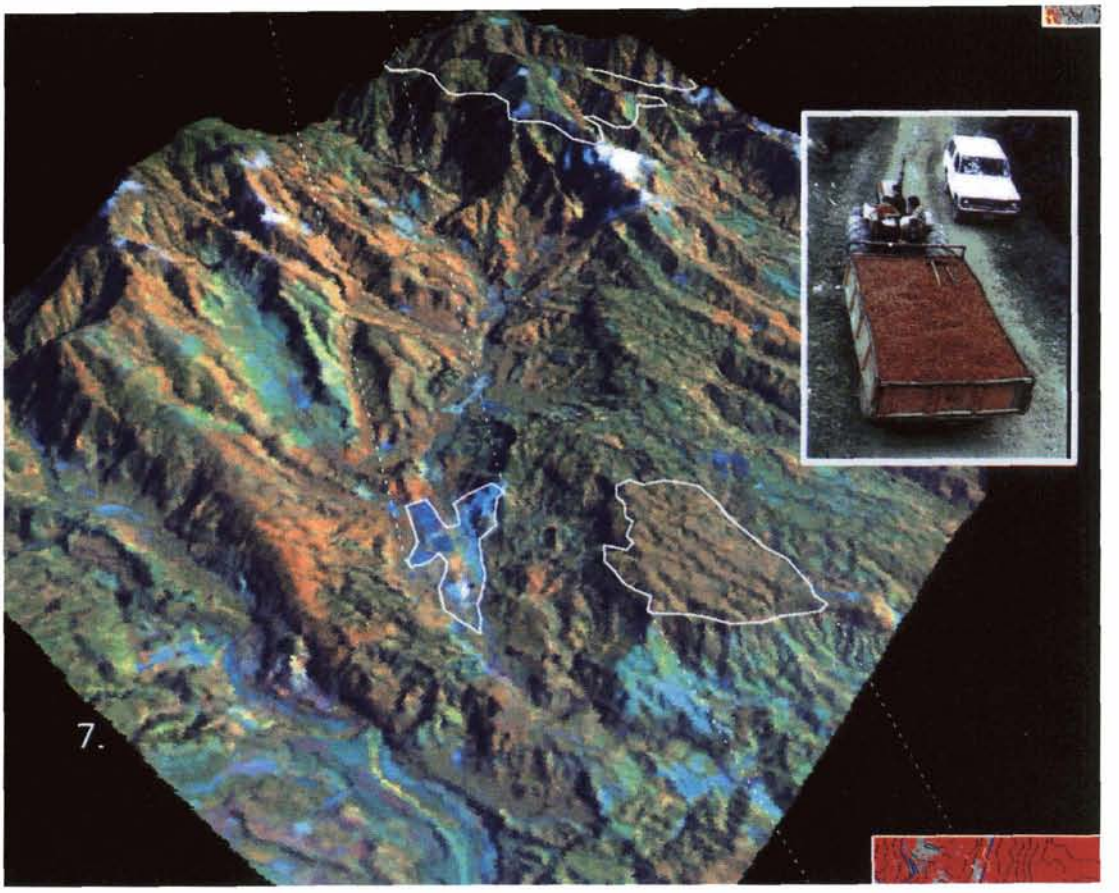
In an effort to accelerate the growth of commercial remote sensing in the national interest, NASA has created a number of mechanisms designed to promote greater awareness among industry firms of the remote sensing potential and to provide basic training in the commercial application of the technology. Among the mechanisms is the Visiting Investigator Program (VIP), managed by Stennis Space Center.

VIP is oriented toward companies that might be able to integrate remote sensing into their operations to create new products and new markets, or to improve existing product lines. Recognizing that such companies generally have limited resources to invest in exploring new technologies, VIP offers a chance for a firm to expand its capabilities on a low-risk basis; VIP costs them nothing but their own employees' travel expenses.

A prospective VIP participant submits a proposal involving use of remote sensing in an actual project, detailing research objectives and outlining the commercial possibilities. If the proposal is accepted, Stennis Space Center acquires the necessary remote sensing data, instructs company personnel in the use of remote sensing hardware and software, and provides guidance in executing the project. A typical project runs six to nine months; if it produces promising concepts, the potential exists for further NASA/company joint research.

