Introducing:

The SETI League's Secretary

by H. Paul Shuch

Heather Wood, a British subject residing in the US, is living proof of the existence of intelligent aliens. She came on board at the very beginning as volunteer administrative assistant to our Executive Director, and was appointed Secretary two years later. If you received this newsletter, it is because it was folded, stapled, and mutilated personally by Heather. If this newsletter didn't arrive, you have only Heather and the Postal Service to blame.

Like most of her fellow Mensans, Heather hasn't quite figured what she wants to be when she grows up. She burst upon the folk music scene quite successfully in the 'Sixties, as one third of the vocal group *Young Tradition* (their collected works are only now being reissued on CD), but soon discovered that playing clubs at nine pounds a gig is not the best way to support oneself in royal style. There followed a succession of careers in food service, military service, writing, publishing, music recording, computers, electronics manufacturing, and banking. Which makes her eminently qualified for the multidisciplinary aspects of SETI.

Being by nature anentropic, Heather brings to The SETI League offices a wonderful sense of order. Any piece of documentation which you might have received in a timely and efficient manner came from Heather's desk. All lost forms, and inaccuracies contained herein, are my own doing.

433 Liberty Street
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SearchLites

the Quarterly Newsletter of The SETI League, Inc.

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Conference Calendar

SearchLites' readers are apprised of the following conferences at which SETI-related information will be presented. Check out our World Wide Web site, at www.setileague.org/ under Membership Services and Activities, or email to us at info@setileague.org, to obtain further details. Members are also encouraged to send in information about upcoming events of which we may be unaware.

September 12, 1997, 0100 hours UTC: Mars Global Surveyor spacecraft reaches Mars.

September 13 - 14, 1997: *UKW Tagung Amateur Radio Exhibition*, Weinheim Germany.

September 20 - 21, 1997: *European Radio Astronomy Congress*, Heppenheim Germany.

October 4, 1997: *Mid Atlantic VHF Conference*, Horsham PA.

October 17 - 19, 1997: *AMSAT Annual Meeting and Space Symposium*, Toronto Canada.

October 23 - 26, 1997: *Microwave Update*, Sandusky OH.

November 14 - 16, 1997: *Philcon '97*, Philadelphia PA.

January 21 - 23, 1998: *International Conference on SETI in the 21st Century*, Sydney Australia.

February 13 - 15, 1998: *Boskone*, Framingham MA.

March 20 - 22, 1998: *Lunacon 1998*, Rye Brook NY.

March 29, 1998: SETI League *Annual Membership Meeting*, Little Ferry NJ.

April 3 - 5, 1998: *Southeastern VHF Conference*, Marrietta GA.

April 10 - 12, 1998: *Balticon 32*, Baltimore MD.

April 25 - 26, 1998:*Trenton Computer Festiva*l, Trenton NJ.

May 15 - 17, 1998: *Dayton Hamvention*, Dayton OH.

May 22 - 25, 1998: *BayCon '98*, San Jose CA.

May 29 - 31, 1998: *Rochester Hamfest and ARRL Atlantic Division Convention*, Rochester NY.

July 23 - 26, 1998: *Central States VHF Conference*, Kansas City KS.

August 5 - 9, 1998: *BucCONeer* / 1998 Worldcon, Baltimore MD.

May 14 - 16, 1999: *Dayton Hamvention*, Dayton OH.

September 2 - 6, 1999: *Aussiecon Three* / 1999 Worldcon, Melbourne Australia.

May 12 - 14, 2000: *ARRL National Convention* and *Dayton Hamvention*, Dayton OH.

Ask Dr. SETI

I believe that we must have some fundamental problems with our perceptions of what we should be able to detect. In my opinion, the calculations relevant to our detection equipment's ability is only a minor consideration in the likelihood of detecting ET radio waves. There may be 1 or even a 101 technical reasons, that we don't yet understand, as to why the radio waves we are looking for aren't getting here.

I suggest that we look for other radio waves nearby in our galaxy that have about the same power as our most powerful common transmissions, namely radio waves generated by lightning. Lightning generated radio waves should be studied to learn if their frequency composition is unique in any way. If it does have any unique properties, we may be able to sort them out from the rf din of this galaxy. If we can not detect or identify such equally weak waves that we "know" are out there, it would safe to say that ET waves aren't going to punch through either.

JP, Ludington, MI

The Doctor Responds:

Your basic premise may of course be true. On the other hand, there is no clear evidence that these radio waves aren't getting here! All we can say for sure is that we have not yet received them in a verifiable, repeatable, conclusive way.

