

Conference Calendar

SETI League members are apprised of the following conferences at which SETI-related information will be presented. SETI enthusiasts are invited to check the web at <http://www.setileague.org/general/confnce.htm>, or email info@setileague.org, to obtain further details.

* - SETI League participation confirmed

- * **January 15 - 17, 1999:** *Arisia*, Boston MA.
- * **March 28, 1999:** *SETI League Annual Meeting*, Little Ferry NJ.
- * **April 2 - 4, 1999:** *Balticon 33*, Baltimore MD.
- April 9 - 10, 1999:** *Southeastern VHF Conference*, Atlanta GA.
- * **April 16, 1999:** *Susquehanna Valley Amateur Astronomers*, Bucknell University, Lewisburg PA.
- May 14 - 16, 1999:** *Dayton Hamvention*, Dayton OH.
- * **July 11 - 14, 1999:** *Society of Amateur Radio Astronomers*, NRAO Green Bank WV.
- * **July 22 - 25, 1999:** *Central States VHF Conference*, Cedar Rapids IA.
- August 2 - 6, 1999:** *6th Bioastronomy Conference*, Kohala Coast HI.
- September 2 - 6, 1999:** *Aussiecon Three / 1999 Worldcon*, Melbourne Australia.
- * **September 23 - 26, 1999 (tentative):** *Microwave Update*, Richmond VA.
- * **March 26, 2000:** *SETI League Annual Meeting*, Little Ferry NJ.
- May 12 - 14, 2000:** *ARRL National Convention and Dayton Hamvention*, Dayton OH.
- July 20 - 23, 2000:** *Central States VHF Conference*, Winnipeg, Manitoba.
- August 7 - 19, 2000:** *XXIVth International Astronomical Union General Assembly*, Manchester University, UK.
- August 31 - September 4, 2000:** *Chicon 2000 World Science Fiction Convention*, Chicago IL.
- September 9 - 10, 2000:** *European Radio Astronomy Club Second International Convention*, Heppenheim Germany.
- * **February 12 - 14, 2001:** *OSETI III Conference*, San Jose CA.
- * **August 30 - September 3, 2001:** *Millennium Philcon World Science Fiction Convention*, Philadelphia PA.



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the Quarterly Newsletter of The SETI League, Inc. Volume 5 Number 1 Winter 1999



Introducing:

Our Volunteer Coordinator for Finland

Michael Fletcher was born in Farnham in 1962 near his hometown of Farnborough, Hampshire, England. His mother is Finnish and his father (now deceased) was from Normandy, Surrey. The family decided to move to Finland in 1970, so, at the age of nine, Michael ended up in a Finnish school with his Duffel coat and Teddy Bear. It didn't take him long to recover and acquire total oral and written control of this unusual language said to descend from Hungarian (the aliens from outer space), Russian, Swedish and a few other strange races from far out.

Having matriculated by the age of 17 (Michael was permitted to jump one class in school having started his education at the age of five), he continued his studies at the Helsinki Technical College (nowadays the Helsinki Institute of Technology). By this time he had been a ham radio operator for several years and indicated a strong tendency toward experimenting with microwave equipment. After graduation from college Michael joined the Anritsu Corporation.

Michael's enthusiasm for microwaves has led him to many interesting projects including participating in constructing a 10 GHz payload for the Phase III D amateur satellite. Michael has also constructed various microwave systems used for Finnish firsts in Earth Moon Earth communications (more on his homepage).

Michael's SETI work is very much driven by his interest in microwave work and he is willing to give help on RF and microwave hardware construction and alignment in his extensive 100 square meter amateur laboratory.

Hardware Corner:

Disabling AGC in the ICOM R-8500 Receiver by Rich Tyndall, NJ1A (NJ1A@erols.com)

Introduction and Disclaimer:

The Icom model R-8500 scanning microwave receiver is gaining popularity among SETI League members. Its chief drawback is an Automatic Gain Control (AGC) circuit which cannot be turned off. AGC effectively reduces the sensitivity of your Digital Signal Processing (DSP) program by making weak signals stronger, and strong signals weaker. These modification instructions allow you to disable AGC in the Icom R-8500. They involve removing (actually, destroying) one chip capacitor on the receiver's main board, and will most assuredly void any receiver warranty. In addition, the modification will render your signal strength meter ("S-meter") inoperative. SETI League members performing this modification do so at their own risk.

