SIR-A: A radar look from space at the rocky earth

NASA

On June 26, 1978, the National Aeronautics and Space Administration launched Seasat, an earth-orbiting satellite instrumented to study the ocean's surface. One of its sensors was a synthetic-aperture radar (SAR), designed to provide images of wave patterns and wave directions. A small fraction of the instrument's coverage, however, included solid ground, and that little bit confirmed what geologists already suspected on the basis of earlier airborne measurements: that an orbiting SAR could be as useful over land as it was over water.

This month, the researchers had a chance to study the possibility in depth, using a SAR carried aboard the space shuttle Columbia on its second flight (SN: 11/21/81, p. 324). Known as SIR-A (Shuttle Imaging Radar-A), the instrument in eight hours covered some 10 million square kilometers of the earth's surface, about 90 percent of it dry land. This was virtually the entire amount of coverage planned, although some of the target areas had to be changed when a mulfunctioning fuel cell caused the flight duration to be cut by more than 50 percent. The experiment aimed for a wide range of geologic types, from rolling plains to mountain ranges, tectonic fault zones and volcanic regions.

Synthetic-aperture radar depends upon the fact that its beam is moving along the terrain. The length of the SIR-A beam's "footprint" on the ground, combined with its incidence angle and the speed and altitude of the space shuttle, meant that each point on the surface was in the beam for about 2 seconds; successive radar echoes from each point, integrated over that time, produced a radar image as sharp as if the antenna had been nearly 15 kilometers long, instead of its actual length of 9.35 meters. The width of the radar ground track (the footprint's "real" dimension) was 50 kilometers.

The first image processed (above) from SIR-A's vast compilation shows a 50-by-100-km swath of the Hamersley mountain range in Western Australia. Unaffected by darkness, cloud cover or vegetation, it shows terrain features as small as 60 meters. The circular pattern of eroded folds at center surrounds a prominent granite dome, with the Hardey River (liquid water is a strong radar reflector) crossing it vertically at right.

Planned for the future (if it can get funded), says principal investigator Charles Elachi of Jet Propulsion Laboratory, is SAMEX, the Shuttle Active Microwave Experiment, sought for two shuttle flights in 1986. Unlike the Seasat SAR and SIR-A, SAMEX will include multiple radar frequencies to measure surface roughness on different scales, variable polarization angles to evaluate the surface material as much as 50 centimeters deep, and a variable beam-incidence angle for stereo imaging.

And two years later, if an even taller funding hurdle can be crossed, a similar instrument may be sent to Venus.

—J. Eberhart

Lasker awards for brain and gene work

The 1981 winners of the Lasker awards —America's most prestigious medical research awards and often prefaces to Nobel prizes in medicine — have been announced. The recipient of the $15,000 Albert Lasker Basic Medical Research Award is Barbara McClintock, a distinguished service member of the Carnegie Institution of Washington at Cold Spring Harbor, Long Island, N.Y. The recipient of the $15,000 Albert Lasker Clinical Medical Research Award is Louis Sokoloff, chief of the Laboratory of Cerebral Metabolism at the National Institute of Mental Health in Bethesda, Md.

McClintock, 79, has been honored for her discovery made over 40 years ago that certain genetic elements are not static, as was once believed, but are transposable—that is, they can move about from one location to another on DNA. These transposable genetic elements in turn appear to play a fundamental role in gene control and in genetic recombination, provide an explanation for the extensive genetic variability that occurs in organisms and allow for the development of new species and evolution. Although her discovery remained unappreciated for many years, largely because it was made in corn and only confirmed in other organisms many years later, McClintock is today considered America's most distinguished cytogeneticist. Her findings have also sparked an ongoing wave of genetic experiments (SN: 6/17/78, p. 390).

Sokoloff has been honored for pioneering a method for measuring brain function both as a whole and locally. His technique involves measuring the brain's use of glucose (the primary fuel of the central nervous system) with an analog of glucose that, unlike quickly dissipated glucose, can be trapped in brain tissue long enough for chemical analysis and to provide a marker for cerebral energy metabolism. His technique for measuring brain function has also paved the way for Positron Emission Transverse Tomography (PETT), which visualizes the brain and central nervous system in action; this is in contrast to the CT scanners, which provide anatomical pictures of the brain and other organs. PETT is being used to map brain activity, analyze disease and follow drug action (SN: 11/18/78, p. 340). □