Hat Creek Radio Observatory

Technical Details

1 January 2024

Overview

The Hat Creek Radio Observatory is a multi-disciplinary facility which is operated by the SETI Institute. The observatory houses a number of instruments and research projects including the 42-element Allen Telescope Array.

HCRO use

Use of the Hat Creek Radio Observatory is available for shared-risk scientific and research activities. Observing time on the ATA is available on a proposal and cost-recovery basis. Proposals are evaluated based on scientific merit and are accepted from all research and educational institutions as well as individual investigators. Guest experiments, instruments and equipment must comply with observatory policies including those related to electromagnetic interference minimization.

Services

HCRO offers the following services to research and educational institutions:

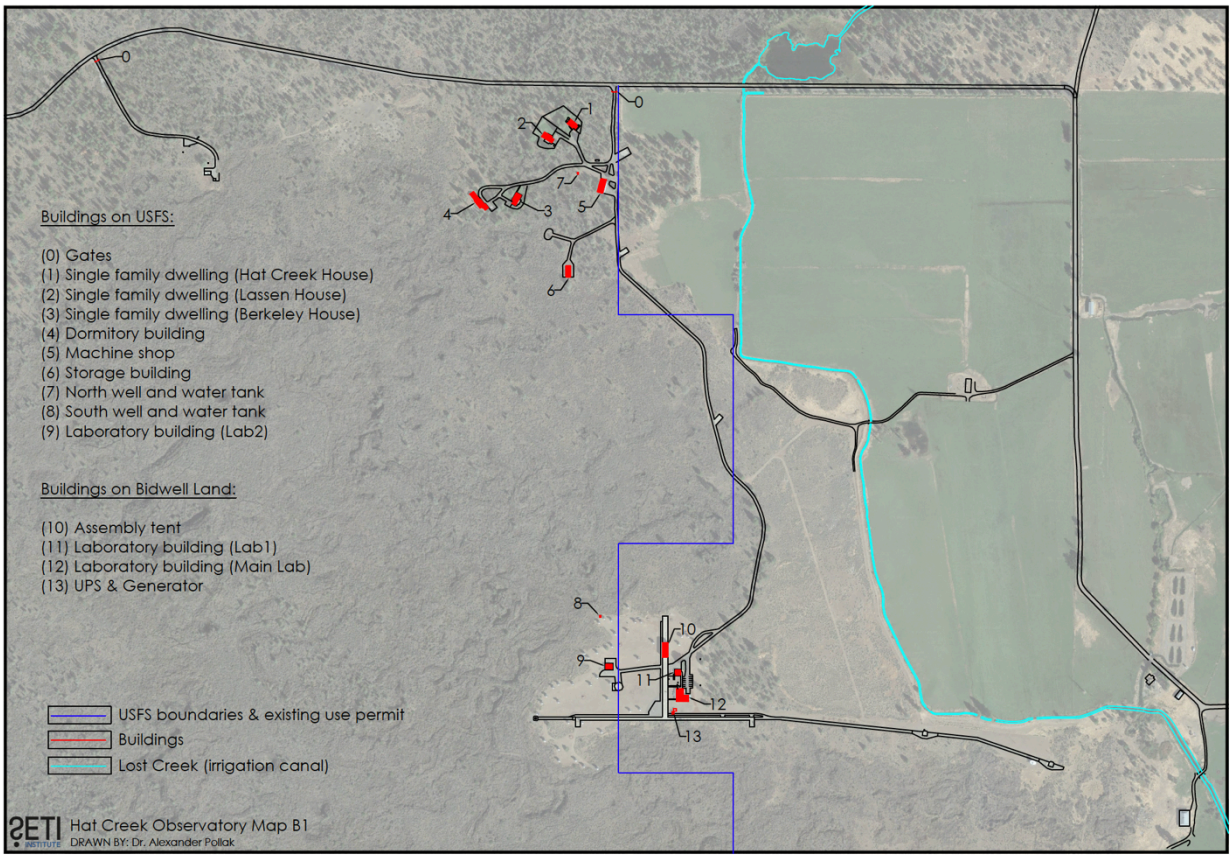
- Observations using the Allen Telescope Array
  - As individual antennas, groups of antennas or the entire array
  - Using the ATA's general purpose DSP backend
  - Using USRP and other SDR peripherals
  - Using user-supplied equipment
- ATA general DSP backend modes
  - Raw digitized signals available via 100Gbit ethernet
  - Arbitrary spectral or temporal resolution full Stokes spectroscopy
  - Wide-bandwidth multi-antenna voltage recording
  - Real-time Correlator, user-defined integration time, 0.5 MHz frequency resolution
  - Real-time Beamformer, user-defined integration time and frequency resolution (1 Hz to 0.5 MHz)