Notice: Read and understand this document before attempting the modification. (FYI: Your warranty may be adversely affected.)

Warning: The main board could be damaged by static electricity. Be sure to wear a ground strap after the top cover is removed.

1. Remove any power, audio, RS-232 etc. cables plugged into the rear panel.
2. Remove top cover per steps 1 and 2 on page 37 of manual. (Ten #2 Phillips screws.) Lift the cover off slowly being careful not to break the speaker cable. Unplug it from main board.
3. Remove 13.8 DC Power connector by squeezing the retaining clips on each side of connector while pushing in from the rear. (It may be tight.)
4. Remove all the #2 Phillips screws holding down the main board.
5. Remove the two #1 Phillips screws holding down the RS-232 connector.
6. Remove the steel heat sink clip holding down 13.8 VDC power cable. **Note:** In order to lift the main board up to do the mod without removing too many cables, you will need to provide slack in some cables and unplug the ribbon cables.
7. Unbend the metal cable holder clips near the white ribbon cables to provide the necessary slack. (These clips hold small coax, etc.) You could use a pen to make a line on the ribbon cables, so you will know how far to push them back in during reassembly.
8. Unplug the (4) white ribbon cables by:
 - (A) Gently lifting up (2 mm) on the locking tabs on each end of the connectors until they are in the UP position.
 - (B) Grasp the white ribbon cable on both sides and pull it out of the socket.
9. Grasp the large metal (filter) clip in the center of the board and lift. (If the board does not move, you missed a screw.)
10. You must lift the board at an angle and then toward the front panel, so as to allow the long RCA sockets in the rear panel to clear their holes.
11. Once the rear of the main board can be lifted and flipped over, you can locate C-114 and perform the mod by cutting

the center of C-114 in with small wire cutters. [**Caution:** Wear safety glasses.] Use a toothbrush to clean the site, then inspect it with a magnifier to ensure the AGC RF path is now open.

Hardware Reassembly:

Reverse the above steps. Before replacing the main board screws, check around the sides to insure that you don't pinch any cables under the edges. (Watch those cables bundled with the +12VDC cable.)

Be sure that the locking tabs on both ends of the ribbon cable sockets are in the UP position before plugging the flat cables back in. As you apply down pressure, you will feel some resistance and then the cable will 'Click in' and bottom out in the socket. Push down on both ends of the locking tabs until they snap into locked position. After reassembly, tune the R-8500 to a strong signal, you should not see any S-meter movement except in the WFM mode.

Addendum: Adding an AGC Switch

by Chris Dapples, KF7KN (ccdapple@wtp.net)

Performing the foregoing modification involves cutting a SFM capacitor (C114). This permanently disconnects the AGC function in AM, SSB and CW modes. However, I have found a way to install a switch to allow AGC disconnect as wanted.

Step 1: Prepare a small toggle switch with about 12 to 15 inches of mini-coax (twisted pair will work too.) I used a Radio Shack micro-mini SPDT toggle switch (RS 275-625). Prepare and tin about 3/8 inch of the wire to connect to the main circuit board of the 8500.

Step 2: Remove the main circuit board as per the already posted instructions. Place the board upside down in front of you with the rear edge (with the RS232 connector) nearest to you. Measure exactly 4 inches from the left card edge and 15/16th of an inch back from the nearest card edge (with RS232 connector). You should find at this point a trace that is an inverted and backwards "L" shape with C114 on the short leg and the double diode (D20) chip on the long leg. Just below the diode chip (nearer you) the trace splits into two parallel traces and there are two feed-through holes at the coordinates you measured. Clean the copper of these holes and carefully solder the ends of the mini-coax to these holes.

Step 3: While the main circuit board is out of the receiver case, use a reamer or drill (3/16) to enlarge one of the long slots just to the left of the 12VDC connector to receive the switch. Be sure to remove any metal filings that result from the drilling.

Step 4: Replace the main circuit board to the receiver case routing the wires to the switch to the front side of the board and then back across the top of the board. There are several convenient notches in the circuit board where the ribbon cables connect where the wires can come from underneath without binding. Replace the ribbon cables, but, before fastening down the screws, power up the receiver and tune a strong signal. The switch should toggle the AGC on and off as indicated by the S-meter showing a strong signal when the AGC is active and showing nothing when the AGC is deactivated. If everything is working and there are no shorts of your switch wires to the case under the circuit board, screw everything down and replace the cover.