Analysis of the lightning spectrum has been done, extensively, by an electrical engineering professor named Paul Ryan. His work was done twenty years ago while developing a device called a Storm Scope, used by pilots to detect and avoid thunderstorms. Lightning does indeed have a unique and unmistakable electromagnetic signature, at least on Earth. Unfortunately, its energy peaks near a frequency of 50 kHz, a portion of the spectrum which will not penetrate our ionosphere. Certainly space-based searches for extra-terrestrial lightning are feasible, but far beyond our budget. This is my personal opinion, which not everybody in the SETI community shares. For an alternative viewpoint, see the article on the following page.

You do bring up an important point. One good way to verify that our equipment is doing what is expected of it is to use it to detect known natural electromagnetic phenomena. We do this with our SETI receivers, when we point them at known extra-solar radio sources and measure signal strength. By using SETI receivers for conventional radioastronomy (the detection of those "equally weak waves that we 'know' are out there"), we have indeed determined that their ultimate sensitivity is adequate to the task at hand.

Incidentally, we also use known artificial signals to verify the operation of our equipment. When Project Phoenix went on the air two years ago from the Parkes observatory in Australia, scientists calculated that they should be able to receive the 10 watt beacon from the Pioneer 10 spacecraft, beyond the edge of the solar system. They received not only the carrier, but also the modulation sidebands, verifying the sensitivity of their equipment. More recently (as reported in the last issue of *SearchLites*), SETI League members have received the 1.3 Watt omnidirectional beacon from the Global Mars Surveyor satellite at 5 Million km from Earth, at levels consistent with what our calculations predicted.

It is often assumed that our failure to verify SETI hits to date is somehow due to their being unreceivable here on Earth. In fact, all our studies and computations indicate that they should be quite easily detectable, with the equipment at hand, if we only look on the right frequency, in the right direction, at the right time. But all the world's SETI searches to date have logged just a few thousand hours of observation, over a tiny fraction of the sky, on precious few plausible frequencies. Not only have we not yet scratched the surface, we haven't even yet felt the itch.

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

Participatory SETI: A Model for Public Involvement

Beginning with the promulgation of the Project Cyclops report a quarter of a century ago, the public perception of SETI has been that it required the kinds of facilities which only governments can afford. The 1990's signaled a shift in this perception, culminating in the cancellation of the NASA SETI program. It is now widely held that not even governments can afford SETI. Yet significant advances in microwave circuitry and computer technology have continued to lower the cost and increase the performance of facilities capable of communication over interstellar distances. If our basic assumptions about the abundance of technologically advanced civilizations are correct, equipment which stands a reasonable chance of SETI success is today within the reach of even the dedicated amateur. Yet general misconceptions about the cost and complexity of mounting a viable search continue to limit public interest in, and support of, privatized SETI.

This paper explores recent educational initiatives of the non-profit, membership-supported SETI League to generate more realistic public perceptions as to the requirements for a widespread, privatized SETI effort. Current thinking as to the probable distribution of extra-terrestrial civilizations is explored, and the equipment and coordination costs associated with a global search effort are estimated. The SETI League feels that the public still lacks an appreciation for the true costs and benefits of a large-scale SETI program. Reality probably falls somewhere between the extremes articulated in Hollywood and in Washington.

Editor's Note:

Above is the abstract to an Invited Paper which SETI League executive director H. Paul Shuch will be presenting at the *SETI in the 21st Century Conference*, Sydney Australia, 21-23 January 1998. Conference details may be found on this Web site: <http://coder-dc.macarthur.uws.edu.au/conf.htm>.

Correspondence

The following is a sampling of letters and emails received by our executive director in response to the lead article in the last SearchLites, *announcing his new five-year contract to remain at the helm of The SETI League.*

Congratulations. It cannot have been easy kicking the professorship out of the door. But it shows one thing....you've walked that passage of fire that persuades you SETI is worth committing to and at whatever cost. Best wishes, Carol Oliver**,** UWS Macarthur

Wonderful news, Paul. I am delighted by your decision. Allen Tough, University of Toronto

I congratulate you for your commitment to the League and for your willingness to take on the challenge of leading it over the next five years. 73, Peter Coffee, AC6EN

I just read on the SL Web site that you are going to be sticking around for another 5 years! Now I know the League will continue to thrive and survive! I certainly understand your need for a career change, not to mention the importance of what you are undertaking for science. You made the right move. All the best, Larry Klaes

