

# **Collaborative Workshop on Strategy and Execution of the Next Generation of SETI Signal Processing for the ATA**

**Where:** Hat Creek Observatory (SETI Institute as a fallback)

**When:** 1pm March 11 – 3pm March 12, 2005

**Who:** SETI Institute SonATA team plus invited technical experts

**Why:** SETI is one of the sexiest scientific explorations ever undertaken. People everywhere (and particularly within the technology sector) appear eager to participate (5 million users of SETI@home, numerous corporate and individual sponsors, etc.). The SETI Institute is about to move into our next phase of observations with the dedicated Allen Telescope Array, that will employ software-only, real-time signal detectors running on COTS platforms. We must proactively design and implement an efficient architecture for signal processing that will be able to grow throughout the lifetime of the array, and we need to tap into the enthusiasm of the external community to optimize the modest resources of the SETI Institute.

**What:** By the time the ATA has been built out to 350 or more antennas, clusters of commodity servers should have the raw processing speed to perform all the signal detection algorithms that we currently execute using a special-purpose system (based on PC's and custom hardware accelerators). There may be viable alternative technologies as well. In planning for observations with the completed array, we face three challenges:

- 1) getting the data from the synchronous environment of the telescope, at full bandwidth, onto an asynchronous data transport technology and into the general purpose computing environment in real time (we've designed a custom interface, but would prefer a commercial product),
- 2) implementing an optimal architecture for the software signal processing, and
- 3) developing additional signal processing algorithms for the efficient detection of classes of more complex signals than those currently enabled in the operational search system.

This next generation SETI signal processing system is called SonATA (SETI on the ATA) and we are engaging experts beyond the SETI Institute to help us identify solutions to our challenges. For years we've been inventing custom hardware/software solutions. The current moment seems to be an opportunity to move real-time SETI signal detection into an environment where programming general purpose devices is our sole concern.

During the original SETI 2020 workshops in the late 1990's, we successfully combined the skills of our in-house team with external technical volunteers to innovate three new paths for SETI research in the coming decades: an affordable, dedicated radio telescope with  $10^4 \text{ m}^2$  of collecting area (the ATA now under construction), optical SETI (now operating on a handful of meter-class telescopes), and the omnidirectional sky survey instrument (awaiting further decrease in computational costs). The goal of the current short workshop is to create another successful interchange that leads to an ideal signal processing architecture for SonATA – and an implementation path to achieve it.

**Deliverable:** A roadmap for the SETI Institute to acquire the necessary resources (computational horsepower, custom or commercial hardware interfaces, management talent, software code, documentation, infrastructure for software testing, validation, and maintenance) to implement the optimal hardware and software architecture suggested by this workshop.

## **SonATA WORKSHOP TIMELINE**

### **Friday March 11, 2005**

Noon –1 pm	lunch served and site tours ongoing
1–3 pm	Show and tell of current hardware – the ATA, IF chain, and the NSS (demo of RFI scanning and comparison of results to date with Arecibo)
3–3:30pm	Coffee break
3:30–4:15pm	Presentation of current classes of signal detection algorithms with statistical constraints on probability of false alarms, and proposed multi-beam observing scenario
4:15-5pm	Presentation of the current baseline hardware and software architectural design for SonATA, including specific data rates and the hardware interfaces that must be matched
5- 6pm	Self-assemble into groups with relevant technical specialties (e.g. fast video, interconnection fabrics, computing architectures, signal processing, software/hardware management)
6-8pm	Cocktails and dinner
8-10pm	Brainstorming within groups

### **Saturday March 12, 2005**

7:30-8:30am	breakfast, regroup
8:30-9:30am	Discussion of logical steps to proceed from SonATA baseline to an optimal solution for use with the ATA. What are the discrete and separable pieces of such an architecture and what is needed to develop them?
9:30-10:30am	Explore the operational alternatives for software and hardware development, maintenance, and evolution in the context of the limited resources of the SETI Institute, required reliability for 24x7 operations, and requisite robustness against hoaxes.
10:30-11am	Coffee break
11am – noon	Discussion of value of either open-source or some sort of ‘grand challenge’ approach for cost-effective implementation of previously discussed optimal architecture and the development of new classes of signal detection algorithms.
Noon -1pm	Lunch (and more demonstrations if desired)
1-2:30pm	Rearrangement of small groups as needed and drafting of recommendations for the SETI Institute.
2:30-3pm	Summaries of group recommendations
3pm	Adjourn