If we are ever going to pick up a signal from E.T., it is going to happen soon, astronomers say. And we already have a good idea how events will play out.

*By Tim Folger*

The 100-meter-wide radio dish at Green Bank, W. Va., is the largest steerable antenna in the world. Astronomers use the dish as part of the search for extraerrestrial intelligence, a worldwide collaborative effort, to scan the skies for artificially-produced radio signals.
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ne day last spring Frank Drake returned to the observatory at Green Bank, W. Va., to repeat a search he first conducted there in 1960 as a 30-year-old astronomer. Green Bank has the largest steerable telescope in the world—a 100-meter-wide radio dish. Drake wanted to aim it at the same two sunlike stars he had observed 50 years ago, Tau Ceti and Epsilon Eridani, each a bit more than 10 light-years from Earth, to see if he could detect radio transmissions from any civilizations that might exist on planets orbiting either of the two stars. This encore observing run was largely ceremonial for the man who pioneered the worldwide collaborative effort known as SETI—the search for extraterrestrial intelligence. As a young man, Drake had half-expect...
FedEx in there with a replacement drive,” Tarter says. “In the meantime, we had telescope time in West Virginia”—SETI observations typically piggyback on other, mainstream astronomical research—“and we were going to use it. Without our second site, the only thing we could do was nod back and forth between two different stars.”

Tarter, who had been scheduled to fly home to California at noon that day, canceled her flight and left a phone message for Chris Neller, her assistant in Mountain View, to tell her about the change in plans. By late afternoon the target star that was thought to be the source of the signal began to set below the horizon. That is when Tarter and her team realized something was wrong. Although the target star was setting, the source of the signal seemed to be climbing, its strength undiminished. The signal, they eventually determined, was coming from a NASA satellite, the Solar and Heliospheric Observatory, or SOHO.

During all the excitement, no one remembered to call the Mountain View office to tell them the whole episode had been a false alarm. Meanwhile Ann Druyan, Carl Sagan’s widow, had by chance called Mountain View to talk with Tarter about something unrelated. Neller told Druyan that Tarter was delayed at Green Bank observatory, studying what might be a signal from an extraterrestrial civilization. Druyan immediately called William J. Broad, a science reporter for the New York Times. Broad in turn called Shostak to confirm the story.

“The beauty of a false alarm is that you see what really happens,” Shostak says. “It’s no longer theoretical. Not a false alarm that lasts five minutes, but where for the better part of a day you think, maybe this is it. You have these nifty protocols, but what really happens? People don’t follow protocols. It’s not that people do anything mischievous or malevolent—you’re so caught up in the excitement of the moment, the media are immediately calling you on the phone, people send e-mails to their friends.”

In the event of a signal that survives initial scrutiny—one that is quickly verified by a second observatory—the astronomers who made the discovery would send an International Astronomical Union (IAU) telegram—now delivered as an e-mail—to observatories around the world. Astronomers use IAU telegrams to notify one another of time-sensitive observations: supernovas, comets or gamma-ray bursts. Tarter says a SETI observation would be treated like any other astronomical discovery. “If something like that happens, we’ll want everybody who can to look at it right away,” she says. “We’d like people to look in the signal’s direction, with different tools, checking different frequencies, and try to figure it out.”

**VERIFYING THE MESSAGE**

SETI scientists think they know, in broad terms, what an ET signal will look like. To stand out as obviously artificial against a background of natural cosmic radio emissions, the signal would have to be narrow, with a lot of energy packed into a few frequencies. Natural phenomena, such as pulsars and interstellar gases spew out radio emissions at many different frequencies. If an observatory ever receives a narrowband signal coming from an astronomical distance, the source would almost certainly be artificial.

According to voluntary, nonbinding protocols adopted by SETI researchers around the world, if IAU astronomers confirmed a signal as genuine, they would then notify the United Nations and various world leaders. Tarter says that some generous SETI sponsors would also receive discreet thank-you calls. At that point the astronomers who made the discovery would be free to hold a press conference—if the story had not already been leaked. But even those modest constraints would probably be breached. “The protocols are just a nice idea,” Shostak says. “They’re like red lights in Naples, Italy,” he laughs. “They’re suggestions.”

What happens next? A triumphant announcement, followed by headlines? Panic? New Age celebrations of galactic harmony? Probably none of the above, except for the headlines, if Douglas Vakoch is right. A psychologist by training, Vakoch has an office across the hall from Tarter at the SETI Institute and must have the world’s most unusual job title: director of interstellar message composition.

“While we may be able to detect that there is a signal that at least initially appears distinctly artificial, I suspect even that claim would be questioned,” Vakoch says. “There would be a lot of people trying to come up with natural explanations. I think the assumption that one day someone is going to announce that we’ve discovered extraterrestrial intelligence, and now the world knows, is a fallacy, because there’s going to be much more ambiguity in the process. It might be similar to what was recently considered a plausible claim that there was evidence of fossils in Martian meteorites—interesting enough to consider, but now let’s look at this over the next few months.”

