



SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

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A Science, Not A Search

by H. Paul Shuch, Executive Director

Recently, the notion that we share our universe with countless sentient species has emerged out of the realm of fiction into the scientific mainstream. Over the past forty years, dozens of organizations have conducted scores of experiments in the emerging discipline of SETI, the Search for Extra-Terrestrial Intelligence. As executive director of the grassroots, nonprofit SETI League, I am privileged to head up one of those searches. But I do not speak for SETI!

Perhaps the most highly visible of the various scientific organizations seeking our cosmic companions is the prestigious SETI Institute in California. Spun off from a onetime NASA SETI effort, SETI Institute scientists conduct numerous *Life in the Universe* studies, as well as one of the most comprehensive surveys ever for artificial radio emissions from space. It was their expertise that informed the technical content of the popular film *Contact* and their efforts that keep SETI high in the public consciousness. They are among the most highly respected of my colleagues, and I am proud to practice SETI in such august company.

But SETI is a science, not a single search. I frequently read glowing press accounts of my colleagues' accomplishments, which are invariably attributed to some monolithic organization referred to as 'SETI.' "SETI has received a grant..." I read in the paper, or "SETI's chief scientist is lecturing at..." or "the director of SETI says that..."

Certainly, this generalization of SETI Institute into simply SETI is not the doing of my modest Institute colleagues, but rather represents a tendency of the media to lump together all related efforts under a common banner. But to call the SETI Institute (or any one organization) 'SETI' is equivalent to referring to the National Science Foundation as simply 'science' or to NASA as 'space.' It implies a level of homogeneity which, if it indeed existed, would rob our discipline of its broad diversity and stifle creative science.

Each of the various SETI organizations around the world tackles a complex problem from a unique perspective. Since we cannot yet say which approach is the right one, we certainly cannot say that any is wrong. The efforts of hundreds of scientists now working on several independent searches may some day gain us entry into the cosmic community. Collectively, one might call them SETI. Individually, each is but a piece of the puzzle.

The other day I was preaching SETI to a group of students, one of whom said, "We already know all about it. We use your screen-saver." She was referring to SETI@home, a highly successful initiative out of the University of California, Berkeley. That famous experiment in distributed computer processing is also a piece of the puzzle. But shouldn't we, educators and media alike, try to show the world the big picture?

Dr. Shuch, executive director of the nonprofit, membership-supported SETI League, Inc., does not speak for SETI. ❖

Book Reviews:

**To Seek Out New Life: The Biology of Star Trek
By Athena Andreadis, reviewed by Larry Klaes**

Long ago, when I was a very big fan of Star Trek in almost all its forms (I still am to some degree, just older and more experienced in the ways of the world), I believed that almost everyone who was a Star Trek fan was also either quite versed in the astronomy and other sciences presented on the series, or at least had a very strong interest in learning about them.

I soon learned, however, that this was not the case. Many fans loved Star Trek primarily for the characters, stories, and exciting special effects. They had an interest in the science, perhaps, but only in the most elementary way. For them, Star Trek really served as a culture within a culture, where they could fit in. In many ways, Star Trek has almost become a religion. There was a lot of sad truth to the famous William Shatner (a.k.a. Captain James Tiberius Kirk) "Get a Life!" sketch on Saturday Night Live from 1986.

Now, there is nothing either wrong or required that those who like Star Trek and similar science fiction must also be scientists or even into the sciences. But when I see reviews attacking Dr. Andreadis for cutting down all the "bad" biology and other science in Star Trek, as if they had just been personally insulted, it is apparent that the main purpose of her book is being missed by these folks, along with an opportunity to learn something both wonderful and true about the real universe around them.

It is perhaps a sad commentary on today's educational values that a good portion of the general public has learned what little science they know from watching Star Trek. This is one reason why scientists like physicist Laurence M. Krauss and biologist Athena Andreadis have created very popular books examining Star Trek in all its television and film incarnations and exposing their many major faults in terms of science. For one thing, there should be much gratitude that these authors know their Star Trek so well, compared to some works I have seen exploring the series in past decades.

