



SearchLites

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Offices:

433 Liberty Street
PO Box 555
Little Ferry NJ
07643 USA

Phone:

(201) 641-1770

Facsimile:

(201) 641-1771

Email:

info@setileague.org

Web:

www.setileague.org

President:

Richard Factor

Registered Agent:

Marc Arnold, Esq.

Secretary:

A. Heather Wood

Treasurer:

Martin Schreiber, CPA

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Robert S. Dixon, Ph.D.

Frank D. Drake, Ph.D.

Malcolm I. Raff, Ph.D.

Clifford Stoll, Ph.D.

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Greetings, Carbon-Based Bipeds!

By Sir Arthur C. Clarke

There are two aspects of the Search for Extra-Terrestrial Intelligence, or SETI – the technological and the philosophical. The first is the primary concern of engineers and scientists: Where and how do we search, and with what equipment? The second should be the concern of every thinking person, because it deals with one of the most fundamental questions that can possibly be asked: What is the status of that recent arrival on the scene, *Homo sapiens*, in the cosmic pecking order?

The spectrum of conceivable answers is enormous and has supplied material for legions of science fiction writers. However, they have usually been concerned with contact rather than detection, because that has far greater dramatic possibilities. A spaceship landing on the White House lawn is considerably more exciting than a string of blips on a radio-telescope monitor – though that is a much more likely scenario.

Nevertheless, however it occurs, the detection of intelligent life beyond Earth would change forever our outlook on the universe. At the very least, it would prove that intelligence does have some survival value – a reassurance worth having after a session with the late news.

The first thing we would like to know about an ET is “What does it look like?” and this might quickly be answered if we received video signals. (It should not be difficult to display them, as the principles involved in picture transmission are universal.) Almost certainly, we would then be in for a shock. Although our basic design seems an efficient one, which may well occur frequently on Earth-type planets, nowhere in the galaxy will there be creatures we could mistake for human beings, except on a very dark night.

We are the end products of countless throws of the genetic dice; never in the whole of time and space would that exact evolutionary sequence be repeated. From the engineering viewpoint, men and apes are virtually identical, yet we seldom confuse them. Even humanoid ETs would look far more – well, alien – than a gorilla. And most ETs may well be stranger in appearance than an octopus, a mantis, or a dinosaur.

This may be the reason that many people are opposed to SETI, because they realize that it is ticking like a time bomb at the foundation of our pride – and of many of our religions. They would applaud the old B-movie cliché “Such knowledge is not meant for man.”

There is one way in which they could be right. If there are higher civilizations out there in the Milky Way, some SETI enthusiasts hope that they are continually broadcasting an easily decoded *Encyclopedia Galactica* for the benefit of their less advanced neighbors. It may contain answers to almost all the questions our philosophers and scientists have been asking for centuries, and solutions to many of the practical problems that have beset mankind.

But could we absorb such a flood of knowledge, and would its very existence not give us an – perhaps terminal – inferiority complex? Even the most well-intentioned contacts between cultures at different levels of development can have disastrous results. It might be better, in the long run, for us to acquire knowledge by our own efforts, rather than be spoon-fed. I recall how a tribal chief once remarked, when confronted with the marvels of Western technology, “You have stolen our dreams.”

Nevertheless, I believe the promise of SETI is far greater than its perils. It represents the highest possible form of exploration; and when we cease to explore, we will cease to be human.

But suppose the whole argument for SETI is flawed, and that intelligent life has arisen only on Earth? It would, of course, be impossible to prove that for the entire cosmos; there might always be ETs just a few light-years beyond the current range of investigation. If, however, after centuries of listening and looking, we have still found no sign of extraterrestrial intelligence, we might be justified in assuming that we are alone in the universe.

And that is the most awesome possibility of all. We are only now beginning to appreciate our duty toward planet Earth. That could be merely the prelude to far greater responsibilities.

If we are indeed the sole heirs to the galaxy, we must also be its future guardians.

