NASA's Search for ETs Hits a Snag on Earth

The space agency has a new device to listen for signals from the cosmos but it is hearing derision from Congress

As IF NASA's STAR were not far enough in eclipse in the wake of leaky shuttles, a myopic space telescope, and a faltering $30-billion space station project, Congress seems poised to kill even a bargain-basement program proposed by the agency. For only $12 million next year, NASA was hoping to launch a 10-year quest for radio signals from beings beyond the solar system. The effort would be a million or even a billion times more capable than all previous searches combined. But that didn't impress the U.S. House of Representatives, which voted late last month to eliminate from its version of NASA's 1991 budget all funding for the search for extraterrestrial intelligence (SETI).

"At a time when good people of America can't find affordable housing, we shouldn't be spending precious dollars to look for little green men with misshapen heads," intoned Representative Silvio Conte (R–MA) when NASA's appropriations bill landed on the floor of the House last month. "Of course there are flying saucers and advanced civilizations in outer space," Conte said. "But we don't need to spend $6 million this year to find evidence of these rascally creatures. We only need 75 cents to buy a tabloid at the local supermarket."

Tongue still firmly in cheek, Conte then treated the House to a parade of banner headlines: "Noah's Ark Was Built by Space Aliens," "Space Aliens Stealing Our Frogs!," and "Magic Ray from This UFO Cures 22 People!" Buttressing this evidence, freshman congressman Ronald Machtley (R–RI) admonished his colleagues that, given the tight federal budget, "money ought not to be spent on curiosity." After a few cheap laughs, the House as a whole voted nay.

The program's proponents feel like they're in some kind of a space-time warp. They've heard critiques like these for three decades—ever since radio astronomer Frank Drake made the first search in 1960 when he spent 150 hours listening for radio transmissions from two nearby stars. Drake heard nothing, but over the years he and his compatriots have managed to overcome the skeptics enough to scrape together money for 60 or more modest searches. And while no little green men have picked up the phone, the dramatically increased sophistication of the search technology and the relatively cheap price tag—$100 million over 10 years—sufficiently impressed NASA officials that they went to Congress for a jump in funding—only to be rebuffed in the House.

"It's an international embarrassment," says Drake, now at the University of California at Santa Cruz. "American leadership in the field is recognized worldwide. Everybody is going to be giggling when they see the government's incompetence. And it costs a pittance compared to other NASA programs."

A big SETI ear. *NASA wants to listen with the 305-meter dish of Arecibo Observatory in Puerto Rico.*

The heart of the proposed new effort would be an instrument capable of monitoring 20 million radio channels every second. This spectacular capability will be required to have any chance of spotting the ET needle in the cosmic haystack of radio noise.

The most promising segment of the electromagnetic spectrum, in the microwave region just above the commercial radio bands, falls between frequencies of 1,000 and 10,000 megahertz. That is above the natural noise of our own galaxy and below the interference from Earth's atmosphere. For economy's sake and to make their signal stand out from natural emissions, extraterrestrials would presumably broadcast over a narrow frequency range, one perhaps only a few hertz wide. But any listener tuning into a chunk of the spectrum much wider than the signal might find it swamped by noise at frequencies adjacent to the signal.

Millions of narrow channels are necessary to cut down on noise, but those channels must also span a good part of the microwave spectrum if a search is to be comprehensive. The ongoing Megachannel Extra-Terrestrial Assay (META) being conducted by Paul Horowitz of Harvard University has 8 million channels to work with, but they span only 0.3 megahertz. That means the search must be limited to a few "magic frequencies," such as the hydrogen emission line, that extraterrestrials might choose to send on. The NASA SETI would have a bandwidth of 320 megahertz, permitting a search of the full window in a few years.

NASA decided not to ask for any new big-ticket hardware for SETI. In the early 1970s, SETI researchers floated the idea of an array of 100-meter-diameter telescope dishes, 1000 in all, whose combined observations would be sensitive enough to eavesdrop on routine radio and TV emissions from any planets around a million stars. There is no way such a grandiose proposal would fly in today's fiscal climate, so NASA is proposing that SETI's ears should be existing radio telescopes, which would probably be capable of picking up only powerful, deliberately transmitted signals.

These telescopes, none of which would be totally dedicated to the search, would include the 305-meter Arecibo Observatory in Puerto Rico, the largest in the world. Hooked to the Arecibo dish, the NASA system would be able to search about 1000 sun-like stars with the sensitivity to detect a signal of a trillionth of a trillionth of 10 milliwatts per square meter. Similar equipment attached to the 34-meter antennas of the Deep Space Network, which NASA uses to control its planetary missions, would provide one thousandth of that sensitivity but allow coverage of the entire sky and the 300 billion stars of our galaxy.

NASA's emphasis on sophisticated electronics over expensive construction is also evident in the SETI signal analysis system. By dint of a massively parallel design, it would run faster than a general-purpose supercomputer in order to process the observations in real time. That would allow the processor to promptly alert human operators if a signal looked promising. "One search after another has turned up good candidates," says Drake, "but the operators only realized this after the fact, and when they go back, the signals aren't there." The proposed search will also be able to recognize pulsed signals, frequency-modulated signals, and other complex types. All previous searches required that the signal be a simple, continuous wave.

