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Allen Tough and the Billingham Connection

by H. Paul Shuch, Executive Director Emeritus

At its 2005 meeting in Fukuoka, Japan, the SETI Permanent Study Group (now known as the SETI Permanent Committee) of the International Academy of Astronautics (IAA) voted to establish an annual *Billingham Cutting-Edge Lecture* (BCEL), as a forum to showcase breakthrough thinking in advancing the Search for Extra-Terrestrial Intelligence. A number of SETI League volunteers serve on the IAA's SETI Committee, which I am privileged to co-chair along with Dr. Claudio Maccone, one of The SETI League's most active members. The lecture honors longtime SPSG member and former chairman Dr. John Billingham, a major force for forty years in promoting innovation within the SETI field. Speakers are selected by the Committee, with one Cutting-Edge Lecture delivered each year at the opening of the SETI II (SETI and Society) sessions of the IAA Symposium on SETI, at the annual International Astronautical Congress.

The BCEL was first proposed by, and initially endowed by, longtime Committee member Dr. Allen Tough (Professor Emeritus, University of Toronto; Chief Scientist, Invitation to ETI). Allen was a SETI League stalwart, an early Life Member who served us in several leadership positions, ranging from Regional Coordinator to Chairman of our Strategic Planning Committee. Though it is no longer a compensated lecture, the BCEL continues, now honoring the memories of Tough, who passed away in 2012, and Billingham, who died this year. Thus, I was honored by being scheduled to present the 2013 Billingham Cutting Edge Lecture, in Beijing, China in late September.

The project to be described in my 2013 Billingham Cutting Edge Lecture forms the bulk of this Special Issue of *SearchLites*. It details Prof. Allen Tough's final SETI research effort, and elucidates an analysis in which he was actively involved at the time of his death on 27 April, 2012. I am indebted to Prof. Tough for his tutelage and collaboration on this, and many other, SETI projects over the years, and would like Tough to be recognized as the rightful co-author of the present work. ❖



2013 Billingham Cutting Edge Lecture:

Analyzing the Stephens Mystery Signal

by H. Paul Shuch

Executive Director Emeritus,
The SETI League, Inc.

ABSTRACT

In April, 2012, longtime Canadian SETI researcher Robert Stephens informed The SETI League, Inc. of his reception of an unknown signal suggestive of extraterrestrial intelligence. Because of Mr. Stephens' reputation and extensive experience, the author opted to drive up to Stephens' Area 31 Radio Observatory personally, to participate in signal verification activities. He observed the signal in question, found it to exhibit a temporal persistence inconsistent with sidereal motion, and devised an experiment to test (and invalidate) the hypothesis that the signal was entering the receiver through the facility's antenna. This test was thus unable to confirm the Stephens Mystery Signal as a valid SETI candidate. Neither was it able to disprove Mr. Stephens' hypothesis that the signal observed was a manifestation of extraterrestrial communications sent by a mechanism heretofore unknown to humankind.

KEYWORDS

SETI, radio astronomy, radio telescope, signal verification, Stephens Mystery Signal

APRIL FOOL

If the email had come from anyone else, I might well have disregarded it out of hand. After all, as Executive Director Emeritus of the nonprofit SETI League, I am constantly bombarded with (generally unsupported) claims of extraterrestrial contact. The date of this latest claim, 1 April 2012, was in itself suspicious, and I am no fool.

But then, neither is Robert Stephens. A highly respected Canadian radio astronomy enthusiast, Stephens had studied under the legendary John Kraus at the Ohio State University, had built his first radio telescope in the early 1980s, and had performed credible SETI research at both the Algonquin Observatory and much farther North, at a decommissioned DEW Line station. He was, to my knowledge, not one to make unsupported claims. So, after consulting with Prof. Allen Tough (with whom Stephens had already spoken), I drove a day up to Rob's Area 31 Radio Observatory in Ontario Province, to see for myself what Stephens had uncovered.

THE AREA 31 RADIO OBSERVATORY

The detection in question occurred at Rob Stephens' personal radio observatory north of Toronto. The facility consists of a number of radio telescopes operating over a wide range of microwave frequencies. In the case of the subject detection, the instrument in use is a repurposed Telesat Canada Anik communications satellite uplink/downlink station, consisting of a 4.5 metre diameter Cassegrain parabolic reflector, illuminated by a 3.7 to 4.2 GHz high-efficiency feedhorn driving a broadband, low-noise GaAs FET preamplifier (Fig. 1).