Congrats on the new long-term position. We need all the leadership we can get!! Malcolm Mallette, WA9BVS

GREAT 2 HEAR You'll be with SETI!! 73, Claude H. May, N6IQ

Congratulations on the bold leap! You bring such incredible and positive energy to the SETI League, that I know the organization, as well as the world wide SETI effort, would be lost without you. Sincerely, Nancy Parker

Paul, it was really wonderful news to learn that you have come to the momentous decision to stay with The SETI League for a further five years as our Executive Director. I know you will have burnt the midnight oil on several occasions, both you and your new family, before you came to your final decision. I am, as I know all the members are, truly delighted. Cheers, Ken Chattenton, G4KIR

Congrats on your bold step into full time SETI. I suspect it feels a bit the way my leaving NASA did to me. D. Kent Cullers, WA6BSV, SETI Institute

I too recently retired from a long teaching career. I know that it must have been a very difficult decision. I have a feeling that the years ahead will fully justify it. Best wishes on your "new" career. 73 de Tom, W6QJI

Congratulations on your 5-year contract with the SETI League. I'm sure it was the right decision. And good luck! Best wishes, Marcus Chown

Sounds like you've taken a bold leap indeed! Gerry Fleming, KE2RC

Congratulations on going 'full time' with The SETI League...you have a most interesting job and I know you are excited about it. Felton "Mitch" Mitchell, W4OA

To The SETI League, 500 of my closest friends:
Many thanks for your kind words and tireless efforts. This has not been an easy decision for me, but you've all helped to make it the only logical course. It will be a pleasure working with you for the next five years. All the best, H. Paul Shuch

Technical Feature:

Searching for Habitable Planets

by Ron Blue (rcb5@msn.com) and Woody Lakey
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Abstract:
The usage of radio emissions from lightning storms in extraterrestrial oxygenated atmospheres or Jovian atmospheres are proposed to provide detectable radio signals suggesting Earth type planets and Jovian type planets. Significant technical problems and procedures are discussed.

Discussion:
The debate over whether or not there are earthlike planets outside our own solar system has raged for quite some time. Recently, in an effort to support that there are other planets capable of sustaining life as we know it, the necessary mathematical calculations, based on current knowledge about planet formation and stellar evolution, were made. The results supports that life on other planets is mathematically probable. Although, the calculations show that life should be on other planets, there is no strong empirical evidence to lend credence to this theoretical statement.

Many advances have been made in the "art" of predicting planets around other stars. Radio astronomy has detected evidence that planet formation may be common in the universe. For example, it has been noticed that a one hundred meter wobble occurs on a certain star. It was then theorized that a planet about ten times the size of Jupiter is causing this particular wobble due to it's gravitational pull. Analysis of pulsar radio signals strongly suggest a planet like object is interfering with the signal. Further analysis of other radio signals reveal circular spaces of material missing around many stars. This absence of a signal is believed to be due to planet forming forces that may have swept that area clean of any type of debris when planets were formed. The Hubble space telescope pictures of developing star systems provided more confirming evidence.

The theory that stars have planets is seductive. The theory that some of these planets may have life is provocative. Extreme caution must be exercised in the procedures used to discover planets, as the history of science clearly points to the fact that scientists often find what they are looking for, even if it does not exist.

Scientists will not know for a fact that other stars have planets until they or their equipment arrives at another star system. The empirical evidence needed to accurately assess whether or not a planet has the ability to sustain life as we know it will not be available until such time as man actually sets foot upon that planet. However, evidence has advanced enough to strongly suggest that stars have planets, and some of these planets may be able to sustain life. What is required are promising techniques to suggest where and how to look

for other planets. One way that this mission could be accomplished, maybe using naturally occurring phenomenon to our advantage in discovering these planets. One type of phenomenon that may be used, is lightning.