Step 5: Pat yourself on the back for completing a good job!

Guest Editorial:

What Should We Tell the World?

by Douglas A. Vakoch, Ph.D.

Receiving a signal of intelligent extra-terrestrial origin would radically and permanently change our view of ourselves and our place in the universe. The impact of such news would probably vary over the course of time. Upon first receipt of a message, we would need to deal with the fact that we are not alone. But after that, the impact depends a lot on how readily we could understand the message. I would imagine that the differences between us and an extraterrestrial civilization would initially prevent us from understanding the world as ETI does. But if, gradually, we are better able to understand their experience of the universe and of themselves, and if we can begin to make meaningful comparisons between their civilization and our own, then we might begin calling into question some of our assumptions about the way our own society must be. And although this may not be easy, at least at first, ultimately it may be very liberating for us to start to perceive the universe as members of another civilization do.

This same sort of change can be seen when different ideologies make contact with one another on earth. Initially, the ideology of a different culture or group may be seen as quite alien and even as evil or dangerous. But for those who honestly try to understand an alternate way of life in its own terms, an expansion of world views can occur. If, on the other hand, we attempt to fit an alien world view into our own prior preconceptions, then we lose a tremendous opportunity for growth.

One of the greatest challenges of truly entering into a dialogue with an alien world is that it can be very disorienting. To call into question our habitual ways of life may leave us wondering WHAT is true and constant. There are limits, however, to how much new material any individual and any generation can assimilate. These limits to new perspectives are seen throughout the history of science, insofar as the scientists most open to revolutionary ways of viewing the universe have tended to be younger people, for whom the traditional view is not as deeply entrenched. Thus, at a cultural level, we only gradually incorporate new experiences. And at a personal level, if we make contact with ETI, basic psychological mechanisms for maintaining our personal equilibrium would help protect us from complete relativization of our beliefs and values.

Do SETI scientists have ethical obligations to communicate to the public the potential impact of a search? In my opinion, we do. And in addition, one of our responsibilities is to communicate to the general public the importance of fostering the exploratory spirit. There may well be some people who would, at least initially, prefer not to hear that there is intelligent life beyond earth. But as I look back on our history as a species and as a civilization, it seems that one central characteristic of being human is to attempt to understand ourselves and our world around us. To me, this is one of the core values that motivates SETI. And I would hope that we would not shrink back from that goal, and that we would not avoid a few growing pains as we attempt to understand better our place in the universe.

Rebuttal:

Nobody Here But Us Earthlings?

by Dr. H. Paul Shuch, Executive Director

Editor's Note: On 16 July 1997, *The Wall Street Journal* published a letter by Guillermo Gonzales, a research astronomer at the University of Washington, titled "Nobody Here But Us Earthlings." In that article, Gonzales made a case for humanity's uniqueness in the universe. He ended by stating "We should not be asking: 'Are we alone?' We should be asking instead: 'Why are we alone?' " What follows is our response.

"Nobody Here But Us Earthlings" (WSJ, 16 July 1997) serves as a prime example of how two scientists can look at the same data, upon which they agree, and draw totally disparate conclusions. Dr. Gonzales states, "It becomes obvious *why* we have not found any evidence of extraterrestrial intelligence" (emphasis added). I counter that the data shows only that we have detected no such evidence. As for why, there could be as many reasons for a lack of evidence as there are habitable planets orbiting Sun-like stars.

Any conclusion that we are alone in the Universe (Dr. Gonzales' null hypothesis) is a welcome gauntlet flung at the feet of those of us devoting our careers to SETI. It is axiomatic in science that you can never prove the negative. Rather, it falls to us to investigate the alternative hypothesis, by designing and conducting experiments to seek evidence of other life in the cosmos. That we have yet to succeed should surprise nobody -- it's only an eye-blink ago, by the cosmic clock, that we even learned how to detect radio waves. Not only are our electromagnetic searches for other life yet to scratch the surface, we haven't even felt the itch.

As computer power is continuing to double every year, our search sensitivity can do nothing but improve. A disciplined search will eventually lead us to one of two possible conclusions: that we are not alone in the Universe, or that we most likely are. Either possibility boggles the imagination.