- Hosting guest instruments on site including colocation in the ATA Signal Processing Room
  - Complete systems
  - Antennas
  - Guest receivers on ATA dish(es)

Location

Name	Hat Creek Radio Observatory
Address	42231 Bidwell RD, Hat Creek, CA 96040
Altitude	1008 m
Latitude	40° 49' 03" N
Longitude	121° 28' 24" W

Site Map

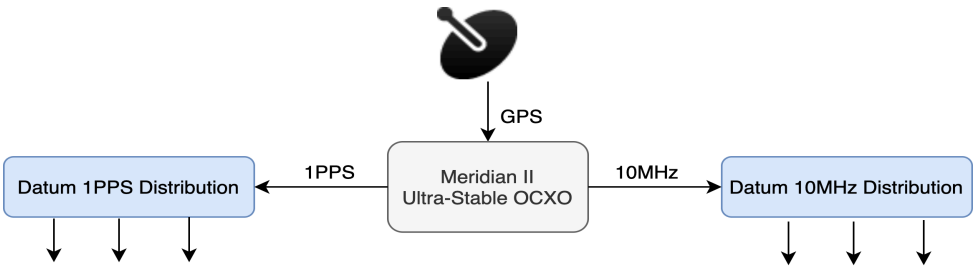


Antennas

Architecture	42 dishes – 6.1 m offset Gregorian
Currently available for observations	20 + 8 as of 1 March 2024
Array maximum baseline	300 m
Elevation range	16 to 87 deg
Max elevation speed	1 deg/sec
Azimuth range	-90 to 450 deg
Max azimuth speed	3 deg/sec
Operating frequency	1 – 11.2 GHz
Feed design	Log-periodic / Quad-Ridged Feed Horn (QRFH)
Polarization	Dual linear
Feed operating temperature	80 Kelvin
System temperature (T_{sys})	Log-Periodic: 45 Kelvin @ 2 GHz; 60 Kelvin @ 8 GHz QRFH: 20 Kelvin @ 2 GHz; 30 Kelvin @ 8 GHz
HPBW	3.5° @ 1 GHz; 0.58° @ 6 GHz; 20.9′ @ 10 GHz;

Time Standard

Time sync	GPS (Meridian II)
Station clock	Ultra-Stable OCXO
Available reference signals	10MHz; 1PPS

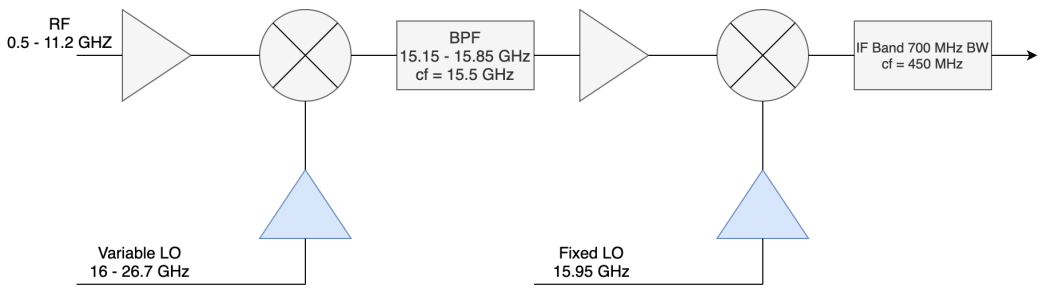


Radio Frequency (RF)

Cryogenic low noise amplifier	Low Noise Factory; 35dB gain; 1 – 15 GHz; Noise Figure 0.15dB
Post amplifier module (PAM)	60dB gain; 0 - 63 dB variable attenuator; 0.5 dB step
PAM 1 dB gain compression	+14 dBm
Analog fiberoptic link converter	Photonic Systems; PSI 1601
Fiber link noise figure	≤ 45 dB
Fiberoptic 1 dB gain compression	+11 dBm
Fiberoptic connectors	FC/APC
Optical wavelength	1550 nm

Intermediate Frequency (RF)

Number of independent IF bands	4
IF bandwidth	700 MHz
Number of tunable LO	4
Number of fixed LO	1
Frequency range of tunable LO	16 – 26.7 GHz
Frequency of fixed LO	16.012 GHz
AAF center frequency	512 MHz
IF output power range	-10 dBm to -30 dBm
IF output connector	SMA