I suppose it is better than letting the public live in their ignorance, though. It can be a good first step in the right direction to learning more about the real sciences and how amazing that world really is.

I am bemused at those who jumped on the author for not getting the point that Star Trek is science *fiction*, when that is exactly the point she is making in her book! Apparently they are the ones who are taking the Federation and its celestial neighborhood a bit too seriously. Emotions are getting in the way of the facts. Not everyone likes to have their emperors revealed as having no clothes.

And for the readers who have griped that Dr. Andreadis showed her bias and emotional bent in the book,

what else can be said but that *To Seek Out New Life* was written by a human being and not a post-Sarek Vulcan or a computer, especially one that could be blown up into clouds of white smoke by a few attacks of illogic from Captain Kirk. For me, those personal commentaries kept the book from becoming dull and showed me that the author truly cared about her subject.

Perhaps I am asking too much of some to think, rather than that Dr. Andreadis is "attacking" Star Trek for having so many concepts which veer away from the known facts, that they should instead realize how fortunate they are that a trained biologist took the time and effort to enrich the world about real biology, a science which can hardly be ignored or denied in our daily existence.

And, let's face it, even if the author were out to "destroy" your beloved Star Trek (which she is not), does anyone honestly think that Paramount would suddenly close up the franchise and crawl away in ignorant shame? Not at over two billion dollars a year they won't!

So, please read *To Seek Out New Life*. Know that Ms. Andreadis is simply sharing her wonderful gift of knowledge about the biological sciences in a way that can be enjoyed far better than some dry, old textbook. ❖

**When SETI Succeeds:
The Impact of High-Information Contact
Edited by Allen Tough.
Foundation for the Future,
Washington, D.C., 2000 (\$10).**

The Search for Extraterrestrial Intelligence has yet to discover any alien radio signals or other signs of life elsewhere, but some astronomers give it a 50-50 chance of success within the decade. What might a positive result mean for human society? The question has long engaged some of science's leading thinkers. This anthology contains papers from a conference last year on the subject. Through their discussions, the conferees said they hoped to get humanity ready for the revolutionary consequences -- not all of which will be good -- for our knowledge, religion, politics, art and self-conception. A few suggested that scientists should take UFO reports and other anomalous phenomena more seriously

(see members.aol.com/AllenTough/mel.html).

The author list reads like a who's who of SETI research. This, alas, is also the book's flaw: conspicuously absent are social scientists, such as Duquesne University political philosopher Charles Rubin, who believe the impact of a SETI detection would not be as great as generally thought (see www.coseti.org/mov/2704-11.ram).

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Probing for ETI's Probes in the Solar System

By Scot Stride (email: sstride@jpl.nasa.gov)

Working at JPL for many years and subscribing to its charter tends to affect a person's worldview. Many of the scientists and engineers at this NASA center don't see our robotic probes as just machines, but as extensions of our senses, intellect and being. Indeed, Matt Golombek used to humorously call the Mars Pathfinder Sojourner rover a "mini-geologist" version of himself. My views are similar. This has indirectly resulted in a personal interest in how advanced ETI might carry out galactic exploration and the construction of interstellar robotic probes.

It turns out that a great deal of research and writing on the subject of ETI probes has been done (Freitas, et. al), most of it within the context of complementing radio SETI. Presently, the scientific community, news media and general public associate the term SETI with large radio telescopes and the search for weak signals from far away. Most people know there is a possibility of radio communication (CETI), but many don't realize the unfavorable odds of it working in practice over vast distances and multigenerations of human participants. Professional SETI scientists and engineers know full well the potential of microwave/mm-wave for both radio astronomy and for deep space telecommunications.

The SETI focus so far has been on the detection of narrow-band beacons or leakage from ETI civilizations, complemented by radio astronomy observations and mappings to better understand the origins of ET life. However, the SETI lenses that focus so clearly on the task of searching for far away signals are philosophically out of focus when it comes to searching for ETI telecommunications signals that may originate within our solar system.