Bruno Nominations Now Due

Nominations for the 1999 Giordano Bruno Memorial Award, The SETI League's highest honor, are due by January 1, 1999. Named in memory of the Italian monk burned at the stake in 1600 for postulating a multiplicity of inhabited worlds, the Brunos are awarded for significant contributions to the art and science of SETI. Neither nominator nor nominee need be SETI League members, although a written nomination, citing the contributions of the nominee, is required.

The 1999 Bruno Award winner will be announced at our fifth Annual Meeting on Sunday afternoon, 28 March 1999. Past Bruno recipients include:

1996 - Dr. D. Kent Cullers, WA6TWX

1997 - Daniel Boyd Fox, KF9ET

1998 - Ken Chattenton, G4KIR; Trevor Unsworth, G0ECP

Please email your 1999 Bruno award nominations now to bruno@setileague.org, fax them to 1 (201) 641-1771, or mail them to SETI League headquarters.

So You Want To "Get Into" SETI

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SETI League Northeastern US Regional Coordinator

The Dream

So you have spent your whole life hearing about, reading about, and seeing humanity's numerous interpretations of alien life beyond Earth. You look up at a clear night sky full of stars and wonder if someone else is also sitting on some alien world around one of those suns, pondering the same thoughts as you.

Eventually, your intellectual curiosity builds to the point where you must do more than just read and think about alien beings: You want to see for yourself if they really are out there, somewhere in our vast Universe.

The Realities

First you discover that, despite everything you see and read about traveling to other star systems in science fiction, in reality we are a long way off from reaching even the nearest of suns with any kind of actual vessel. Besides, with over 400 billion stars in our Milky Way galaxy alone, searching their countless worlds with star probes would take many generations of human lives to accomplish.

One reason for this dramatically slow process is, ironically enough, due to the fastest achievable velocity in existence: The speed of light and radio waves. The universal speed limit is about 300,000 kilometers per second. To go any faster than this would require more energy than exists in the entire Universe, and that just is not feasible.

Granted, light speed is incredibly fast, but even if you had a starship which could achieve 99 percent of that velocity, it would still take you 100,000 years (measured in Earth time, but not allowing for the accelerating and decelerating phases of the trip) just to go from one end of the galaxy to the other. As for the various faster-than-light (FTL) proposals, such as cosmic wormholes and warp drives, they are still very much in the realm of theory.

Conversely, this also means that the sheer volume of Milky Way star systems and the incredible amounts of space between them make the chances that alien races would construct large fleets of starships, find Earth, journey many light years to our planet, and then spend time here, quite slim.

Most often reports of alien visitors turn out to be hoaxes or misinterpretations of natural and human-made phenomenon. If anything, UFOs and abduction stories tell us far more about human psychology and culture than about anything or anyone from other worlds.

Then you learn that some genuine scientific methods for finding extraterrestrial life actually exist. Some astronomers and engineers are using giant optical and radio telescopes to listen and look for signals from alien civilizations which may be trying to let the galaxy know that they exist and want to make contact with their celestial neighbors. Other scientists hope to find less advanced -- but no less interesting -- life forms on various planets and moons in our own solar system.

You are overjoyed that not everything about the Search for Extraterrestrial Intelligence (SETI) is either just science fiction or destined for some future era. You might actually be able to personally satisfy your desire to know if We Are Not

Alone. Maybe you can even be sitting at the controls of the telescope when that first message from the stars reaches our blue planet, forever changing the course of human history.

More Realities: Can You "Do" SETI?

In an ideal world, the search for life beyond Earth would be one of the highest priorities for humanity. To know if other beings -- especially intelligent ones -- exist with us in the Cosmos, to contact them and hopefully learn something of their perspectives on reality, and perhaps even more. Large amounts of resources, time, and manpower would be devoted to this ultimate quest for knowledge.

To anyone who knows how vast the Universe is in terms of its size and quantities of celestial bodies, it should be the goal of every intelligence such as ours to seek out others in space to learn from them and find our true place in existence.

To quote from Carl Sagan: "In a very real sense this search for extraterrestrial intelligence is a search for a cosmic context for mankind, a search for who we are, where we have come from, and what possibilities there are for our future -- in a universe vaster both in extent and duration than our forefathers ever dreamed of."

