



# SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

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## SETI League Seeks Engineering Intern

Thanks to a significant hardware donation from a corporate sponsor, The SETI League, Inc. is now looking for a full/part time intern to advance a cutting-edge SETI project at its Northern New Jersey headquarters. Since the project is largely software-based, only part-time attendance at HQ will be necessary.

### The Project

The SETI League has received a major donation of equipment, including high-speed A/D converters, digital receivers, and Quad-TI6701 floating point DSP boards. These are all "VME" boards which together can form the foundation of a microwave receiver capable of searching a million channels or more for narrowband signals possibly transmitted by extraterrestrial aliens. This is all modern hardware (most manufactured by Pentek) with enormous processing power. In order to be useful, software will have to be written to unify the boards into a working receiver, and to process the data to find signals in the noise. This potentially enormous job is simplified somewhat by resources available on the Internet, but it is still a lot of work.

### The "Job"

The SETI League is looking for someone who is willing to work on this project for several months, or longer if possible. It will require selfless devotion for minimal reward. (The project has no budget.) However it will be an intellectual challenge of the highest order, and will allow the budding scientist to get some practical experience in electronics, DSP, advanced math, and other disciplines that will look good on a resume and be pretty interesting, too. (And if your receiver actually finds that elusive alien signal, a little fame may come along.)

The successful volunteer will need these skills:

- Understanding of DSP, FFT and possibly the KLT
- Ability to program same in C
- Sufficient mental versatility to deal with lots and LOTS of hardware registers, VME cards, etc., (in a software sort of way)
- Reasonable charisma with mathematics

Although hardware skills would be desirable, there should be sufficient help around HQ to assist with electronic hardware and construction issues.

This position is open immediately. Of course The SETI League understands that potential student interns will more likely be available during the summer. Interested parties are invited to contact SETI League president Richard Factor via email (rcf@setileague.org). ❖

## Awards Announcements:

### California Amateur Receives SETI Technical Award

TRENTON, NJ., 17 April 2005 -- The SETI League, Inc., grassroots leader in the privatized Search for Extra-Terrestrial Intelligence, has awarded its highest technical honor to a prominent California radio amateur. Retired engineer James Brown of Del Mar, CA, also known by his amateur radio call-sign W6KYP, has received the coveted Giordano Bruno Memorial Award for 2005, honoring his significant technical contributions to amateur SETI science. The award was announced at The SETI League's annual membership meeting today at The College of New Jersey.

Brown was one of the first amateurs in the world to build a radio telescope dedicated specifically to the search for intelligent life in space. Begun in 1978 (sixteen years before the formation of the nonprofit SETI League), Brown's SETI station was powered by Zeke, a computer he built himself before personal computers became commercially available. Brown is now an active participant in The SETI League's *Project Argus* all-sky survey, and has written extensive astronomical, coordination, and signal analysis software, which he freely shares with other SETI League members worldwide through his seti.net website. When notified of the award via telephone this morning by Awards Committee chairman David Ocame, Brown was in the middle of running tests of his Remote SETI Client, which will allow SETI League members around the world to operate participating radio telescopes remotely via the Internet.

The Bruno is awarded annually for significant contributions to the art and science of SETI. It is dedicated to the memory of Giordano Bruno, the Italian monk burned at the stake in 1600 for postulating the multiplicity of inhabited worlds. This award was first suggested by sociologist Donald Tarter, at a SETI dinner held at the American Association for the Advancement of Science meetings in Atlanta on Feb. 17, 1995 (coincidentally the 395th anniversary of Bruno's death). Past recipients include physicist Dr. D. Kent Cullers, WA6TWX; software volunteer Daniel Boyd Fox, KF9ET; English amateur radio astronomer Trevor Unsworth, G0ECP, and Ken Chattenon, G4KIR; Australian coordinator Noel Cedric Welstead, VK4AYW; photonics engineer Dr. Stuart Kingsley, German amateur radio astronomer Peter Wright, DJ0BI; Italian space scientist Dr. Claudio Maccone; SETI pioneers Dr. Philip (W8FIS) and Phylis Morrison; and Italian radio astronomer Dr. Stelio Montebugnoli. ❖

### SETI League Announces 2005 Best Ideas Awards

Mountain View, CA., 19 March 2005 -- The editors of The SETI League's scholarly journal Contact In Context tonight recognized three individuals for major contributions to the SETI literature. Honored with "Best Ideas Awards" this year at the annual CONTACT conference were conference organizers

Jim Funaro and Joel Hagen, and science author Gerald D. Nordley. CONTACT, an informal gathering of artists, authors, educators, and social scientists, as well as SETI enthusiasts, has been held annually since 1983, but this is the first time their conference has hosted the Best Ideas Awards.