Some time beginning in the early 1970's LDE's (Long-Delayed-Echoes) were a hot topic of discussion. First recorded in the 1920's by Burrows and later advocated by Lunan in the 1970's, these signals were first thought to be radio returns from ETI robotic probes residing in the solar system. It was later shown by Lawton et. al. that these echoes were likely caused by plasma and dust in the Earth's upper ionosphere. LDE's are a surprising and unusual natural phenomenon that is not fully understood, but they are far too ambiguous to be from ETI robotic probes.

Russian scientists have tried some limited searches for probe radio signals within the solar system. Freitas and Valdes did an optical search for probe artifacts (SETA) at the five earth-moon-sun libration points. These searches, also done within the SETI context, were primarily negative and inconclusive.

This fleeting, yet serious, research was not embraced by mainstream SETI scientists and for the most part ignored. It's chilling to think what the reaction would have been if Freitas and Valdes had detected and verified a robotic probe stationed at L5. Aside from these few studies, nothing else has been done within the SETI context to actively search for radio signals from possible ETI probes in the solar system, but there is room for hope.

Presently at least one SETI telescope is periodically observing robotic probe transmissions emanating just beyond 75 AU. These are not ETI, but from NASA's Pioneer 10 spacecraft. Pioneer 6 has been observed occasionally, as is Galileo when its Jovian orbit is suitable. Detection of these S-band signals dem-

onstrates that both radio and optical SETI have the capability to search the solar system for signals that could be considered ETI in origin. ETI probe radio transmissions would be clearly distinguishable from those of our own deep space robotic probes, because we know the locations, frequencies and Doppler of our spacecraft.

It might be argued that, if an ETI probe were within our solar system and transmitting a signal toward Earth, intended for us or not, we would detect it with the current SETI effort. No one with a working knowledge of the current SETI effort would accept this allegation for any frequencies other than the 1 to 3 GHz band (particularly the 18 and 21 cm lines). Millimeter-wave or optical signals from an ETI probe may be illuminating Earth right now, and we would never know it.

Why not? Because a wideband, all-sky survey is not actively underway. This kind of effort, which I term Solar System SETI (S3ETI), was briefly carried out at the JPL Deep Space Tracking Network during 1992-93, as a part of the NASA HRMS (High Resolution Microwave Survey) effort. At the time, the intent was not to search for ETI probe microwave transmissions within the solar system, but it certainly could have found them if they were there and between 1 and 10 GHz. Nothing was detected, but one year is not very long to find much of anything.

Project Argus, under the direction of The SETI League, Inc., is now diligently trying to recapture some of that sky coverage in the 1 to 3 GHz band. The goal of Argus is 100% sky coverage continuously; quite different from the JPL HRMS effort. This goal, if met even at 1-3 GHz, would outperform even the HRMS effort in terms of sky coverage. If this search were extended in frequency to cover 1 to 40 GHz, Argus would be the best bet for detecting strong leakage, a powerful beacon, or robotic probe transmissions in the solar system.

I doubt that ETI probes would transmit telecommunications signals below 2 GHz. In all likelihood the preferred frequencies are mm-wave or optical. This means that if an S3ETI all-sky survey system is built, it should be done at frequencies up to 40 GHz and have a receive sensitivity to a radial distance of 50 AU. Limiting the detection range to <50 AU (Pluto's approximate farthest distance) simplifies receiver design in terms of amplifiers, noise figure and integration times. There is nothing magic about 40 GHz; it is within the microwave window, and there is a moderate selection of commercial hardware available with which to build a mm-wave SETI station. Easing the range requirements allows the use of broad beam antennas (e.g., slightly flared WR28 waveguide) and inexpensive GaAs PHEMT MMIC LNA's that don't need liquid nitrogen cooling.