But noble intentions and plans do not always occur as hoped for in reality. The concept of extraterrestrial life and the quest for it has been on a long and obstacle-laden road ever since the idea first appeared among a few brilliant thinkers in ancient Greece over two thousand years ago. For millennia after, however, even thinking that intelligent beings could exist beyond Earth was considered blasphemy! After all, we appeared to be at the Center of the Universe, where everything literally revolved around us. Existence was made just for humanity by the gods: To think that it could be shared by anyone else was considered an absurd idea.

Once we began to enlighten ourselves with science, philosophy, and technology, such attitudes began to shed away in favor of freely thinking about such possibilities. We were no longer the Center of Everything, but rather Earth was just one of several planets orbiting what turns out to be an average yellow star among hundreds of billions of other suns in an average spiral galaxy in a Universe with hundreds of billions of such star islands scattered throughout the vastness.

Of course with this freedom of thought and expression, some people went too far with the idea of extraterrestrial life and intelligence. Percival Lowell stands out as a prime example here. In the 1890s, Lowell considered the straight lines perceived on the planet Mars to be a huge system of canals constructed by an advanced race of Martians to bring water from the planet's polar caps to their great cities along the equator. The only evidence Lowell had for this was his imaginative speculation.

Lowell supported and promoted this idea with great gusto and publicity. Many astronomers, however, felt Lowell was assuming a great deal from such scant and uncertain evidence. When it finally became generally accepted that the "canals" were really just optical illusions created by the human eye and mind trying to make patterns out of the indistinct natural surface features on Mars, professional attitudes towards alien life turned negative.

Add to this the growing popularity of science fiction with its bug-eyed monster portrayals of ravenous, conquering ali-

ens, and then the business of Unidentified Flying Objects (UFOs) as alien spaceships doing all sorts of strange things to the populace, and astrobiology was given a major setback from which it is still recovering today.

We are finally at a stage where searching for extraterrestrial intelligence is no longer completely considered a crazy or foolish idea. The human race is finally beginning to grow up and expand its mental and physical horizons. SETI is becoming accepted, especially once the scientist pioneers showed that it could be done, even though no definite signal of alien origin has yet been proven.

Now that you are riding in the wake of those who paved the way for you to make even considering doing SETI possible, which route do you want to take? And what do you need to follow your plans?

The Professional Route

The first item I want to make clear is that at present, almost no one who is conducting professional SETI started out doing SETI in their careers. Very few places conduct professional SETI -- The SETI Institute being among the most notable exceptions -- and the majority of their employees came from careers in astronomy and engineering. Most other SETI projects, such as BETA and SERENDIP, are run primarily by skilled volunteers with donated funds.

So if you want to hunt for aliens, you have to learn more than just how to sit at a monitor and wait for a needle to jump. And don't expect to get paid as much as other professions in terms of financial rewards, if at all. But usually one does not get into this field just for the material benefits.

Getting a degree in astronomy is my first recommendation. You have to understand the fundamentals of the Universe before you can truly begin to comprehend what life forms might be out there and why. If you don't even have an idea of where to look for them, the search will be essentially a waste of time for you and everyone else. The same applies to my recommendation of studying physics.

Knowledge of computers and radio technology is highly recommended, as conducting SETI takes up massive amounts of computer data crunching power. SETI sifts through literally millions and billions of data bits per second, and trying to find some faint artificial signals in a Universe full of very noisy natural objects is a job for nothing less than advanced computers which can work fast and handle lots of information at once. Knowing how to work with such machines will be a big plus.

I would also recommend learning biology and chemistry. The beings you hope to pursue may be quite different from anything you might find on Earth, but understanding the fundamentals of how life forms on this planet exist and function will give you a good base to work from.

Since you will be searching for intelligent beings who will have some form of advanced technological civilization (otherwise we won't be able to detect ETI from Earth with our current radio and optical telescopes), I would suggest studying sociology to learn about how cultures develop and function with themselves and others. There certainly are a wide variety of human societies to study which will give you at least some ideas for what alien cultures just might be like and their motivations and methods for reaching out to the

galaxy at large. Plus all of this is good for you to know for your own intellectual benefit and personal growth. Yes, this is my "it builds character" statement.

All Creatures Great and Small: Becoming an Exobiologist

Of course the alien life you can search for does not necessarily have to be intelligent, at least on the technological civilization level. NASA and many universities are developing very nice programs on searching for extraterrestrials of the much simpler kind. Our latest journeys into the solar system with planetary probes have shown that some of our neighboring worlds might not be as hostile as once thought to microbes and other hardy and relatively unsophisticated creatures.