Editor's Note: This paper was commissioned by Life Magazine for its September 1992 issue, and also appears in an excellent collection of essays by the same title, published in 1999 by St. Martin's Press. It is reproduced here by the kind permission of Sir Arthur, and the Scoville Chichak Galen Literary Agency. ❖

A Word of Thanks from our Bruno Winner

I would like to take this opportunity to thank everyone in The SETI League for presenting me with this year's Giordano Bruno Memorial Award. No one was more surprised as I was to receive this award. At our last European Radio Astronomy Congress in Heppenheim Germany, Paul casually invited me to come to the very first SETICon01 as a return match, so to speak, which excited me a lot. Due to very tight finances, however, I did not have much hope of coming. What I did not know is that the plan was thicker than I could imagine. Paul had spoken to my wife Geli, to get me over with certainty so as to receive my Bruno.

Last Christmas, I opened my presents under the tree and found a plane ticket to Philadelphia, which was a great surprise indeed. And so it happened that I came over to SETICon01. I thought, to hold a lecture and present a slide show at the banquet. Everything went very well indeed, and I think everyone enjoyed my slide visit to some of the large Radio Telescopes in Europe. At the end, I was re-sorting my slides when the announcement was made of me being awarded this year's Bruno. I was taken totally and utterly by surprise! Paul and my wife had kept this a secret and, to be perfectly honest, I was caught on the wrong foot. Thanks, everyone; I am really honoured, as being a "strictly non-sport person," this becomes the very first trophy I have ever received. It is also the most important trophy I think I will ever receive. Thank you all for the nomination.

I realize that now, belonging to a small group of people having received the Bruno award, this will bind me to respect its ideals, and to direct my future activities in support of the future of SETI throughout Europe.

Peter Wright, DJ0BI ❖



SETI League awards committee chairman David Ocame (right) presents Peter Wright, DJ0BI, with the 2001 Giordano Bruno Memorial Award, at the SETICon01 Awards Banquet at The College of New Jersey.

Technical Symposium Announcement And First Call for Papers



In accordance with Article IV, Section 1 of our duly approved Bylaws, as amended, the Trustees of The SETI League, Inc. hereby schedule our Eighth Annual Membership Meeting for 10 AM Eastern time on Sunday, April 28, 2002. The 2002 Annual Meeting will be preceded by a two-day SETI League Technical Symposium, which will run from 1 PM on Friday, April 26, through 5 PM on Saturday, April 27, 2002. Both events will be hosted by the Engineering Department of The College of New Jersey, Ewing township (Trenton area) NJ.

Our second annual SETI League Awards Banquet, complete with door prizes and a keynote speaker, is planned for Saturday night, 6 PM, at the Student Center of The College of New Jersey. The Banquet is once again being co-sponsored by the Trenton Student Chapter of the Institute of Electrical and Electronic Engineers (IEEE). Further details will be posted to our website early in 2002.

We hereby solicit Technical Symposium presentations on SETI-related hardware, software, search strategies, and philosophy. This notice serves as a first Call for Papers. Those SETI League members wishing to present a paper should email a proposed title and 100-word abstract to the Executive Director at n6tx@setileague.org, no later than 30 September 2001. Be sure to include your full name, affiliation, postal address, and email address.

A formal Proceedings will once again be published prior to the Symposium. This year, papers will be peer-reviewed by a panel of SETI League members with appropriate professional expertise. First draft manuscripts must be received no later than 30 November 2001, with acceptance notification expected by 31 December 2001. Upon final editing of accepted papers, camera-ready copy will be due no later than 28 February 2002. Due to printer's deadlines, manuscripts received after that deadline will not make it into the Proceedings. Instructions for preparation of final manuscripts may be found in The SETI League Policy Manual, and will be emailed to the authors of all accepted papers.

The fee for Technical Symposium pre-registration has been set at \$40 US for SETI League members, and \$90 US for nonmembers, if received by 31 March 2002. Registration fees will increase by \$10 after that date. One copy of the Proceedings, an evening Hospitality Suite, and refreshments are included in the registration fee. Tickets for the Saturday night Awards Banquet may be ordered in advance at \$30 US each, and additional Proceedings copies may be purchased at the door for \$20 US. All SETI League members in good standing are welcome to attend Sunday's Annual Membership Meeting, whether registered for the Symposium or not.