At 50 AU, two-way telecommunication delay with a probe would be about 14 hours, allowing expedient contact between civilizations to occur if that's one objective. Were the detection range reduced and the bandwidth increased, an effort like Argus could possibly detect radio emissions from an ETI probe in the solar system. Many members of The SETI League will admit that the prospect of detecting a telecommunications signal from a nearby robotic probe is certainly more exciting than the detection of a faraway single-tone beacon. Food for thought! ❖

Author's Note: *The opinions expressed in this article are personal and in no way represent officially sanctioned attitudes, beliefs, interests or policy of NASA, JPL or Caltech.*

A Young Journalist's SETI Interview

Editor's Note: SETI League executive director H. Paul Shuch is frequently interviewed by members of the press. The interview which follows is noteworthy because the journalist in question is twelve years old. Yonah Meiselman is a seventh grade student in the Humanities and Communications Magnet program at Eastern Middle School, Silver Spring MD. He also happens to be Dr. Shuch's nephew.

Mr. Meiselman: What do you do at SETI?

Dr. Shuch: It is important to note that SETI is a science, not a single organization. There are several groups around the world engaged in SETI research. I am executive director of one of those groups, the nonprofit, international SETI League, Inc.

Mr. Meiselman: What kind of experiments or research do you conduct?

Dr. Shuch: We design, build, and operate small radio telescopes all over the world and use them to search for artificially generated signals from space. We hope to detect indirect evidence of other civilizations, from their microwave radiation.

Mr. Meiselman: Do you enjoy the work? Why, or why not?

Dr. Shuch: This is both the most exciting and the most frustrating work of my career. Exciting, because we are at the scientific cutting edge, and I get to work with some of the brightest minds in the world. Frustrating, because as a membership-supported nonprofit, we have a very limited budget and often lack the resources to follow through on some good ideas.

Mr. Meiselman: Have you ever found any extraterrestrial life? If so, what is the life like? If not, what, if anything, do you expect you will find?

Dr. Shuch: SETI searches over the past 40 years have stumbled across several dozen interesting, but unexplained, radio emissions. Whether or not they represent life, we cannot yet say. We hope eventually to find clear, unambiguous signals, which persist long enough to be independently verified by multiple observers. Such signals could indicate the presence of other technology-using civilizations in the cosmos.

Mr. Meiselman: Do you think you will find anything else?

Dr. Shuch: I think it's almost certain. With a large number of observers combing the cosmos, it is highly likely that one or more of them will stumble across some completely unanticipated discovery -- possibly a previously unknown natural, astrophysical phenomenon.

Mr. Meiselman: Where did you go to college and graduate school?

Dr. Shuch: College: Carnegie Institute of Technology, West Valley College, and San Jose State University. Three engineering degrees (AS, BS, MA). My education was interrupted by four years of military service during the Vietnam War. Grad school: University of California, Berkeley. Ph.D. in Engineering.

Mr. Meiselman: What did you study there?

Dr. Shuch: Electrical, industrial, civil, and aerospace engineering.

Mr. Meiselman: Did you like it?

Dr. Shuch: Grad school much more than college.

Mr. Meiselman: How did that affect your choice to work with SETI?

Dr. Shuch: SETI is perhaps the most highly interdisciplinary of sciences. Having background in multiple engineering disciplines gives me the flexibility to deal with the unknown.

Mr. Meiselman: Where do you live?

Dr. Shuch: On a remote hilltop just north of Williamsport, PA (about 200 miles from any major city).

Mr. Meiselman: Why?

Dr. Shuch: That's a very perceptive question, Yonah! I choose to live far from technological civilization because industry generates electromagnetic radiation, which would interfere with the operation of my radio telescopes.

Mr. Meiselman: What other occupations have you had?

Dr. Shuch: Aerospace engineer; college professor.

Mr. Meiselman: Did you find connections between earlier occupations and your current scientist/astronomer status?

Dr. Shuch: Absolutely. I am practicing (at a higher level) what I used to teach my students. In addition, I am still teaching -- just in a larger classroom and with *much* better students.