For example, NASA is quite interested in finding either fossils of Mars life that lived there several billion years ago, or microbial life that still thrives on the Red Planet, perhaps dwelling under the surface where conditions are a bit wetter, warmer, and safer than above ground. Jupiter's smallest Galilean moon, Europa, appears to have a liquid ocean underneath its incredible ice crust. Some scientists are speculating that conditions in those alien seas might be just right for harboring some aquatic Europeans.

These are just two possibilities you could end up researching if you decide to become an exobiologist -- a career that didn't even exist in any true form until well after the advent of the Space Age. Much of the learning tools which applied to professional SETI also apply here, though with added emphasis on biology and chemistry.

You may initially think that finding an alien microbe won't be as thrilling as detecting a whole civilization of very intelligent beings: But just look at the wonder and excitement generated by the possible microfossils found in Martian meteorite ALH84001 when their discovery was announced in 1996.

It is most important to realize that finding any kind of life form that did not originate on planet Earth will be the key evidence humanity needs to let us know that we are not alone in the Universe. And finding organisms in our solar system could happen long before we come upon beings from other planetary systems.

The Amateur Route

While you probably won't make a living at doing SETI the amateur way, the wonderful thing about living in this era is that the search technology has reached the point where any serious amateur astronomer (non-Ph.D.) with a few hundred to a few thousand dollars (or equivalent currency) for the right equipment can actually conduct a serious search for other galactic civilizations. You can actually possess the technological ability to scan the skies with devices that would have been the envy of most professional institutions just a decade or two ago.

The extra beauty of doing your own SETI project is that you can essentially be your own boss as to how things are run. SETI does not have to belong only to the "big" boys and girls.

Naturally, to conduct amateur SETI, it will help to have a more than casual interest in astronomy, a working knowledge of telescopes -- radio and optical, depending on which type of amateur SETI you want to pursue (more on that later) -- a working knowledge of computers, a good place to set up your observatory, plenty of free time, and some extra spending cash. Yes, if you want to do serious astronomy and/or SETI, it can't be done properly as a weekend hobby.

Of course you can do this any way you want, but since we do not know who may be sending signals from out there by what methods, when, or where, a near-constant vigilance is the only way to be sure of catching their call when it comes. And since it is likely that such signals will not be very powerful, especially to amateur equipment, it will also make a major difference as to how "serious" your equipment is as well.

Amateur SETI Organizations: The Microwave Approach

Another nice thing in this era of computers and the Internet is that you don't have to be alone in pursuing your personal SETI dream. There are some actual amateur SETI organizations which can help you with all aspects of your search plans.

If you want to find alien intelligences in the microwave (radio) realm, the most common pursuit at present, check in with The SETI League. The SETI League, Inc. was founded by Richard Factor in 1994, in response to the United States' Government cutting all funds for NASA's SETI program, called the High Resolution Microwave Survey (HRMS), and the Superconducting Super Collider (SSC) in October, 1993.

Executive Director Dr. H. Paul Shuch felt that between the advancements in computer technology and the vast numbers of actual and potential radio astronomers around the world, a serious amateur effort could be mounted to have a constant global coverage of the sky, free from the budget-cutting politicians and scant time on the professionals' giant radio telescopes.

The SETI League's Web site contains just about everything you need to know about setting up your own radio telescope for the search. They can also postal mail you the same information if need be. There is also loads of information on SETI in general.

The Optical Approach

There is another way one can look for ETI transmissions that briefly gained prominence in the early 1960s, only to be overshadowed by the microwave field until just recently: The optical spectrum.

While not as popular or well known to those with a casual knowledge of SETI due to microwave's dominance for the past three decades, optical SETI seeks to detect pulsed and continuous wave laser beacons signals in the visible and infrared spectrum. To truly advanced societies, laser communications offer a way to transmit large amounts of audiovisual information over vast distances. Seeing as we do not exactly know how ETI might communicate, looking for them in both the microwave and optical spectrums seems the only logical way to cover all the bases.

For the past several years, Dr. Stuart Kingsley of Ohio, who has often referred to himself as a "frustrated astronaut," has led the effort to promote optical SETI for both amateurs and professionals. He has designed his own system called the Columbus Optical SETI Observatory. At first glance, it looks like the typical kind of observatory you would find in a serious amateur astronomer's backyard. But Dr. Kingsley's choice of targets goes beyond planets and stars to the very beings which may dwell in other star systems.