"The earliest Best Ideas Awards went to authors for a particular book or paper," stated Contact in Context editor Prof. Allen Tough. "Last year we expanded our scope. We chose The SETI League's entire website because it provides a nourishing forum for fresh bold ideas. This year we chose an entire conference." He then recognized Funaro and Hagen for their two decades of dedication and leadership, as founders and organizers of the popular CONTACT meetings. "The annual CONTACT conference is the best conference on this planet as a forum for innovative new ideas related to SETI and contact," noted Tough.

Nordley, a real-life rocket scientist, publishes extensively in the technical literature under his own name, and writes science fiction under the thinly disguised pseudonym of G. David Nordley. He received the journal's first Lifetime Achievement Award, for his extensive body of work in support of the efforts to achieve interstellar contact. Over the years, Nordley has produced poetry and paintings as well as technical articles, short stories, and a book. "He is widely known for his prompt, precise, blunt email messages whenever he detects thinking that is sloppy, unduly narrow, or short-term. He makes us think big," said Tough.

### SETI League Presents Annual Service Award

Mountain View, CA., 17 March 2005 -- This evening, the nonprofit SETI League, leaders in a global search for extra-terrestrial intelligence, recognized one of its key volunteers for extraordinary service to the grassroots, nonprofit organization's educational and scientific mission. University of Kentucky Prof. Robert Lodder was honored at a private awards dinner held in conjunction with the annual CONTACT conference at the NASA Ames Research Center.

Lodder, one of The SETI League's earliest members and staunchest supporters, received the fourth annual Orville N. Greene Service Award, which honors the memory of patent attorney and SETI League co-founder Orville Greene. Rob Lodder has served as a SETI League volunteer Regional Coordinator, and as a member of the group's Strategic Planning Committee. He and his students built and operate an active Project Argus radio telescope, and have been working on technology to assist members in getting involved in Optical SETI. Lodder serves as founding editor-in-chief of Contact In Context, The SETI League's online peer-reviewed scholarly journal. He has participated in every one of The SETI League's annual SETICon Technical Symposia, and helps to administer and present Contact In Context's annual *Best Ideas* awards. "Especially now that we are an all-volunteer organization," noted Dr. H. Paul Shuch, the group's volunteer Executive Director, "The SETI League's success and very survival depend upon such stellar contributions of time, talent, and energy as Rob Lodder has long demonstrated. He sets the standard for us all." ❖

## An Open Letter to Would-Be Transmitters by David Brin

Hello. My name is David Brin. I am an astronomer who is better known as an author of books such as *The Postman* (filmed by Kevin Costner in 1998) and *The Transparent Society*.

I am also a member of the Transmissions from Earth subcommittee of the International Academy of Astronautics SETI Permanent Study Group (<http://iaaseti.org>), the advisory body that has been charged with working out protocols and conventions having to do with the Search for Extraterrestrial Intelligence, or SETI. This study group has drafted and circulated the main internationally accepted documents concerning recommended standards for researchers and others who might receive or initiate contact by radio or other means with extra-solar civilizations.

I am writing to inform you that this subcommittee exists. A Protocol exists. And since you have announced an intention to beam messages from Earth into interstellar space, you may wish to familiarize yourself with these matters. What you propose to do comes under the category of "active SETI" and it has implications of which you may not be aware.

While this is not an official or majority point of view, a number of members of the subcommittee have called for a moratorium when it comes to deliberate beaming of messages from Earth at detection levels significantly above background. The matter - controversial both inside the committee and outside - is still being debated. In any event, enough prestigious scholars and scientists have expressed concern that it might seem reasonable to ask that you pause a little and consider.

