The Uses of a Large Array

Sometimes a tool has more than one use—witness the Very Long Baseline Array (VLBA), a proposed network of radio telescopes that would stretch from Europe to Hawaii and from Alaska to the Caribbean.

If and when the VLBA is completed, its individual antennas will be able to combine their signals into astronomical images having an angular resolution of 0.3 milliarcsecond—100 times better than any other telescope at any wavelength, and good enough to see a dime in New York from the distance of Los Angeles. The likely targets of the array include x-ray stars, the cores of quasars, the nuclei of galaxies (including our own galaxy), and star-forming regions within the interstellar molecular clouds. The technology required, although sophisticated, is essentially off-the-shelf; the VLBA could be built within a few years for a relatively modest $50 million.

Thus, it is not surprising that the VLBA won a strong endorsement last year from the National Academy of Science's Astronomy Survey Committee (the "Field Committee," *Science*, 16 April 1982, p. 282), and more recently, from presidential science adviser George A. Keyworth. Indeed, Keyworth saw to it that the President's fiscal 1984 budget for the National Science Foundation included funds for a VLBA design study, and he has pledged to push for full-scale funding in fiscal 1985.

Not the least of the VLBA's charms, however, is its potential for nonastrophysical spin-offs, particularly in geophysics and geodesy. To remind people of that, and to give the wider community some input into the array's design—and not incidentally, to help turn potential funding rivals into allies—astronomer Herbert Friedman, co-chairman of the National Research Council's Commission on Physical Sciences, Mathematics, and Resources, organized a multidisciplinary VLBA workshop on 8–9 April.

"The results were everything we expected," says Friedman. "The geophysics community was impressed with the power of the instrument, and the astronomers were impressed with the quality of the geophysical science that could be done." Some highlights:

• *Geodesy*. As the VLBA antennas record the signals from distant quasars, they will also be establishing their positions relative to one another with extraordinary precision. Experiments with existing antennas have already achieved accuracies of a few centimeters over thousands of kilometers. The VLBA could thus be important in determining deformations and large-scale motions in the earth's crustal plates; in monitoring the motion of the polar axis and variations in the earth's rotation; and, for mapping purposes, in providing a terrestrial reference system far more accurate than any now in existence.

• *Astrometry*. Measuring the positions and motions of the stars and planets is an unglamorous, meat-and-potatoes kind of science. But it is fundamentally important in deriving the distance to the stars and clusters, and thus in understanding their masses, luminosities, and general state of evolution. Moreover, observing tiny, cyclic shifts in a star's position could be the most straightforward way of detecting planets in other solar systems. The VLBA would help by relating its own coordinate system, which is fixed to the rotating earth, to a coordinate system pegged to the quasars, which is probably the closest approximation possible to an inertial reference frame.

• *Satellite orbits*. A higher precision determination of satellite orbits would be useful both in geodesy and in studying irregularities in the earth's gravitational field.

• *Timekeeping*. Astronomical signals from the individual VLBA antennas will be correlated by means of very accurate maser clocks, which will have to be very precisely synchronized. Thus, almost by accident, the array will provide the standards for an improved, worldwide master clock.

"The idea was to let people articulate their needs early on," says workshop co-chairman Bernard F. Burke of the Massachusetts Institute of Technology. "At this point in the process we can easily make accommodations [in the software, electronics, and antenna placement] that will cost the astrophysics nothing, yet will yield big payoffs for the geophysicists. Six months from now, it would have been too late."—**M. MITCHELL WALDROP**

If HTLV does cause AIDS then there must be a way of maintaining the immunosuppressed state even after the virus is no longer detectable. The immune systems of the patients do not appear to recover.

Simply finding HTLV or the DNA in AIDS patients does not mean that the virus caused the disease. "From our data it could be an opportunistic infection," Gallo concedes. "But Essex's data argue that it is more than opportunistic."

Essex and his Harvard and CDC collaborators detected antibodies against membrane-associated antigens of HTLV in at least 25 percent of 75 AIDS and 23 lymphadenopathy patients. Another 10 percent or so would be positive if the investigators used a somewhat less stringent criterion for a positive antibody test.

In contrast, only one of 81 homosexual controls who had been matched for age, race, and place of residence with 36 of the AIDS patients had the antibodies. The one positive individual was a friend, but not a sex partner, of one of the patients. Only two of an additional 305 controls, including homosexuals who had visited a venereal disease clinic, healthy blood donors, kidney dialysis and chronic hepatitis patients, had the antibodies. "The message is that 25 to 40 percent of AIDS cases have the antibodies and 1 percent or less of control groups do," Essex says.

Other attempts to identify differences in viral exposures between AIDS patients and controls have not turned up such a large discrepancy between the two groups. Nevertheless, some 50 percent of the patients did not have the antibodies, either because the test was not sensitive enough to detect them or because their immune systems failed to make the antibodies—or because they had not been infected by HTLV.

Militating against the possibility that HTLV causes AIDS, Gallo says, is the relatively short period of time required for the immune deficiency disease to develop. CDC officials have reported the latency period of AIDS to be several months to a year. The T-cell leukemia caused by HTLV may require years, if not decades, to develop after infection by the virus.

Perhaps more disconcerting than the discrepancies in the latency periods of the two conditions is the apparent lack of AIDS in southern Japan, an area where the rate of HTLV infection is very high. Some 25 percent of the population there have antibodies against the virus, compared to 4 to 5 percent in Haiti and 1 percent in the United States.