



SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

Offices:

433 Liberty Street
Little Ferry NJ
07643 USA

Phone:

(201) 641-1770

Facsimile:

(201) 641-1771

Email:

info@setileague.org

Web:

www.setileague.org

President/Registered Agent:

Richard Factor

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SETI's New Horizons

By H. Paul Shuch, Executive Director Emeritus

In September of 2006, even as astronomers were in the process of demoting Pluto to dwarf status, a half-ton robotic spacecraft was already enroute to a close encounter with the former planet. Engineered by the Applied Physics Lab at Johns Hopkins University, NASA's New Horizons mission had been launched from Cape Canaveral in January 2006, into an Earth and solar system escape trajectory. It would slingshot around Jupiter a year later, the giant planet's gravity accelerating it to become the fastest object ever launched by humans. After flying within 10,000 km of Pluto in 2015, it is expected that New Horizons will survey several Kuiper Belt objects, before exiting our solar system and drifting into interstellar space.

Seven years after launch, the spacecraft is already more than 26 Astronomical Units from Earth, and within less than 6 AU of its primary target. At that distance, radio commands from Earth take nearly four hours to reach its receivers. And now, with New Horizons far from our local neighborhood, my colleague Jon Lomborg has come up with an ambitious plan to turn the planetary probe into an interstellar ambassador.

Lomborg is no stranger to galactic greetings. In the 1970s, he was the Design Director of the famous Voyager Golden Records, later the subject of many a good science fiction film. So, it was no surprise that he proposed attaching a similar message from humanity to the rapidly receding spacecraft. But, how does one saddle a horse that has already long left the barn? Jon, a staunch SETI supporter, adopted a strategy quite familiar to those of us who spend our days searching for signals from the stars. He would employ photons, the fastest spaceships known to man.

The plan, after crafting a suitable Encyclopaedia Terrestria, is to beam it via microwave from NASA's Deep Space Communications Network, directly into New Horizon's onboard computer memory, from which extraterrestrial computer scientists may attempt, some eons hence, to extract it. All of which is highly speculative (but no more so than the SETI enterprise itself). A number of SETI League members (including myself) have joined a team to try to pull off this newest Hello from the Children of Planet Earth. There is now a website devoted to this endeavor, and a petition at <http://www.newhorizonsmessage.com> that you can sign to support it. It remains to be seen whether, and how, we will address the many artistic, political, technical, economic, and social challenges we face. Stay tuned!



Works of Fiction by Dr. John Boardman

Some cable channels have lately produced several programs about alien life forms - that is to say, life forms which evolved on other planets and have allegedly made contact with residents of Earth. Sometimes these programs from science or history channels have claimed that many of the accomplishments of ancient human cultures might have been provided by, or inspired by, visitors from other planets. And some speculate on what would happen if such aliens were to land on Earth in the near future. And sometimes such programs report on contacts allegedly made in recent years between Earthlings and space aliens. Such aliens are supposed to have arrived on "Unidentified Flying Objects" (UFOs), although this term is something of a misnomer. People claiming to have made such contacts have identified these craft and their occupants in great detail, sometimes including accounts of sexual intercourse. I prefer the original term "flying saucer", since this term conveys precisely the lunacy of such alleged contacts.

In one such case, an Australian woman claimed that a space alien was the father of her baby. It should be pointed out that a human being is more closely related to a turnip, than to anything that evolved on another planet. The life of Edgar Rice Burroughs's character John Carter may make interesting reading as adventurer fiction set on Mars, but it is impossible that Carter and an egg-laying Martian female could have had children, even if we concede the existence of humanoid life on Mars.

In a letter to the New York Times of 31 August 2013, John Walker insisted that the scientific evidence on the evolution of living things makes it highly likely that living things and even intelligent living things, could have evolved on other planets with the right conditions. But that same scientific evidence makes it highly unlikely that such alien life forms could have traveled to Earth. There are no other planets in the solar system that have conditions anything like Earth's, so the evolution of intelligent life is virtually impossible on those planets. And the notion of intelligent beings coming from the planets of other solar systems, let alone other galaxies, runs up against the findings of the special theory of relativity, that travel faster than light is impossible. These findings are solidly supported by a century of observation and experiment, and we have nothing in the way of solid evidence to suggest that anything can travel faster than light. In fact, travel speeds approaching that of light are unlikely at present, even though the mutual annihilation of matter and anti-matter might accomplish speeds on this order. But even with a velocity 99% that of light, it would take about nine years for a round trip to Alpha Centauri, the star nearest to the Sun.

It should be emphasized that science fiction, including science-fiction films, are works of *fiction*. And reports of contacts with intelligent beings from outer space may be as popular as sightings of sea serpents once were, but they are also works of fiction.