At present there is a limited range of ways that Earth civilization has become detectable. A common belief holds that TV broadcasts have already screeched loudly enough for all to hear, but this fable has been disproved. Beyond a few light years, these signals - and even military radar beams - fade into background.

It is narrowly targeted beams that will far more likely call attention to our planet. Should we transmit such beams while knowing absolutely nothing about the situation out there? Everybody has a favorite opinion about what interstellar civilizations will be like. Hollywood portrays bizarre threats. Many others feel that advanced societies will naturally be benign. These unproved opinions are not at issue.

What is at issue is the presumption that a few people may commit our world down a no-return road, without taking any time to discuss the matter with others who have pondered deeply on this subject, and who might shed light on the possibilities, both good and bad.

While smiling at the ingenuity and entertainment value of this public relations gambit, I am also hoping that you will consider dipping a little deeper into the subject. There may be ways to get the effect you desire, while still behaving as responsible citizens of a tiny planet, all alone in a dark and unknown wilderness.

With cordial regards,

David Brin  
[www.davidbrin.com](http://www.davidbrin.com) ❖

## Event Horizon

SearchLites' readers are apprised of the following conferences and meetings at which SETI-related information will be presented. League members are invited to check our World Wide Web site ([www.setileague.org](http://www.setileague.org)) under *Event Horizon*, or email to us at [info@setileague.org](mailto:info@setileague.org), to obtain further details. Members are also encouraged to send in information about upcoming events of which we may be unaware.

**May 27 - 30, 2005:** *Balticon 39*, Baltimore MD.

**June 3 - 5, 2005:** *Rochester Hamfest*, Rochester NY.

**June 19 - 21, 2005:** *Society of Amateur Radio Astronomers Conference*, NRAO Green Bank WV.

**July 28 - 31, 2005:** *Universus 2005*, Osservatorio Astronomico Scientifico Gian Camillo Gloriosi, Montecorvino Rovella, Salerno, Italy.

**July 28 - 31, 2005:** *Central States VHF Conference*, Colorado Springs CO.

**August 4 - 8, 2005:** *Interaction World Science Fiction Convention*, Glasgow, Scotland UK.

**September 23 - 25, 2005:** *Mid Atlantic VHF Conference and Hamarama*, Wrightstown PA.

**October 8 - 9, 2005:** *AMSAT Space Symposium* Lafayette LA.

**October 17 - 21, 2005:** *56th International Astronautical Congress*, Fukuoka, Japan.

**October 27 - 30, 2005:** *Microwave Update*, Cerritos CA.

**April 22, 2006, 0000 UTC - 2359 UTC:** Eighth annual SETI League Ham Radio QSO Party, 14.204, 21.306, and 28.408 MHz.

**April 30, 2005:** Twelfth Annual *SETI League Annual Meeting and SETICon06 Technical Symposium*, SETI League Headquarters, Little Ferry NJ.

**June 2006 (dates TBA):** *Society of Amateur Radio Astronomers Conference*, NRAO Green Bank WV.

**July 2006 (dates TBA):** *Central States VHF Conference*, Minneapolis MN.

**August 23 - 27, 2006:** *L.A.Con IV World Science Fiction Convention*, Los Angeles, CA.

**September 8 - 10, 2006:** EuroSETI06, in conjunction with the Fourth International Congress for Radio Astronomy, Heppenheim Germany.

**September, 2006 (dates TBA):** *57th International Astronautical Congress*, Valencia Spain.

**April 21, 2007, 0000 UTC - 2359 UTC:** Eighth annual SETI League Ham Radio QSO Party, 14.204, 21.306, and 28.408 MHz.

**June 2007 (dates TBA):** *Society of Amateur Radio Astronomers Conference*, NRAO Green Bank WV.

**July 26 - 29, 2007:** *Central States VHF Conference*, San Antonio TX.

**August 30 - September 3, 2007:** *65th World Science Fiction Convention*, Yokohama Japan.

**September, 2008 (dates TBA):** *58th International Astronautical Congress*, Bangalore India. ❖

# Minutes of the Eleventh Annual Membership Meeting

17 April 2005, The College of New Jersey, Ewing, NJ

## Call to Order

The meeting was convened at 1004 hours EDT, in Armstrong Hall, The College of New Jersey, Ewing Township NJ, by Executive Director Dr. H. Paul Shuch. Eight SETI League members in good standing present. Our Bylaws requiring one percent of the current membership to be in attendance for the conduct of SETI League business, the above represents a quorum.