Mr. Meiselman: What is privatized science?

Dr. Shuch: Studies which are paid for by private donations, rather than government tax dollars. In the present economic climate, that's the direction in which all scientific research is ultimately going. ❖

Introducing:

Our Hundredth Argonaut

Little Ferry, NJ., December, 2000 -- The SETI League, Inc., nonprofit leaders in a global Search for Extra-Terrestrial Intelligence, has achieved a significant milestone with the registration of its one hundredth amateur radio telescope, now under construction in northern New Jersey. Part of the planned *Project Argus* network of 5000 such instruments worldwide, this telescope brings the grassroots science group a little closer to its eventual goal of being able to see in all directions at once, so that no part of the sky shall evade our gaze.

The newest addition to the *Project Argus* network is being built by SETI League member Tom Hutter. Like the 99 other telescopes it is joining, this instrument will scan the skies 24 hours a day, in search of our cosmic companions. Hutter, a retired fire captain, admits to having no formal electronics or radio astronomy background. He considers construction of his *Project Argus* station a learning experience. "There are people who say we are all alone in the universe," comments Hutter, "and others who say we're not. Everyone wants to know, so let's do the experiment and find out!"

The SETI League's radio telescopes are constructed by individual members out of discarded satellite TV dish antennas, along with sensitive microwave receivers and powerful home computers. Traditionally, radio telescopes are used to study the structure of the universe by analyzing microwave radiation emitted by natural astrophysical phenomena. In the SETI application, it is artificial radiation from other technological civilizations that the telescopes seek to identify. ❖

SETI League Announces First Technical Symposium

Little Ferry, NJ., January 2001 – The SETI League, Inc., nonprofit leaders in the privatized Search for Extra-Terrestrial Intelligence, will be holding its first Technical Symposium the weekend of April 28 - 29, 2001, at the College of New Jersey (formerly Trenton State College) in Trenton NJ. SETI League members from around the world will present papers on radio astronomy, microwave communications, and the hardware, software, and search strategies being used to seek scientific evidence of other intelligent civilizations in the cosmos. In attendance will be a respectable sampling of The SETI League's 1200 members from sixty countries, including many of the over one hundred SETI League members building and operating their own observing stations.

Pre-registration is requested by not later than 1 April 2001. The conference registration fee (\$30 US for current SETI League members, and \$80 for nonmembers) includes one copy of the Conference Proceedings, being published as a service to The SETI League by the American Radio Relay League. Registration after the April first deadline will be ten dollars more. An Awards Banquet is scheduled for Saturday night, with banquet tickets available only in advance, at \$30 US. The Banquet will include a guest speaker and door prizes, and culminate in presentation of our sixth Giordano Bruno Memorial Award, The SETI League's highest honor, to an individual who has made significant contributions to the art and science of SETI. Registration details, lodging and transportation information are posted to The SETI League's website, at

<http://www.setileague.org/admin/meet2001.htm>.

The SETI League's Seventh Annual Membership Meeting will be held in conjunction with the Technical Symposium, on Sunday, 29 April 2001 beginning at 10 A.M. SETI League members in good standing, their guests, interested radio amateurs, amateur and professional astronomers, and members of the press are cordially invited. Since a quorum is required to transact business, all SETI League members are encouraged to attend.

SETI scientists seek to determine through microwave and optical measurements whether humankind is alone in the universe. Since Congress terminated NASA's SETI funding in 1993, The SETI League and other scientific groups have been attempting to privatize the research. Experimenters interested in participating in the search for intelligent alien life, or citizens wishing to help support it, should visit us on the Web at <http://www.setileague.org/>, email to join@setileague.org, send a fax to 1 (201) 641-1771, or contact The SETI League, Inc. membership hotline at 1 (800) TAU-SETI. Be sure to provide us with a postal address to which we will mail further information. The SETI League, Inc. is a membership-supported, nonprofit [501(c)(3)], educational and scientific corporation dedicated to the electromagnetic Search for Extra-Terrestrial Intelligence.



