Summary of 2013 SARA Western Conference ~ Socorro, New Mexico
9 ~ 10 February 2013

Contents

The 2013 SARA Western Conference was held in Socorro, New Mexico USA at the Best Western Hotel & Suites. We had 22± attendees at this year's conference. The format was similar to previous western conferences – opening remarks by the president, presentations by outside speakers and SARA members followed by a tour of local radio astronomy facilities. These are described below. During opening remarks, SARA president Bill Lord asked for suggestions for the location of the 2014 Western Conference, and it was stated that Owens Valley Radio Observatory near Big Pine and Bishop, California may be a good location.

Pictured: Front left-right: Stuart Rumley, Bill Lord, Joe Hobart, Jane Gray, Kevin Kinghorn. Back left-right: Jim Moravec, Whitham Reeve, Curt Kinghorn, James Boswell, Tom Hagen, Marcia Tucker, Kent Gardner, Robert Tucker, Ken Redcap, Lorraine Rumley, Keith Payea, Frank Schinzel, Stan Nelson, Nikki Payea, Caleb Kinghorn. Not pictured: Melinda Lord, David Westman.

Presentations

Frank Schinzel from University of New Mexico at Albuquerque presented an overview of the Long Wavelength Array project. The LWA will be used to study plasma astrophysics and space science such as space weather, cosmic evolution, the high redshift universe, and the transient universe. When completed, the LWA will consist of over 50 array sites, almost all in New Mexico, with a total collecting area of around 1 km^2. The first array, called LWA1, is collocated with the NRAO Very Large Array (VLA) about 1 hour drive west of Socorro. The core of each array consists of 257 dual-polarization dipoles distributed pseudo-randomly over a footprint forming an ellipse of 110 x 100 m (see photos in the tour description later in this report). Five additional dual-polarization dipoles for calibration are located from 150 to about 500 m from the center of LWA1. The signals from each dipole are digitized and either recorded individually or combined into beams. Four of these independently-steerable dual-polarization beams are available that can be independently tuned to any frequency between 5 and 88 MHz. However, for most applications the usable frequency range is 10 to 88 MHz.

James Boswell was our next speaker. James works at the VLA Site in VLA Engineering Services. He discussed a new dry-air system he has been building for use with the EVLA, or Expanded VLA. It was found that when the original VLA was expanded in terms of bandwidth and sensitivity that removing moisture from the air in the

antenna feeds became even more critical. James put together a suitable dry-air pressurization system based entirely on commercial off-the-shelf components. The system uses a small air compressor electric motor/pump and tank with several different stages for removing the moisture and maintaining a small positive pressure to keep outside air and its associated moisture from entering the system. Each of the 27 VLA dish antennas is equipped with the dry-air system, and all antenna feeds on each dish that require dry air are fed in series. The installation of this dry-air system is underway. Jim brought a complete set of components for demonstrating and viewing – they all fit on a regular folding table.

We next heard from SARA member Keith Payea. We usually see Keith at our western conferences, particularly those in California where he lives. He discussed the Robert Ferguson Observatory (RFO) in California's Sugarloaf Ridge State Park in Sonoma County. The observatory originally was dedicated to visible astronomy but to add to the experience, Keith helped install a Radio Jove receiver and antenna system. It primarily is used for solar radio observations at 20 MHz and to explain some of the inner workings of the Sun in conjunction with the visible observations.

After lunch Whitham Reeve discussed software tools used with the e-CALLISTO solar radio spectrometer network. This was a follow-up to his presentation at the 2012 Western Conference in which he discussed e-CALLISTO hardware. In addition to a slide presentation, Whit demonstrated the software tools on a live system setup at the conference. The Callisto receiver portion of e-CALLISTO has many uses. It originally was designed for observing solar radio bursts with very high frequency resolution at VHF and UHF but it also is used for RFI surveys, up-converter front-end for software defined radio, observing satellite to derive Doppler-information, receiving meteor trail reflections and echoes from the Moon or satellites related to space radars and amateur radio Earth-Moon-Earth (EME) transmissions, and participating in VHF-SETI activities.