## Minutes of 2004 Membership Meeting

The Minutes of the 2004 Membership Meeting having been previously posted to The SETI League's World Wide Web site, a motion was passed to accept the minutes as published.

## Treasurer's Report

Presented jointly by the Executive Director and Secretary/Treasurer A. Heather Wood, covering the calendar year 2004 (unaudited).

1. Revenues: Dues and Contributions \$92,237, Interest Income \$52, Other \$2,642, Total \$94,931.
2. Expenses: Educational/Scientific Programs \$116,925, Management/General \$5,916, Fundraising \$1,365, Total \$124,206.
3. Revenues minus Expenses: (\$29,275) [a deficit].
4. End of 2004, SETI League account balances equalled \$7,166. End of 2003 balance was \$36,441.
5. 2005 Budget: Projected Revenues \$13,122, Program Expenses \$10,000, Management/General Expenses \$5,914, Fundraising Expenses \$1,365, Projected Deficit \$4,157, Projected Ending Balance \$3009.
6. The SETI League is undergoing an IRS audit for fiscal year 2003. No determination has yet been received.
7. This report was accepted by those present.

## Secretary's Report

Flyers have been mailed to inquirers; hundreds were distributed at conventions, etc.

## Executive Director's Report – 2004 Program Service Accomplishments

### (a) Science Programs:

- Coordinated 127 Project Argus radio telescopes in 23 countries, built and operated by volunteers, logging an estimated 100,000 hours of astrophysical observations. Argus stations analyzed and cataloged several candidate signals during 2004.
- Operated W2ETI Moonbounce Beacon for 4 1/2 months, providing 1600 hours of free microwave

calibration signals to the world's amateur and professional radio telescopes.

- Provided Committee leadership (as co-chairman) to the SETI Permanent Study Group of the International Academy of Astronautics.
- 246 members contributed an additional 1,000 additional years of processing time to the SETI@home distributed computing experiment.
- Performed laboratory measurements to help refute a claim of extraterrestrial technology on Earth.

### (b) Technology Programs:

- Designed and tested an analog power combiner circuit for the Very Small Array radio telescope prototype.
- Provided design consultation and proposal assistance to the Montecorvino SETI Telescope Array (MStar).
- Coordinated and archived four closed technical email lists.
- Inducted five more amateur radio astronomers into the Extra-Terrestrial Century Club.

### (c) Public Education Programs:

- Conducted EuroSETI04, The SETI League's first European Technical Symposium, and published Proceedings on CD-ROM.
- Conducted SETICon04, The SETI League's fourth annual Technical Symposium, and published Proceedings on CD-ROM.
- Distributed 15 copies of "Tune In The Universe!", a radio amateur's guide to the Search for Extra-Terrestrial Intelligence.
- Distributed 7 print copies of "The SETI League Technical Manual."
- Executive Director delivered ten public lectures in four countries, on radio astronomy techniques and related SETI science.
- Published more than a dozen technical articles in the popular and scientific press.
- Published third issue of "Contact In Context," a Web-based peer-reviewed SETI scholarly journal.
- Provided webmastering services to the Society of Amateur Radio Astronomers, the International Academy of Astronautics SETI Permanent Study Group, and Invitation to ETI.

### (d) Media and Outreach Programs:

- Published four issues of SearchLites, the quarterly newsletter of The SETI League, Inc.
- Coordinated and archived two open public email lists.
- Distributed six Press Releases and twelve Editorials to over 700 media outlets worldwide.
- Filed 52 weekly updates to The SETI League's extensive website, bringing its total document count to over 2800 pages.

- 65 volunteer Regional Coordinators in 49 countries conducted a dozen print and broadcast media briefings and interviews.
- Executive Director granted print media and broadcast interviews in the US, Canada, Italy, and Germany.
- Presented the tenth annual Giordano Bruno Memorial Award, the third annual Orville N. Greene Service Award, four Best Ideas Awards, and twelve SETI SuperStar Awards.