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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.

August 9 - 11, 2001: *Small Radio Telescopes Conference*, Pisgah Astronomical Research Institute, NC.

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

September 8, 2001: Dr. SETI ® is Banquet Speaker at ARRL Southwest Regional Convention, Riverside CA.

September 27 - 30, 2001: *Whirlpool 2001 Star Party*, Birr County, Ireland.

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

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

October 5 - 7, 2001: *19th AMSAT Annual Meeting and Space Symposium*, Atlanta GA.

October 13 - 14, 2001: *ARRL EME Contest*, first weekend. Point your dish at the moon and tune 1296.000 to 1296.050 MHz.

November 10 - 11, 2001: *ARRL EME Contest*, second weekend. Point your dish at the moon and tune 1296.000 to 1296.050 MHz.

April 21, 2002: *Fourth Annual SETI League Ham Radio QSO Party*; 14.204, 21.306, and 28.408 MHz.

April 26 - 28, 2002: *SETICon02 Technical Symposium and Annual Membership Meeting*, Ewing (Trenton area) NJ.

May 4 - 5, 2002: *Trenton Computer Festival*, Edison NJ.

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

May 18, 2002, 0700 hours: *SETI Breakfast*, Marriott Hotel, Dayton OH.

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

August 16 - 18, 2002: *10th International Amateur Radio Moonbounce Conference*, Prague Czech Republic.

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

September, 2002 (date to be announced): *Third European Radio Astronomy Congress*, Heppenheim Germany.

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

April 21, 2003: *Fifth Annual SETI League Ham Radio QSO Party*; 14.204, 21.306, and 28.408 MHz.

April 25 - 27, 2003: *SETICon03 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 21, 2004: *Sixth Annual SETI League Ham Radio QSO Party*; 14.204, 21.306, and 28.408 MHz.

April 23 - 25, 2004: *SETICon04 Technical Symposium and Annual Membership Meeting* (location TBA). ❖

Book Review

Life Everywhere: The Maverick Science of Astrobiology

New York, Basic Books, 2001[ISBN 0465015638, 206 pages]

By David Darling; reviewed by Prof. Albert A. Harrison

The parade of new books on astrobiology and SETI continues. Which of these new offerings add substantially to the pre-existing literature base? The first way a new book can contribute is by broadening and deepening the knowledge of people who are already versed in the search for life on other worlds. The second way a book can contribute is as a useful introduction for people who have little or no background in astrobiology. Although it may seem that these two goals are mutually exclusive, David Darling's remarkable new book, Life Everywhere, should appeal to both seasoned veterans and the general public. The key to this achievement is a very generous helping of fresh, up-to-date material coupled with superb organization, a conversational writing style, and the lavish use of anecdotes and examples that make potentially difficult material understandable and engaging.

Veterans will discover that Life Everywhere takes us way beyond the usual tales of finding Jupiter-sized planets and mashing up Martian meteorites. In a clear, concise, and orderly fashion this book strengthens almost every term in the Drake Equation. For example, Darling describes how, rather than narrowing the search for the origin of life, astrobiologists keep finding new ways that life may have begun. He tells us how to identify promising stars, and warns that the usual discussions of habitable zones may be unnecessarily limited. Life Everywhere unveils emerging technologies that will allow astronomers to identify Earth-like planets in other solar systems, and then monitor chemical processes that we would expect if simple forms of life evolved there. SETI League members are sure to enjoy his provocative analysis of the "Rare Earth" hypothesis, and his chance discovery of how pre-Copernican thinking may influence contemporary astronomy.

Life Everywhere is a great book for initiating friends and relatives into the mysteries of astrobiology. Do you have an aunt who gets a headache trying to think about planets or moons in orbit? Darling will ask her to visualize a dinner plate with a helping of mashed potatoes in the center and a used stick of chewing gum whizzing around the rim! Do you have an adolescent son who can't "get into" science? He may be thrilled by Darling's discussion of the formidable survival skills of life forms such as "Conan the Bacterium." Although upbeat and [at least when it comes to other worlds] definitely "pro life," Darling is a careful scientist who explores both sides of important issues and carefully separates hypothesis from fact. His discussion of panspermia is a good example of his evenhanded treatment of controversial topics. No book accomplishes everything and, while Life Everywhere is definitely multidisciplinary, we still await discussions of how the social sciences and humanities might contribute to astrobiology.