Rather than applying the output of the preamplifier to a stable downconverter as initially implemented, Stephens had modified the receiver to crystal-video configuration, with the preamplifier's output signal further amplified before applying it to a bandpass filter, square-law detector, and baseband amplifier (Fig. 2). The baseband signal is then digitized in the sound card of a personal computer, which then performs a fast fourier transform, the results of which are seen as a waterfall display on a computer monitor. The result is a highly sensitive

direct-power radio telescope responding to the amplitude changes of any C-band signal falling within its capture area.



FIGURE 1: THE 4 GHz, 4.5 METRE RADIO TELESCOPE AT ROBERT STEPHENS' AREA 31 RADIO OBSERVATORY IN CANADA

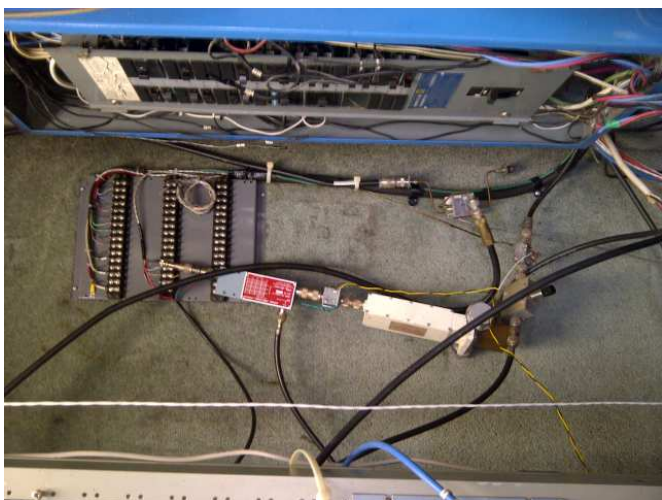


FIGURE 2: PRECISION SQUARE LAW DETECTOR USED AT THE AREA 31 RADIO OBSERVATORY

Stephens related to me that, beginning on 1 April and continuing for some weeks thereafter, the waterfall display revealed glyphs of apparently intelligent origin, emerging from out of a visual background of random noise with varying signal-to-noise ratio. The patterns he observed were described as containing both an apparent alphabetic or numeric symbology, and morphologies suggestive of alien faces (Fig. 3).



FIGURE 3: ROBERT STEPHENS ANALYZING THE STEPHENS MYSTERY SIGNAL ON AN FFT-DSP WATERFALL DISPLAY

From the earliest days of SETI science, it has been suggested that interstellar communications between diverse species might well be facilitated by the transmission of pictograms. It was my desire to see these pictograms for myself that motivated my visit to Stephens' facility.

THE DRIFT-SCAN DILEMMA

The Anik terminal being used by Stephens operates in meridian transit, or drift-scan, mode. That is, the declination being observed is set by an elevation rotor, the antenna is aligned with a meridian of longitude, and it is the rotation of the Earth itself that provides right ascension aiming, so that a full 360 degree scan is made over 23 hours and 56 minutes of time (one sidereal day).

In order to time my visit to coincide with a period of detectability, I asked Stephens for the right ascension and declination from which the signals appeared to be emanating. His rather startling response was: "Come up any time. The signals are continuously present."

This statement was reminiscent of the serendipitous 1964 discovery of the cosmic microwave background radiation, by Arno Penzias and Robert W. Wilson at Holmdel NJ. They stumbled across a signal which was always present, seeming to come from all directions as their antenna completed its drift-scan of the heavens. Their reluctant conclu-

sion was that the signal was coming from *everywhere*. Could the Stephens Mystery Signal be somehow associated with the cosmic microwave background?

Penzias' and Wilson's historic detection was, after all, made at 4 GHz, the same frequency band which Stephens was monitoring. Rob and I speculated about the ability of a truly advanced extraterrestrial civilization to modulate the cosmic microwave background. This was an intriguing hypothesis that just might be testable.