Keith Payea returned to the podium for another presentation, this one on Techniques for powerline noise reduction in VLF sudden ionospheric disturbance (SID) radio observing. Keith has experimented extensively to eliminate the powerline hum that interferes with our SID observations. In particular, he described a method by which the powerline hum is actively cancelled at the SID monitor resulting in 20 dB reduction. SARA members interested in this technique should watch the SARA journal for an article by Keith.

After Keith finished, Whitham Reeve presented a tutorial on the basic types of solar radio bursts, Type I through Type VII, including actual spectrograms of each burst type observed by various stations in the e-CALLISTO network. The spectrograms were provided by Christian Monstein, who conceived and designed the Callisto receiver and most of the associated software tools.

Our next speaker was SARA member Tom Hagen assisted by Ken Redcap and Bill Lord. Tom described two ongoing SARA projects including the 3rd generation SuperSID monitor, which is presently undergoing evaluation and test. The main difference between the current and new SuperSIDs is that the new one is powered by a USB connection to a PC. This reduces (or eliminate) the ongoing problems of radio frequency interference (RFI) from power supplies. It has been found that the 5 Vdc power provided by USB ports is much quieter than the switchmode ac adapter power supplies so far tested. Tom also discussed the "Comberator", a battery powered squarewave oscillator that is used to validate or troubleshoot a SuperSID installation. The "Comberator" was originally developed by the late Dave Benham, who was a SARA member and director.

Next up was SARA director Jim Moravec, who described his work with young people in Colorado and his efforts to get them interested in science. In spite of the many obstacles he has had impressive results, some of his students going on to very successful careers in various science fields. Jim was followed by Curt Kinghorn, who described his ongoing series of radio astronomy experiments. Curt was inspired by a talk at a previous SARA Western Conference to make radio astronomy observations within the UHF television band at 608 to 614 MHz (channel 37). This range of frequencies cannot be used by TV stations.

VLA and LWA Tours on Sunday

We were very lucky this year to be treated to two tours, both at the Very Large Array site about 65 km west of Socorro out in the open desert. The VLA has both the Expanded VLA (EVLA) and the first LWA station (LWA1). The coordinates for the VLA Visitor Center are 34-04-24.10 N, 107-37-27.00 W. We were greeted by the sign below as we entered the VLA site.

The Very Large Array consists of 27 radio antennas in a Y-shaped configuration. The data from each 25 m antennas are combined to give the resolution equivalent to an antenna 36 km across and sensitivity equivalent to a dish 130 m in diameter. The EVLA has a point-source sensitivity better than 1 μJy between 2 and 40 GHz. The operating frequency range is between 1.0 and 50 GHz with up to 8 GHz bandwidth per polarization, a minimum of 16,384 channels, 1 Hz frequency resolution, and 128 independently tunable sub-bands.

The satellite image below, seen from the altitude of the ionosphere's D-layer, shows the desert surrounding the VLA/LWA (far-left), Magdelena, which we passed through to get to the VLA Site (middle) and Soccoro (far-right), where our conference was held. The temperature at the VLA Site during our tour was around +7 °C, cool enough to keep the rattle snakes in their dens and to keep us from being broiled by the hot Sun. Needless to say, we had to wear jackets and some people wore gloves.

James Boswell was our host for the VLA tour, which included climbing one of the 25 m dish antennas. Joe Craig was our host for the LWA tour, and he allowed us to wander among the LWA antenna forest. Between tours we ate a catered lunch brought in from Datil, about 22 km west-northwest of the VLA. The following is a photo essay of the tours.

Below: Panoramic view showing all 27 VLA dish antennas.

James Boswell (center) discusses the dish surface immediately above.

