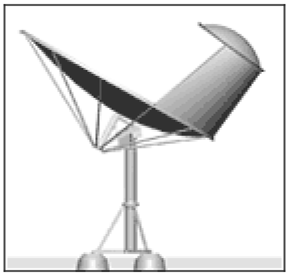
http://www.seti.org/ata/general.php/

Allen Telescope Array

General Overview



It's one of the most persistently enticing sirens to beckon the SETI community: a major telescope that can be dedicated to the search. Despite the seductiveness of this idea, construction of an instrument designed to meet the requirements of full-time SETI has always foundered on the large costs.

That situation is changing. Thanks to the far-sighted benevolence of technologists Paul Allen (co-founder of Microsoft) and Nathan Myhrvold (former Chief Technology Officer for Microsoft), a new telescope is being constructed that will allow a targeted SETI search to proceed 24 hours a day, 7 days a week.

The new instrument, appropriately called the Allen Telescope Array, known formerly as the One Hectare Telescope, or 1hT, is a joint effort by the SETI Institute and the University of California, Berkeley. Because of its novel construction - an array of inexpensive antennas - it can be simultaneously used for both SETI and cutting-edge radio astronomy research. It is being built at the existing Hat Creek Observatory, run by the Radio Astronomy Lab at Berkeley, and located in the Cascade Mountains just north of Lassen Peak (California).

Most SETI experiments of the past have relied on existing radio telescopes. While this allows such searches to be conducted on quite large instruments (for example, the mammoth 305 m Arecibo dish, in Puerto Rico), the amount of telescope time available for the search is necessarily restricted. Project Phoenix for example took control of the Arecibo telescope for approximately three weeks in the spring and a similar block of time in the fall. Since our observations take place only at night (the sun can seriously degrade the type of narrow-band signals that SETI looks for when observing close to the ecliptic, as required by Arecibo's limited sky coverage), this really amounts to a total of three weeks of full-time observing annually. During the period from September 1998 through March 2004, Project Phoenix observed for a total of 100 days at Arecibo. That's only 5% of the available time. The Allen Telescope Array will offer SETI scientists access to the telescope 24 hours per day, seven days a week and permit the search of many different target stars simultaneously. As a result, the Allen Telescope Array will speed up SETI targeted searching by a factor of at least 100.

Because of its ability to study many areas on the sky at once, with more channels and for 24 hours a day, the Allen Telescope Array will permit an expansion from Project Phoenix's stellar reconnaissance of 1,000 stars to 100 thousand or even 1 million nearby stars.

The fundamental idea behind the Allen Telescope Array was hatched during a series of workshops held in 1997 - 1999 in which a group of scientists, engineers, and technologists considered how best to pursue SETI in the coming two decades (the SETI Science and Technology Workshops). The scheme they favored was to fashion the telescope as an array of commercial satellite dishes. Because of the enormous market for these backyard metal mushrooms, they are surprisingly inexpensive when purchased in quantity. The Allen Telescope Array will consist of 350 antennas of 6.1 meter diameter each, resulting in an instrument with a collecting area exceeding that of a 100 m telescope.

The pseudo-random arrangement of the telescopes on the ground places all of the telescopes well inside a 1 km circle, carefully located to provide a very high quality beam shape (the spot in the sky to which the telescope is most sensitive) for both SETI observations and radio astronomy research. The large number of antennas provides unprecedented control of unwanted sensitivity outside the primary beam.

Comparison of the Allen Telescope Array and Project Phoenix

The Allen Telescope Array is optimized to cover frequencies between 1,000 and 10,000 MHz, which is more than five times the range encompassed by Project Phoenix. It will be useful from 0.5 to 11 GHz. The system temperature, which is a critical factor in determining the sensitivity of the telescope, is typically 45 K. The Phoenix search system has been reconfigured for use with the first phase of the ATA (42 antennas). Renamed Prelude, the system will divide 60 MHz of spectrum (90 million channels per polarization) between two or three positions on the sky.

The name “Prelude” alludes to a new software-based processing system named SonATA (SETI on the ATA). SonATA will have more channels and capabilities than any other SETI system but will require additional funding.

By building the new telescope as an array, several major advantages can be realized. To begin with, many "pixels" can be generated on the sky at once. Rather than looking at only one star at a time, as the Arecibo telescope and its kin are constrained to do, several stars can be examined simultaneously. This again speeds up the process of stellar reconnaissance. In addition, it is easy to expand an array by merely buying additional antennas and connecting them into the system. Single, large dish antennas are not amenable to such simple improvement.

The bottom line is compelling. Because of its ability to study many areas on the sky at once, with more channels and for 24 hours a day, the Allen Telescope Array will permit an expansion from Project Phoenix's stellar reconnaissance of 1,000 stars to 100 thousand and eventually 1 million nearby stars. For the first time in its history, SETI will be able to check out a truly significant sample of the cosmic haystack. This is not an incremental step forward: the Allen Telescope Array will increase the stellar reconnaissance by orders of magnitude. It is a very large step for SETI research.

The design for the Allen Telescope Array's antennas feature offset optics because sometimes, as in football, going to the side can reduce interference.

The antennas' somewhat unconventional appearance is what's called an offset Gregorian system. A secondary mirror to bounce incoming radio signals collected by the large (6.1 meter diameter) primary reflector back to the feed horn (hidden from view by the shroud), where they are amplified and sent on their way to the control buildings.

"This is a definite improvement on your backyard antenna," says Dave DeBoer, former Project Engineer for the Allen Telescope Array." By moving the feed off-center, we've bettered sensitivity in the directions we want to see."

By introducing a secondary mirror and a surrounding shroud, the antenna is less likely to pick up noisy radiation from the (relatively hot) ground surrounding the telescope. Moving the reflector assembly off-center minimizes the chance of terrestrial signals bouncing off the antenna structures and interfering with our study of cosmic emissions. This offset design has also been used for the new 100 m Robert C. Byrd Telescope, which is in operation in West Virginia.