Astronomers' Search for Other Worlds Brings Contact with Politics

One conclusion of modern astronomy is that man is probably not alone in the universe, and that astronomers should be listening to see if man's bretheren on other worlds are trying to communicate. Indeed, many astronomers have become eloquent spokesmen for what they characterize as the universal human yearning to know whether we are not alone in the vast reaches of space.

Unfortunately, at somewhat closer range, the heavens are loaded with earthbound clutter—satellites, weather balloons, aircraft, and the like—which have sometimes impeded and confused the astronomers' search for extraterrestrial intelligence. And the "universal" human yearning to learn of the existence of other worlds is not necessarily shared by the maritime industry, the airlines, the intelligence community, and other groups whose activities are gobbling up the portion of the radio-frequency spectrum that astronomers say is uniquely suited to their loftier goals.

At present a test of the astronomers' political clout in Washington, and indirectly of public support for their science, is shaping up in the preparations now under way for the World Administrative Radio Conference (WARC) to be held in 1979 in Geneva. The conference meets every 20 years so nations who are members of the International Telecommunications Union and who number 150, can decide how to allocate different parts of the radio-frequency spectrum.

In the 19th century, when the conference first convened, the spectrum was more emptier and decisions on allocation were easy. But with the explosion of television (which requires a very broad band of the spectrum), long distance communications, and satellites, the spectrum has become rather crowded and decisions about apportionment have become trickier. Recently, radio astronomy has entered the competition and, just as optical astronomy has had to adjust to interference of air pollution, radio astronomy has been jostled by growing interference from other radio-frequency spectrum users.

Already this traffic has produced some odd, close encounters, such as when a group of Soviet radio astronomers announced they might have found signs of another civilization, only to learn belatedly that the signals came from American military satellites (see box).

A group of American radio astronomers led by Frank D. Drake, director of the National Astronomy and Ionosphere Center at Cornell University, has started an international lobbying effort by writing to astronomers in some 20 countries, urging them to suggest at the WARC that the portion of the spectrum from 1400 to 1727 megahertz be allocated to the search for extraterrestial intelligence. Ironically, the biggest obstacles to the success of the astronomers' quest are American government and American industry—the largest users of the portion of the spectrum the astronomers want cleared. This makes it unlikely, at present, that the United States will adopt Drake's suggestion as a formal U.S. position at the meeting. But the astronomers say they hope the public will be their ally and show sufficient enthusiasm for the search for other worlds that both the United States and other nations will respond at the WARC.

At present, as a result of the 1959 WARC, the region from 1400 to 1427 megahertz is allocated for radio astronomy.

The astronomers' request for more spectrum space is based on a study of the search for extraterrestrial intelligence, or SETI, by a blue-ribbon panel and sponsored by the National Aeronautics and Space Administration (NASA).* The report concluded it would be economical to conduct a systematic search for signals sent by other civilizations by outfitting existing radio astronomy observatories with relatively cheap special equipment. Although the radio noise of man's activities on Earth may constitute a signal to other worlds, the SETI report did not advocate the sending of a special intergalactic signal to tell other worlds of our presence at this time. NASA currently supports SETI research to the tune of about $2 million per year.

The wider region includes an area romantically dubbed the "water hole" because it contains the basic spectral lines of the hydrogen atom (1420 megahertz) and the hydroxyl radical (1662 megahertz). Above the hydroxl radical line are regions thought promising for the sending of interstellar signals.

The SETI report, in reaching these conclusions, reasoned that anyone sending an interstellar signal would want the most information for the energy expended to transmit the signal. This would make the radio-frequency spectrum above 1727 megahertz unfeasible because at higher frequencies more energy would be required to transmit such a signal, due to the quantum effect of light. Below the water hole region, the SETI report said, the background radio noise emitted by our galaxy and others would tend to interfere with the signal. Since another civilization, wanting to notify the universe of its existence, would face these same physical limitations, the astronomers reasoned that it would, for the same reasons, pick frequencies near the water hole to send their signals. The SETI report quoted a typically eloquent passage on the subject that originally appeared in an earlier NASA report:

> Nature has provided us with a rather narrow band in this best part of the spectrum that seems especially marked for interstellar contact. . . . Standing like Om and Um on either side of a gate, these two emissions of the dissociation products of water beckon all water-based life to search for its kind at the age-old meeting place of all species: the water hole.

"When you listen to the arguments of the astronomers, or any group that wants a portion of the spectrum, it is extremely convincing," Kalman Schaefer, the chief of the Federal Communication Commission (FCC) steering committee preparing for the WARC, told *Science*. "The problem comes when you have so many different groups making eloquent arguments in favor of using the same part of the spectrum." And, indeed, it looks as though the astronomers' search for the meeting place of "all species" has several, more mundane, rivals.

According to the FCC, the region between 1400 and 1727 megahertz is now occupied by the following other users: taxi drivers talking to their dispatchers; fire engines communicating with their station houses; ship-to-shore radio; test aircraft telemetry signals; navigation for ships; commercial and military aircraft navigating and communicating; satellite tracking operations. It is also used by radiosondes, which are the signal stations on weather balloons.

At present, despite all these goings on, the region is not terribly crowded, but in the next 20 years—the period to be antic-

*Philip Morrison, John Billingham, John Wolfe, Eds., *The Search for Extraterrestrial Intelligence: SETI* (NASA SP-419, Superintendent of Documents, Government Printing Office, Washington, D.C., 1977).

