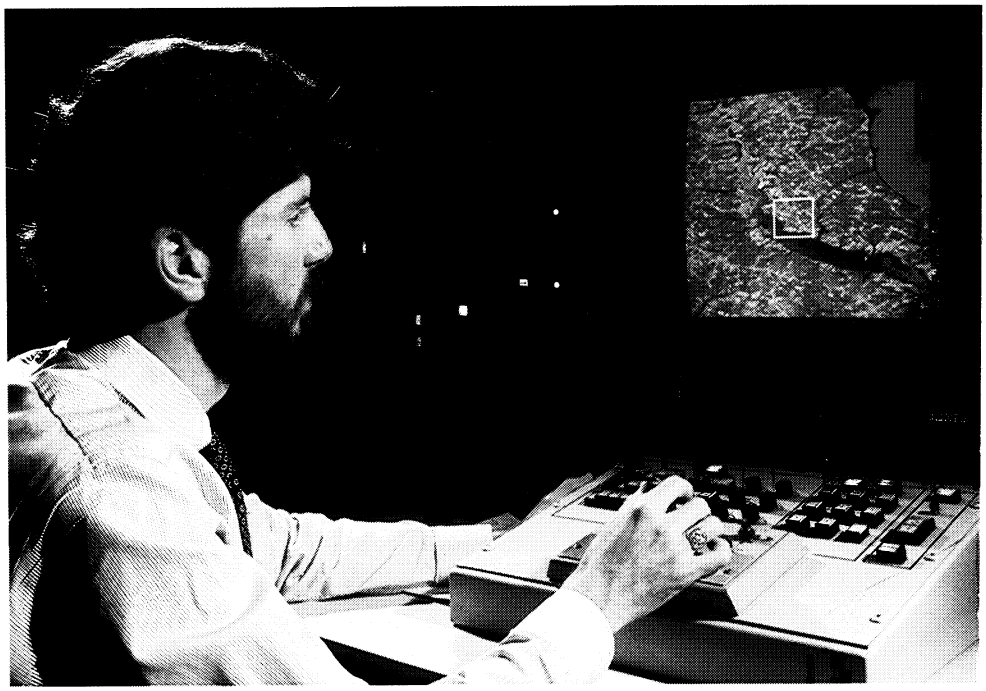
Spurred by NASA technological advances, a budding industry is manufacturing equipment and providing services toward better management of Earth's resources

The Earthscan Industry



Remote sensing is the acquisition of physical information from a source some distance away. It is as old as man, for the human eye is a remote sensor. When primitive man scaled a mountain for a better look at the valley, he was sensing from a distance. So was Galileo when, in 1610, he turned his newly-developed telescope toward the moon. Perhaps the first effort to utilize remote sensing as a practical Earth-survey tool came in the middle of the 19th century when aerial photos of Paris were made from a balloon.

Since 1959, when the first picture of Earth was taken from a satellite, a remote sensing has progressed to sophisticated science that offers high potential for public benefit, particularly in better management of Earth's resources. By itself, remote sensing is not a total information system, nor does it replace traditional means of gathering resources data; it is an additional tool capable of providing voluminuous information not readily collectible by other means. When incorporated into a larger information system that utilizes data from various other sources, the technology offers broad utility in such areas as agricultural inventory, prospecting for new oil and mineral resources, charting sources of fresh water, monitoring air and water pollution, delineating urban growth patterns, studying floods to lessen their devastation, improving the accuracy of maps, plotting ecological changes resulting from earthquakes, forest fires or strip mining activities, and scores of other applications.

There are many different systems for acquiring Earth information from airborne or orbiting platforms, for example, advanced photographic systems, imaging radars, infrared devices, laser detectors and multispectral scanners (MSS). A description of the latter system, as it is employed aboard NASA's Landsat survey satellites, best exemplifies the remote sensing process.

The MSS is designed to take advantage of the fact that every object on Earth reflects light or emits radiation in different wavelengths of the electromagnetic spectrum. Thus, each object has its own unique radiation "signature" which, like a human fingerprint, offers a means of identifying a particular object. As Landsat orbits Earth, the sensitive detectors of the MSS pick up these signatures, including radiations in both visible light and in parts of the spectrum not visible to the human eye. Converted to digital signals, the information is transmitted to a ground station where a computerized signal-deciphering system translates the flow of data into tapes and images—electronic pictures of Earth. Landsat data can be interpreted to tell the difference, for example, between one type of vegetation and another, between densely populated urban areas and lightly populated farmland, or between clear and polluted water. The basic imagery can be enhanced by computer processing to correct sensor errors, to compensate for atmospheric effects or changing Sun angle, to make the image compatible with standard maps, or to emphasize certain features in the image.

Toward exploiting the remote sensing potential, NASA has led the way in developing satellites, sensors and other on-board equipment, along with means of processing the data acquired by satellites or aircraft. So far, the major users of remotely-sensed data have been federal, state and local governments, but the private sector has become more aware of the technology and its possibilities for economic and productivity gain. Resource exploration companies looking for oil, gas and mineral sources are the

largest private sector users and the technology is beginning to find acceptance in other industries.

To support both government and private users, there is a small but growing commercial remote sensing industry. It cannot yet be described as a "booming" industry, but there is real promise for expansion. The industry consists of about 150 firms, some of them long engaged in aerial photography and now moving into other sensing activities; others are relative newcomers to the field, companies which have been formed in the last decade or so to pursue the opportunities afforded by satellite remote sensing. Some of these firms manufacture various types of sensors used in aircraft or spacecraft; others produce ground-use equipment for computer-processing the data acquired; still others offer a variety of specialized services ranging from aerial photography to interpretation and analysis of data.

An example of a company engaged in all these areas is General Electric's Space Systems Division, Valley Forge, Pennsylvania, which builds the Landsat satellites, manufactures equipment for ground processing of data, and offers Landsat image analysis services to a variety of users. The most recent of these offerings, provided by GE's Earth Resources Applications, Lanham, Maryland, is a Landsat geologic reconnaissance package—called GEOPAK™—that enables exploration geologists to evaluate quickly large areas of Earth for resource potential.

GE's customers get a Landsat image of a specified area, geometrically corrected to make it map-compatible, and computer-enhanced to emphasize topographic features and subtle color differences. The package also

includes a geologic analysis which pinpoints lineaments—such as faults and fractures—along with surface structural features and other indicators of prospecting potential. The GEOPAK package is not an instant oil discovery system, GE officials state; it is simply another tool, useful in the early stages of geologic exploration as an aid to focusing on most promising areas. Its advantage is that it provides geologists a packaged analysis in six weeks that would otherwise require months and many miles of surface examinations to accomplish. The GEOPAK program was introduced in 1980 and since then the volume of business has grown consistently.

On the opposite page, a General Electric technician is using a computerized image analyzer to process a Landsat image, a first step in preparation of the company's GEOPAK information package designed to aid companies prospecting for oil or natural gas. At left is an example of the basic GEOPAK package, an image of a part of Utah which has been coordinated with standard maps and computer-enhanced to emphasize topographic and subtle color features. Below, a GE geologist is adding an overlay to the image; the overlay is part of a geologic analysis which pinpoints Earth faults, fractures, domes and other features of interest to prospectors.

Some other examples of commercial remote sensing companies, the types of equipment they produce and the services they provide are contained in the following pages.

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