NASA to Help Listen For E.T.'s Call

When E.T. calls home, his message is converted to a series of electrical pulses by circuitry in the telephone instrument. Circuitry in the receiving instrument at the other end detects his message and reprocesses it into a form understandable to his mother or some other of his species. Earthling astronomers who want to search for actual E.T.s have long wanted their own analogy to this kind of a receiver: a signal processor and analyzer that could determine the presence of an intelligently constructed signal among the large flux of natural radio emanations that come from all parts of the sky and that could assemble and display it for study. (It would not attempt to decode as there is no way of knowing how such a message might have been coded in the first place.)

According to a recent announcement, the National Aeronautics and Space Administration is now prepared to help astronomers develop such an instrument and deploy it on deep-space-tracking antennas at Goldstone, Calif., Tidbinbilla, Australia, and Madrid, Spain. Congress authorized NASA to spend $1.5 million on the search for extraterrestrial intelligence (SETI) in fiscal year 1983. (Fiscal 1983 began on Oct. 1, 1982, but most of its budget has yet to be passed. Another budget, for fiscal 1984, which begins Oct. 1, 1983, is due to be presented to Congress early in February.)

The authorization is a reversal of recent political attitudes toward SETI, and interested astronomers are celebrating. In past years Congress has explicitly prohibited NASA from spending money on SETI. Sen. William Proxmire (D-Wis.) was the chief instigator of the prohibition. In recent months he has been the subject of a persuasion campaign by prominent astronomers, including Carl Sagan. Meanwhile, SETI has risen in the professional estimation of astronomers.

In April 1982, the so-called Field Report, which lists important projects American astronomers would like to accomplish in the 1980s and which represents a consensus of the profession, listed a modest SETI program among its priorities. In August 1982, the International Astronomical Union, meeting at Patras, Greece, established a commission for SETI. Each established and respectable branch of astronomy has an IAU commission that watches over it, organizing meetings and other opportunities for exchange of information. The August action admits SETI to the respectable company. Whatever may have influenced Proxmire, this time he did not object, and the authorization went through.

Nevertheless, there are astronomers opposed to SETI. Frank J. Tipler of Tulane University in New Orleans in a letter to the editor of SCIENCE (published in the Jan. 14 issue) contends that SETI is not a true scientific experiment because its basic premise — that E.T.s exist — cannot be unequivocally falsified no matter how much negative evidence piles up. Proponents can always say there's a chance of finding something if they look a little farther or a little longer. An unproductive search could go on forever, Tipler alleges.

In a press conference at last week's meeting in Boston of the American Astronomical Society, two astronomers who are prominent proponents of SETI, Jill Tarter and Stuart Bowyer, both of the University of California at Berkeley, responded somewhat indignantly that Tipler is right —the premise cannot be falsified—but so what? Tarter and Bowyer insist that that is no reason not to look. They agree that the search could be a very long one, but not endless. As Bowyer put it there is "a threshold of pain," both financial and psychological, that would eventually shut off an unproductive search.

Tarter described the receiver that SETI astronomers want to develop over the next five or six years. It would be a multichannel narrow-band spectral analyzer. It would start with a capacity for analyzing 74,000 channels of one-hertz bandwidth simultaneously and gradually build up to 8 million. It would be able to process a gigabit of information, one billion bits, per second. (A bit is one digital information unit, a digit of a binary number or a yes or no to a given question.)

Such a receiver is a reversal of the ordinary trend in development of radioastronomical receivers as well as a political reversal. As astronomers are fond of saying, nature is not coherent. Natural processes emit radio waves over a wide range of frequencies, and astronomical radio receivers have usually been designed to take a wide-band look at the sky. To critics who say that this is a lot of money and effort to put into a receiver that will be good for only one purpose and one with a very slim chance of success, Tarter replies that even though nature is not coherent, a narrow-band survey of the sky should give a new perspective on *natural* emissions and so be of interest to all astronomers.

—D.E. Thomsen

'Severe' effects of natural acidification

For perhaps as long as 1,000 years, acrid smoke has streamed from spots along the sea cliffs in the Smoking Hills area of the Canadian Arctic. Shale, ignited by a spontaneous chemical reaction, burns continually there, and huge heaps of baked and charred material adorn the beaches. When researchers embarked on a project to assess the long-term effects of the sulfurous smoke on ponds in the 30-kilometer-long area, they found that "effects have been both severe and extensive." Magda Havas and Thomas C. Hutchinson of the University of Toronto described their findings in the Jan. 6 NATURE.

While the effects of acidic fumes and precipitation are extreme in the area, the researchers found that generally the 46 ponds sampled follow a response pattern similar to that in areas subjected to industrially induced acid rain. Alkalinity was highest in ponds furthest from the cliffs, and ponds nearer the burning shale that probably were alkaline once now have pH levels as low as 1.8, a reflection of extreme acidity. (pH refers to concentration of hydrogen ions; values greater than 7 are considered alkaline, while values less than 7 are considered acidic.) Such low pH levels, the authors note, are more typical of acidic hotsprings, acidic volcanic lakes, and ponds that receive drainage from mines than of those ponds simply subjected to industry-related acid rain. However, the ponds reflect an oft-observed response to acid precipitation. Of the 46 ponds, most were either alkaline, with pH levels of about 8, or very acidic, with pH levels of about 4. Few were in between because there are no chemical buffers in the intermediate range.

Once an alkaline pond begins receiving acidic material, the bicarbonates that act as buffers rapidly are overcome. The pH drops dramatically and stabilizes at the lower level. One consequence of this rapid change is that many aquatic organisms cannot survive. Also, as in other ponds and lakes exposed to acid fumes and precipitation, toxic elements build up with grave effects on pond water chemistry and biota. For instance, once aluminum, charged with killing fish in Adirondack lakes, reaches a certain level, it acts as an acid buffer and maintains the low pH level, says Havas, now of Cornell University.

Still, the ponds are not devoid of life. In four acidic ponds, 14 algae species were identified, compared with 90 species in alkaline ponds. While the algae in the alkaline ponds are typical to the Arctic, those in the acidic ponds are characteristic of algae from acidic environments found in other regions of the world. While the acid-adapted species are normally found in temperate environments, Havas says, it is not yet known if they are widely distributed in the Arctic. *—C. Simon*