All planets in our solar system are suspected of creating lightning or lightning like phenomenon. Lightning has been observed on Venus, Jupiter, Mars, Uranus, and possibly Neptune, Titan and Mercury. The type of lightning and type of atmosphere that lightning is created in, creates a unique radio signal. The easiest signal
from another planet to detect is from Jupiter. This strong radio signal goes through our atmosphere easily. A way to further substantiate the theory that there are other planets around other stars would be to tune in for this signal by using a radio telescope. It is known that the lightning from Jupiter's atmosphere occurs at a frequency of 10 megahertz. Therefore, if another planet were to be discovered having a lightning radio signal frequency of 10 megahertz, it could be assumed that the planet's atmosphere would be similar to that of Jupiter. Whether the signal strength is strong enough will have to wait until further experimentation and improved technology. Current opinion is that it is unlikely the signal is strong enough based on current technology. In science you should never say never. The plasma (lightning like activity) on Jupiter is similar to signals from the sun from Type II and Type III bursts. Other stars will produce the same type of signal. We have already observed this from relatively nearby stars. There may no way to differentiate between a Jovian planet and a star. Using our planet as shield to protect us from the strong signals from strong local noise produced by the sun and Jupiter we may increase our chances for success. If your dream is big enough you will search for solutions to your problems. While doing this you will learn a lot about yourself and nature and sometimes accomplish your dream. Based on computer simulations of planet formation Earth type planets should be quiet common but Jovian type planet may be rare. This rareness will lower the probability of intelligent life because a Jovian type planet is necessary to sweep a solar system of comets. Collisions with comets once every million years do to the absence of a Jovian type planet would limit the chance of development of stable life systems. This means it will be important to also listen for radio signals from Jovian type planets.

Since the bigger goal is the discovery of empirical evidence of earth-like planets, some further discussion is in order. Life as we know it has created as a biological waste, our oxygenated atmosphere. No known planet in our solar system has an oxygenated atmosphere, except for Earth. There is no known way to have an oxygenated atmosphere, without the process of photosynthesis to create the oxygen. Currently, our national program for searching for extra terrestrial intelligence is searching the radio window (those signals that the atmosphere allows through) for patterned signals, similar to radio broadcasts, or television signals. Our own man made radio signals are now about 100 light years from Earth and could be detected by a SETI like program created by intelligent beings on another planet in another star system.

While the SETI program should continue, a radio search as we are proposing could locate planets in the future for the SETI program to monitor. In addition, a draw back of the SETI program is that life must have evolved in a manner similar to that of Earth, in order to be sending signals of this type. Another limitation, is the obtaining of useable information from any of these signals that are received. Again, in order for mankind to make any type of sense from these signals, the other planet would have to have evolved in such a way that information would need to be within these signals, and not carried on some type of carrier wave. It is likely that within two hundred years all our electronic information will probably be carried over optic fibers. There is still another limitation. That is that in the history of mankind, radio and television have existed for a "mere tick of the clock", a clock that has been running for about 4.5 billion years. If life has evolved upon other planets, SETI could be searching star systems that have not yet reached that level of development or have already gone past that level of technology. The oxygenated atmosphere on Earth has existed for at least 3.75 billion years. Lightning storms have been sending signals of our existence as a planet with life for the same amount of time. Even if the SETI program never hits "pay-dirt," it would be of a great importance to know where other earth-type planets exist.

One cannot be lulled into a false sense of expectancy. There are considerable difficulties associated with the proposal of using lightning storms as an indicator of earth-type planets. Some of the problems could be eliminated with the use of a lunar radio telescope observatory on the dark side of the moon, a earth orbit space radio telescope, or a solar orbit space telescope at 550 AU or 7.4 light hours using the sun as a gravitational lens to focus radio waves. Since at best this is problematic and hundreds of years in the future, other ways should be considered.

One possible solution would be the use of radio-telescopes placed at strategic locations on Earth. A major problem with this proposal is that the radio telescopes will experience strong local radio noise from our own lightning storms. The question then becomes, are the radio signals that we need from another earthlike planet strong enough to get through our atmosphere and be detected. Current opinion is that the answer to this question is no.

A star that is quite similar to the sun, is called Epsilon Eri., which is about 11 light years away from Earth. A planet in the Epsilon Eri system, with a radio transmitting at 1 megawatt of power, with a 600 foot antenna could easily be detected from Earth according to Frank Drake, professor of astronomy at University of California at Santa Cruz.

On Earth, a bolt of lightning produces from 10,000 to 200,000 amperes of electricity moving over a distance of about a mile. This superheats the air from 20,000 to 40,000 degrees Celsius. The average frequency rate for lightning on Earth is from 60 to 100 cycles per second. The average power of all these lightning strikes, is about 100 billion watts per second. A single bolt of lightning can easily be detected around the world as a radio "whistler," or "spike." "Whistlers" are due to an interaction effect from lightning