Shortly after Life Everywhere was published there appeared a spate of negative "reviews" on the Internet. To me, these reviews said more about the anonymous authors' politics than about the qualities of Dr. Darling's new book. Some of these commentators seemed to favor creation science over evolution, and some preferred new-age thinking to scientific procedures. After 400 years, the Copernican Revolution continues, and the ability of Life Everywhere to outrage pre-Copernican thinkers is much to Dr. Darling's credit. ❖

Implications of Astrobiology for SETI

by Albert A. Harrison, Ph.D.
(email aaharrison@ucdavis.edu)

Astrobiologists use telescopes, interferometers, spectrometers and other devices to discover suitable locations for life, find life's physical or chemical precursors, and identify signs of past or current biological activity. As currently practiced, astrobiology strengthens preliminary terms in the Drake Equation (stars, planets, habitability, initiation of life), for now avoiding concluding terms such as the evolution of intelligence and longevity. SETI searches bypass specific components of the Drake Equation and seek unequivocal signs of technologically advanced civilizations. By developing evidence in support of specific parts of the Drake Equation, astrobiologists bolster the rationale for SETI. This brief paper identifies other possible implications of astrobiology for SETI.

Astrobiologists are discovering large (multiples of Jupiter) planets almost faster than they can be catalogued. Within a decade, new Earth-based and space-based telescopes will go on line. NASA's planned Terrestrial Planet Finder (TPF) and Next Generation Space Telescope (NGST) are but two examples. These instruments will make it possible to image Earth-like planets in other solar systems. Subsequent generation (circa 2020) devices will enable us to identify more distant habitable planets and monitor chemical activities suggestive of simple forms of such as bacteria. Within the 21st Century, the range of these imaging devices could increase from 30 to 100 LY.

Despite various rules of thumb or "heuristics" such as exploring frequencies in the vicinity of the "cosmic water hole," a continuing difficulty confronting SETI astronomers is where they should look. Advances in astrobiology will lead to new heuristics that should help astronomers aim their telescopes in promising directions. Of course, astrobiology cannot help astronomers locate machine intelligence broadcasting from interstellar space, and many promising planets will host life that does not progress to technologically advanced civilizations. Still, astrobiology may help astronomers steer clear of really unpromising locations.

Many SETI organizations including the Planetary Society, the SETI Institute, and the SETI League are supplementing microwave observation (MSETI) with optical observation (OSETI) intended to find continuous or pulsed lasers. One rationale for adding OSETI is that Earth may be "pinged" by a civilization within 50 LY that has detected terrestrial radio activity. Perhaps a much older and more technologically advanced civilization could use advanced astrobiological procedures (including remote imaging from multiple locations) to discover life on Earth from hundreds or even thousands of LY away. If so, we may not be invisible beyond the 50 LY boundary of our radio signature. Astrobiology increases the plausibility of theories suggesting that Earth has been detected by civilizations that fall beyond the range of our radio emissions.

We discount interstellar probes (such as Pioneer and Voyager) as practical means for encountering distant cultures. One of the many reasons for this is that there are countless possible destinations, and another is the tremendous time requirement for traversing interstellar distances. Still, an ancient civiliza-

tion's discovery of life on Earth would give their scientists a promising destination and eliminate the need to dispatch fleets of probes in every imaginable direction. Because extraterrestrial civilizations are estimated to be billions of years older than our own, and because imaging extrasolar planets (like radio, lasers, and spacefaring) is a relatively early technology, extraterrestrial astrobiologists could have found our life-bearing planet well before the evolution of humans. There could have been ample time for a probe traveling at a small fraction of the speed of light to reach our solar system.

