

The Only Game In Town

H. Paul Shuch
The SETI League, Inc.
USA

Abstract

Current SETI technology is hardly recognizable from the perspective of the discipline's first experiment more than forty years ago. The state of the search four decades hence will be equally remote from today's scientific practice. Even neglecting the profound consequences of contact, SETI as much reflects as it stimulates societal change.

We were the only game in town – but not for long. The preponderance of scientific opinion held humankind to be the only sentient species in the vast cosmos, a perspective that was about to change. The young radio astronomer was fresh out of grad school, the ink on his diploma as wet as he was, behind the ears, when Frank Drake hit upon this ludicrous idea. Why not, Frank Drake figured in 1959, use his employer's radio telescope to search for intelligently generated signals from the stars? Only do so quietly, Drake cautioned himself; this science-fiction search might well be professional suicide. So, he set to work, quietly assembling a crude, one-channel listening station, to train on two nearby, sunlike stars.

Then the Cocconi and Morrison article came out. In a brief letter in the scientific journal *Nature*,¹ the two Cornell professors proposed the very search which Drake was already setting out to perform! This is a prime example of what I call the Parenthood Principle: when a great idea is ready to be born, it goes out in search of a parent. Sometimes, it finds more than one. Now Schrodinger's cat was out of the bag, and Drake had to go public. But discretion still ruled the day. Even his first detection was of necessity held close to the chest. Just a few hours into the search, Drake encoun-

tered a periodic microwave pulse from beyond. "My God," he thought, "could it really be this easy?"

When the signal reappeared days later, Drake was ready. Armed with a small horn antenna, he determined that the pulses were emanating not from the neighboring star Epsilon Eridani (toward which his eighty-five foot dish was pointed), but rather from much closer to home - possibly from a high-flying aircraft. Only, this was April of 1960. Aircraft cruising at such lofty heights were still the stuff of comic strips. The U2 didn't actually "exist" until May first of that year, when Powers was famously shot down over the Soviet Union. So, Drake wisely held his tongue.

Today, Drake is somewhat more vocal. In recent years we have detected over 100 extra-solar planets, an abundance of interstellar organic molecules, and strong circumstantial evidence suggestive of fossilized microorganisms arriving on earth encased in meteor space-ships. Bolstered by such discoveries as these, the Search for Extraterrestrial Intelligence (SETI) has emerged out of the fringes, into the scientific mainstream. Along the way, we have developed technologies the likes of which the young astronomer could scarcely have dreamed. Drake himself has grayed into the elder statesman of an established scientific disci-

pline. In the past four decades, thousands of humans have conducted hundreds of searches for our cosmic companions, scanning billions of microwave and optical channels, and spending millions of dollars in the process. SETI is no longer a four-letter word. But for all of our efforts, we are today no more successful than Drake had been with that first search at Green Bank.

Yet, we are not discouraged.

So why do Drake, and his professional colleagues, and many a dedicated amateur, and your faithful correspondent himself, all continue to hit our heads against the brick wall of SETI silence? Possibly because this is the cheapest lottery ticket, with the highest potential payoff, in humanity's history. What is the worth of that one-in-a-zillion longshot of gaining entry into the cosmic community? The value of Encyclopaedia Galactica is incalculable. Whether or not we ever managing to pry open its cover, the sure knowledge of its existence is enough to shake our species out of its chronic complacency. And even the crudest one-bit message, a coherent carrier with no accompanying intelligence whatever, would still announce to a waiting world that we are not alone, changing forever humanity's view of our place in the cosmos. What's a trifling telescope or two, alongside that kind of payoff? To play is to anticipate defeat; to pass is to demand it.