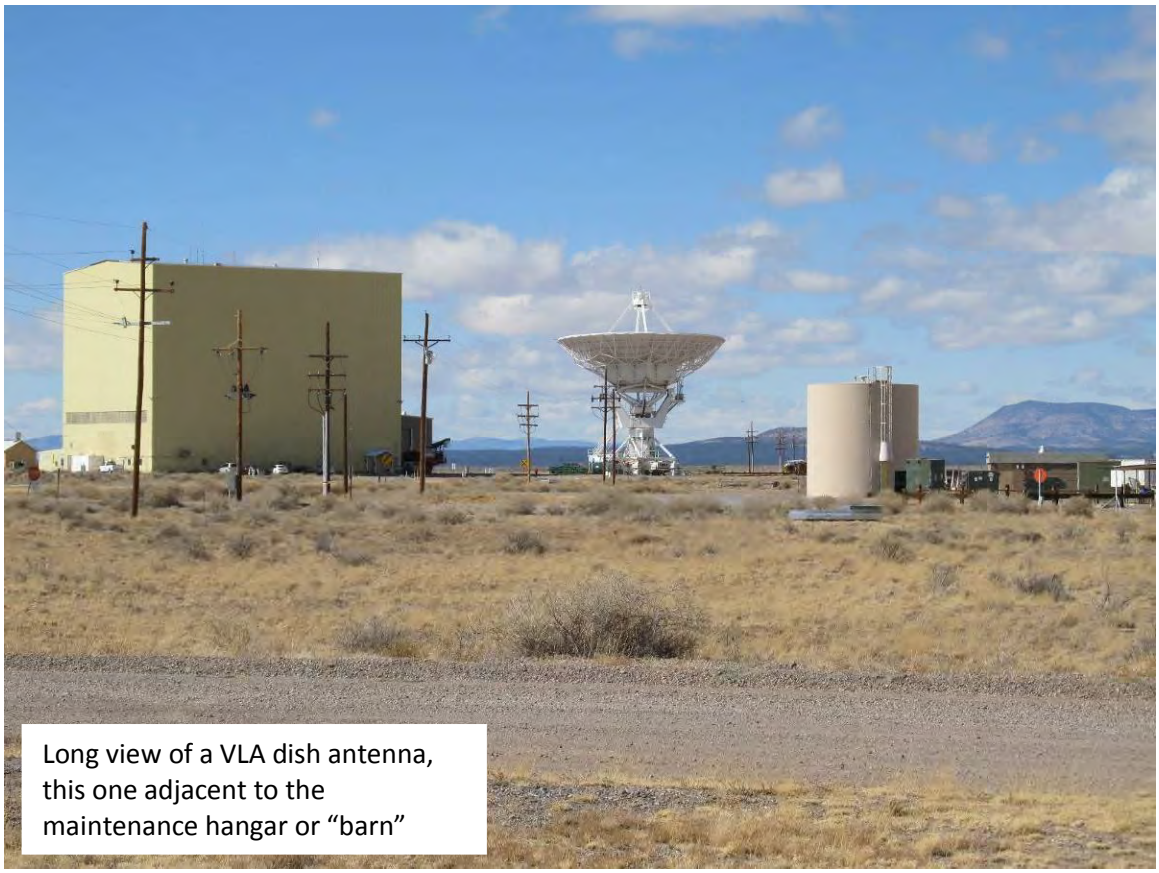
Dish antenna sub-reflector as seen from the dish surface. The “dog house” at the bottom of the picture houses the receivers