Seeing as more amateurs have optical telescopes than radio ones, it can be relatively easy to adapt your system to con-

duct this kind of SETI. Dr. Kingsley has provided a great deal of information on how to do this in his Web site.

As with microwave, while you won't need a large radio dish, you will still require a dedication and seriousness to astronomy, a working knowledge of telescopes and computers, a good place to set up your observatory, plenty of free time, and some extra spending cash.

Beyond Radio and Lasers

Of course ETI might be sending messages through the Milky Way using techniques which are neither radio nor optical, but most of these methods are far beyond current amateur -- and in some cases professional -- capabilities. Thus they will remain out of the main scope of this article.

Beyond the Observatory

If you decide not to become an active SETI scientist, but still want to make some kind of a living in the field, you can always pursue other avenues that, while they may not allow you to find ETI in person, can go a long way towards making those discoveries possible. One avenue is to write about extraterrestrial life for periodicals and Web sites. You do not have to be a professional exobiologist to get published on the subject matter in the popular science magazines. Your research into alien life could go far in making breakthroughs in a field that still has so many unknowns to answer.

You can also write about astrobiology and SETI to explain its intricacies to the general public, a valuable service in its own right. Just think, your works could inspire others to become scientists in the SETI field and elsewhere, just as you were probably once inspired by similar circumstances.

Most important, don't ever forget in your pursuit of alien life to enjoy what you are doing. SETI and its related fields should always retain at least some of the wonder and excitement which drew you to it in the first place. Never forget to keep reading, thinking, and speculating about life out there, whether you pursue this as a profession or just an "armchair" enthusiast. You will do yourself and the field a great deal of good with this one basic point.

The Choice is Yours

Despite how it might seem at first glance, my goal with this article is not to discourage you from "doing" SETI. Rather, I am presenting to you up front the realities of what is involved as the field stands now. It would be worse for you to get all worked up and make elaborate plans about SETI, only to be shot down in midstream. If exploring the stars is your dream, learn how to do it realistically, rather than be defeated out of lack of knowledge on the subject.

If you discover that you do not really want to pursue SETI beyond reading and thinking about it, then at least I hope I saved you some time and energy on the matter so that you can still enjoy the subject. Remember, you do not have to make your own SETI station to participate in this great endeavor. Thoughtful speculation can be just as helpful with so many unknown factors out there which have yet to be found.

If you are still determined to pursue either a professional career or serious amateur goal to do SETI, then more power to you! At the very least, you will be well rewarded in terms of what you discover about yourself and the Universe as a whole.

Who knows, maybe someday you will be the one sitting at the observatory controls when the signal of a lifetime comes drifting in from deep space. With a Cosmos as large as ours, the possibilities are truly astronomical.

Ask Dr. SETI™

Send your questions to Ask Dr. SETI, PO Box 555, Little Ferry NJ 07643, or email to askdrseti@setileague.org. Remember, he's not a *real* doctor (but rather, a Ph.D., the kind who actually has to work for a living!). For health questions, consult a competent medical professional.

Dear Dr. SETI:

I am extremely interested in project ARGUS, however I do not understand a couple of things. First, why choose a frequency associated with water? After all, we are carbon-based lifeforms dependent on water, yet we use all types of high and low frequency transmission. You can't take a cell phone or any microwave transmission and directly relate that to water, so why pick the "Water Hole"?

Monty G.

The Doctor Responds:

The "water hole" frequencies are not directly related to water, Monty, that's just a poetic description. In the quietest part of the sky, in the microwave region where interstellar space is most transparent, are two radiation lines which can be seen from anywhere in the cosmos. One is from interstellar hydrogen, the other from hydroxyl. Hydrogen plus hydroxyl forms water under the proper conditions, hence the name. These radiation lines are signposts which are not geocentric, of which any civilization which has radioastronomy will be aware. Since we're already looking for astrophysical phenomena in this region, and it's very well suited to interstellar propagation, why not seek civilizations there as well?

Dear Dr. SETI:

Many of us live in apartment, condos or 'controlled neighborhoods' that do not allow 10 meter dishes and the like. But I am wondering if anyone is using the small 16" dishes that is made for PrimeStar and USSB television reception. Are they too small? Can they not be modified to do any useful scans?

