

DB 13

PROJECT ARIES (ASTRONOMICAL RADIO INTERFEROMETRIC EARTH SURVEYING)

Project ARIES further demonstrated the feasibility of three-dimensional Earth position determination with a few-centimeter accuracy over baselines of 180 to 500 kilometers. The technique employs very long baseline interferometry (VLBI) and uses quasars as a reference frame. Caltech's Owens Valley Radio Observatory (OVRO) and the Deep Space Network at Goldstone are used with the ARIES transportable 9- and 4-meter antennas to establish distance vectors between the two reference stations and a grid of remote points.

The 4-m diameter radio interferometric station began operations. This high-mobility station allows a data acquisition yield of two distinct locations per week compared to the 9-m station's one location per month. The 4-m station has been made possible by utilizing an X-band (8.4 gigahertz) low-noise traveling wave maser receiving system, with the maser cooled to four kelvins by liquid helium.

The microwave performance of the X-band receiving system is equivalent to an operating system noise

temperature of 30 K across a 100-megahertz bandwidth. This technology was originally developed for interplanetary spacecraft communications. Validation experiments comparing the two antennas were conducted by locating the antennas 30 m apart at the JPL ARIES site. They proved that the smaller antenna yielded the same results as the larger within 10 centimeters or better in three dimensions. The transition to primarily X-band ARIES geodetic monitoring offers immunity to ionospheric errors by a factor of 13 over previous monitoring using S-band (2.3 GHz) reception techniques.

The ARIES Project is continuing to monitor its previously established network of ten locations while pursuing the refinement of radio interferometric geodesy goals of high accuracy at reduced costs. Cost-effectiveness objectives are being met by the 4-m system and computerized data analysis at a joint facility of JPL and the Caltech Astronomy Department.

*Figure (opposite page):* A handy tool for increasingly accurate Earth measurements is the 4-meter high-mobility radio interferometric station put into operation this year by Project ARIES at JPL and elsewhere.