These considerations were also taken up in the obituary of Dr. John Billingham (William Yardley, *New York Times*, 11 August 2013). Dr. Billingham felt that extra-terrestrials might be sending out radio messages that could be heard on Earth,

and in 1992, as chief of the Life Sciences Division of a NASA research center in California, he began running a Search for Extra-Terrestrials Intelligence (SETI). But after only a year, Congress eliminated NASA SETI funding, calling it a "great Martian hunt" and a waste of money. Dr. Billingham later got involved in other, privately funded SETI projects. SETI workers quite reasonably accepted the idea of contacting extra-terrestrials by radio, but face-to-face contact with interstellar visitors seems unlikely in the highest degree.

Even conversations by radio with other intelligent species would take a great deal of time. Radio, being an electromagnetic radiation, travels at the same speed as light, and after a mutually intelligible code were worked out, it could take decades for the simplest question to be answered. ❖

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.

January 17 - 20, 2014: *Arisia*, Boston, MA.

February 14 - 16, 2014: *Boskone 51*, Boston, MA.

March 17 - 21, 2014: *Search for Life Beyond the Solar System*, Tucson, AZ.

March 20 - 21, 2014: *5th IAA Search for Life Signatures Symposium*, Paris, France.

March 22 - 23, 2014: *Society of Amateur Radio Astronomers Western Conference*, Owens Valley Radio Observatory, Bishop CA.

March 29 - 30, 2014: *LI-Con 1*, Rockville Centre, NY.

April 19, 2014, 0000 UTC - 2359 UTC: Fifteenth annual SETI League *Ham Radio QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.

April 20, 2014: Twentieth SETI League *Annual Membership Meeting*, Little Ferry NJ.

April 25 - 26, 2014: *Southeastern VHF Conference*, Atlanta, GA.

April 26, 2014: Northern Lights Radio Society *Aurora Conference*, White Bear Lake, MN.

May 23 - 28, 2014: *Balticon 48*, Hunt Valley, MD.

June 29 - July 2, 2014: *Society of Amateur Radio Astronomers Conference*, National Radio Astronomy Observatory, Green Bank WV.

August 14 - 18 August, 2014: *Loncon3*, 72nd World Science Fiction Convention, London, England.

September 29 - October 3, 2014: *65th International Astronautical Congress*, Toronto, Canada.

April 18, 2015, 0000 UTC - 2359 UTC: Sixteenth annual SETI League *Ham Radio QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.

April 19, 2015: Twenty First SETI League *Annual Membership Meeting*, Little Ferry NJ.

April 24 - 25, 2015: *Southeastern VHF Conference*, Morehead, KY.

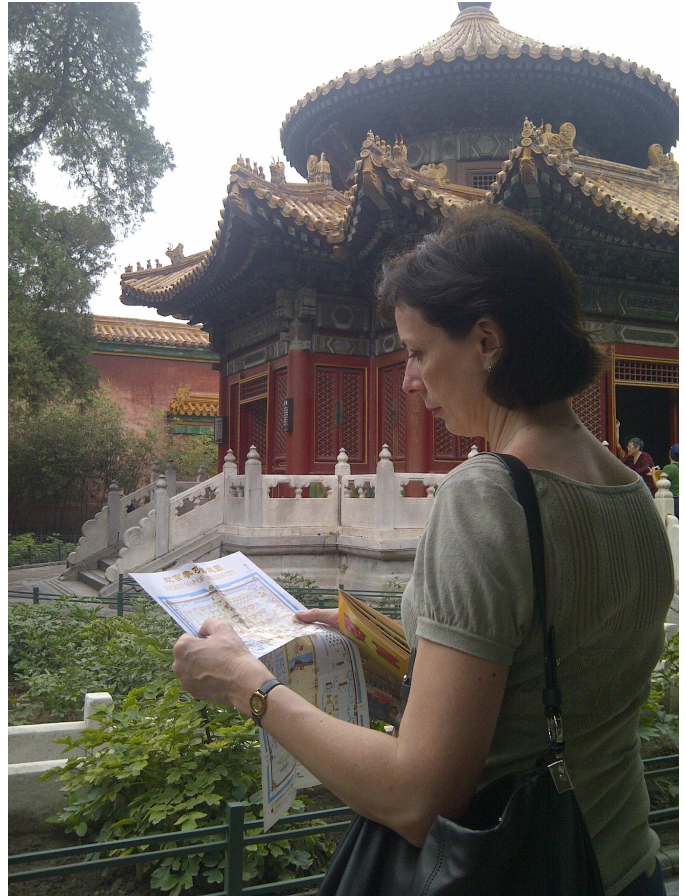
October 2015 (dates to be announced): *66th International Astronautical Congress*, Jerusalem, Israel. ❖

Photo Gallery

These pictures were taken at the 64th International Astronautical Congress held in Beijing, China, in September, 2013.