Thus, astrobiology is more than an esteemed partner conducting routine grunt work to increase our confidence that SETI will lead to a confirmed detection. Advances in astrobiology force us to rethink our search strategies and our plans for managing contact and its aftermath. Could it be that the step-by-step approach of astrobiology, rather than the direct approach of SETI, would first confirm the existence of extraterrestrial intelligence? Astrobiology's advantage over SETI is that it does not have to depend on civilizations billions of years older than our own sharing contemporary terrestrial technology. Breathe easy, SETI aficionados, NASA specifically prohibits its astrobiologists from searching for extraterrestrial intelligence!

References

- Allen Tough, Ed., *When SETI Succeeds: The Impact of High-Information Contact*. (Bellevue, Washington: Foundation for the Future, 2000)
- David Darling, *Life Everywhere: The Maverick Science of Astrobiology*. (New York: Basic Books, 2001) [reviewed elsewhere in this issue -- ed.]
- Brian McConnell, *Beyond Contact*. (Santa Rosa, CA: Charles O'Reilly and Associates, 2001) ❖

Bruno Nomination Deadline Nears

Nominations for the 2002 Giordano Bruno Memorial Award, The SETI League's highest honor, are due at Headquarters by 31 December, 2001. 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 technical 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 2002 Bruno Award winner will be announced at our Second Annual Awards Banquet, to be held at the College of New Jersey on Saturday evening, 28 April 2002. Past Bruno recipients include:

1996 - Dr. D. Kent Cullers, WA6TWX

1997 - Daniel Boyd Fox, KF9ET

1998 - Ken Chattenton, G4KIR; Trevor Unsworth, G0ECP

1999 - Noel Cedric Welstead, VK4AYW

2000 - Dr. Stuart Kingsley

2001 - Peter Wright, DJ0BI

Please email your 2002 Bruno award nominations now to bruno@setileague.org, fax them to 1 (201) 641-1771, or mail them to The SETI League's New Jersey office. ❖

SETI Innovations

By Dr. Allen Tough, University of Toronto

(email: allentough@aol.com)

from Proceedings of SETICon01

Innovations can bring fresh vigor and excitement to a scientific field. Three innovations in particular have rejuvenated the SETI field during the past few years. These three innovations are (1) The SETI League, (2) optical SETI, and (3) the web-based Invitation to ETI.

THE NEED FOR INNOVATIONS

Innovation in the SETI field is highly appropriate for four major reasons.

First, the history of scientific discoveries teaches us the value of widening the array of approaches and research methods. It is quite common for a breakthrough to result from a new, fresh, unorthodox strategy or research method. Forty years of radio SETI have not produced any confirmed evidence of extraterrestrial intelligence (ETI). Clearly, we need to expand the array of search strategies.

Second, the SETI field is trying to detect something that is totally unknown and presumably deeply alien. We do not even know whether we are searching for biological intelligence based on flesh-and-blood brains, artificial machine intelligence, or some advanced integration of the two. We have no certainty about the origins, history, thought patterns, emotions, ethics, core values, purposes, technological capacities, or other major characteristics of extraterrestrial intelligence. It is likely that ETI will turn out to be surprisingly different from what we expect--deeply alien, puzzling, unlike anything we have ever encountered before. It has, after all, likely advanced to a level of knowledge and technology that is thousands or millions of years beyond our current human level. Because we are facing such a profound unknown, an attitude of humility and scientific open-mindedness seems appropriate. The pursuit of a somewhat diverse array of search strategies seems wiser than keeping our approach too narrow.

Third, more than one extraterrestrial civilization is likely available to be detected. It is all too easy to think only about the first detection, ignoring the likelihood of multiple detections over time. The early years of a new millennium provide a good opportunity to look ahead at the likely pattern of detections over the next thousand years. If several civilizations have arisen in our galaxy, as most SETI scientists hypothesize, then we may detect several forms of ETI during the next millennium. For example, we may detect an artificial radio signal, an encyclopedic laser message, a large spacecraft parked in the asteroid belt, and a tiny probe near the Earth's surface.

Fourth, widening the assumptions and strategies of the SETI field may reinvigorate the people, conferences, and writing in the field. Fresh ideas and bold conceptualization, some attention to long-term visions, a vigorous worldwide grassroots organization such as The SETI League, and a wider variety in conference papers can retain the field's intellectual excitement and avoid a feeling of boredom, fatigue, and disappointment.

