SETI Astrophysics

Jill Tarter

Bernard Oliver Chair

Curriculum Vitae:

[Tarter, J CV2009.pdf](http://www.seti.org/sites/default/files/Tarter%2C%20J%20CV2009.pdf)



Discipline: SETI

*"The probability of success is difficult to estimate, but if we never search, the chance for success is zero. [Cocconi & Morrison 1959]" I wish that TED would empower Earthlings everywhere to become active participants in the search for cosmic company.*

Major Awards:

* 1989 Lifetime Achievement Award from Women in Aerospace
* Two  NASA Public Service Medals (one at Ames Research Center and one at NASA Headquarters in Washington, DC) and a HRMS Group Achievement Award (1993)
* Chabot Observatory Person of the Year Award (Feb. 1997)
* Bernard M. Oliver Endowed Chair, SETI Institute (1997- )
* Women of Achievement Award, Science & Technology category, presented by the Women’s Fund and the San Jose Mercury News (1998).
* Telluride Technology Festival Award of Technology (July 2001)
* AAAS Fellow (2002)
* California Academy of Sciences Fellow (2003) and member of the Board of Trustees (2006 -)
* Named*Time 100* most influential people in the world (2004)
* Asteroid 74824 Tarter (1999 TJ16), named and approved by the International Astronomical Union’s Small Bodies Naming Committee (2005)
* 2009 Technology, Education, Design (TED) prize winner

Jill Tarter holds the Bernard M. Oliver Chair for SETI Research at the SETI Institute in Mountain View, California. Tarter received her Bachelor of Engineering Physics Degree with Distinction from Cornell University and her Master’s Degree and a Ph.D. in Astronomy from the University of California, Berkeley. She served as Project Scientist for NASA’s SETI program, the High Resolution Microwave Survey, and has conducted numerous observational programs at radio observatories worldwide. Since the termination of funding for NASA’s SETI program in 1993, she has served in a leadership role to secure private funding to continue the exploratory science. Currently, she serves on the management board for the [Allen Telescope Array](http://www.seti-inst.edu/seti/projects/ata/index.php), an innovative array of 350 (when fully realized) 6-m antennas at the Hat Creek Radio Observatory, it will simultaneously survey the radio universe for known and unexpected sources of astrophysical emissions, and speed up the search for radio emissions from other distant technologies by orders of magnitude.

Tarter’s work has brought her wide recognition in the scientific community, including the Lifetime Achievement Award from Women in Aerospace, two Public Service Medals from NASA, Chabot Observatory’s Person of the Year award (1997), Women of Achievement Award in the Science and Technology category by the Women’s Fund and the San Jose Mercury News (1998), and the Tesla Award of Technology at the Telluride Tech Festival (2001). She was elected an AAAS Fellow in 2002 and a California Academy of Sciences Fellow in 2003. In 2004 Time Magazine named her one of the Time 100 most influential people in the world, and in 2005 Tarter was awarded the Carl Sagan Prize for Science Popularization at Wonder fest, the biannual San Francisco Bay Area Festival of Science.

Tarter is deeply involved in the education of future citizens and scientists. In addition to her scientific leadership at NASA and SETI Institute, Tarter was the Principal Investigator for two curriculum development projects funded by NSF, NASA, and others. The first, the Life in the Universe series, created 6 science teaching guides for grades 3-9 (published 1994-96). Her second project, Voyages Through Time, is an integrated high school science curriculum on the fundamental theme of evolution in six modules: Cosmic Evolution, Planetary Evolution, Origin of Life, Evolution of Life, Hominid Evolution and Evolution of Technology (published 2003). Tarter is a frequent speaker for science teacher meetings and at museums and science centers, bringing her commitment to science and education to both teachers and the public. Many people are now familiar with her work as portrayed by Jodie Foster in the movie *Contact*.

Technical Description of work

The Center for SETI Research uses the Allen Telescope Array (ATA) and the SonATA signal processing system to observe the thousands of candidate exoplanets being found by the Kepler spacecraft, as well as the confirmed exoplanets cataloged in the Exoplanet Encyclopedia.  We are exploring the quiet terrestrial microwave window from 1 to 10 GHz, looking for deliberately broadcast signals from distant technological civilizations.  Our signal detection system has been optimized to find narrowband signals exhibiting a degree of frequency compression that is not expected from any form of natural astrophysical emitters.  For strong signals, there is limited sensitivity to broadband signals.