### Committee Reports

- **Awards Committee**

Report by chairman Dave Ocame.

During the year, 12 websites have received the SETI SuperStar Award.

Three finalists each were nominated for the Bruno and OG Awards, and one each award presented.

- **Legal Services Committee**

Report presented by Executive Director H. Paul Shuch, on behalf of Chairman Steve Carver (not present).

Our three trade/service marks were renewed for an additional five years, at a fee of \$300 each. Steve Carver is providing his time and legal services *pro bono*.

- **Strategic Planning, Membership Services, Finance, Hardware, and Software Committees**  
No report.

- **Internet Services Committee**

Report by Richard Factor:  
No major changes.

- **EME Committee**

Report delivered jointly by Richard Factor and chairman Dr. Allen Katz:

The amplifier, after running for three months without interruption then began to degrade. Allen Katz volunteered an intern to inspect it. After some discussion on repairing the old amp, Richard said he would look for a new amp unless Steve Kostro at Down East Microwave thinks the old one can be fixed. New antennae are a possibility: moving to yagis.

- **Very Small Array Committee**

Report delivered by Dr. Shuch:

Only small progress due to lack of funds. The preamp has been built Richard found some matched FETs on eBay. There is the possibility of a federal grant through Rob Lodder. A quote has been received for 32 matched LNAs at \$150 each. After this, the next phase is the coax.

### Old Business

No old business items pending.

### New Business

The 800 phone number was discussed (800-TAU-SETI). At approximately \$30 per month, it was decided to retain it.

A member requested a return to the previous SETICon format, with papers etc. Paul detailed the jobs that such a conference entailed:

- Conference Chair
- Facilities Chair
- Hotel Liaison
- Program Chair
- Proceedings Editor
- Publicity Chair
- Prize Chair
- Vendor Liaison
- Banquet Chair
- Hospitality Coordinator
- Registration Chair
- Marketing Coordinator
- Green Room Coordinator
- Awards Chair
- Audio-Visual Chair
- GoH Gopher

After some discussion, it was decided that the 2006 AGM will be held on 30 April 2006 at the SETI League offices in Little Ferry. Efforts will be made to return to the full conference format. Heather agreed to be Conference chair.

### Good and Welfare

The Bruno award was presented by Awards Chair David Ocame (via telephone) to James Brown.

### Adjournment

The Annual Membership Meeting was adjourned by the Executive Director at 1127 hours EDT on 17 April 2005.

The annual Board of Trustees meeting occurred immediately afterward. All members in good standing were invited to attend. The only business conducted at that meeting was Election of Officers, as follows:

President - Richard Factor

Secretary/Treasurer - A. Heather Wood

Executive Director - H. Paul Shuch, serving on a volunteer basis.

Respectfully submitted, A. Heather Wood, Secretary



**Remembering:**

**Prof. Philip Morrison**

by H. Paul Shuch, Executive Director

**Monday, 25 April 2005...** It grieves me to report the passing of a legend, and an honored friend. I have just been informed by his son Bert that Professor Philip Morrison, co-author of the world's first serious scientific paper on SETI, passed away quietly at home on Friday, 22 April 2005. He was 89 years of age.

Dr. Philip Morrison, Institute Professor and Professor of Physics at the Massachusetts Institute of Technology, was a distinguished theoretical astrophysicist and a pioneer in the search for extraterrestrial intelligence through radio communication. He authored scores of books, produced television documentaries, and lectured tirelessly around the world, despite the physical limitations imposed upon him by Post-Polio Syndrome. In one of his many roles as a science educator, Dr. Morrison served on the Board of Advisors for the television science series NOVA. In another, he was columnist and book reviewer for Scientific American. In yet a third, it was Phil Morrison who chaired NASA's early study groups on SETI.