Guest Editorial:

SETI Is Amateur Radio

by Richard W. Wilson, W5ETI
(email: Chiefbroom@aol.com)

Editor's Note: The following letter appeared on page 25 of the December 2000 issue of *QST*, the monthly journal of the American Radio Relay League.

I must take issue with a letter in the October *QST* titled "SETI is not Amateur Radio." Mr. Kadner seems to think the hobby is only about chatting and not about science, as though radio's connection to the sciences is something new.

He states that he got into Amateur Radio in the late '50s. In that case, he may have missed a great article titled "Astronomy and Amateur Radio" in the November 1943 issue of *QST*, written by Hollis French, W1JLK. In the article Mr. French proclaims, "Radio development has entered a stage in which the amateur experimenter of necessity must become an amateur in other vitally related earth and sky sciences. He must learn to understand and use new tools and apparatus in order to make the most effective use of the very high and higher frequencies. The factors which govern weather and the electromagnetic field of the earth - astronomical, meteorological and topographical. Radio is not strictly a terrestrial art. With advancing knowledge, ever closer relations appear between the science of astronomy and the art of radio communication. These are more evident as we pass the limitations of the old astronomy of position and enter the fascinating field of astrophysics, where radiation becomes the foundation of the science."

There have been many exciting articles published in *QST* over the years concerning the role that radio amateurs can play in furthering earth and space sciences, including SETI. I believe the hobby of Amateur Radio can be broad enough to include whatever our interests dictate; there are no bandwidth limitations on our imaginations. Personally, I find the scientific application of radio, in any form, just as "romantic" as a good old down-to-earth QSO. Besides, how much more exciting could a radio contact be than one with another world...a DXer's dream! I just hope they send their QSL info. That's a card and/or certificate I must have!



SETI LEAGUE

Extraterrestrial QSL

The SETI League, Inc. hereby confirms reception by _____ of an Extraterrestrial Signal from _____ on _____ (date) _____ (frequency)

Natural
 Human
 Alien
 Moonbounce

Signed: _____
QSL Manager

Further Note: Per Mr. Wilson's request, The SETI League, Inc. indeed plans to act as ET's QSL manager, issuing the above card for *confirmed* contacts. Watch *SearchLites* for details.

Abstracts:

The following are Abstracts of a few of the papers scheduled to appear in *Proceedings of the First SETI League Technical Symposium*, American Radio Relay League, April 2001. Copies of the *Proceedings* will be available at the Symposium, as discussed elsewhere in this issue of *SearchLites*.

**Near-Infrared (IR) Spectrometric Imaging
Using a One-Meter Fresnel Telescope**

Drs. Robert Lodder and Cynthia Banyon

Advanced Science and Technology Center, Univ. of Kentucky

A near-infrared optical telescope with a one-meter aperture has been constructed to detect interstellar laser transmissions. The near-IR (4760 to 12500 cm⁻¹) telescope is being operated at the University of Kentucky in conjunction with a microwave radiotelescope for Project Argus. The telescope comprises a one-meter visible/near-IR Fresnel lens, an aluminum compound parabolic concentrator, tilting interference filters, a new robot for detector translation and star tracking, a liquid nitrogen Dewar and detectors (PbS, InSb, and InGaAs), and a 50 MHz preamplifier with 26 dB gain (max. data rate approximately 3 Gb per minute). Data are being processed using correlation and flexible Bayesian methods, including a new hierarchical covariance compromise method. The results of these spectrometric studies will be presented.