Still, forty years and not a single confirmed hit - it has to give one pause. We can improve our chances for success by redefining SETI. For as presently practiced, SETI is as narrowly focused as the spectral emissions which we hope to intercept. What started off as a search for microwave beacons should be expanded to encompass all signaling technologies which we can conceive, whether or not we can achieve them ourselves at our present level of societal and technical adolescence. Might we some day launch robotic interstellar probes? If so, then we should have an organized strategy for seeking out such probes launched by more advanced societies. Can we imagine the day when we will be capable of great feats of astro-engineering? Then our present efforts should include a search for the engineering marvels of

our more capable neighbors. Might our own starships someday leave in their wake a detectable residue? Then the search for the advanced propulsion signatures of others should be on our agenda. If we can imagine it, then we should be looking for it! For, as Haldane's Law² teaches us, the Universe is not only queerer than we imagine, it is queerer than we *can* imagine.

So, let's take a moment to imagine what we might learn from our cosmic companions. The common myth holds that our brothers and sisters in space will hand us a silver platter brimming with solutions to all of humanity's mundane problems: cures for disease and poverty and ignorance and prejudice, problems which *everyone knows* are trivial matters for those advanced beings conquering the interstellar gulf.

Everyone is most likely wrong. Since our planet is a relatively recent companion to a fairly young star, it's widely held we're the newcomers on the block. There are stars abundant twice as old as our Sun. Top astrophysicists have estimated that other civilizations could well be anywhere from a thousand to a *billion* years older than our own. If the first extraterrestrial civilization we encounter is at the upper end of that age continuum, then SETI scientists are in for a big disappointment. We'll be lucky to even recognize that its artifacts are a manifestation of intelligence, let alone interpret them. And their electromagnetic communications means, if indeed they still employ such means, will most likely blend into the cosmic din. To paraphrase Clarke,³ any sufficiently advanced technology is indistinguishable from—static.

Such an ancient race would be as far ahead of us as we are beyond bacteria. And although the presence of bacteria in meteorite fragments, and their ability to traverse interstellar distances, is interesting when contemplating the origin of life on Earth, those bacteria themselves don't make particularly good communications partners. I mean, what would you say to a bacterium, beyond small talk?

We'll be far better served if our cosmic communicators have advanced only a little bit

beyond ourselves. If they lead us by, let us say, a million years, then they might make their culture known to us, much as we "communicate" with household pets. This is speculative, to be sure, but what if they regard us much as we regard dogs? What do we stand to gain? And to lose?

One could argue that *canis domesticus* enjoys a longer lifespan, and better nutrition, than his wild ancestor; that by taking him under our protection, humans have given him a higher standard of living. And pulling our sleds, herding our sheep, guarding our children and leading our blind is a small price to have him pay for the benefits we benevolently bestow. But did anyone ever bother to ask Fido how he feels about the arrangement?

Science fiction is full of cautionary tales of humanity being subdued, subjugated or consumed by advanced aliens.⁴ Surely, if their technology is capable of announcing its presence across the cosmic gulf, they have the capacity to come here in conquest. Better to let well enough alone, some argue, and simply pull the plug.

But wait—SETI is all about communication, *not* contact. Unless we've got the laws of nature all wrong, an advanced civilization at the far end of the Galaxy will still take fifty to seventy thousand years to get here, assuming it wants to, or even knows about us.

Now that distant cousin in Kansas receiving your Christmas card might just take seriously your casual invitation to "drop by sometime," and show up on your doorstep unannounced for New Year's dinner. But ET? Not so likely.

For one thing, they haven't been invited. We humans inhabit a paranoid planet, whose world governing bodies have adopted stern policies against interstellar transmission. The SETI Permanent Study Group of the International Academy of Astronautics (on which I am privileged to serve) has, over the past fifteen years, adopted a number of protocols on interstellar transmission from Earth. They all say the same thing: keep it down, kids!

And although those policies are merely advisory, they are generally respected. With only a few minor exceptions, we have refrained

from shouting in the jungle. And the act of listening in no way reveals our position, our interest, or our intent. So by sifting through the cosmic cacophony, we make ourselves no more vulnerable to invasion and domination than we would by turning a deaf ear on the universe. Given that SETI is a passive activity, it would seem we have nothing to lose in pursuing it.