Receivers that are in the “dog house” along with their feed horns

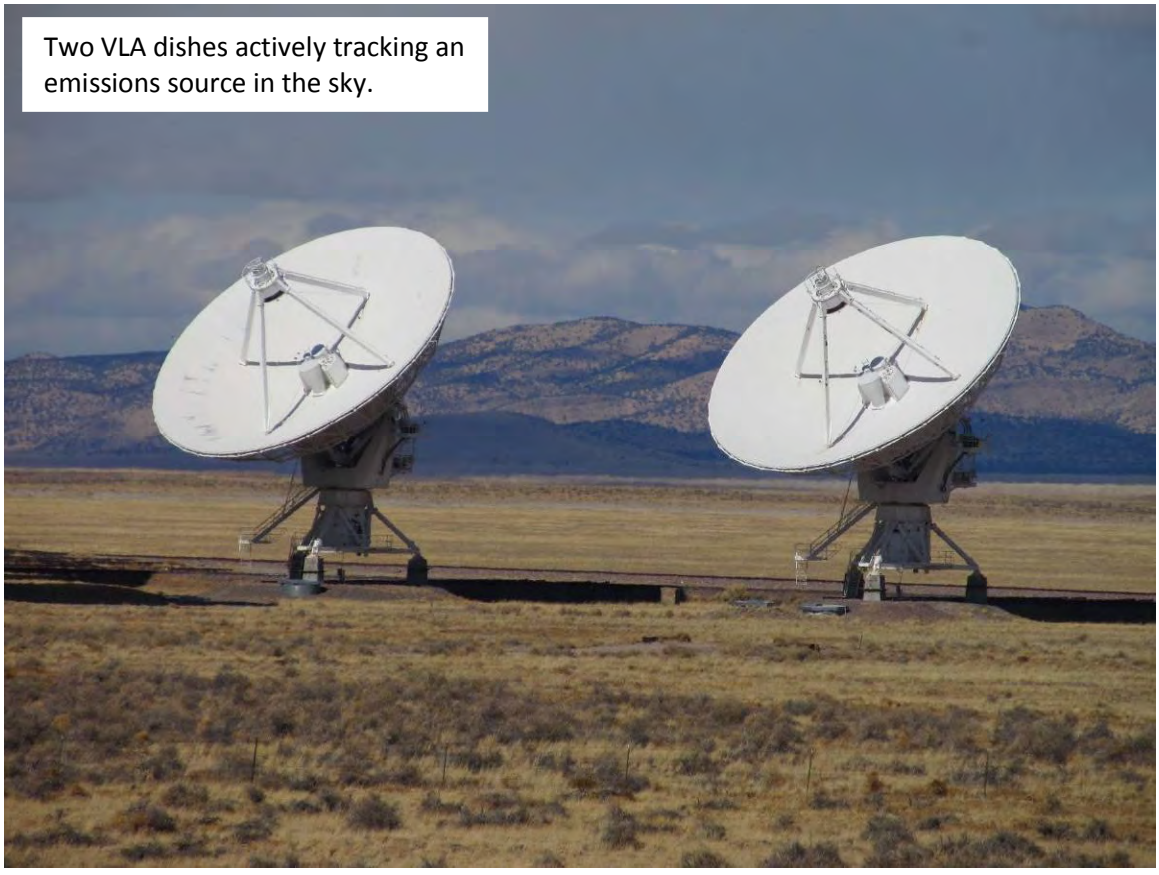
Additional receivers and their feed horns