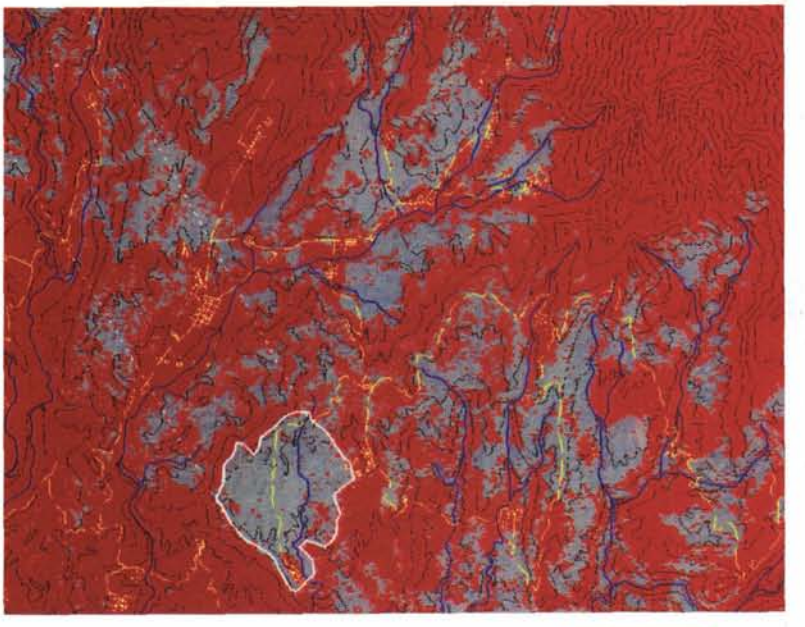
An example of a VIP project is the experience of Community Coffee, Inc., Baton Rouge, Louisiana, an importer buying coffee primarily from Guatemala and Brazil. To maintain competitiveness, the company needs advance information about a growing area's crop yield and quality at the next harvest. But the information coming out of producing countries is usually sketchy and sometimes questionable. Looking for an efficient way of monitoring coffee growth and yield trends, Community Coffee undertook a VIP project involving the use of remote sensing data and Geographic Information System (GIS) technology as a means of tracking coffee growth and assessing crop health.

Stennis Space Center provided satellite imagery of an area in Guatemala and supplemented it with infrared aerial photography of the same area. Working with NASA remote sensing experts, Community Coffee's George Guthrie, director of green coffee purchasing, enhanced the imagery in a multistep process, adding ground reconnaissance information about the production of individual coffee *fincas* and surrounding environmental conditions, together with such GIS data as the location of urban areas, roads, contours, hydrography, etc. By computer processing, the investigators eventually produced a composite image of the area showing (by color coding) the size and location of coffee-growing areas, along with a three-dimensional perspective of the same area.



***At left** is an enhanced satellite image of coffee growing areas in a region of Guatemala, developed in a multistep land classification process that ruled out non-coffee land (red) and highlighted coffee fincas (gray). **Below** is a three-dimensional perspective of the same area in which elevations and other topographic features have been added. Community Coffee, a Louisiana importer, used satellite imagery, aerial photography and geographical information in a prototype study that explored the potential of developing coffee crop yield forecasting maps.*

These products represented an experimental prototype of what Community Coffee hopes will be an efficient system of forecasting coffee crops. Using satellite imagery, the company seeks to produce detailed maps that will separate coffee cropland from wild vegetation and show information on the health of specific crops. This information is economically important. Timely knowledge that the coffee crop yield in a given area would be greater than average could result in lower prices at harvest time; therefore, the company's buyers could delay purchases until prices drop. If satellite imagery indicates a lower than average crop, meaning higher prices, Community Coffee could turn to other coffee sources to hold prices down.



Community Coffee's interest in remote sensing goes beyond procurement strategy. The company is looking into the possibility of marketing this sophisticated forecasting technique to other coffee buyers, or to coffee farmers and government agricultural services, who could use the information to optimize application of fertilizers, pesticides and irrigation for maximal crop yields, minimal pollution and lower production costs.

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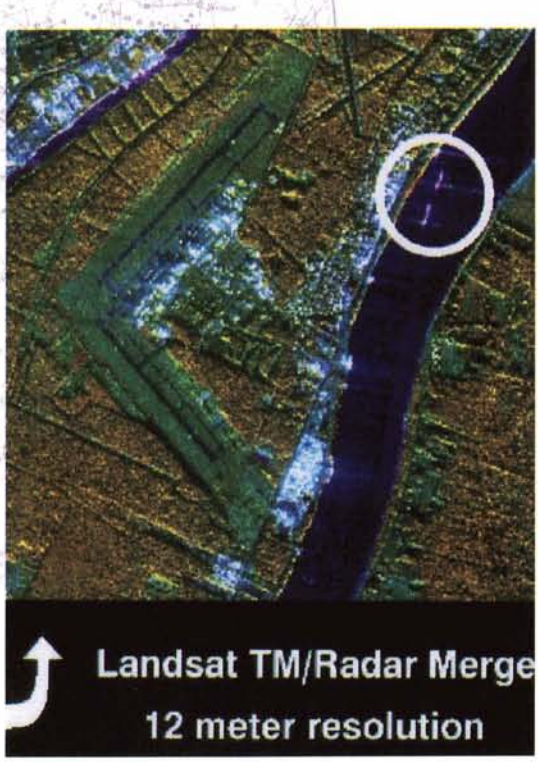


Nesbit Environmental, a Louisiana firm, investigated the potential for locating abandoned barges in the Mississippi River and channels using airborne and spaceborne imagery. This sample image was developed by combining Landsat satellite data with Side-Looking Airborne Radar data.