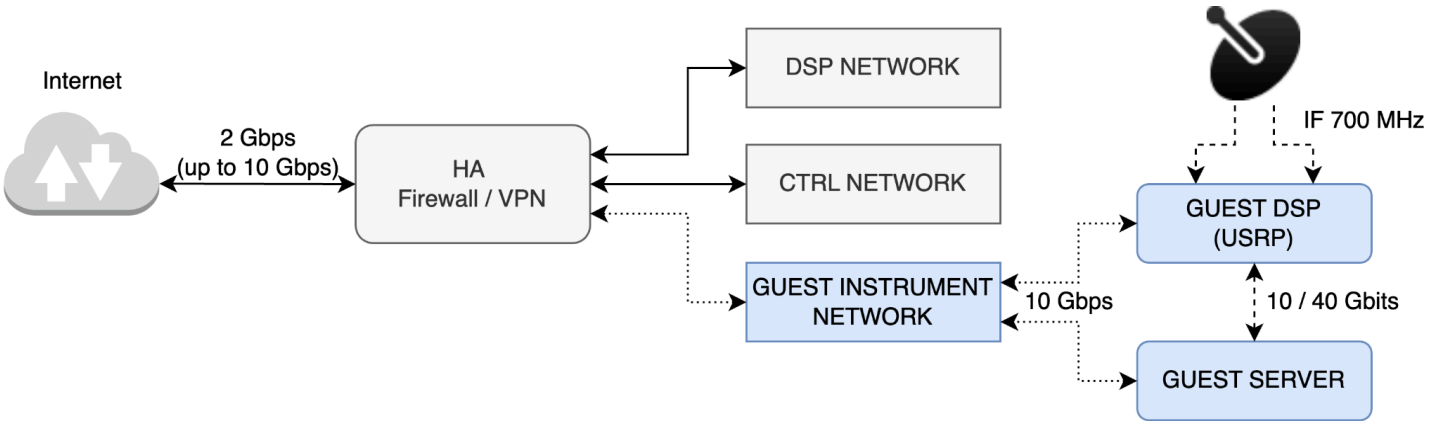


Control Interface

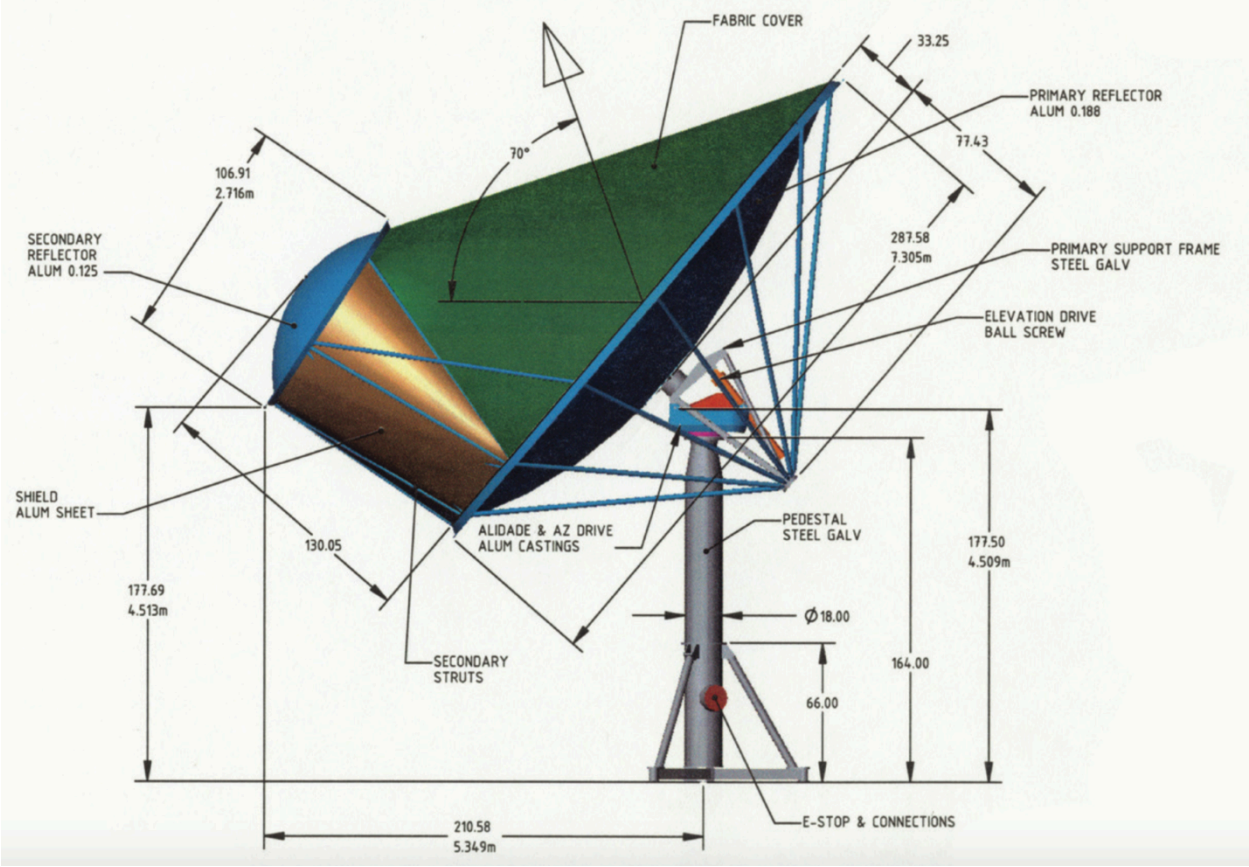
Telescope control software	Python 3.5 based library; ATATools.ata_control
GitHub location	https://github.com/SETIatHCRO/ATA-Utils
Software version	1.0.3
Requirements	'pyephem'; 'astropy'; 'numpy'; 'tftpy'; 'pyuvdata', 'casperfpga'

