

---

# The Expanded Very Large Array

## Phase II Baseline Plan and Constraints

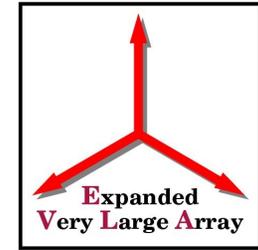
---

Rick Perley

EVLA Phase II Definition Meeting  
Aug 23 – 25, 2001.



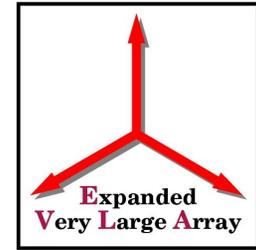
# Why Phase 2?



- 
- Why is the VLA Expansion Project split into two phases?
  - Historically:
    - Preparation for the 1990 Decadal Panel indicated a budget for the whole ‘Upgrade’ would be  $> \$70\text{M}$ .
    - Administration declared this too large, and broke the project into two ~equal pieces.



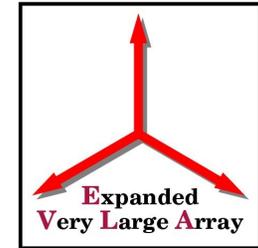
# Why Phase 2?



- 
- Regrettably, neither half was funded in the 1990s.
  - When we began to prepare for the 2000 Decadal Panel process, it was decided to retain the distinction.
  - This two-phase approach makes sense.



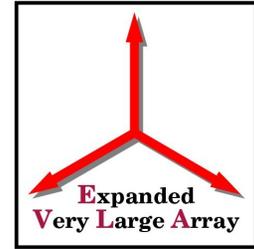
# Why Phase 2?



- 
- Phase I: An upgrade of an existing facility, using modern technologies.
    - Includes items for which there is broad community support.
  - Phase II: An expansion to new configurations, with new stations/antennas.
    - Includes items which need more study, more discussion, more thought.



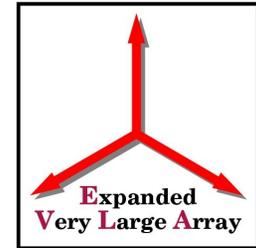
# Why Phase 2?



- 
- However, the realities of budgets and timescales have blurred this distinction.
  - Migration of items from Phase I to Phase II has occurred, and may continue.
  - Reverse migration is still possible ...



# Phase II Baseline Plan



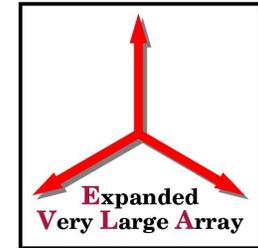
---

There are currently four components in the baseline plan:

1. Improving resolution by a factor  $\sim 10$
2. Providing continuous frequency coverage between  $\sim 300$  MHz and 1000 MHz
3. Improving large-scale imaging capability
4. Incorporating the VLBA



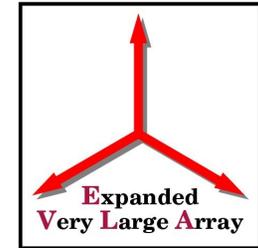
# Improving Resolution



- Goals:
  - Improve resolution by a factor  $\sim 10$ .
  - Attain image fidelity as good as that from the existing VLA.
- Achieve this by:
  - Addition of new stations with distances up to  $\sim 250$  Km.



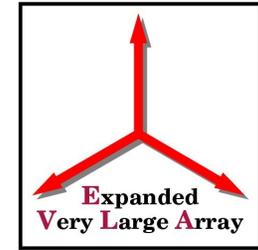
# Improving Resolution



- Sensitivity-Resolution Synergy
  - Phase I will improve VLA sensitivity by large factors – 2 to 20 (continuum modes), depending on band.
  - The full science potential of this increase in sensitivity cannot be attained without a similar increase in resolution.



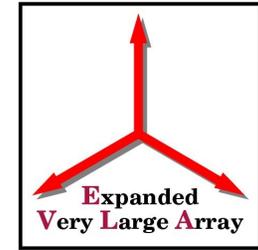
# Low-Frequency Coverage



- The goal is to implement a system to permit full frequency coverage from ~300 MHz to 1 GHz.
- This item is a transfer from Phase I. Why?
  - Budget Overrun!
  - Implementation of an efficient, wide-band low-frequency facility on the VLA antennas is difficult.
  - Details will be given in my later talk.



