

Antenna Specifications for the Next-Generation Very Large Array

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The National Radio Astronomy Observatory (NRAO) completed two major projects this decade: the sensitivity upgrade for the Karl Jansky Very Large Array (VLA), and construction of the Atacama Large Millimeter/Sub-Millimeter Array (ALMA), in collaboration with international partners.

The VLA has proven to be one of the most productive radio telescopes in the centimeter wavelengths. The NRAO is now investigating the future of centimeter wavelength astronomy in the northern hemisphere, spanning the gap between thermal and non-thermal emission mechanisms, and bridging the capabilities of ALMA and SKA.

The scientific potential and technical feasibility of a next-generation VLA (ngVLA) is presently being assessed. Preliminary goals for the ngVLA are to increase both the system sensitivity and angular resolution of the VLA five to tenfold, and frequency coverage spanning 1 GHz to 120 GHz.

A number of key technical challenges have been identified for the project. These include cost-effective antenna manufacturing (in the hundreds), suitable wide-band feed and receiver designs, broad-band data transmission, and large-N correlators. Minimizing the overall operations cost is also a fundamental design requirement.

The design of the antenna is anticipated to be a major construction and operations cost driver for the facility. The antennas must have acceptable aperture efficiency up to 120 GHz, with five to ten times the total collecting area of the VLA. Improved reliability, and ease of access to the receiver and servo electronics packages, will be required to meet the operations cost requirement.

The focus of the presentation will be the projected performance requirements for the antenna, parameter tradeoffs within the antenna system specification, and areas of technical risk, where technical advances may be required for successful antenna production and installation.