Network

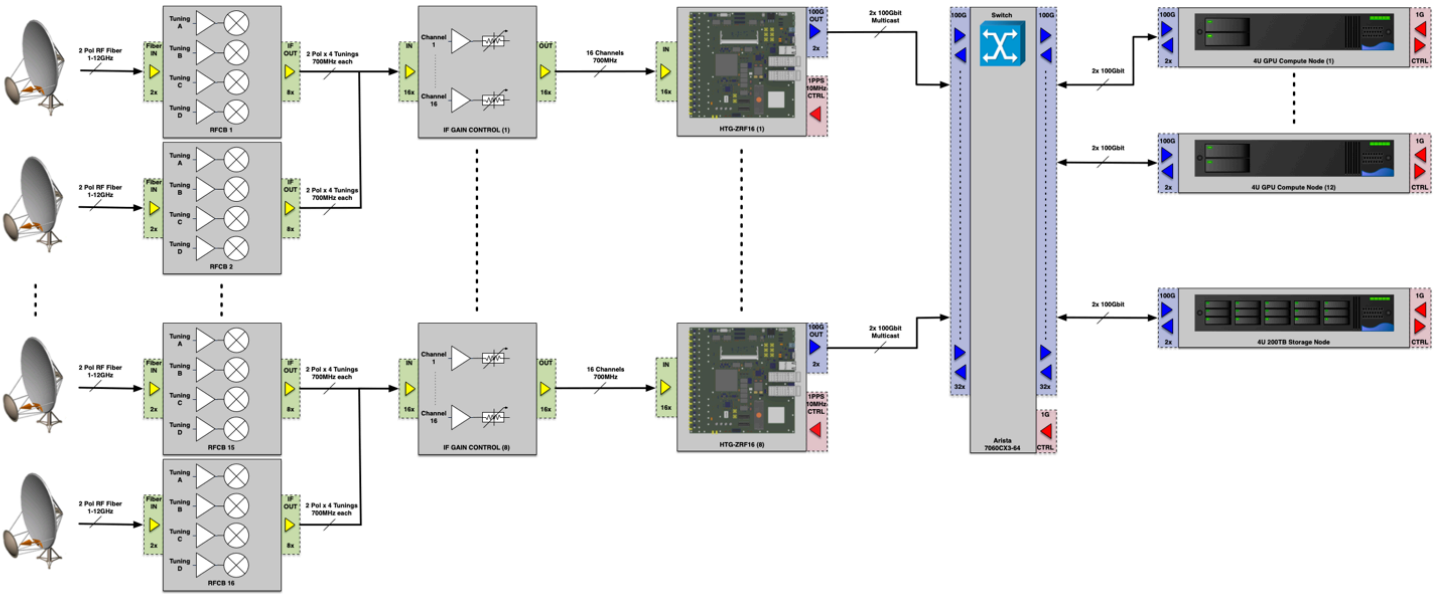
Internet connection	2 Gbps full duplex (up to 10 Gbps possible)
Site access	VPN; SSH
Network Architecture	Fully redundant, 10 Gbps backbone, 100 Gbps DSP
Available public IPs	254



ATA Antenna Diagram



ATA RF/IF and SIGNAL PROCESSING DIAGRAM



ATA Cryogenically Cooled Broadband FEEDS

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