On the Sunday before the IAC began, many academicians enjoyed the opportunity to tour Beijing's Forbidden City.



Space architect Olga Bannova from the University of Houston consults a map, trying to navigate the immense Forbidden City.



During IAC Academy Day, Prof. Shuch (left) congratulates Caltech Prof. Ed Stone, director of the Voyager interplanetary probe missions, on his children finally leaving the Solar System. When Voyager 1 crossed the heliopause in 2012, it became Earth's first interstellar spacecraft.



The International Academy of Astronautics SETI Committee holds regular meetings each year at the annual International Astronautical Congress.



SETI enthusiasts from Italy, Netherlands, Scotland, and the US gather in China for the annual IAA SETI dinner.

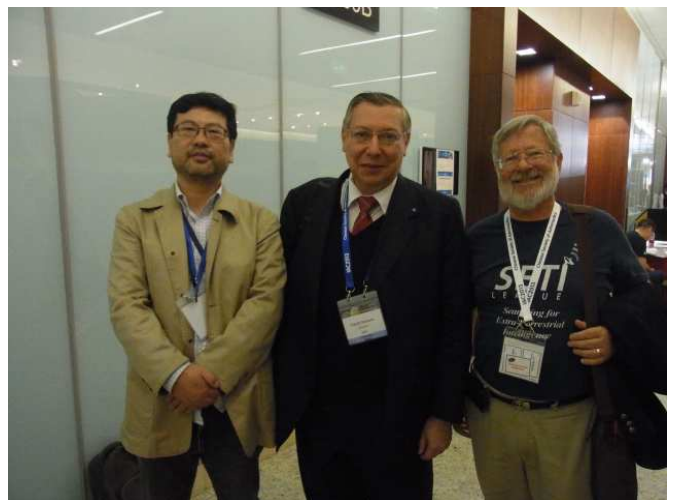


Michael Busch, who now works for the SETI Institute, shows off a morphologically correct model of asteroid 2008 EV5, on which he performed bistatic radar studies while employed by the National Radio Astronomy Observatory.

Session co-chairs Claudio Maccone and H. Paul Shuch greet their colleague Shin-Ya Narusawa, who delivered the Pesek keynote lecture at the 2013 SETI Science and Technology session. >>



SETI League Executive Director Emeritus H. Paul Shuch had the honor of delivering the Billingham Cutting Edge Lecture at the 2013 SETI and Society session.



Guest Editorial

How To Be Understood By Aliens

by Michael Busch

The title I've given this piece is really false advertising. The actual answer to "how to be understood by intelligent aliens?" will remain unanswerable until we've actually been understood by a real-life alien and learned how that worked. And the answer would depend on the alien concerned. How we would communicate with intelligent jellyfish living under the ice of Europa would be more like how we currently communicate with dolphins than how we would communicate with aliens who we first saw as they lit up fusion rockets a light-month away.

So let's narrow the question to a more traditional SETI one. How can we design a message to be transmitted into space that will be intelligible to someone who knows as little about us as possible while still being able to receive the message? This question has been thought about for a very long time, but there are a couple of points about it that I'd like to make.

One basis of all forms of communication is having some common knowledge, which is then used to convey new information. We would by definition have some common knowledge with any alien watcher who picks up transmissions from Earth - be those at any frequency and either deliberate or leakage. Said watcher will need to know some astronomy, some physics, some engineering, and likely a fair bit of math. I don't see any way around that, unless someone can come up with a plausible science fiction scenario where a population evolves non-technological narrow-band high-sensitivity receivers - be those receivers radio or optical or something else. This common knowledge base need not be extensive. I can envision a watcher from a culture in what we might call the Iron Age, except with nearly-parabolic metallic cooking mirrors that lead to a strictly limited phenomenological understanding of radio astronomy. But there will at least be a starting point.

To convey new information, we need a standard way of representing ideas - a vocabulary. Many different groups have come up with ways to do this: the Arecibo Message, the various Cosmic Calls, Lincos, my own test message designs, among others. All of these follow a seemingly-inevitable approach: build from what should be common knowledge, convey the relationships between ideas with a series of examples until the meaning of the symbols is unambiguous, and then progressively add more information. With enough data, a sufficiently capable watcher would be able to interpret almost any such scheme. The question then becomes what ways of encoding a given set of ideas are most efficient and easily understood.

