

EVLA Construction Project: Overview and Status

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Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array



The EVLA Project

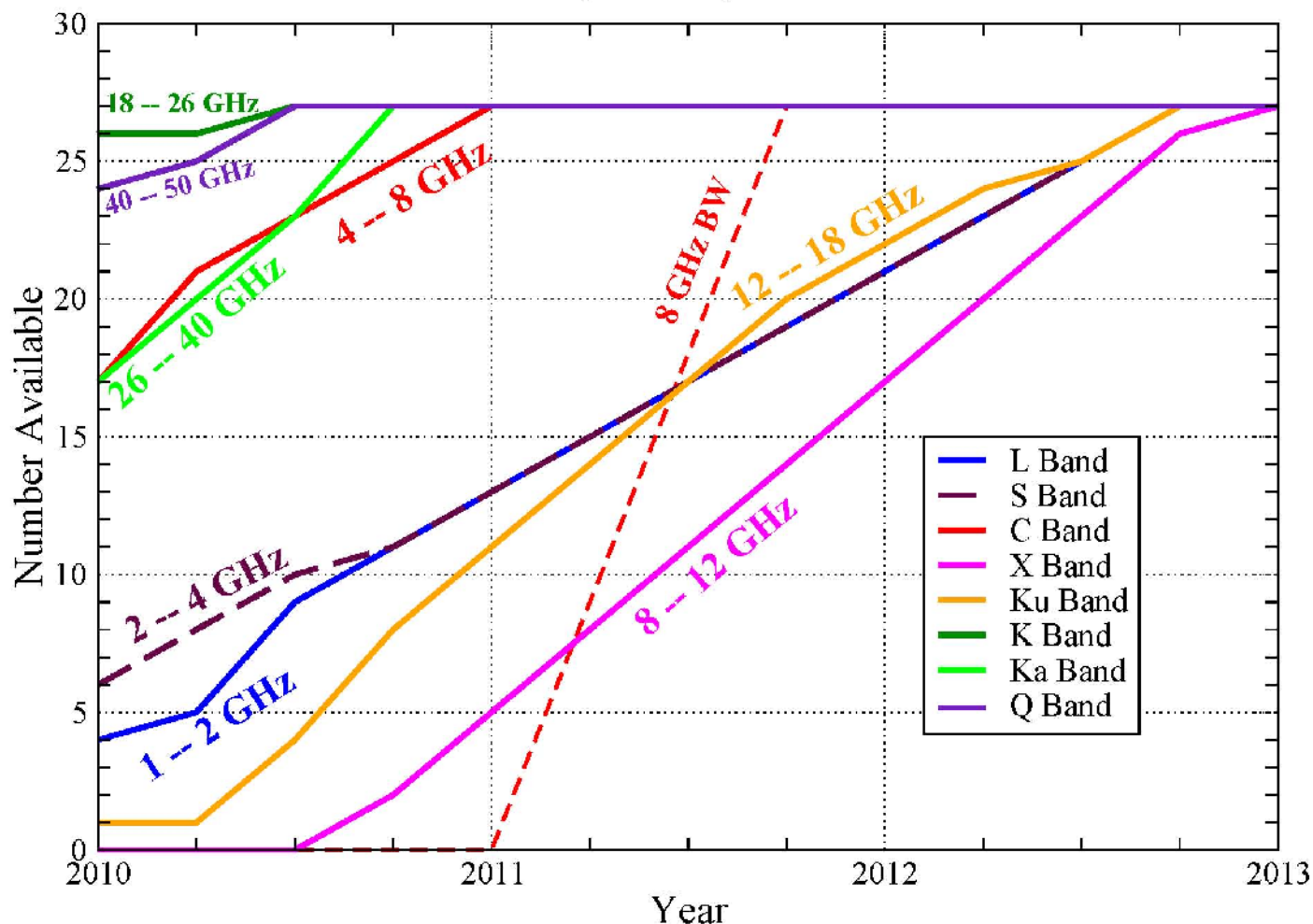
- Project Goal: Improve the VLA by at least a factor of 10 in all performance metrics save those fixed by the number of antennas in the array
- Project Scope Included:
 - New or upgraded receivers: Complete frequency coverage from 1 to 50 GHz
 - High-speed, wide-band fiber optic digital LO/IF and data transmission system
 - Wideband, flexible correlator backed by fast, affordable computational resources capable of producing superb astronomical images
- Project Cost \$93.8M (FY 2006 fiscal base)
 - Nearly 40% of this cost was offset by
 - International partnerships with CONACYT (Mexico) and HIA/DRAO (Canada) – New WIDAR correlator from Canada (~20%)
 - Contributed effort from VLA operating staff, recovered as medium and long-term reductions in maintenance activities that could be sacrificed to replacement/upgrade of subsystems in the upgrade project (~20%)
- 11-year timeline: (FY01-F12) → **The array has been kept operating during the upgrade**
- **Construction remains on budget and schedule for delivery at end of CY2012**