Some Algorithms for Lunar Archaeology

Dr. Alexey V. Arhipov,

Institute of Radio Astronomy, Nat. Acad. Sci. of Ukraine

Our planet's Moon could have been used by ETI as a base for the exploration of Earth billions of years ago. New computer algorithms are proposed and used for sub-surface archaeological reconnaissance of our satellite. They are a useful instrument for studies on lunar tectonics, too. Thus, the SAAM algorithm reveals otherwise indiscernible details of extremely low contrast in orbital images of the Moon. The SCHEME algorithm searches for local extremity of lunar relief. As a result, some ruin-like patterns have been found in high resolution images from the Clementine lunar probe. Several examples of such curiosities are discussed as an argument for Lunar SETI.

A Hierarchy of Civilizations in the Universe

Nikiforos A. Sideris, Greece

The possibility of existence of Extraterrestrial Intelligent Life is examined in this paper on the basis of some new strange numerical coincidences that appear for the first time in the related literature (Physics-Cosmology-SETI). Under a single hypothesis that advanced civilizations can (and have no other choice) communicate with each other in a peculiar manner that will be described in the text, instantaneously, it can be proven that in the ob-

servable universe may exist at least 100 billions (10¹¹) and at most 10¹⁷ civilizations. These civilizations are at a level of technological development comparable to or much higher than our civilization. Beyond that, the proposed theory indicates that the hierarchical development of civilizations in the observable universe is achieved by now (i.e., for an age of the universe equal to 18±2 billion years from the Big-Bang) to the level of Superclusters of galaxies. This means that beyond the boundaries of a Supercluster, communication of its civilizations with the civilizations of another Supercluster is still unattainable.

Effectiveness of a Low-Cost Peltier Effect Thermoelectric Cooler in Reducing LNA Temperature

C. Lee Kitchens, SETI League Hardware Committee Chair

Tests will be conducted to measure and record, over time, the temperature of the LNA case, the ambient temperature in the shade, and the ambient temperature in the sun at the focus of the antenna. A performance curve will be developed to indicate LNA case temperature, voltage (V_{max}), and power. Information on the SETI station design will include LNA, thermoelectric cooler, heat sink, and exhaust fan specifications. The resulting quantitative data should be useful to SETI League members deciding whether or not to install a thermoelectric cooler on the LNA.

Overview of the First 100 Project Argus Stations

Harry Kimball, McLouth KS

The SETI League's Project Argus started approximately five years ago with five radio telescopes. Since that time, the number of Argus stations has grown to 100. These stations were constructed by avocational radio astronomers with personal funds. Because of limited funding, "what-cha-got" construction techniques were often employed resulting in a variety of station configurations and capabilities. This paper, using member-supplied information, summarizes the diversity and commonality of the components that have gone into these stations. The combined capabilities of these 100 stations is also examined.

**Optical SETI Monitoring and
Event Recording Software**

Noel Welstead, Regional Coordinator for Eastern Australia

This paper describes a novel method (probably never tried before) of using an optical telescope (14" Celestron) fitted with an extremely fast, wide bandwidth photo resistor that is used to control the frequency of a very stable oscillator. The oscillator frequency will alter when the light intensity in the "frame" varies for any reason whatsoever. The idea is that a "frame" from the sky will produce

a cumulative luminosity reading that should remain unchanged each time the telescope is pointed at that location. By doing a scan of the desired locations of interest (nearby stars), it would be possible to build up a database of readings for each target that could be re-checked again for variations each time the location was revisited.

The database value would be compared with each new observation run and any variations would be flagged for further study. We needed to mask out unwanted effects for meteors, satellites, clouds, and moonlit nights that would cause false positives (and negatives). This rationale is similar to what the SETI Institute does with strong radio and known sources of interference, so they don't waste time when something is detected.

The project was completed late last year and we now have all the material including software to play with. The actual photo resistor detector is still being played with so we can select the best one for the job (stability is an issue), but all else is now completed. We even have the telescope. This system would find super-novas, asteroids and comets for sure. Laser beams from ET? Well, who knows?