THE EXPERIMENT

In early May of 2012, I traveled to Stephens' Area 31 Radio Observatory north of Toronto, to observe for myself the phenomenon in question. Stephens was quite hospitable, and I found his facility to be well equipped and professionally operated and maintained. The pictograms which he had described were not immediately visible to me on his waterfall display, appearing to my untrained eye to be nothing more than random thermal noise. Rob insisted that, buried in that noise, could be detected alphabetical, numerical, and mathematical symbols indicative of extraterrestrial intelligence, in a language and symbology unknown to him. I could see how one might so interpret such apparent patterns in the noise.

To determine whether the artifacts in question were actually coming through the antenna, I devised an experiment to isolate the receiver from its antenna-mounted front end. The coaxial cable connecting the antenna-mounted low-noise preamplifier to the balance of the receiver system was removed. An identical high-performance preamplifier inside the shielded equipment trailer was connected to the square-law detector via a precision variable attenuator. To that amplifier's input waveguide connector I attached a waveguide directional coupler terminated in a precision matched dummy load. A solid-state diode noise source was connected to the coupled port of the directional coupler through another precision variable attenuator, and the noise diode was reverse-biased into breakdown with a 24 volt DC power supply (Fig. 4). This arrangement enabled duplication of the gain and noise profile of the

complete radio telescope, while preventing any input signals other than random thermal noise from entering the signal path.



FIGURE 4: STEPHENS WITH THE APARATUS USED IN THIS EXPERIMENT TO ISOLATE THE ANTENNA INPUT FROM THE RECEIVER CIRCUITRY

Having totally isolated the receiver circuit from any possible signal artifacts entering via the antenna, I activated the calibrated noise source and asked Mr. Stephens to observe the waterfall display on his signal analysis computer. When asked if his mystery signal were still visible, he answered in the affirmative (Fig. 5). Thus, I concluded that the observed phenomenon was not a microwave SETI candidate signal being received in the conventional manner.

ANALYSIS OF EXPERIMENTAL RESULT

It is widely documented and well established that the human eye-brain combination is especially well adapted to pattern recognition – in fact, such a skill has remarkable survival value for predator and prey alike. The scientific record is replete with ex-

amples abundant of observers seeing patterns where in fact none exist. A familiar case is the appearance of a human face on the surface of Mars, detected by the Viking spacecraft in 1976. Subsequent high-resolution analysis by the Mars Global Surveyor space probe some decades later proved the “Face on Mars” to be nothing more than a trick of light and shadow playing down on a pile of rocks, but those who were enamored of alternative explanations continue to this day to “see” a human face, and to concoct conspiracy theories to refute the widely held scientific explanation.

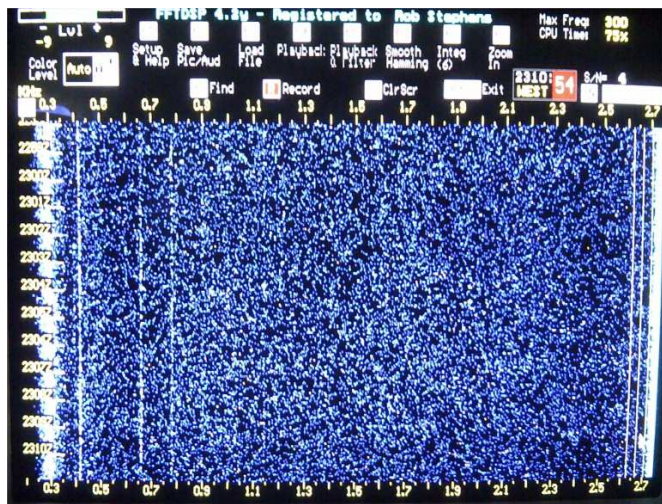


FIGURE 5: FFT-DSP WATERFALL DISPLAY WITH THE RECEIVER INPUT ISOLATED FROM THE ANTENNA

In the present case, I must give serious consideration to the hypothesis that Mr. Stephens is seeing glyphs and patterns in random noise, precisely because that is what he fervently wishes to see. In fact, in addition to alphanumeric and mathematical symbols, he told me he could detect faces, which he said resembled “monsters” and “gargoyles.” I am no psychologist, but I have to wonder whether a noise pattern on the screen might in fact be a very effective Rorschach test illuminating a combination of the observer’s hopes, dreams, and fears. Rather than an example of extraterrestrial intelligence, one might consider this experimental result as possible evidence of intelligence that resides within the observer. In any case, it clearly isn’t RF coming in from photons captured by the antenna.