*Keep up the good work.
SB, Winston-Salem, NC*

The Doctor Responds:

Unfortunately, the Ku-band DBS dishes don't appear particularly practical for interstellar communications. All of our sensitivity calculations are based upon the gain of the larger C-band dishes. (Of course, if we happen to be off by several orders of magnitude as to what power levels other civilizations might be transmitting, then all bets are off! But practically speaking, we tend to calculate capabilities assuming radiated powers similar to those emanating from Earth. That's the conservative approach.)

I doubt that it's practical to scan the skies with the Direct Broadcast Satellite dishes, but they've proven a boon to amateur SETI in another way. Since their proliferation, an abundance of the old-style BUDs ("Big, Ugly Dishes") have come up for grabs, and many of our members are acquiring them to build their own SETI stations.

If you happen to be an apartment dweller or similar, it may not prove feasible for you to build your own SETI station. However, don't be discouraged; there's much else which you can contribute to our quest. We are ever in need of hardware designers and programmers and writers and public speakers and fundraisers and ... the list is endless. And, of course, they also serve who merely pay their dues. Since The SETI League receives no Government support whatever, by just becoming a member you're helping us to complete the research Congress wouldn't let NASA finish. We do hope you'll be choosing to join The SETI League.

Dear Dr. SETI:

I live in a rather densely populated suburban area in a city of 400,000 people. Lots of radio emissions around here, to be sure. How much interference can I anticipate? and would this interference be enough to drown out (or otherwise make indiscernable) the signals I'd be looking for?

Chris, The Suburbs

The Doctor Responds:

Radio frequency interference (rfi) is a very real problem in and near cities, Chris, but not an insurmountable one. Of all the antenna designs which have been used for SETI, the most immune to radio frequency interference is the properly aimed and illuminated parabolic reflector, or "dish."

What many of our urban members do is aim their dish straight up ("birdbath" mount). Since any direction in the sky is as likely as any other as a source of at least nearby signals, this keeps you very much in the running. (Out to about 300 parsecs [1000 light years] or so, stars are pretty uniformly distributed anyway.) Under-illuminate your dish (see this article) to minimize sidelobes. Keep your dish low (on the ground is fine; putting it on a tower exacerbates the rfi problem). Use plenty of filtering between the LNA and receiver. And hope for the best. Remember that if you can program your signal analysis software to recognize and ignore known sources of rfi, your false alarm rate goes down and detection of a valid SETI hit is facilitated. Radio frequency interference is only fatal to SETI if it convinces us not to search.

Dear Dr. SETI:

Is there any way I can convert a satellite TV receiver, down converter, LNA and feedhorn for SETI use? I have quite a bit of equipment just sitting here on my desk. I got all this stuff free with a dish so if I can convert it I'm out nothing. It just seems like I should be able to adapt this equipment for SETI use. Any ideas?

Thanks, JS

The Doctor Responds:

4 GHz (the band at which your satellite TV equipment operates) is just as viable a frequency for SETI as any other, so, by all means, this is worth a try. The LNA, polarization rotor and feedhorn could certainly be used as-is. The receiver itself is not likely to be particularly useful (unless, as happened in the film Contact, the aliens choose to send us TV signals!). The downconverter would probably require extensive modification. The reason is, a satellite TV channel is typically 40 MHz wide, so the converter need not exhibit particularly good frequency stability (and, in fact, does not). Our FFT bins for SETI are typically 10 Hz wide, so we expend a lot of effort on making our converters very frequency stable. You could probably phase-lock the LO in the downconverter to a very stable reference oscillator and use a communications receiver at the IF output, but this becomes a major engineering effort (and may or may not be worth the bother).

One very successful 4 GHz SETI system based upon TVRO hardware is Project BAMBI. You may wish to visit their web site for technical details.

By the way, 4 GHz is a great frequency range for continuum radio astronomy (for which you can use a TVRO receiver). In fact, the discovery of the cosmic background radiation was made in this band (by Penzias and Wilson at Bell Labs; work which won them their Nobel Prize. Only don't expect to be able to measure the cosmic background radiation with a satellite TV dish!).

SearchLites, Volume 5, Number 1, Winter 1999.
SearchLites, ISSN 1096-5599, is the Quarterly Newsletter of
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