Inside the pedestal room

One of the tour groups below a VLA parabolic dish antenna

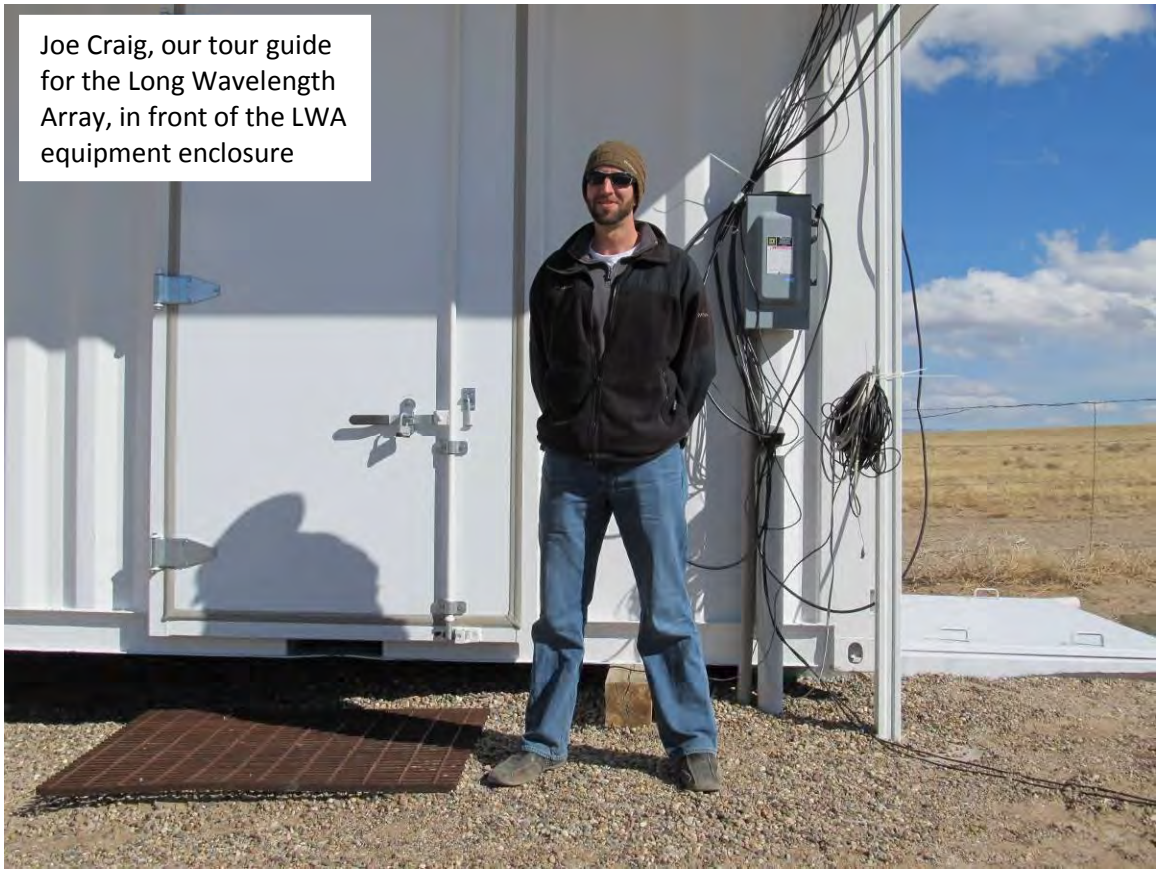


Long view of a VLA dish antenna, this one adjacent to the maintenance hangar or “barn”



Two VLA dishes actively tracking an emissions source in the sky.

Above: Panoramic view of Long Wavelength Array Station 1, an area 110 x 100 m



Joe Craig, our tour guide for the Long Wavelength Array, in front of the LWA equipment enclosure