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ipated in the debates of the 1979 WARC—both astronomers and FCC officials expect this region of the spectrum to become more crowded. As an example, one FCC official notes that much commercial aircraft communications and navigation now going over long-distance radio is expected to go via satellite.

Drake's letter to other nations notes that "SETI can share the waterhole with numerous services that use only low-power, earth-based transmitters," such as the taxi drivers. "Transmitters on orbiting spacecraft" are what get in the way, it explains. One example is the government's new NAVSTAR global positioning system which will operate at frequencies that SETI wants left alone.

Already satellites have interfered in radio astronomy activities. In one such instance reported in *Science* (11 March 1977, p. 932, and 26 August 1977, p. 822), astronomers at Penticton, British Columbia, complained that a satellite, transmitting strong pulses at 1427, 1432, and 1434 megahertz, was interfering with their observations. The satellite system was later identified as an American "SSU" allegedly for observing Soviet ships and submarines. Radiosondes on drifting weather balloons also cause problems because the signals resemble those the astronomers expect to hear from other civilizations. "We've had more than one false alarm from radiosondes at Arecibo," says one astronomer.

At present, three routes of action are open to the astronomers. One is to vie with other nongovernment users of the spectrum before the FCC. The FCC allocates spectrum space by issuing "notices of inquiry" that are proposed positions the FCC will take at the WARC on spectrum use. The eighth such notice, recently issued, proposes that users of the 1400 to 1727 megahertz part of the spectrum be "advised" that SETI activities might go on in that region. The astronomers would like the FCC to take a stronger stand, and note that the deadline for public comment on the notice is 30 June.

"It's a domino problem," explains FCC official Schaefer. "If we told the maritime industry to move somewhere else on the spectrum, they would scream at us and cause someone elsewhere on the spectrum to be moved somewhere else." The astronomers counter that whereas the maritime industry can communicate just as well at other frequencies, the water hole is uniquely suited to the needs of SETI.

Another method would be to lobby through the government committee that decides government use of the radio-frequency spectrum. This is called the Interdepartmental Radio Advisement Committee. Both NASA and the National Science Foundation, supporters of radio astronomy and SETI research, sit on the committee and could take up the astronomers' cause. NSF reportedly has done so but NASA, other officials point out, has a conflict of interest. "NASA sponsors other satellite programs that want that part of the spectrum, too."

Because the prospects that the United States will take up the astronomers' cause are bleak, Drake and his colleagues see other countries as their best hope. So far there have been favorable responses from the Soviet Union and Japan, although there has been no sure indication that either country's delegation will put forward the formal SETI position at the meeting. Nonetheless, smaller countries can help the astronomers out, they note, because at the 150-nation meeting each country has one vote. This means that the United States, with its vast array of satellites, long distance communications, and military hardware, has the same say at the WARC as Sri Lanka. Drake says he has received a very warm response from the noted scientist Arthur C. Clarke, who is living in Sri Lanka and who will try to get that country's delegation to take up the SETI cause. It will be ironic if the countries least involved in communicating with each other turn out to be the strongest advocates of the search for other worlds.—DEBORAH SHAPLEY

"Close Encounters" à la Russe

Sitting and listening for the telltale blip or pulse that will signal that Man is not alone in the universe requires that the astronomer be steel-hearted against self-delusion and betrayal. His difficulties were illustrated in an incident involving two Russian radio astronomers, Nikolai Kardashev of Moscow University and Vsevolod Troitsky of Gorky University, who found coherent pulses in the sky and concluded that they might be signs of extraterrestrial life. Unfortunately, it didn't turn out that way.

In 1973 at the 24th Congress of the International Astronautical Federation at Baku, U.S.S.R., Kardashev and Troitsky announced they were receiving bursts of radio emissions every 2 to 10 minutes on seven receiving stations located around the Soviet Union, according to American sources who were in the Soviet Union at the time. Some of the properties of the signals, the scientists announced according to these sources, resembled "those of dispersion in the interstellar environment." The possibility that the signal came from life on other worlds was not ruled out, and the announcement, was carried by Tass and Western wire services.

Another Russian astronomer, Yuri Pariskiy, had met with Frank D. Drake, the Cornell astronomer, in London before the Baku announcement and told Drake in very excited terms about the signals. Pariskiy told Drake that the Russians had asked their defense department and the U.S. Embassy in Moscow if the signals could come from either country's space activities, and were told they couldn't. "He was so excited. He was convinced they had found it. He was six feet off the ground," Drake recalls.

Yet as Drake noted down the information, the signals sounded like those of a satellite. They occurred at one and a half hour periods, which would be a typical satellite orbit. Moreover, they occurred around the clock, whereas astronomers assume that because of the earth's rotation relative to the source, extraterrestrial signals would be received for 12-hour periods.

In November 1973, *Aviation Week* writer Philip Klass, wrote a story about the Russian observations saying, "U.S. observers believe the signals may be coming from a secret American satellite . . . [which is] to provide polar region coverage for Strategic Air Command bombers. . . . It is expected to operate in the 225 to 400 megahertz band, the same general part of the spectrum the Soviets are understood to be receiving the new type signals."

Kardashev has now submitted a report of the signals to the American journal *Icarus*, although the report concludes that their source is an American satellite and not extraterrestrial life. Whether *Icarus* will publish the paper depends in part on whether the discovery that extraterrestrial life isn't "extra," after all, still counts as science.—D.S.