

# DR. SETI'S STARSHIP

Searching For The Ultimate DX

## Testing the Null Hypothesis

What exactly would constitute incontrovertible proof of extra-terrestrial contact? When SETI was the exclusive province of professional radio astronomers, scientific rigor set high standards of proof. The question is now complicated by the privatization of SETI, which has opened up this exciting field of research to laymen. The public may make only a vague distinction between proof and faith. The spectrum of human skepticism versus gullibility encompasses a wide range of extremes, characterized by diverse viewpoints ranging from "of course they exist; we couldn't possibly be alone!" to "I'll believe in the existence of intelligent extra-terrestrials only when one walks up and shakes my hand." We must take pains to prevent such declarations of faith from clouding the judgment of our SETIzens.

As radio amateurs striving to embrace scientific professionalism, we start by acknowledging that one can never conclusively prove the negative, but that it takes only one counter-example to disprove it. Conservative experimental design demands that we frame our research hypothesis in the null form: "resolved that there are no civilizations in the cosmos which could be recognized by their radio emissions." Now a single, unambiguous radio signal is all it takes to disprove the

null hypothesis and negate the notion of humankind's uniqueness.

What constitutes an unambiguous signal? A popular definition holds it to be one which could not have been produced by any naturally occurring mechanism that we know and understand. This is an insufficient condition. The first pulsars, after all, fit that definition. They were first labeled "LGM," for Little Green Men, and their intelligent extra-terrestrial origin was seriously considered for several months, until our knowledge of the mechanics of rapidly rotating, dense neutron stars became more complete. There is the risk that any signal that cannot be produced by any known natural mechanism could well have been generated by an astrophysical phenomenon which we have yet to discover. Therefore, we need an additional metric.

Here are several of the hallmarks of artificiality, which we can expect an electromagnetic emission of intelligent origin to exhibit:

- spatial/temporal characteristics consistent with sidereal motion
- coherence not achievable by known natural emission mechanisms
- Doppler signatures indicative of planetary motion
- frequency selection that exhibits a knowledge of one or more universal constants
- information content suggestive of a mathematically based culture

The common denominator of all these

characteristics—in fact, of all human (and we anticipate, alien) existence—is that they are anentropic. Any emission that appears (at least at the outset) to defy entropy is a likely candidate for an intelligently generated artifact. In that regard, periodicity is a necessary, although not a sufficient, condition for artificiality (remembering, once again, the pulsar).

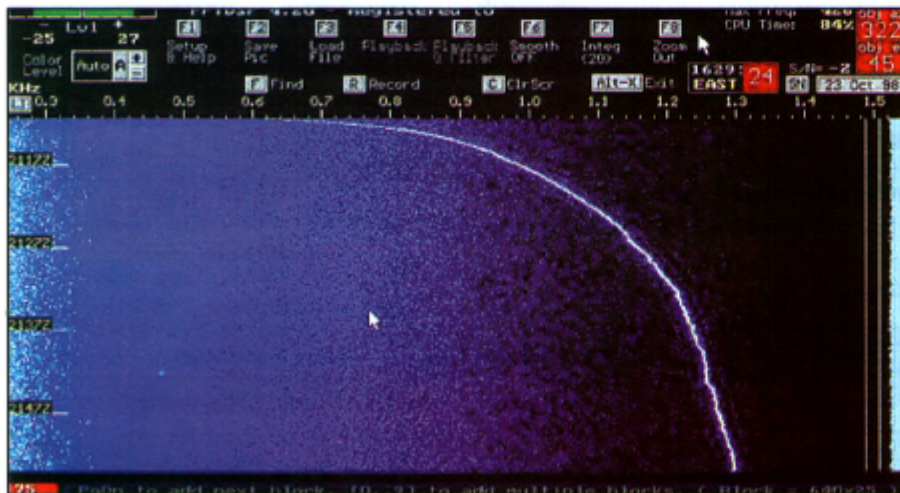
Unless we are blessed with communication rich in information content, signals that convey otherwise unknown information about the culture that generated them, we are unlikely to ever achieve absolute certainty that what we have received is indeed the proof of existence we seek. Multiple independent observations, however, can do much to dispel the obvious alternative hypotheses of equipment malfunction, statistical anomaly, human-made interference, and deliberate hoax. In that respect, the development of well-coordinated signal-verification protocols can do much to narrow our search in space. Once again, in signal-verification activities it is the null hypothesis we should be attempting to verify. We thus expect that we ultimately will rule out most candidate signals. However, there eventually may come a signal that simply cannot be explained away.

"Once you have eliminated the impossible," Arthur Conan Doyle wrote in the voice of Sherlock Holmes, "whatever remains, no matter how improbable, must be the truth." Above all else, this truth must pass the interocular trauma test: When the proof we seek is so powerful as to hit us between the eyes, we can no longer deny it.

No government pronouncement is likely to pass this demanding test, as far as a skeptical public is concerned. However, if a diverse, international group of laymen, working independently, can produce multiple, internally consistent observations, backed by the corroboration of our professional counterparts, then the world is most likely to accept that group's interpretation as reasonable.

SETI continues to seek clear, unambiguous evidence, without even knowing for certain what form that evidence will take. We hope to stumble across the inescapable. Until then, as responsible radio amateurs we will continue to test the null hypothesis.

(Errata: In Dr. Shuch's article "SETI Horn of Plenty" in the Spring 2003 issue, figures 2 and 3 [pages 8 and 9] are reversed. This results in the performance figures of the N6TX horn being attributed to the Even horn and vice-versa. We regret any confusion this may have caused readers.—ed.)



This allegedly captured signal, supposed proof of extra-terrestrial contact, was anonymously hacked into a closed SETI League e-mail in October 1998. It proved to be a blatant hoax. SETI requires standards of proof which guard against such fraudulent claims.