The ATA currently consists of 42 6.1m antennas and is designed to grow to 350 antennas.  Because of the small size of the individual dishes, the array observes a large field of view having a FWHM = 3.5°/ (f in GHz).  We utilize three phased array beamformers to observe three objects at the same time. Although we usually observe with all three beamformers tuned to the same sky frequency, it is possible to tune two of them to one frequency and the third to another frequency within the 1-10 GHz range.  We follow up on detected candidate signals in near-real-time in order to discriminate against human-generated sources of radio frequency interference.  Thus we have poor sensitivity to transient signals whose persistence is less than a few minutes.

The  SonATA  system is fully automated and is controlled by observing scripts.  The beamformers are calibrated (focused) over a frequency span of several hundred megahertz at least once every 24 hours.  Targets are selected for each of the beams and data are collected, and temporarily stored, from an input bandwidth of 104 MHz and filtered down to individual spectral bins ~1 Hz in width.  These stored data are analyzed by efficient signal detectors optimized for drifting continuous wave signals or drifting pulses, while new data are being collected at the next, higher frequency.  Signal paths identified as having statistically significant power levels are flagged as candidates by the detector algorithms and followed up on in the next activity cycle.  If no candidates are found, the next activity cycle analyzes the next batch of data in temporary storage and collects data at the next higher frequency.  Before classification as a candidate signal, simple tests exclude signals that have zero drift (they are internally generated and locked to the observatory frequency standard), or signals that are seen in more than one beam at the same time (they are entering the far sidelobes of the synthesized beams), or signals that are cataloged in an RFI database for the past week, as being due to interference. Any remaining candidates are scheduled for a sequence of reobservations on and off the source direction.  Candidates that are not reacquired when reobserved, or are seen when pointing off source are reclassified as interference and the automated observing script continues with the next frequency range to be observed.

There are regions of the microwave window that are heavily used for terrestrial communication services.  Sometimes the signal detectors register so many different signals at the same time that it becomes impossible to complete the process of classifying signal candidates within the time allotted to each activity cycle.  Such spectral regions are labeled ‘crowded bands’ and are subsequently ignored during observations.  In an attempt to recapture these frequency bands, we are experimenting with a citizen science application called SETI Live!.  Over time, small portions of these crowded bands are displayed to volunteers who help to identify and classify these signals, closing the feedback-loop to the SonATA detectors at the same near-real-time cadence as the software system.  The ultimate purpose of this activity is to detect an extraterrestrial signal that might otherwise have been missed among all the terrestrial signals.  If volunteers can help to recognize the transmitting source for these crowded bands, then it may eventually become possible to schedule around the interfering transmitters and regain these frequencies again.

[« Back to Our Scientists](http://www.seti.org/seti-scientists/scientists) | [Peter Tenenbaum »](http://www.seti.org/users/ptenenbaum)



[The Allen Telescope Array](http://www.seti.org/ata)

The Allen Telescope Array (ATA) is a "Large Number of Small Dishes" (LNSD) array designed to be highly effective for “commensal” (simultaneous) surveys of conventional radio astronomy projects and SETI (search for extraterrestrial intelligence) observations at centimeter wavelengths.

[Detection of Complex, Electromagnetic Markers of Technology](http://www.seti.org/seti-institute/project/detection-complex-electromagnetic-markers-technology)

The proposed work seeks to extend the current capabilities of SETI searches for signals indicative of technology in remote locations. This is significant because current searches of this type simply look for carrier signals, the transmissions used to synch receivers with the coded information either on or adjacent to the carrier signal. The carrier signal detections would not necessarily contain any of the information transmitted. As such, a detection of a carrier signal only indicates the presence of technology, but little about the content of the transmission. The proposers seek to expand the SETI search toward the more complex transmissions that are superseding the use of carrier signals on Earth today.