Along with most of the bright young physicists of his generation, Phil Morrison spent the war years working on the Manhattan Project, the development of the first atomic bomb. Unlike many of his Los Alamos colleagues, he went on to become a staunch pacifist, anti-war activist, opponent to nuclear proliferation, and a co-founder of the Federation of American Scientists. I asked him, just a few years ago, if he regretted his wartime activities. "On the whole, no," was his paradoxical reply. "At the time, we believed Germany was close to developing an atomic bomb. Even when they failed to do so, ending the war with Japan remained a priority. The regrettable bombings of Hiroshima and Nagasaki did bring that conflict to an end, and saved countless tens of thousands of lives on both sides. My only regret is the dark period that followed."

Undeniably one of the patriarchs of SETI, Professor Morrison had long since gone inactive on the ham bands when in 1959 he coauthored "Searching for Interstellar Communications" in the British science journal *Nature*. His boyhood interest in Amateur Radio had motivated his interest in exploring the feasibility of microwaves for interstellar communication. During SETI's Golden Age, he inspired a whole generation of engineers and scientists, including the founders of The SETI League, to think beyond human limitations.

On a personal note, my own SETI interests were motivated by following in Phil Morrison's footsteps (albeit from a distance of 30 years). As an EE undergraduate at the Carnegie Institute of Technology, I had the privilege of operating W3NKL, the campus ham radio station he had founded three decades prior. From Carnegie Tech, Phil went on to earn a Ph.D. from the University of California, Berkeley. Many years later, so did I. Phil encouraged my SETI League efforts from the start. He did me great honor of writing the jacket blurb for my hypertext book "Tune In The Universe!" (Copyright ©

2001, ARRL), contributed generously to The SETI League of his time and financial resources, and over the years became a close friend and mentor.

Phil Morrison is remembered as much for his modesty as for his energy. Nearly a decade back, on November 7, my wife Muriel and I happened to be in Cambridge MA, where I was to interview that year's crop of outstanding MIT and Harvard graduate students. We rang up Phil's wife and longtime collaborator, the late Phylis Morrison, and asked if we could get together. She immediately suggested their favorite Japanese restaurant, where we met, dined, and talked until closing time, whereupon Phil insisted on picking up the check. From the restaurant, the four of us went to the Morrison's modest Cambridge flat, where we proceeded to sit up half the night, engaging in one of the free-wheeling and intellectually stimulating conversations for which the Morrises were noted.

A week later, having returned home, I began working on an essay which was to include a mention of Phil and his contributions to the art and science of SETI. In order to get my facts straight, I thumbed my well-worn copy of David Swift's "SETI Pioneers" to Phil's biography, and was shocked to read his date of birth: 7 November 1915. We had spent the whole evening of his eightieth birthday together, and neither Phil nor Phylis had said a word about it!

I rang up Phil, and asked, "Why didn't you tell me it was your birthday?"

He replied, "Because if you had known, you might not have come."

My last telephone conversation with Phil Morrison occurred seven weeks ago, following the death of my own father (they were of the same generation). I expressed concern for Phil's health, and we made plans to celebrate his 90th birthday, next November 7th. A father figure to many of us, Phil Morrison's death leaves a void that can never be filled - but I feel compelled to try. When I grow up, I want to be Phil Morrison.



**Prof. Morrison and Dr. Shuch regale each other with their ham radio adventures, at the 1996 BioAstronomy Conference in Italy.**



**Ask Dr. SETI:**

## Why Water-Based Life?

**Dear Dr. SETI:**

All contemporary astrobiology research seems to focus on water-based life. For example, a planet is described as being in the habitable zone of its star if its surface temperature is consistent with the existence of liquid water. Just because life on Earth is water-based doesn't mean all life in the Universe will be. Why are you restricting your studies to water planets alone?

A student  
Toronto

**The Doctor Responds:**

There are three possible answers to this very important question: a short one, a long one, and a flippant one. The short answer is that we are water-based life, therefore we know for certain that water-based life is possible. That some other basis for life might be possible is, at this point, only speculation.