THE RESEARCHER’S HYPOTHESIS

Confronted with clear evidence that the phenomenon being observed was not a conventional radio astronomy detection, Mr. Stephens hypothesized that he was observing communications from an extraterrestrial civilization beamed somehow directly into his computer, through a mechanism unknown to humankind. Though there is no way I can dispute this hypothesis, neither is there any way that I can test it, since the mechanism of communications is unknown to us. Since I can neither confirm nor invalidate the observation as being extraterrestrial in nature, we are left with an enigma. Mr. Stephens firmly believes in the existence of intelligent extraterrestrial beings (as, in fact, do I). He also fervently hopes to establish their existence through scientific evidence (as, in fact, do many in the SETI community), and hopes to personally establish contact (as, in fact, do most thinking humans). Whether his hopes inform his observation, perhaps to the detriment of objectivity, is not a judgment I am prepared to make. Yet, the possibility must be considered.

For now, the Stephens Mystery Signal remains yet another example of an inconclusive result from an otherwise well designed and executed SETI experiment.

CONCLUSION

Prof. Allen Tough once said that SETI research required the patience, intellect, perseverance, and objectivity of a Sherlock Holmes. In literature, Holmes is said to have stated: “Once you have eliminated the impossible, whatever is left, no matter how unlikely, must be the truth.” However, in SETI science (and, in fact, in science altogether), truth requires rigorous scrutiny, and independent verification. The Stephens Mystery Signal has been subjected to such scrutiny, and (at least to date) has defied independent verification. Thus, it seems appropriate in the present case to paraphrase Sir Arthur Conan Doyle: “Once you have eliminated the testable, whatever is left, no matter how tantalizing, must remain a mystery.”



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 29 - September 2, 2013: *Lonestarcon 3*, 71st World Science Fiction Convention, San Antonio TX.

September 23 - 27, 2013: *64th International Astronautical Congress*, Beijing, China.

October 18 - 19, 2013: *Microwave Update 2013*, Morehead, KY.

November 8 - 10, 2013: *Philcon 2013*, Cherry Hill, NJ.

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

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. ❖

Extraterrestrial Visitors? No Way!

by Dr. John Boardman

There are persistent rumors that extraterrestrials have contacted Americans, including members of the armed forces and other government officials, but that the government is keeping all such contacts secret. Now, six former members of Congress are claiming that such secret contacts were made, and are demanding that they be made public. (Andrew Siddons, *New York Times*, 4 May 2013). Ex-Senator Mike Gravel (D-AK) actually delivered himself of the remark: "Something is monitoring the planet, and they are monitoring it very cautiously, because we are a very warlike planet." This remark merely indicates that Senator Gravel has given up all hopes of being returned to public life by the electorate, even in a state which has elected Sarah Palin. Other ex-legislators in this group are Roscoe G. Bartlett (R-MD), Carolyn Kilpatrick (D-MI), and Merrill Cook (R-UT). Representative Bartlett once represented the district where I live, but was booted out last November by voters who objected to his numerous statements bearing little relation to reality.

Believers in frequent visits to Earth by extraterrestrials blithely ignore numerous scientific facts. Form one thing, it's a very big universe. Distances from our Sun to other stars have to be measured in light-years, the distance light travels in one year. One light-year is just under 9.5 trillion kilometers or, in medieval measurement, about 5.9 trillion miles. And the star nearest to the Sun is a triple star system with at least one known planet, Alpha Centauri, 4.4 light years away. Going there would not be Columbus spending three months crossing the Atlantic, but a staggering engineering operation.

As for travel faster than light, this is not a scientific reality, or even a reasonably based speculation, but a creation of science fiction writers who want travel times to fit into their plot lines. More than a century ago, Albert Einstein showed in the special theory of relativity that nothing could travel faster than light. Since then, no scientific fact or reasonably based theoretical argument has found anything wrong with this concept. I can speak with some authority here, since I was a student of Peter G. Bergmann, himself an associate of Einstein at Princeton.

So, unless their lifetimes are fantastically long compared with ours, no extraterrestrials are likely to be landing their spaceships on Earth and confounding yokels with strange stories, or even (as some "reports" have it) by sexual intercourse with them. There is a reason why such reports come from remote deserts or isolated rural communities, rather than from an alien spaceship landing at Harvard's Department of Astronomy or India's Tata Institute. ❖



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