And everything to gain. For I've skipped over that other alternative: that we could well encounter a civilization *just a little more advanced* than ourselves. One that has, in its recent history, beaten its exoswords into exoplowshares. One that has, in generations not too remote, had to learn to harness its planet's resources in an environmentally responsible way, to embrace genetic engineering with compassion and reason, to ensure the survival of its species through cooperation rather than conflict. Lessons which we need to learn if we are to survive the next thousand years or so, and thus to reach their level. If we're incredibly fortunate, their transmissions might contain their own social and cultural history, including a glimpse into their crossroads and crises. But even lacking such details, a signal received from such a society will testify to life's tenacity: its capacity for survival against long odds. We would do well to learn from their example.

And part of that example is in the medium itself. If a modestly advanced civilization chooses to fling photons our way, then we can conclude that they have deemed it safe to do so. Safe for them might imply safe for us (although caution of course dictates making reasonable efforts to decontaminate incoming signals, much as we have developed protocols for decontaminating samples returned to Earth from the Moon, Mars, and beyond). Here we might do well to follow their example, by re-examining our planetary paranoia, and considering that it may be our responsibility to transmit warm greetings to those other young civilizations near our point on the developmental continuum. Should the phone happen to ring, etiquette demands we answer it pleasantly!

We tend to think of interstellar transmission as an altruistic endeavor, practiced by those civilizations wishing to share their wealth

of knowledge with their distant brethren. Alarmists suggest the motives of the transmitter might be more sinister, enabling them to advance some selfish cosmic agenda. I see a third possibility: that interstellar transmission and reception are synergistic endeavors, somehow improving the survival chances of both communications partners. And if this is indeed a cosmos founded on cooperation, we need to consider how best to emerge from our isolationist phase.

And what of the inherent dangers in making our presence known? Here we can be a bit philosophical. There is danger if they know about us. There is danger if they don't know about us. The Universe is a dangerous place. Of course, that's no reason to hide under a rock (or to remain on our own rock). It is human (and, I presume, alien) nature to confront danger head-on, in the pursuit of knowledge. To live in constant fear is never to live at all.

Two groups who know no fear today are the world's dedicated SETI professionals, and (more recently), a global cadre of SETI amateurs. While the former dream on a large scale and struggle for funding, the latter push the limits of technology with budgets as modest as that which funded Drake's early effort. Ten years ago at the time the US Congress terminated a modest NASA SETI effort (confirming our suspicions that there is no intelligent life in Washington), a handful of enthusiasts established the grass-roots nonprofit SETI League to privatize the search. They are amateurs, in the sense that the word derives from the Latin for "love." Today, they have grown to 1400 radio amateurs, microwave experimenters, digital processing experts and backyard astronomers in 66 countries, and together they have put over one hundred small radio telescopes on the air. Though the number is modest, it still exceeds the total number of radio telescopes doing SETI in the rest of the world, combined!

This approach is not without controversy. Today's hundred backyard SETI stations, kludged together out of discarded home satellite TV dishes, achieve sensitivities no better than Drake's 1960 effort could muster. They hope to make up in strength of numbers what

they lack in funding and sophistication. Drake himself is skeptical of their chances for success, believing that modern SETI is too complex, too costly, too demanding for the average amateur. And perhaps he's right. But it's also too important to be left to the professional. So the SETI League continues to push the technological envelope, much as two brothers from Ohio did for the field of aeronautics a century ago. Whether their efforts will ultimately fly remains to be seen.

It could well be that we are at the midpoint of the SETI pursuit. If technology continues to advance as it has in the past, just a few decades from now will likely see another billion-fold increase in search space. And perhaps that's what it's going to take to achieve SETI success. For this field of study offers little to he or she who demands instant gratification. Lest we become discouraged, we should remember that it's less than half a century since Drake's first modest effort at Green Bank. This span constitutes a mere eyeblink in human history. Not only have we yet to scratch the surface, we haven't even felt the itch.

So, where will SETI be in five more decades? Thus far, our technological progress (which SETI both reflects and stimulates) has been exponential. Like the expanding universe hypothesis, we have insufficient data to yet detect any slowing of that trend. In all likelihood, our receivers will soon span the electromagnetic spectrum, from radio through microwaves into the infrared, across the visible, ultra-violet, X-ray, and gamma ray spectra, all in real time. We are developing technologies today that will enable us to see in all directions at once. A half-century from now we will be scanning farther out in time and space than Drake ever deemed possible. If there are electromagnetically polluting civilizations out there, surely we will have detected their photonic debris by then!