Quantifying SETI

Peter Vekinis, University of Oregon

Over the last few decades, much research has been done to satisfy the individual elements of the Drake equation. Solar systems have been discovered, new data on habitable zones made available, and technology has been improved many times over. Research has also shown that large planets are essential to ETI-bearing solar systems as they attract life-destroying comets, and questions have arisen about the length of a communicable civilization. Frequencies to search for SETI are moving away from the regular 1.4GHz line to millimeter waves, and modulation also changes accordingly. All of these elements are quantifiable and, using Sol's viewpoint in our galaxy, we have come up with a total number of ETIs in this galaxy.

Array2k: Sixteen Dishes, Five Designs

Dr. H. Paul Shuch, SETI League Executive Director

For the past two years, the SETI community has marveled at the development of the ambitious Paul Allen Telescope, a mini-Cyclops consisting of up to a thousand phased satellite TV-type dishes. While saluting the efforts of our California colleagues, The SETI League has been hard at work on its own phased array design, more modest in scope but quite as technologically audacious. When completed, Array2k (patent pending) will employ a unique mix of analog and digital techniques to operate in five distinct modes simultaneously. Optimized as a drift-scan sky survey instrument in the proud tradition of Ohio State's Big Ear, it will serve as its own Follow-Up Detection Device, verifying its own findings in real time. ❖

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) under *Event Horizon*, 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.

March 2 - 4, 2001: Contact 2001, Santa Clara CA.

April 20 - 21, 2001: Southeastern VHF Society Conference, Nashville, TN.

April 21, 2001: Third Annual SETI League *Ham Radio QSO Party*, 14.204 MHz.

April 28 - 29, 2001: SETI League *Technical Symposium* and *Annual Membership Meeting*, Trenton NJ.

May 5 - 6, 2001: *Trenton Computer Festival*, Edison NJ.

May 18 - 20, 2001: *Dayton Hamvention*, Dayton OH.

May 18, 2001, 0700 hours: SETI Breakfast, Marriott Hotel, Dayton OH.

May 25 - 28, 2001: *Balticon 35*, Baltimore MD.

June 22 - 24, 2001: Dr. SETI ® to appear as Toastmaster at *Conterpoint Four* Filk Music Convention, Rockville MD.

July 14, 2001, 1600 hours: Frank Drake delivers *Friedman Lecture* at Penn State University.

July 15 - 18, 2001: *20th Anniversary SARA Conference*, NRAO Green Bank WV.

July 26 - 29, 2001: *Central States VHF Conference*, Fort Worth TX.

August 30 - September 3, 2001: *Millennium Philcon* World Science Fiction Convention, Philadelphia PA.

September 27 - 30, 2001: *Microwave Update*, Sunnyvale CA.

November 16 - 18, 2001: *Philcon 2001*, Philadelphia PA.

October 1 - 5, 2001: *52nd International Astronautical Congress*, Toulouse France.

October 5 - 6, 2001: *19th AMSAT Annual Meeting and Space Symposium*, Atlanta GA.

April 27 - 28, 2002: SETI League *Technical Symposium* and *Annual Membership Meeting* (location TBA).

May 17 - 19, 2002: *Dayton Hamvention*, Dayton OH.

July 8 - 12, 2002: *Bioastronomy '02*, Hamilton Island (Great Barrier Reef) Australia.

August 29 - September 2, 2002: *ConJose* World Science Fiction Convention, San Jose CA.

October, 2002 (date TBA): *Microwave Update*, Washington DC.

April 26 - 27, 2003: SETI League *Technical Symposium* and *Annual Membership Meeting* (location TBA).

May 16 - 18, 2003: *Dayton Hamvention*, Dayton OH.

August 28 - September 1, 2003: *Torcon 3* World Science Fiction Convention, Toronto ON Canada.

October, 2003 (date TBA): *Microwave Update*, Seattle WA.

April 24 - 25, 2004: SETI League *Technical Symposium* and *Annual Membership Meeting* (location TBA).

❖

Keeping Score

	<i>SETI League Members</i>	<i>Project Argus Stations</i>	<i>Regional Coordinators</i>
Total:	1233	104	61
Countries:	61	19	49



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