Just when, if ever, NASA will be able to turn on this electronic marvel remains to be seen. SETI researchers hope it is soon. Any extended delay would not only make their electronics designs obsolescent, but it would also exacerbate problems of radio frequency interference from terrestrial sources. Michael Klein, a SETI manager at the Jet Propulsion Laboratory, estimates that the allocation of microwave frequency bands to everything from spacecraft telemetry to cellular phones is doubling every decade.

But the battering SETI received in the House doesn't bode well. NASA had asked for $12 million in 1991, triple the expenditure on SETI this year. Much of the increase would allow NASA to begin building the multichannel spectrum analyzer, which the agency is hoping to turn on in 1992—the 500th anniversary of Columbus's discovery of the New World. But even before the bill got to the House floor, the appropriations committee had halved the request; Machtley's amendment excised the rest.

SETI supporters are now working in the Senate in the hope that it will take substantial SETI funding to a House-Senate conference. But NASA must still get its budget through the Senate appropriations subcommittee chaired by Barbara Mikulski (D-MD). She is already "outraged," in her words, that NASA blew the focusing of the Hubble Space Telescope.

Then again, SETI researchers have survived other funding crises. In 1982, then Senator William Proxmire was instrumental in eliminating funding altogether, but intense lobbying by SETI proponents won the restoration of funds the next year. SETI enthusiasts believe they must prevail again. "I would bet my house on interstellar communication," says Klein of JPL, "but I can't tell you when. The only way to distinguish between science fact and science fantasy is to do experiments." ■ RICHARD A. KERR

Science Digests the Secrets of Voracious Killer Snails

The cone snails have evolved a remarkable array of toxins that bring them dinner—and offer neuroscientists a bag of new tools

YOU'RE A SNAIL. You're hungry. And the only food around is a fast-moving fish. You could starve. Or you could fire off some potent nerve toxins to stop your dinner dead in its tracks.

That's a solution the cone snails have perfected. This genus of unlikely predators includes species that specialize in killing and eating fish, and others that prey exclusively on mollusks or worms. To be effective hunters, these snails—which live on tropical coral reefs—have evolved deadly and unique brews of nerve toxins that paralyze prey before it can escape.

The venoms are valuable not only to the snails but also to neuroscientists. Researchers find them a rich source of new, exquisitely precise chemical probes for dissecting and manipulating the protein channels that allow ions to pass into and out of nerve and muscle cells.

The general approach of using natural toxins to study ion channels is time-honored. For decades, toxins from sources as diverse as marine dinoflagellates and venomous snakes have been used to block or alter the function of specific ion channels (or neurotransmitter receptors, many of which are just neurotransmitter-activated ion channels), to help define their roles in normal nerve or muscle function. Labeled toxins can be used to find the pattern of distribution of their targets, and in some cases toxin binding has provided an assay by which the target proteins could be purified.

Cone snail cognoscento. *Baldomero Olivera of the University of Utah.*

But while such approaches have been fruitful for studying some ion channels and neurotransmitter receptors, the demand for new toxins is ever increasing as researchers discover new receptors and channels at a rate that has outpaced the availability of toxins to distinguish among them. There may be as many as eight different types of calcium channel, for example, and neuroscientists are eager for new and more specific toxins to help tell them apart.

That's where cone snails come in. Their venoms represent "the biggest recent gold mine" of new and potentially useful toxins according to Stanford ion channel researcher Richard Aldrich. And since there are more than 500 species of cone snails, only a few of which have been investigated, the surface has just been scratched. Already the snails have yielded an important toxin for distinguishing among calcium channels, and those close to the field expect that more exciting finds will follow.

In spite of their value, this obscure family of snails might have been overlooked altogether had it not been for an enterprising scientist working in a developing country, without even a centrifuge in his lab. But what that scientist—Baldomero Olivera—did have was a unique background that enabled him to recognize the value of the cone snails. During his youth in the Philippines, Olivera had been fascinated with the beautiful, deadly snails (some of which have been known to kill humans). In his college studies, and his further training in the United States, another piece of the puzzle fell into place, as Olivera learned of the contribution natural toxins had made to understanding ion channels.

But it wasn't until returning to the Philippines that these pieces came together in a research project. After receiving a Ph.D. in chemistry from California Institute of Technology and doing a postdoc in biochemistry at Stanford, Olivera went home in 1970 to accept a position as assistant professor at the University of the Philippines. "I ended up in a lab that had essentially no equipment," he recalls. "No ultracentrifuge, no scintillation counters, no cold room. It was fairly clear that we wouldn't be competitive in any kind of molecular biology. So we decided to look for a research project for which there would be some local advantages." Cone snails seemed like a good bet.

Olivera (now at the University of Utah) says he initially had modest expectations for the cone snail toxins, which he dubbed conotoxins. He expected, he says, to find a single toxic component in the venom and