Some Notable Events

- Mark McKinnon left as EVLA PM in March 2010 to assume NA ALMA PM position; Chris Langley is Mark's replacement
- Civil works complete
- Antenna conversions completed May 2010
- LO/IF systems will be completed by end of FY2010
- DTS
 - Complete save for high-speed (3-bit) samplers
 - Redesign necessitated by manufacturer modification of critical chip
 - Prototype units installed, working well
 - Schedule recovery plan under study
 - Receivers on schedule – Risks retired (X-band OMT; refrigerators)
- About 60% of EVLA-compliant receivers have been completed
- See high-level schedule following

EVLA Wideband Receiver Availability



WIDAR: The EVLA Becomes Operational

- Old VLA correlator turned off January 11, 2010
- New WIDAR correlator placed in scientific service March 2, 2010
- The installation of the new WIDAR correlator and the retirement of the old VLA correlator marked a watershed in the EVLA construction project:
 - The VLA ceased to exist, EVLA commissioning and early science began
 - EVLA construction will continue through 2012
- Installation of the new correlator dramatically widened the scope of EVLA commissioning activities and greatly increased its complexity
- Commissioning WIDAR requires both
 - Installing and verifying the correlator hardware
 - Separately developing, verifying and commissioning a significant number of FPGA firmware personalities; many of these push the performance envelope of the correlator hardware in slightly different ways

Construction Project Summary

- Good progress has been made over past 12 months
- Project is going well
- Budget: Financial health of the project is good
- Technical issues largely resolved
- Project is on schedule:
 - 3-bit sampler installation complete Q3 CY2011
 - Receiver installation complete in Q4 CY2012

but

- Construction is not over



Where Next? Operational Constraints on Commissioning

- Prolonged effort will be required to make WIDAR fully operational
- Necessary to maintain and enhance support for peer-reviewed early science while commissioning increasingly powerful and sophisticated WIDAR modes. Therefore:
 - It is necessary to provide a telescope during commissioning that is no less powerful than the old VLA
 - Peer-reviewed general science operations will have to run alongside the extensive hardware and software testing that will, at times, require prolonged access to the telescopes → Balancing these competing demands will require flexibility
 - It is necessary to deliver the broadest set of new capabilities to the user community in the shortest possible time → However, we could not easily augment staff



Commissioning and Early Science (I)

- Deliver Science Opportunity As Quickly as Possible: In order to address the need for additional personnel, three concurrent, peer-reviewed observing programs were created and announced to NRAO user community in February 2009 currently underway.
 - Programs will run for a minimum of two years:
 - *Open Shared Risk Observing (OSRO)*: The staged program described on the previous slide; designed to simplify the transition to increasingly complex EVLA modes for the general user community
 - *Resident Shared Risk Observing (RSRO)*: Early science access to full WIDAR capabilities available at any given time were offered exchange for commissioning assistance from expert users who agree reside in Socorro for a minimum of 3 months
 - *EVLA Commissioning Staff Observing (ECSO)*: The same enhanced system capabilities offered in the RSRO program are also made available to EVLA commissioning staff
 - The response of the community has been gratifying: To date, more than 40 RSRO proposals have been received since October 2009; about 40% of these have been granted telescope time, and more than 7 RSRO observers have been in residence in Socorro since the program began

Commissioning and Early Science (II)

- General Approach: Following advice of advisory committees, we will provide system bandwidth growth for the general user community that maintains stable end-to-end data delivery
 - WIDAR capabilities will be commissioned by systematically expanding the maximum observing bandwidth offered to the general user community in three basic steps: 256 MHz, 2 GHz, and 8 GHz (EVLA design specification)
 - Each bandwidth stage will last one full array configuration cycle (~16 months): By running from most compact to most widely spread out configuration, we will have a gradual growth of data set size
 - Within each 16-month long configuration cycle, a subset of flexible and powerful WIDAR continuum and spectral line configurations having user-selectable bandwidths and resolutions will be offered: → Correlator can be simply configured to support the vast majority of user proposed program



Concerns

- We are managing competing and interacting imperatives – operations, construction, developing & commissioning new capabilities – in a short, 2.5 year time frame; parallel effort is far less possible than before January 11
- Challenges:
 - The pre-existing, “perfected” VLA defines a minimal gold standard for EVLA → User community expectations are (justifiably) high
 - NSF attention and expectation levels are high compared to the past
 - Our staff is small relative to the task at hand, and working very, very hard; single-point failure is a concern
 - The new instrument is far more complex and thus requires a much more structured and disciplined approach to commissioning
- What can we do better? What have we missed?