[The Allen Telescope Array: Science Operations](http://www.seti.org/seti-institute/project/allen-telescope-array-science-operations)

Intellectual Merit The Allen Telescope Array (ATA) is a pioneering centimeter-wavelength radio telescope that will produce science that cannot be done with any other instrument. The ATA is the first radio telescope designed for commensal observing; it will simultaneously undertake the most comprehensive and sensitive SETI surveys ever done as well as the deepest and largest area continuum and spectroscopic surveys. The science of the ATA is enabled by a wide range of innovative technical developments. The astronomy decadal panel, Astronomy and Astrophysics in the New Millennium, endorsed SETI and recognized the ATA (then, the 1 Hectare Telescope) as an important stepping-stone o the Square Kilometer Array (SKA), its highest ranked "moderate project" in radio astronomy.

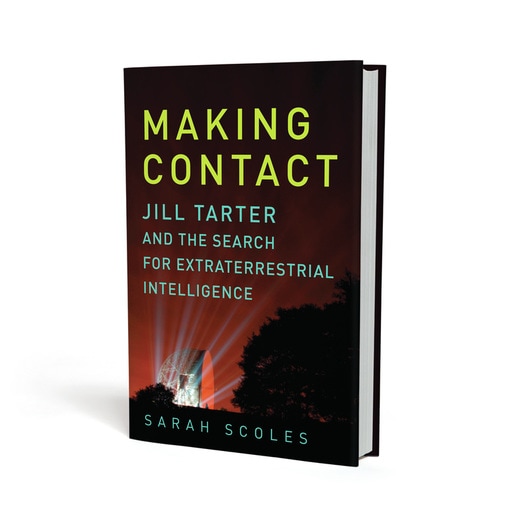
[The Allen Telescope Array: Science Operations](http://www.seti.org/seti-institute/project/allen-telescope-array-science-operations-0)

Operation of the Allen Telescope Array, a radio telescope designed to collect a wide range of data and perform commensal observations. Capabilities include transient and variable source surveys, pulsar science, spectroscopy of new molecular species, mapping of galactic magnetic filaments, and imaging of comets and other solar system objects. The ATA also provides training opportunities for radio astronomers.

Sarah Scoles



I'm a Denver-based freelance science writer and contributor at [*WIRED Science*](https://www.wired.com/category/science/). A writing portfolio lives [here](http://www.sarahscoles.com/selected-journalism.html). In previous lives, I was an associate editor at*Astronomy* and the public education person at the National Radio Astronomy Observatory in Green Bank, West Virginia. When I'm not making sentences or recording our conversations, I enjoy reading short story collections, running weirdly long distances in the wilderness, teaching my dog English, and trying to become a better navigator.  
  
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[Order it](https://www.amazon.com/Making-Contact-Tarter-Extraterrestrial-Intelligence/dp/1681774410/) before you can have it so that you know you'll have it as soon as having it is possible. It comes out in July 2017 from Pegasus Books.  
  
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*For anyone who has ever looked up at the night sky and wondered, "Are we alone?" Making Contact is an examination of the science behind the search for extraterrestrial intelligence and its pioneer, Jill Tarter, the inspiration for the main character in Carl Sagan's Contact.  
  
​Jill Tarter is a pioneer, an innovator, an adventurer, and a controversial force. At a time when women weren’t encouraged to do much outside of the home, Tarter ventured as far out as she could―into the three-Kelvin cold of deep space. And she hasn’t stopped investigating a subject that takes and takes without giving much back.  
  
Today, her computer's screensaver is just the text “SO…ARE WE ALONE?” This question keeps her up at night. It is, in some ways, the question that keep us all up at night. We have all spent dark hours wondering about our place in it all, our aloneness both terrestrial and cosmic. Tarter’s life and her life’s work are not just a quest to understand life in the universe: They are a quest to understand our lives in the universe. No one has told that story, her story, until now.  
  
It all began with gazing into the night sky. All those stars were just distant suns―someone else's suns. Diving into the science, philosophy, and politics of SETI―searching for extraterrestrial intelligence―Sarah Scoles reveals the fascinating figure at the center of the final frontier of scientific investigation. This is the perfect book for anyone who has ever looked up at the night sky and wondered if we are alone in the universe.*