Finding Inhabited Worlds Among the Habitable Ones

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Prior to 1995, the SETI Institute's Project Phoenix used the HabCat catalogs prepared by Turnbull and Tarter[1] and a catalog of the 100 nearest and the 'best and brightest' targets prepared by the NASA HRMS Science Advisory Committee[2] to point large radio telescopes to search for signs of distant extraterrestrial technologies. We had only stellar properties to guide our selection; age; multiplicity; spectral type; distance; variability; sometimes, metallicity. As radial velocity surveys began to identify exoplanet systems, they were added to our target lists and given increased weight. In 2011, the first Kepler data release changed the game for our SETI strategies. With three, simultaneous beams of the Allen Telescope Array (ATA), and thousands of candidate exoplanet systems in one area of the sky, we began efficiently searching where we knew there were planets.

Now that Kepler and the ground based searches have given us the statistical confidence that almost every star will host planets, the game is once again changing and we will be adapting our search strategies to that reality. Moving from our earliest stellar catalogs that disfavored M Dwarf stars, we will shortly begin concentrating on the nearest stars that are predominantly M Dwarfs. As with the rest of the scientific community who are turning their attention to these small stellar hosts, we do so because we can, and because it increases the detectability of any signals that may be there. But we hedge our bets. The field of view of the ATA is 3.5°/f (in GHz). Having selected one, high-priority, nearby M Dwarf target star, there may not be any others within the ATA field of view. In which case, the target selection algorithm reverts back to our older set of stellar catalogs and known exoplanets to find the triad of targets that helps us prevent false alarms in our near-real-term signal detection schemes.

The technologies for remotely observing the atmospheres of planets within the habitable zones of their host stars to discern biosignatures, or to sample in-situ or return and sample materials from solar system bodies seeking biomarkers, are still in the future. Radio SETI searches on the ATA, or other OSETI and NIROSETI searches currently underway, could find technosignatures tomorrow. Most scientists would say this is a long shot; microbes are more probable. But SETI just might work; it would be unequivocal, it would discover inhabited worlds, and is worth supporting at a small fraction of amount being spent on the search for habitable worlds.

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[1] M.C. Turnbull and J.C. Tarter, *ApJS* Vol. 145, pp. 181-198 (March 2003).
M.C. Turnbull and J.C. Tarter, *ApJS* Vol. 149, pp.423-436 (2003).

[2] D.R. Soderblom and D.W. Latham, in *Third Decennial US-USSR Conference on SETI*, ASP Conference Series, Vol. 47, ed. G. Seth Shostak (1993)