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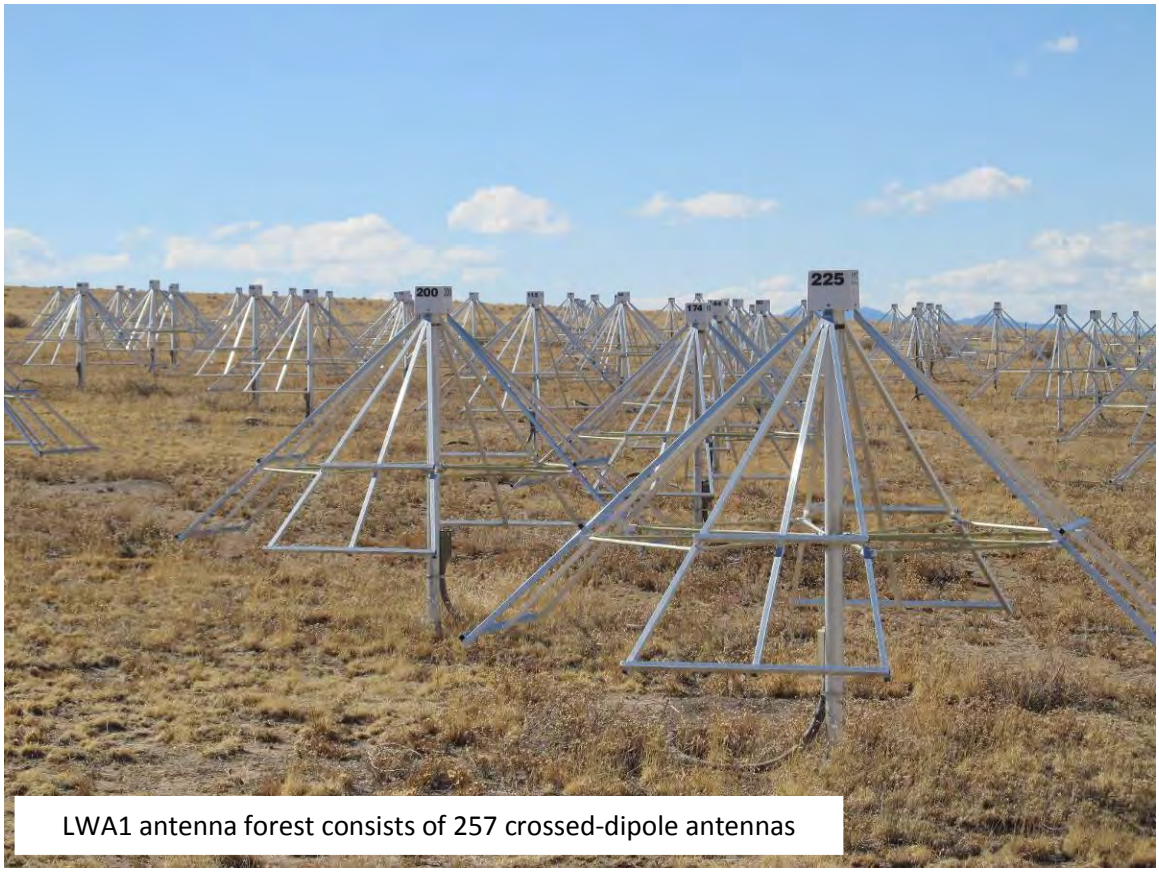
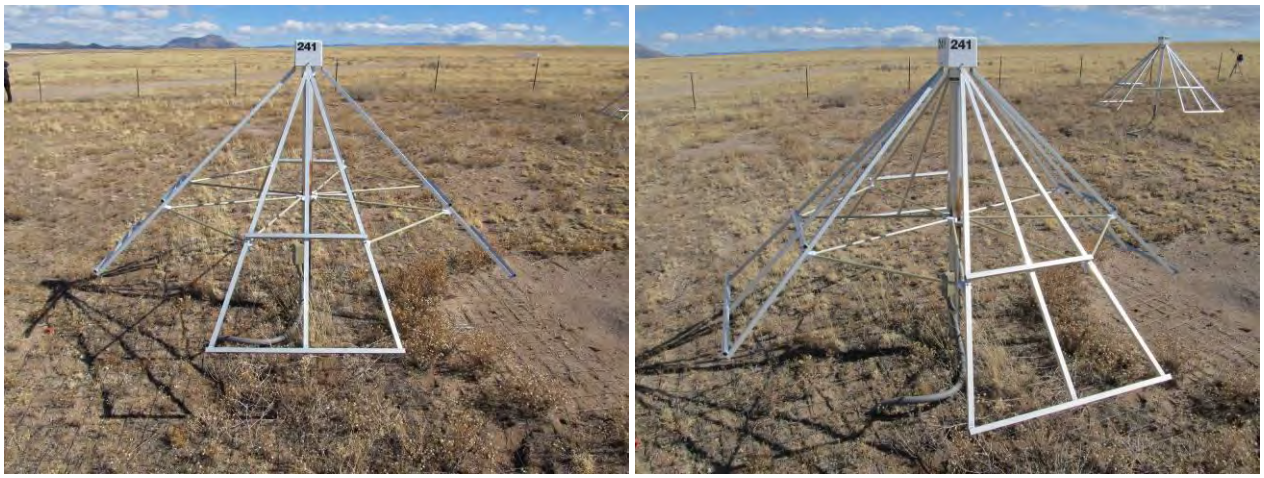
LWA1 equipment enclosure cable entrance panel. Each of the dipoles has a dedicated coaxial cable and they each enter the enclosure through a lightning arrestor shown here