Even if the signal is confirmed as an authentic transmission from an extraterrestrial civilization, it is unlikely that astronomers would be able to extract any information from it for many

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years. SETI’s instruments are designed to search for steady, periodic narrowband radio pulses—carrier waves powerful enough to be detectable across many light-years. The pulse itself would yield no information, other than its artificial nature. Any message content would likely be in the form of changes in amplitude or frequency buried within the pulse. Even a large radio telescope would need to repeatedly scan a small patch of sky to build up the signal pulse above background radio noise. In doing so, it would average out modulations on finer timescales that might contain a message. Resolving the message would require an antenna far more powerful than Earth’s largest, the 305-meter dish at Arecibo, Puerto Rico.

“You would need something on the order of 10,000 times bigger than Arecibo,” Shostak says. Rather than a single enormous dish, such a telescope would probably consist of many smaller antennas spread across a large area and linked electronically. Constructing such an instrument would require international collaboration and funding, with no guarantee that the message—if the signal contained one—could ever be deciphered. “That’s not something you’d do overnight,” Shostak observes. “That’s a big project. I think we would do it, because—gosh darn it—we would want to know what they’re saying.”

**THE Fallout**

Taking into account political debates and the time needed to build a telescope sensitive enough to analyze the signal, years would pass before astronomers or cryptographers could begin to attempt to decipher a message from the stars. So whereas that first contact with another intelligence would in itself be one of the most important scientific discoveries of all time, the lack of any further knowledge about the nature of that alien intelligence would limit the immediate cultural impact. The story of the discovery would monopolize headlines for a while, but our collective attention span would inevitably move on while SETI's instruments are designed to search for steady, periodic narrowband radio pulses—carrier waves powerful enough to be detectable across many light-years. The pulse itself would yield no information, other than its artificial nature. Any message content would likely be in the form of changes in amplitude or frequency buried within the pulse. Even a large radio telescope would need to repeatedly scan a small patch of sky to build up the signal pulse above background radio noise. In doing so, it would average out modulations on finer timescales that might contain a message. Resolving the message would require an antenna far more powerful than Earth’s largest, the 305-meter dish at Arecibo, Puerto Rico.

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Stephen Hawking said that transmitting messages could be dangerous. He warned of the possibility of predatory aliens ravaging the resources of world after world.

E.T.’s signal, astronomers assume, would arrive in a narrow frequency band (for efficiency’s sake) at about 1420 megahertz, the spectral frequency of common hydrogen. In the simulation, above, the signal, at center, pokes through background noise.
level of intelligence compares with our own.

Marcy believes the Fermi paradox presents a genuine problem for SETI researchers, and he sees only three possible solutions. “The fact that aliens haven’t landed tells you they’re rare or that space travel is very hard or that it’s not just worth doing,” he says.

Perhaps Hawking’s fears say more about us than about any aliens we might encounter. Given the history of our own species, who would have more to fear from contact, humans or extraterrestrials? SETI, unavoidably, reflects our own dreams and night terrors about our place in the universe. In postulating the presence of civilizations on other worlds, we are extrapolating wildly from a single known example—our own fragile, remarkable existence.

Realistically, though, the quest to make contact will be an endeavor that spans centuries—if our own civilization lasts that long. SETI is, perhaps, the strangest and most profound experiment in the history of our world. One of the founding fathers of SETI, the late Philip Morrison, a physicist at the Massachusetts Institute of Technology, likened the SETI project to the medieval and Renaissance recovery of the knowledge of classical antiquity, in which scholars labored for generations. The patient transcribing of ancient texts revealed a world that had been lost and eventually transformed the world the scholars thought they knew.

One day we may learn that we are not alone and, indeed, that intelligence is common in the universe. “If SETI succeeds, then intelligence happened in at least one other place,” Shostak says. “So it probably happened in lots of places. In astronomy, the only numbers are one, two and infinity. So if you get two, there are probably lots more. It’s like finding two elephants.”

**MORE TO EXPLORE**

The SETI Institute’s home page has information on telescopes, essays on E.T. signals, podcasts and more (www.seti.org/Page.aspx?pid=1366).

The International Academy of Astronautics quantifies the significance of possible E.T. signals (www.seti league.org/aia SETI/radioscale.htm).

For aliens only! An informal group of 100 scientists, artists and futurists put together an open invitation to all E.T.s (eti.org) in an early attempt at planetary outreach.


The Eerie Silence: Renewing Our Search for Alien Intelligence, by Paul Davies.

By an astrophysicist and the chair of SETI’s Post-Detection Task Group.