and ions trapped in the earth's magnetic field in outer space. The millions of volts in a cloud being simultaneously released in a lightning storm acts like a capacitor and causes the ions in outer space to oscillate, which causes radio waves. It could therefore be logical, from the technical aspects, to use "whistlers" in the search for planets with oxygenated atmospheres from a lunar radio telescope. It would be best, if the original sources, or lightning could be used instead. The moving electrical current in lightning creates radio waves. The electromagnetic waves from Earth lightning are all over the spectrum, but seem to be at a maximum output for radio waves at 5 to 7 kilocycles per second. The good news is that this very low frequency is rarely used by people because of the expensive antenna systems required for this frequency. The bad news is that the lower the frequency the more the noise you will hear. This frequency is very close to the noise of electrons moving randomly in circuits. This frequency is a ground wave which means the wave travels around the world for longer distances than higher frequency. This means the noise from earth lightning storms will be severe. The current in lightning flow in micron size plasma. This will raise the power of the radio signal. The speed of release of the discharge is in tens of a second. This will increase the power of the radio signal. The signal is polarized which increases the power of the signal.

It must be made clear that this radio signal only occurs in an oxygenated atmosphere. While it is true that there are other types of phenomena that could emit the same frequency radio emissions, it should be remembered that lightning occurs in sets.

A single bolt of lightning can be detected and tracked anywhere on the planet Earth. Therefore, it is not illogical to assume that lightning from other oxygenated atmospheres could be tracked from Earth, the moon, or outer space. This is not to say that the process would be easy. To begin with, there is always the possibility of human error. Then there is the problem of insuring that the radio frequencies that are discovered are indeed originating from deep space.

Of human error, there is not much that can be done, except for validation of findings. However, using the technology available today, it is possible to assure that the emanations that are being tracked are indeed from space.

One way of accomplishing this task, would be through the use of computers and discriminators tied into the "listening stations." It would be necessary to use the computer-discriminator system placed at a constant distance and in constant contact with the monitoring radio telescopes. At least two monitoring stations should be used. In this way, any transmission that was received by the monitoring station could be instantly checked against what the other station had received. If the signals matched, it could be investigated further. If they did not, the signals could be discarded as being "spurious radio emissions."

The antennae themselves would have to be a minimum of thirty-five feet high, and seventeen and one half feet long using the 10th harmonic. It would also be necessary for the antennae to be at least four thousand meters apart from each other. It must be understood that the receiving radio antennae must have the ability to track objects. Because the signal we are interested in will be weak a new procedure is suggested to solve that problem. By focusing the reflected radio waves onto a liquid helium cool superconductor the signal strength maybe increase millions of times. The first pair above would be strengthened by adding more pairs in a circular configuration with all data being correlated by a computer to eliminate spurious data. Using these configurations, it may be possible to monitor various star systems that may appear to be promising.

Another problem that must be overcome, is that of spurious emissions. In order to facilitate the most surreptitious response curves, it is suggested that the antennae be surrounded by a "super antenna." This would be constructed from the most conductive materials. In this way, these super antennae would be able to attract the spurious signals, and either send them to ground, or to provide a chart with which the signals from space could be differentiated. The use of the "super antenna" and the discriminator may allow a reasonable chance of success. What the super antenna could not filter out, could be compared to the emissions that are received by the discriminator. Any signals that do not match would be automatically discarded. Using these procedures, it may be possible to recognize an extraterrestrial Earth-type planet, Jupiter-type planet, a Venus-type planet or even a Mars-type planet.

Success will not end with these discoveries; instead, it will only begin. The wealth of information that may be available is staggering. Radio signals are capable of providing more information, if mankind has an idea of what to look for and the future technology to allow him to look. Science has a habit of catching up to our dreams. Lightning storms on Jupiter occur frequently at noon. A signal that peaks every ten hours would show that the Jupiter like planet, around another star system, has a "day" of this time period. On Earth, at Denver, Colorado, lightning storms distribute themselves in a skewed curve with the most frequent starting time being noon, and the highest frequency time being 3:00 PM. Lightning storms are infrequent over the oceans on Earth, therefore, it would be logical to assume that the frequency and location of lightning storms on planets with an oxygenated atmosphere, could show where water-land distributions may be located. This could provide an invaluable aid for mapping Earth type planets. A statistical plot of reception from another Earth type planet may reveal it's water to land mass ratio and the length of it's day.

Intelligent life in the universe could be actively listening to the radio frequencies associated with their type of lightning storms to discover early which planets they would attempt to colonize, explore, or possibly contact. These special frequencies may be the natural frequency to communicate with other species instead of the proposed 21 centimeters. The reason is because the admission price to the galactic civilization is quiet high. It is extremely difficult to have the technological advances necessary to monitor these frequencies. The question then becomes, "Is anybody really listening?"

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