All in all, a reasonably wide array of organizations, projects, and search strategies seems most likely to lead to success.

The phenomenon we are trying to detect is so unknown, so old, so advanced, that we cannot be sure which of our strategies is most likely to succeed. In order to enhance our chances of detecting extraterrestrial intelligence, we should proceed vigorously with all of today's approaches while also being alert to tomorrow's useful innovations.

THE SETI LEAGUE

It is quite possible that some other civilization is broadcasting a radio beacon or message in our direction. Radio telescopes are used to search for these artificial signals, and also to detect any inadvertent leakage from communications or radar. The traditional strategy for 40 years, radio SETI is still going strong. Its radio telescope icon is still the most common symbol for the entire SETI field.

One of the most exciting SETI innovations during the 1990s was the creation of The SETI League. Thanks largely to the leadership of Richard Factor and Paul Shuch, this grassroots organization zoomed from zero to a major force within just a few years. It is now one of the major players on the worldwide SETI stage. It provides a congenial and unique "home" for many SETI people around the world, for their ideas, and for their SETI projects. It maintains a richly informative website at www.setileague.org. Many of us eager for new ideas in the SETI field look for them in The SETI League's newsletters, in its Web guest editorials, and in other pages on its extensive website. Its members come from many parts of the world. One hundred of its members have built a backyard dish to participate in the search for artificial radio signals.

The organization's continuing vibrancy and growth for the next five years, on a reasonably solid financial foundation, is very important to all of us. To ensure this future for The SETI League, several of us are enthusiastically working to create a good plan through its long-range planning committee.

OPTICAL SETI

Optical and radio SETI are similar in that each uses telescopes to search for artificial signals from many light-years away. Instead of searching within the radio spectrum, however, optical SETI tries to detect pulsed lasers, infrared messages, or other artificial optical signals from many light-years away. A highly advanced civilization may well choose rapid laser pulses for its interstellar communications because of their advantages, such as the amount of information that can be packed into laser messages.

The idea of optical SETI has been around for many years, kept alive largely by Stuart Kingsley's efforts. Charles Townes promoted the idea 40 years ago. More recently, Townes promoted optical SETI during the SETI Institute's exercise of looking at potential science and technology over the next 20 years. In 1998, as a result, several new optical SETI projects were inaugurated. These projects have brought a new vigor to the SETI field. In January 2001, the third optical SETI conference (the first since these new projects began) was marked by much more intellectual excitement and much more eagerness to explore fresh ideas than occurs at many SETI conferences.

At this optical SETI conference in January 2001, Dr. H. Paul Shuch made an exciting presentation on the possibility of

SETI League members pursuing optical SETI. This might signal the beginning of an important new approach within The SETI League. Both radio SETI and optical SETI could be highly valuable for finding artificial signals from intelligence in some other part of our galaxy.

THE INVITATION TO ETI

Before we can understand the third major SETI innovation, it is important to understand the likely nature of ETI. SETI is the search for extraterrestrial intelligence, but what are the major characteristics of this phenomenon that we are trying to detect?

Although we know almost nothing about the nature of extraterrestrial intelligence, we do know that it is likely very old and extraordinarily advanced. Because our sun is a relatively young star, civilizations that have arisen around other stars are likely much older than ours. Our technology is very young, largely developed in just the past century or two: any alien technology that we detect will likely be thousands or even millions of years beyond our adolescent technology.

If alien civilizations are thousands of years ahead of us, then they are quite capable of sending intelligent probes to explore other planetary systems. Each probe could be smarter and more knowledgeable than any human being, yet possibly be smaller than a basketball or baseball. Even humankind's adolescent technology will likely become capable of launching interstellar probes within 200 years, much sooner if NASA's current plans are successfully implemented. So, any civilization thousands of years beyond us presumably developed an interstellar capacity long ago.

