URSI AP-RASC, Sydney, Australia, 17 – 22 August 2025

DSA-2000 Test Array

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1 Extended Abstract

The Deep Synoptic Array 2000, or DSA-2000, is a radio telescope array optimized for survey purposes. The array will consist of 2000 5m diameter dishes, which can instantaneously cover the 0.7 – 2 GHz frequency range and will span an area of 19 km × 15 km on a radio quiet site in a valley in Nevada. With near complete sampling of the uv-plane, it will be possible to use a real-time "radio camera" instead of a traditional digital correlator backend.

The DSA-2000 test array functions as an engineering test bed, providing both design verification and a comprehensive staging facility. It is composed of 9 antennas, 5 of which were designed and fabricated in-house at the Owens Valley Radio Observatory (OVRO) and out of the remaining 4, 2 have their turnheads and backing structure manufactured by MTEX (external contractor) based on the Caltech design. The reflectors will be provided to MTEX from OVRO's fabrication line. The total number of Caltech designed antennas is 7 with MTEX supplying 2 of their own design. The project comprises two distinct phases. Phase I focuses on evaluating prototypes of antenna-based subsystems. In phase II, the test array will evolve to become a staging facility. This will be a dedicated environment, separate from the production array, specifically designed for testing, validating, integrating, and pre-deploying hardware or software components before they are released into the operational array. The purpose of a staging facility is to simulate the production environment as closely as possible to ensure that configurations, integrations, functionalities, and performance characteristics of the components meet the desired standards and requirements without impacting live operations. To accomplish this, we will retrofit most subsystems to production standards, ensuring the staging facility accurately represents the production array environment.

Beyond engineering validation, we have established higher-level objectives to evaluate the integrated antenna system's performance. These objectives include implementing the following radio techniques: (1) the delivery of an interferometer with basic capabilities to support testing, (2) radio tracking sources on the sky with a high level of precision with support from optical pointing to help develop and test the pointing model and (3) the capture of fringes from strong radio sources. This paper presents an overview of the test array configuration, testing methodology, key objectives, and preliminary results.

Figure 1. Three of the nine test array antennas.