LWA1 antenna forest consists of 257 crossed-dipole antennas

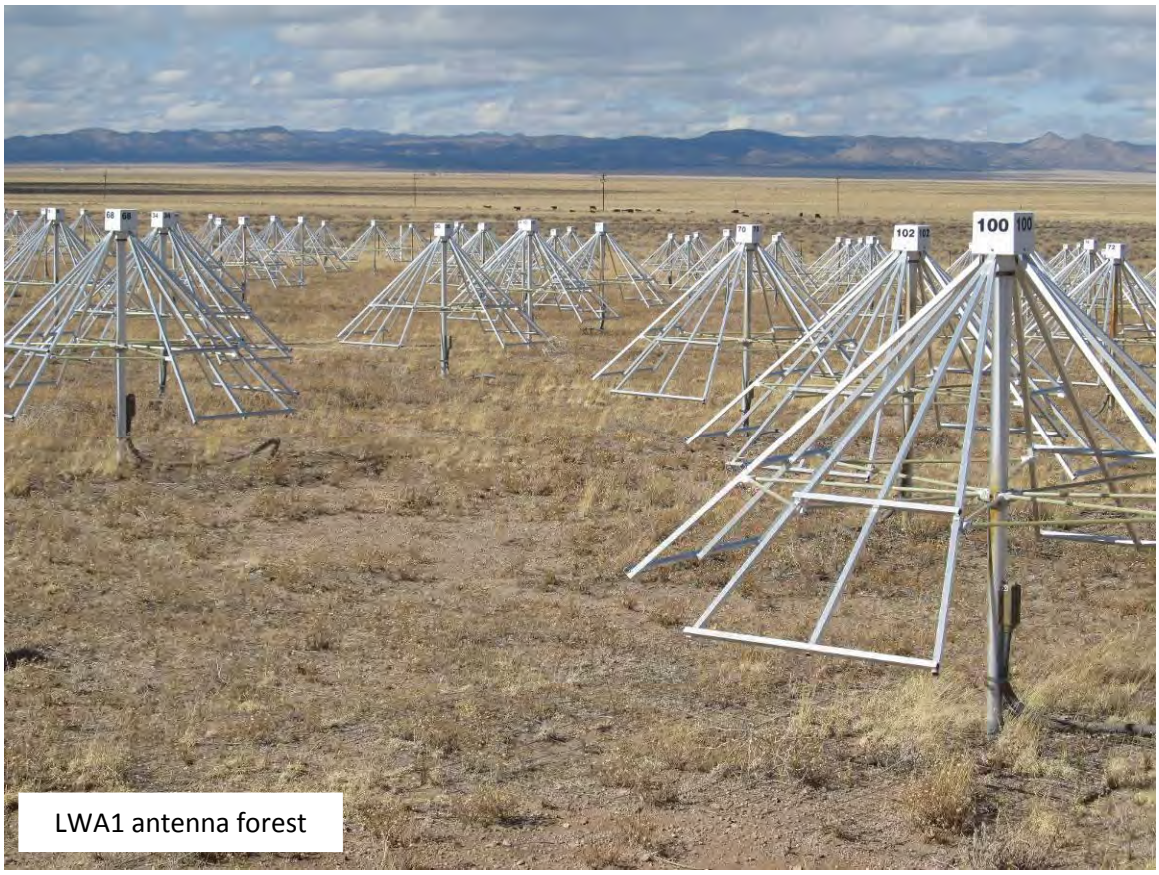


Above: Two views of one dual-dipole antenna assembly. Each antenna assembly has two coaxial cable feedlines and one power cable. The antennas are manufactured by Burns Industries in Nashua, New Hampshire and assembled on-site. The shape of the dipole "blade" elements increases the antenna bandwidth.

Detail view of the mechanical supports for one half of a dipole at LWA1

The enclosure at the top of each antenna houses two active baluns, one for each dipole, consisting of an amplifier for each antenna blade and a 180° hybrid junction to couple the coaxial feed.

"Chicken wire" grounding screen at LWA1 used to stabilize the conductivity and permittivity of the area below each dual-dipole antenna



LWA1 antenna forest

LWA1 equipment shelter and cabinets are custom-built for EMI shielding, providing a total of 100 dB shielding effectiveness