If there are other civilizations (or other forms of advanced intelligence) in our galaxy, it certainly seems possible that some of them have sent intelligent probes to other stars in order to monitor or contact any civilizations that have arisen. Just as we send probes to explore our cosmic neighbourhood, other civilizations will do the same. It would be hard to believe that all mature civilizations lack the motivation and capacity to monitor other planets and societies in some detail, especially since nanotechnology may enable probes to be self-replicating as they spread through the galaxy. Self-replicating probes could spread far and wide by pausing occasionally to manufacture additional probes.

Scientists and engineers now discuss the possibility of faster-than-light communications and travel more seriously than in previous years. Perhaps advanced civilizations learn how to accomplish this. But speeds faster than light are not necessary for travel between the stars. For a patient self-repairing machine, one-half or one-tenth the speed of light is sufficient.

If a few civilizations in our galaxy began sending intelligent probes to monitor various planetary systems thousands of years ago, then an intelligent alien probe could well have reached our solar system by now. Regardless of our emotional reactions to the situation, it is quite possible that at least one alien probe is currently monitoring our civilization. It makes good sense, therefore, to try to detect such an object.

Such efforts might be called "solar system SETI" to distinguish them from searches for signals that come from a distance of several light-years. Over the past three years, The SETI

League newsletter and email discussion lists have contained lively discussions of how such efforts might proceed.

If a probe is highly intelligent, it is likely monitoring our telecommunications, including the World Wide Web, in order to learn about our civilization. We do not know exactly how it does this, of course, but the idea seems reasonable when we consider that our own national security agencies already monitor fax and email messages around the world. Much of this electronic traffic can be intercepted as it travels between the ground and a satellite, or between two microwave relay towers. Just imagine what the National Security Agency's technology will be able to do 100,000 years from now!

Once we realize that ETI is likely monitoring our telecommunications, a fresh strategy for contact comes to mind. Instead of "detecting" ETI, we can shift our focus to inviting contact. We can issue a warm welcome to ETI, along with an invitation to establish a dialogue with humankind.

The World Wide Web is an excellent place for such an invitation, since ETI can readily find it during its routine monitoring. Presumably a technology that is thousands of years beyond ours will have little difficulty learning our languages and surfing the Web as competently as we do. If it uses the major search engines to find web pages on extraterrestrial intelligence, alien intelligence, alien probe, or invitation to ETI, for instance, it will find any invitations that exist on the Web.

The major current project using this strategy is the Invitation to ETI issued by a group of 80 scientists, artists, and graduate students. Most of them are active in the SETI field, the field of futures studies, or the annual CONTACT conference. Several of them are SETI League members. Since October 1998, their warm welcome to ETI and their invitation to engage in dialogue with humankind has been at <http://members.aol.com/WelcomeETI>.

They hope that their ongoing interest in ETI, their vision of a worldwide scientific and educational dialogue between ETI and humankind, and their thoughtful preparations for contact will elicit a positive response from ETI. Perhaps they can be useful to any extraterrestrial intelligence whose mission is to deeply understand human culture, establish contact, help and educate humanity, or link us to some galactic network. If it is successful, the Invitation to ETI could lead to a particularly exciting wealth of knowledge from a rapid back-and-forth scientific dialogue with ETI, unhampered by the language difficulties and slow response time of radio or optical SETI.

This project relies on insights into the likely goals and behavior of ETI, and it focuses on relationship and dialogue rather than physical detection. Consequently, it is primarily a social science strategy rather than a methodology within the physical sciences. The Invitation to ETI could actually succeed and flourish without ever establishing the physical location of ETI. At the same time, it is worth noting that this project depends on an extraordinary physical infrastructure - the World Wide Web. The project itself is small-scale and reasonably inexpensive, but it relies on the technological sophistication of the largest and most expensive computer network in human history.

The Invitation to ETI project has received about 30 responses so far, but most seemed to be delusional, juvenile, or a prank. No respondent continued to communicate for very long

after I (as coordinator of the project) politely asked for evidence of authenticity that would convince scientists. If any respondent succeeds in passing our initial screening, then an independent team (skeptics, scientists, magicians, computer hackers) will request and assess further evidence. A detailed sequence of rigorous procedures (the project's "protocol") are spelled out in section 8.3 of my paper at this URL:

<http://members.aol.com/AllenTough/8.html>.