The long answer involves the need for a solvent to sustain life, if for no other reason than to act as a transport mechanism for fuel (i.e., to carry an energy source throughout the organism, and to help dispose of waste products). There are at least five desirable characteristics of such a solvent, for the purpose of supporting life:

1. It should maintain a liquid state over a wide range of temperatures. That is, the spread between its freezing and its boiling points should be as great as possible. (Water, as you know, remains liquid over a 100-degree C range. That's among the widest liquid-state ranges of known solvents, which seems ideal for the purpose stated.)
2. It should be rather polar. A molecule with a "positive" and a "negative" side can form bonds more easily than an electrically symmetrical one. (Water is indeed quite highly polar.)
3. It should have high surface tension. The ability to glom together in drops, to climb plant stalks through capillary action, and to pool together and flow are all useful for biological processes. (Water does have high surface tension, as you can easily observe any time it is raining.)
4. It should be less dense in the solid than in the liquid state. An ocean that freezes from the bottom up will likely kill all life that may have emerged within it. (Water ice floats on top of liquid water, permitting life to flourish below frozen lakes.)

5. It, or its building materials, should be readily available. (Water is made from hydrogen and oxygen. Hydrogen is the most abundant element in the Universe, and oxygen is right up there among the top ten.)

The flippant answer actually raises another question. Water-based life is, in essence, life as we know it. We know exactly how to look for life as we know it. But how do we look for life as we don't know it? *We just don't know!*

Of course, all three of these answers apply to *organic* life. If we start talking about *inorganic* (non-biological) lifeforms, such as intelligent machines, then all bets are off. ❖

## Arecibo's Range

**Dear Dr. SETI:**

*I am writing a research paper about the Oort Cloud and I was wondering if you would tell me how many light years or kilometers the Arecibo Telescope can see into space?*

A Student (via email)

**The Doctor Responds:**

There's no easy answer to that question, because the Arecibo radio telescope is only one half (the receive part) of a communications link. The transmit side of the link is the particular signal being observed, and its strength will determine range. If I asked you at what distance you could see a light, wouldn't you ask whether I meant a flashlight or a searchlight?

For extremely powerful emitters (such as quasars) it should be possible for Arecibo to receive over many billions of light years. Weaker emitters (say, interstellar hydrogen clouds) are detectable over hundreds to thousands of light years.

Frank Drake once calculated that as a telecommunications facility, Arecibo could communicate with its theoretical twin anywhere in the Milky Way galaxy. That 100,000 light year range seems overly optimistic to me. When I ran the numbers, I came up with a more modest result of perhaps 10,000 LY (still a substantial distance).

A few years ago, the Arecibo radio observatory was able to recover the ten-Watt microwave beacon aboard the Pioneer 10 spacecraft, out beyond the orbit of Pluto. Today, however, that particular signal from beyond the edge of our solar system is no longer detectable at Arecibo, or anywhere else on Earth.

Used as a planetary radar, Arecibo has mapped the Moon and Venus, but not the outer planets. So take your pick as to the nature of the source, and that will help you to determine Arecibo's range. ❖



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**Annual Renewal: Is This Your Last SearchLites?**

SETI League memberships are issued for the *Calendar Year*. Please check the expiration date indicated on your mailing label. If it reads December 2004 or earlier, you have already expired, and *must* renew your SETI League membership **now!** Please fill out and return this page along with your payment.

**Please renew my membership in this category:**

Full Member	\$50 / yr
Supporting Member (elderly, retired, or disabled)	\$35 / yr
Scholarship Member (full-time students only)	\$25 / yr
Household Member (same address as a Full Member)	\$15 / yr
Household Life Member (same address as a Life Member)	\$300
Life Member (until we make contact)	\$1,000
Sustaining Life Member – a generous <i>annual</i> pledge of:	\$1,000 / yr
Patron (priority use of The SETI League's radio telescope)	\$10,000
Director (Patron membership plus seat on advisory board)	\$100,000
Benefactor (a major radio telescope named for you)	\$1,000,000

Annual memberships are issued for the calendar year. Those processed in January through April expire on 31 December of that year. Those processed in September through December expire on 31 December of the *following* year. Those members joining in May through August should remit half the annual dues indicated, and will expire on 31 December of the same year.

**Pleased to Accept Credit Cards**

The SETI League invites you to pay your membership dues and additional contributions via Visa or MasterCard. Please fill out the form below and return it with any order. We thank you for your ongoing support.

Circle One: Visa / MasterCard Exp. \_\_\_\_ / \_\_\_\_  
Card Number: \_\_\_\_\_

**Order Your Membership Premiums:**

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