Begun in 1988, the NASA Visiting Investigator Program (VIP) was designed to bring remote sensing applications closer to commercialization by conducting viability demonstrations toward creation of new products and processes. Industry investigators are granted access to Stennis Space Center's commercial remote sensing facilities and its sophisticated data processing hardware and software. Working with NASA scientists in all aspects of a project from planning through product development, partner companies become familiar with the theoretical and practical bases for remote sensing, airborne/spaceborne data acquisition, related instrumentation, and data analysis techniques.

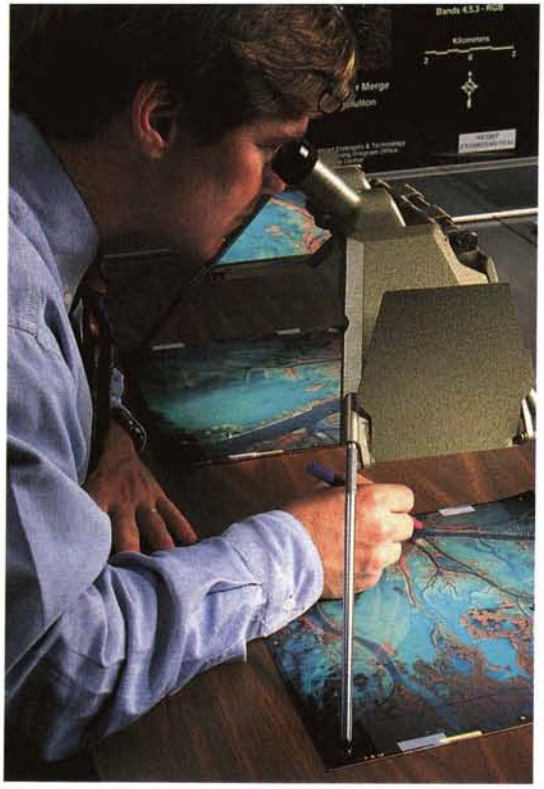
While the primary aim of both NASA and the industry partner is commercialization of the technology, participation in the VIP program often leads to broader long term benefits. An example is the case of Scott Nesbit of Nesbit Environmental, Inc., Baton Rouge, Louisiana, whose VIP work led to a merger with a larger environmental consulting firm.

Nesbit's VIP project was an investigation of the potential of remote sensing for locating abandoned barges in the Louisiana coastal zone. Over the past 40 years, barges and other vessels have been abandoned in the channels and adjacent waterways of the Mississippi River, a major corridor for petrochemical transportation. These barges may become illegal disposal sites for used oil or hazardous materials, which may leak and cause serious pollution of the waterways and coastal estuaries.

However, locating abandoned barges is not easy. The vessels are scattered over a very wide area, seasonally covered by vegetation and undetectable; additionally, the job of differentiating active vessels from abandoned barges requires multiple observations showing the barges anchored in the same location over a long period.

Since 1989, the U.S. Coast Guard and the Environmental Protection Agency have been conducting a program to locate abandoned barges that represent environmental risks. Nesbit Environmental's VIP project was an investigation to determine the detection capability and cost effectiveness of using the U.S. Geological Survey's Side-Looking Airborne Radar (SLAR) together with the Landsat Thematic Mapper (TM), a satellite-based scanning instrument, and panchromatic data from the French SPOT remote sensing satellite. The effectiveness of these data sources was to be determined by comparing their digital remotely-sensed data with color infrared aerial photography.

Assisted by Stennis Space Center experts, Nesbit initiated a process whereby aerial photography was employed as the principal data source with the SLAR, Landsat TM and SPOT as



Scott Nesbit of Nesbit Environmental is viewing aerial images of the Louisiana bayou through a stereoscopic viewer that allows easier and more definitive identification of features.

A typical aerial image used in Nesbit's VIP project for locating abandoned barges in the waterways of the Mississippi River complex.

secondary sources for verification. To provide the abandonment time factor, SLAR and satellite imagery acquired at several times from 1988 to 1994 was used. Potential vessel locations were screen digitized to map coordinates for field checking.

The five-month investigation concluded that a combination of aerial photography backed by SLAR and satellite imagery offered a cost-effective way of identifying potentially abandoned vessels for follow-up field check by boat or plane. Although Landsat TM data were not very useful in initial barge detection (due to coarse resolution), the data were helpful when merged with SLAR data to provide information regarding land/water delineation. The advantages of combining color infrared aerial photography with SLAR data include increasing the overall detection capability by using an additional detection method, and providing multiple surveillance dates to verify abandonment cost-effectively (due to the ready availability and low cost of SLAR data). The combined system offers increased accuracy and reduced cost of follow-up inspections to determine the status of suspect vessels.

The VIP project not only achieved its primary objective and provided new technology for use in barge detection, it also attracted the attention of C-K Associates, Inc., also of Baton Rouge, and led to a merger of Nesbit Environmental and C-K. Where C-K Associates had previously limited remotely-sensed data acquisition to aerial photography, the merged company has since invested in Geographical Information System (GIS) hardware, software and technical training, and initiated the use of a GIS to process multiple sources of remotely-sensed data as an on-line engineering tool.