Over the next decade or two, it would be ideal for humankind to issue a variety of invitations to ETI from a range of groups and organizations. Perhaps The SETI League, for instance, will someday issue its own invitation.

ANOTHER POTENTIAL INNOVATION

Let's conclude by exploring another potential innovation - one that could be very useful but has not happened yet. This potential innovation is the introduction of unassailable research designs into the UFO field.

Many researchers in the UFO field see themselves as similar to SETI researchers: they, too, are trying to find scientific evidence of the existence of extraterrestrial intelligence. Indeed, in a sense they have a great deal of data. The problem is that most mainstream scientists do not accept the validity of the UFO and abductions data. At present, many scientists assess UFO research as faulty science or even pseudo-science.

Unassailable research designs could help to overcome this problem and thus bridge the gap between the fields. Innovative, rigorous, clear-cut designs that incorporate strict safeguards could produce irrefutable data. To stimulate thought on this matter, here are five hypothetical examples of the sorts of data that would merit serious consideration by mainstream science.

Example #1. For our first hypothetical example, let us imagine that someone has an artifact claimed to be of extraterrestrial origin. Perhaps the artifact is claimed to be a spacecraft parts or an implant removed from an abductee. The artifact is analyzed independently by four laboratories of impeccable integrity. All four labs state unequivocally that the artifact could not have been manufactured by humans or nature, and must be of extraterrestrial origin.

Example #2. An autonomous scanning platform with a wide range of carefully calibrated equipment has supplied data about an object that flew overhead three or four times. The data indicate a speed and maneuverability far beyond the capacity of any human craft, even cutting-edge military craft.

Example #3. Nonstop webcams, monitored at an independent location, are focused on the beds of 40 people who often report an abduction experience during the night. In three cases, the camera has recorded the instant and inexplicable disappearance of the person, and their equally inexplicable re-appearance in bed an hour or two later. The following morning, in each case, the person reports being abducted the previous night.

If someone claims to be in frequent contact with ETI, or if someone claiming to be ETI is in direct contact with a researcher, two additional examples arise. In either case, I simply use the word "claimant" in order to avoid awkward sentences.

Example #4. We negotiate that a particular claimant will provide a list of 20 "miracles on demand" that it is willing to perform. These "miracles" will be easy for an intelligence that has nanotechnology and super-smart robots at its command, but far beyond anything that today's human society can accomplish. A panel of scientists, magicians, and skeptics chooses five from the list, and is subsequently satisfied that all five have been performed successfully - along with two others initiated by the panel.

Example #5. We negotiate that another claimant will provide us with scientific breakthroughs, far beyond today's human science, from five fields. Experts in all five fields confirm these breakthroughs and state that they could have come only from a science that has advanced far beyond ours.

So far, none of these five hypothetical examples has actually occurred. Rather, the five examples are presented to stimulate fresh thinking about unassailable research designs for studying UFOs and abductions. I hope that the leading UFO scientists, in consultation with other scientists who are disinterested or even skeptical, will soon design creative but unassailable research projects. Ideally, the UFO researchers and a small group of skeptics should agree on the design before the project begins: all parties should then agree to accept the data, even if it conflicts with their cherished beliefs.

A FINAL THOUGHT

Let us reflect for a moment on just how inspiring, awesome, and transcendent our SETI enterprise is. After all, we are trying to tap into the wisdom, knowledge, and understanding of a deeply alien intelligence that is thousands or millions of years beyond us.

In the SETI field we sometimes get wrapped up in technical details, internal politics, public relations, strategic maneuvering, funding, equipment, data processing, Rare Earth cosmology versus abundant intelligence cosmology, the ultraconservative traditionalists versus the bold innovative explorers. But SETI is a much more profound quest than this.

Ultimately, as a result of the SETI field's heroic efforts, humanity may achieve a dialogue with some extraordinarily advanced intelligence - a dialogue about cosmology, philosophy, science, theology, music, art, and the purpose of life. We might learn about the fascinating diversity of life and intelligence throughout the universe - and we might learn about the meaning of it all!



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