Southern SETI

by Thomas B. H. Kuiper and S. Gulkis

American and Australian investigators, with financial support from The Planetary Society, are collaborating in a search for extraterrestrial intelligence in the southern skies. Southern-hemisphere observations offer unique views of our own Milky Way Galaxy and the Magellanic Clouds, the nearest external galaxies.

The search will use the NASA 64-meter deep space tracking antenna, 20 miles southwest of Canberra at Tidbinbilla, Australia. This is one of three similar antennas (the other two in Spain and in California) which communicate with distant spacecraft such as *Voyager*. The search strategy is to allow the Earth's rotation to carry the antenna beam from west to east across the sky, taking 24 hours to complete a single scan. This strategy takes advantage of a four-month period when the 64-meter antenna will not be tracking spacecraft, but will be held stationary for bearing maintenance.

A receiver will monitor a narrow radio frequency range often used by radio astronomers to detect water vapor in the interstellar medium. A spectrum analyzer and computer will break the signal into 256 discrete bands and record the strongest signals for later analysis.

Water is vital to life on Earth and may also be important for extraterrestrial life. Changes in the rotation of water vapor molecules cause them to emit radiation in certain narrow frequency intervals, called spectral lines. One of these occurs near a frequency of 22.2 gigahertz. Advanced civilizations biologically similar to ours and wanting to attract the attention of others might choose to transmit near this spectral line of water because it occurs in a part of the spectrum where the natural galactic noise background is quite low (see chart on page 7).

Using the Earth's rotation, the system will obtain approximately four seconds of data at each antenna beam position in the sky. By repeating the scan on several different days, the investigators will be able to separate genuine signals from random noise emissions and absorption by water vapor in our own atmosphere, and radio frequency interference. Although normal antenna tracking movement is not allowed because of the bearing maintenance, small adjustments in elevation of the telescope can be made, so as to move the daily west-to-east sweeps slightly north and south, so in four months it will be possible to survey about half a percent of the sky.

The Large Magellanic Cloud, below, and its close companion, the Small Magellanic Cloud, are the Milky Way's nearest galactic neighbors, only 16,000 light years away. These small, irregular galaxies, which appear as faint nebulosities to the naked eye, move about the south celestial pole and were used by early navigators to mark the south celestial pole as they used Polaris to mark the north pole. Among many other possible sources, the southern SETI researchers will listen for radio signals that might be emanating from these nearby galaxies.
Photo: Dr. Hans Vehrenberg

The investigators include Drs. S. Gulkis, T. Kuiper and E. Olsen of JPL, Dr. D. Jauncey of Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) Division of Radiophysics, and Dr. W. Peters of the Australian National Observatory. After the investigators install the instruments on the telescope, station personnel under Director T. Reid will carry out the daily survey activities. Data tapes will be returned regularly to JPL for analysis. Dr. Gulkis coordinates the project.

Independent of SETI, the survey may be of general astronomical interest. Given what we now know about natural water line sources, the survey may detect one or two additional ones. However, if astronomers have by chance overlooked a class of sources, the detection rate may be higher. Discovering a new class of water line sources would be important even if they were not produced by extraterrestrials.

The survey will also evaluate this mode of data acquisition for future SETI programs. Next summer, the 64-meter antenna at Goldstone, California is scheduled to undergo major maintenance. A similar survey could be carried out there with a 65,000-channel receiver, greatly increasing the effective sensitivity and coverage of the search. □ *Thomas Kuiper is a Research Scientist at the Jet Propulsion Laboratory specializing in radio astronomy. Samuel Gulkis is a Senior Research Scientist at JPL.*

SUMMARY OF ALL KNOWN SETI OBSERVING PROGRAMS (AS OF FEBRUARY, 1988)

DATE	OBSERVER	SITE	OBJECTS	TOTAL HOURS
1960	Drake, "Ozma"	U.S.A.	2 stars	400
1963	Kardashev & Sholomitskii	U.S.S.R.	quasar	---
1966	Kellermann	Australia	1 galaxy	---
1968 & 1969	Troitskii, Gershtein, Starodubtsev, Rakhlin	U.S.S.R.	12 stars	11
1970 & on	Troitskii, Bondar, Starodubtsev	U.S.S.R.	all sky search for sporadic pulses	700 and continuing
1970 to 1972	Slysh	France	10 nearest stars	---
1971 & 1972	Verschuur, "Ozpa"	U.S.A.	9 stars	13
1972	Kardashev & Steinberg	U.S.S.R.	omni-directional	---
1972 to 1976	Palmer, Zuckerman "Ozma II"	U.S.A.	674 stars	500
1972 & on	Kardashev, Gindilis	U.S.S.R.	all sky search for sporadic pulses	---
1973 & on	Dixon, Ehman, Raub, Kraus	U.S.A.	all sky search	continuing
1974 to 1976	Bridle, Feldman, "Qui Appelle?"	Canada	70 stars	140
1974	Wishnia	"Copernicus" satellite*	3 stars	---
1974 & on	Shvartsman, "Mania"	U.S.S.R.	21 peculiar objects	---
1975 & 1976	Drake, Sagan	U.S.A.	4 galaxies	100
1975 to 1979	Israel, de Ruiter	Netherlands	50 star fields	400
1976 & on	Bowyer et al. U.C. Berkeley, "Serendip"	U.S.A.	all sky survey	---
1976	Clark, Black, Cuzzi, Tarter	U.S.A.	4 stars	7
1977	Black, Clark, Cuzzi, Tarter	U.S.A.	200 stars	100
1977	Drake, Stull	U.S.A.	6 stars	10
1977 & on	Wielebinski, Seiradakis	German Federal Republic	3 stars	2
1978	Horowitz	U.S.A.	185 stars	80
1978	Cohen, Malkan, Dickey	U.S.A. and Australia	25 globular clusters	80
1978	Knowles, Sullivan	U.S.A.	2 stars	5
1979	Cole, Ekers	Australia	nearby F, G and K stars	50
1979	Freitas, Valdes	U.S.A.	stable "halo orbits" about L4 and L5 libration points in earth-moon system	30
1979 & on	JPL, UCB, "Serendip II"	U.S.A.	apparent positions of NASA spacecraft	400 to date
1979 to 1981	Tarter, Clark, Duquet, Lesyna	U.S.A.	200 stars	100
1980	Witteborn	U.S.A.	20 stars	50
1981	Lord, O'Dea	U.S.A.	north galactic rotation axis	50
1981	Israel, Tarter	Netherlands	85 star fields	600
1981 & on	Biraud, Tarter	France	300 stars	80 to date
1981	Shostak, Tarter	Netherlands	galactic center	4
1982	Horowitz, Teague, Linscott, Chen, Backus	U.S.A., "Suitcase SETI"	250 stars	75
1982	Vallee, Simard-Normandin	Canada	galactic center meridian	72
1983 & on	Horowitz	U.S.A.	sky survey	---

*This search in the ultraviolet is the only program listed that was not performed in the radio spectrum.