Or, perhaps not. Forty years of silence should not discourage us, but it still gives one pause. Just maybe, it is we who are the advanced aliens. Unlikely as it seems given the reputed ages of distant suns, one can envision a universe in which technology is just now begin-

ning to emerge. Synchronicity has been known to dominate other fields, so why not this one?

If other civilizations exist at merely a primitive level, then our SETI efforts are doomed - unless we are in the game for the *really* long haul, for thousands, or millions of years. More likely, we're not anywhere near the head of the class, but just average students, whose classmates are no better off, or worse, than we. Then it would behoove us to start transmitting post-haste, because we're not likely to detect their leakage radiation, or they our own electromagnetic pollution, unless the local population density is so great that they're right next door. And were that the case, Drake's logic would imply, we'd already have detected them.

Or, it could well be that as civilizations advance, they become, by design or chance, effectively invisible. In which case, forty years from now, we'll have arrived at an epiphany: we are not alone, but we might as well be.

And how might such an understanding impact on our view of humanity's place in the cosmos? My guess is that it would send us back to forty years ago, when we were the only game in town.

For Accompanying Photos and Captions, Please visit the following URLs:

Download from < <http://www.setileague.org/photos/sara/sara9903.jpg> >:

Now in its fifth decade of life, the 85 foot diameter Howard Tatel telescope at the National Radio Astronomy Observatory, Green Bank WV, still scans the heavens. This is the instrument used by Frank Drake for Project Ozma, the first modern SETI experiment, in 1960. SETI League photo, used by permission.

Download from <<http://www.setileague.org/vsa/vsa0240.jpg> >:

Modern radio telescopes, like the patented Very Small Array designed by the author, combine a number of small parabolic dish antennas, to achieve the sensitivity of a much larger antenna at significantly reduced cost. SETI League photo, used by permission.

Download from <<http://www.setileague.org/array2k/feedmnt.jpg>>:

Around the world, hundreds of SETI League members are building small amateur radio telescopes such as this one, in pursuit of that elusive fish in the cosmic pond. SETI League photo, used by permission.

About the Author:

A retired engineering professor, *H. Paul Shuch* is the aerospace engineer credited with designing the world's first commercial home satellite TV receiver. A lifelong radio amateur, Paul has been building his own radio telescopes since shortly after Drake's first search. He has spent the past nine years heading the nonprofit SETI League <<http://www.setileague.org>>, an international alliance of some 1400 amateur and professional scientists engaged in circuit design, software development, and grassroots SETI research. Dr. Shuch is a Corresponding Member of the Social Sciences section of the International Academy of Astronautics.

Correspondence

paul@setileague.org

<http://www.setileague.org>

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Notes

- 1 Morrison, Philip. and Cocconi, G., "Searching for Interstellar Communications," *Nature* 184(4690):844-846, September 19, 1959.
- 2 Haldane, JBS, in *Possible Worlds*, 1963: "Now, my own suspicion is that the universe is not only queerer than we suppose, but queerer than we can suppose" (Haldane's Law).
- 3 Clarke, Arthur C., in *Technology and the Future, Report on Planet Three*, 1972: "Any sufficiently advanced technology is indistinguishable from magic" (Clarke's Third Law). See also Factor, Richard C., cited by Shuch, H. Paul, in *Indistinguishable from Magic, SearchLites* 1(3):2, Autumn 1995: "Any sufficiently advanced modulation scheme is

indistinguishable from noise" (Factor's Corollary).

- 4 H.G. Wells' "War of the Worlds" is an obvious example, of Martians coming to conquer Earth. Many of Edgar Rice Burroughs' books had similar themes. Two others that come immediately to mind are Arthur C. Clarke's "Childhood's End" (where the alien race comes to Earth to steal our children), and the dark but humorous "To Serve Man," which title referred to the name of an alien cookbook.