This is where I disagree with the composers of the Arecibo Message and of Cosmic Call (and also with Michael

Chorost's *Guest Editorial* in the last issue of SearchLites). Those messages were based on two-dimensional images, monochrome, represented as zeros and ones. Certainly a watcher could interpret those messages, but it might not be so instinctive as it is for most humans. Perhaps the watcher is blind, and listening rather than watching. Perhaps they see in full three-dimensional volumetric rendering and don't immediately parse two-dimensional arrays. And while pictures are very good for representing certain types of information - such as human figures, chemical structures, and planetary surfaces - they're relatively low in information density. Simple diagrams often contain a lot of white space.

Message designs based on constructed languages, with some elements based on computer programming languages to allow for arbitrary data structures, can be much more flexible and efficient in terms of the number of bits required to convey many ideas. For example, here's a section from one of the test messages that I've variously subjected astronomers, engineers, a historian, and Caltech undergrads to as proxies for actual aliens:

| | | | | |
|----------|----------|----------|----------|----------|
| 00777700 | 10000000 | 37004001 | 10000000 | 00666600 |
| 00777700 | 10000001 | 37004001 | 10000001 | 00666600 |
| 00777700 | 10000002 | 37004001 | 10000002 | 00666600 |
| 00777700 | 10000003 | 37004001 | 10000003 | 00666600 |
| 00777700 | 10001237 | 37004001 | 10001237 | 00666600 |

This may not seem like much, but those 600 bits include a number of important concepts. Did you figure them out?

We have the basic structure of the message as being based around words (each 24 bits, here expressed as 8 characters in base 8), the words that separate out the beginning and end of a statement, the word "=", and the convention for representing positive integers (although the last is a little less obvious).

When I've compared messages based on constructed languages to those based on images in blind tests with human watchers, I've found that both are readily interpreted but the image-based ones take about three times as many bits to convey equivalent information. That means we can either convey that more information with languages designed to be intelligible than with purely pictorial ones, or we can repeat whatever we want to say several times to guard against the watcher missing much of it.

But all of this is primarily my personal opinions. After all, we're trying to mind-read intelligent aliens who plausibly should exist, but of whom we know exactly nothing. Again, this will only truly be resolved when and if we actually find some.

Disclaimer: The opinions expressed in editorials are those of the individual authors, and do not necessarily reflect the position of The SETI League, Inc., its Trustees, officers, Advisory Board, members, donors, or commercial sponsors.

Leaving Academia

(The true story of the founding of The SETI League)
copyright © 2013 by H. Paul Shuch

With this issue of *SearchLites*, The SETI League enters its twentieth year. This seems to be an appropriate occasion for retelling the tale of how Richard Factor, our president and founder, recruited me to this bold enterprise. I know many of you have heard the story before, so this time around, I'm giving it a new twist, and telling the tale in verse. Enjoy!

Richard was a ham friend. Since he didn't live so near,
He'd call me on the telephone, maybe once a year,
So we could catch up on our lives. Early one December,
Richard rang me up. It was a call I'd long remember.
My wife had gone out Christmas shopping. I was home alone,
With lots of time to talk to my friend Richard on the phone.

"So, what's new with you?" he asked. He kept his questions short,
To give me lots of time to file as detailed a report
As I was wont to give. This time, I tried to make it clear
That I had had a busy and most interesting year
Teaching some, and flying some, and getting on the air
Not so very often, just to talk to here and there.

"And you?" I reciprocated. "Tell me, how's your life?
Are you still a bachelor? Did you ever take a wife?"
"I may be deluded," Richard said, "but I'm no dunce.
Marriage is the same mistake I never did make once."
Richard then went on, of matters serious and petty,
Until he asked me, "Do you know what's going on with SETI?"

I was well aware that NASA's funding had been cut,
And the search for life was in its final phases. But...
Maybe private funding would appear to save the day.
We can carry on, I said. There has to be a way.
Richard and I talked on for an hour and a half
About this situation that could make you cry, or laugh.

(It's no more a secret, so now I'm free to tell
His callsign. Richard's WA2IKL.)
Then he dropped his bombshell, and at last I came to see
This wasn't idle chit-chat – he was interviewing me!
"I'm impressed there's so much about SETI that you know.
I've founded a non-profit. Would you like to run the show?"

I was being asked to turn my back on something great:
A job for life, backed by the taxing power of the state,
With pension and full tenure, for a chance to tackle real
Fringe science with uncertain funding. I began to feel
There's just no way that I could pass up such a cushy deal!
So, I told Richard that his offer had a strange appeal.

I first took a sabbatical from teaching, just to find
I liked the change. And so, the next semester, I resigned.
Those twenty years of teaching quickly slipped into the past.
Two decades now I've run The SETI League. It's been a blast!
The classroom was another life that I can scarce remember,
And all because my ham friend, Richard, called me that December.



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

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|---|--------|------|
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