

Soviet, U.S. Scientists Reach Seismic Agreement

An unprecedented agreement to establish seismic monitoring stations near the U.S. and Soviet test sites is aimed at moving the superpowers toward a comprehensive ban

IN a decision of substantial interest to U.S. seismologists, the Academy of Sciences of the U.S.S.R. has agreed to allow independent monitoring of seismic signals in the vicinity of the principal Soviet nuclear test site. The agreement, which was reached in Moscow in late May with representatives of the Natural Resources Defense Council (NRDC), a private environmental group, calls for the establishment of three seismic stations manned jointly by U.S. and Soviet scientists at different sites within 200 kilometers of Semipalatinsk, in south central Russia.

The stations, which are to be established within the next few months, will operate at least into autumn and probably longer, according to Thomas Cochran, a nuclear physicist who works for NRDC in Washington. In exchange, he said, a team of Soviet researchers will be invited to staff three similar seismic monitoring posts to be established near the U.S. nuclear test site in southern Nevada.

The principal goal is "to perfect seismic techniques" needed for verification of a nuclear testing moratorium or comprehensive ban, the agreement states. Bilateral negotiations on a test ban treaty were terminated by the Reagan Administration in 1982, in part because of concerns about verification but more importantly of the need for additional nuclear tests to modernize and expand the present U.S. arsenal, and to develop a defensive nuclear shield. The Soviet Union has pressed for their resumption.

Several weeks before the delegation from NRDC traveled to Moscow, senior Administration officials cautioned that the proposal might play into the Soviets' hands. They also asserted that data from the monitoring station would not resolve uncertainties in the United States about the yields of Soviet detonations, a point that NRDC did not dispute. The group decided to proceed anyway, Cochran says, in order to demonstrate that on-site monitoring in the Soviet Union poses no obstacle to a test ban treaty, and to obtain baseline seismic data for a verification network.

The arrangement is clearly unprecedented.

Both countries agreed to test site inspection as a verification measure in a pair of treaties limiting nuclear test yields during the 1970's, but neither treaty has been ratified by the U.S. Senate, and the inspections were to have been of limited duration. The agreement is also novel in that the cost of the necessary equipment—including at least two sophisticated U.S. accelerometers and velocity meters at each site—will be shared by NRDC and the Soviet Academy, as will all travel expenses and construction costs. Contributions of money and scientific expertise from the U.S. government are wel-

A monitoring site in the Soviet Union "will definitely provide interesting information."

come but essentially irrelevant. (NRDC hopes to obtain \$500,000 in private financing before 18 June.)

The plan was hatched by Cochran in relative secrecy last January. After preliminary discussions with the Soviet embassy in Washington, he presented it to a delegation of visiting Soviet scientists in April, and finally to a scientific workshop in Moscow chaired by Yevgeniy Velikhov, the vice president of the Soviet Academy of Sciences. Seismologists from India and Sweden attended the workshop as observers. On 28 May, the agreement was signed by Velikhov and Adrian DeWind, a New York tax attorney who chairs the NRDC board.

The Soviets' principal motivation is apparently not scientific. Seismic experts consulted by *Science* said that Soviet scientists would probably gain little new information from the monitoring station in the United States, because seismic signals from locations nearer the Nevada test site are routinely recorded and published by the U.S. Geological Survey. U.S. scientists, in contrast, will probably learn a great deal from their site in the Soviet Union. The nearest exist-

ing U.S. seismic station is believed to be in China, more than 400 kilometers from Semipalatinsk, and there is a relative dearth of information in the west on seismic propagation in that region.

"It will definitely provide interesting information," says James Hannon, the program manager for seismic monitoring at Lawrence Livermore National Laboratory. "Everyone will be anxious to look at it." The data will reveal the regional characteristics of so-called high-frequency seismic waves, above 30 hertz or so, presently considered one of the most interesting topics of seismological research. They will also provide helpful clues to overall regional seismicity, earthquake mechanisms, and seismic wave propagation. As such, the data may help determine the number of monitoring stations needed to verify a comprehensive test ban, as well as the optimal design for each station and the optimal frequency at which seismic signals should be recorded, Hannon says.

Ironically, the existence of a related Soviet arms control effort—a unilateral test moratorium begun last August—will slightly diminish the value of the information gleaned from the monitoring experiment. Information about the local geology will perforce be drawn from signals generated by more distant events, including U.S. and French bomb tests. But Cochran stresses that "NRDC is not interested in the intelligence-gathering aspects of the experiment. Our primary goal is simply to demonstrate that Soviet and American scientists can work together and establish these stations in their respective countries." In any event, the experiment will probably continue beyond August, when the Soviet moratorium is expected to end, Cochran says. All of the collected data will be published openly, he adds.

Apparently, the only potential hitch is active Administration opposition. If it wanted to, the State Department could deny the Soviet research team the visas necessary for travel to the Southwest. But this would probably be too embarrassing, as the Soviets have promised to allow the American group in even if their own group is excluded. In addition, the Administration has already invited the Soviets to visit the Nevada test site itself, so travel to an area several hundred kilometers away can hardly be deemed sensitive. The Commerce Department could also prohibit the export of the appropriate seismic equipment to the Soviet Union. But NRDC deliberately plans to use off-the-shelf seismic equipment similar to that purchased by the Soviet Union in the past. "Nobody gave us any hope of pulling this off," Cochran says. "We are as surprised as anyone." ■ **R. JEFFREY SMITH**