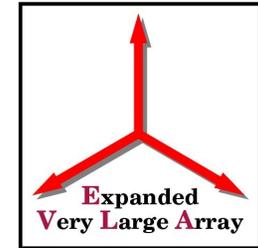
# The 'E'-Configuration



- The goal is to improve the VLA's imaging performance for large-scale, low-brightness emission.
- Achieve this by construction of a new configuration with maximum baselines of ~250 meters.
- Various arrangements to 'dense pack' the antennas have been proposed.



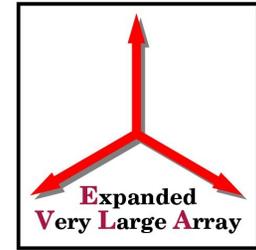
# The 'E'-Configuration



- This item is a 'transfer' from Phase I. Why?
  - Cost (~\$5M)
  - Concerns that 'E' configuration will not add sufficient new capabilities over 'D'.
  - Concerns that other facilities can provide the imaging performance on these scales.
- Frazer will be advancing the case of this component in a later talk.



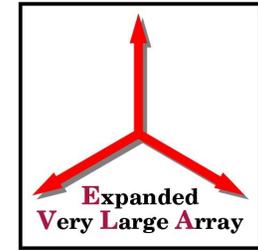
# Inclusion of the VLBA



- A long-range goal of the NRAO is to ‘real-time’ the VLBA.
- Rapid advances in wide-band fiber optic transmission suggest that real-time operation of the VLBA is within the near future.
- The VLBA needs short spacings to achieve better imaging performance.
  - The ‘New Mexico Array’ antennas can provide these spacings.



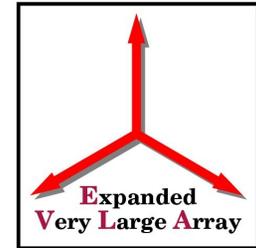
# Inclusion of the VLBA



- These arguments suggest inclusion of a real-time VLBA within the EVLA Project.
  - Note that inclusion of PT and LA has always been in the plan for the New Mexico Array.
  - Full inclusion would be an extension to the plan presented to the Decadal Panel.
  - It is critical at this stage to ensure that our planning does not exclude eventual incorporation of ALL VLBA antennas into a real-time system.



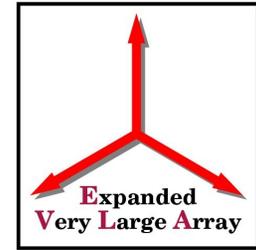
# Practical Matters



- 
- We must decide the relative importance of these components.
  - We must balance the competing demands of performance, cost, and timescale.
    - This is particularly true of the ‘New Mexico Array’ (which in the opinion of the Project Scientist is the defining component of Phase II)



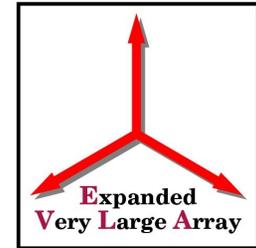
# Phase II Cost



- Is there a cost ceiling to Phase II?
- Probably not ...
  - The suggested budget by the Decadal Panel was \$140M – for ALL the EVLA.
  - The current budget for Phase I is ~\$70M.
- A well-justified increase for Phase II should be presentable!



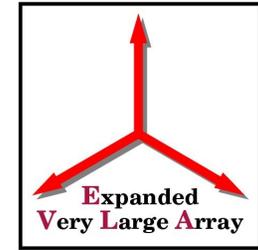
# Phase II Cost



- 
- What are the rough cost estimates for these four components:
    - New Mexico Array: \$5.9M/antenna + fiber.
    - E-Configuration: \$3 – 5M.
    - Sub-L-band: \$7M (?)
    - VLBA inclusion: ???



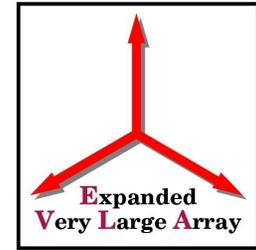
# Phase II Timescale



- How soon should Phase II begin?
- Right away (The ASAP Plan), or
- After some development and thought?
  - Advantages of ‘ASAP’:
    - Existing (‘safe’) technology sufficient
    - Science goals are great
    - Can finish by 2010, along with Phase I.
    - Better synchronism with LOFAR and SKA projects.



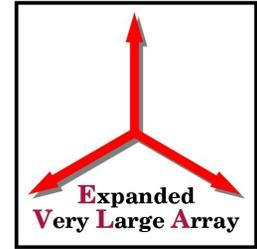
# Phase II Timescale



- 
- Advantages of a more cautious approach:
    - NSF funding probabilities ...
    - Development of new technologies may offer better solutions at lower cost.



# Meeting Goals



- 
- The primary purpose of this meeting is to clarify these competing issues, and give us a sense of:
    - What should Phase II include
    - How fast should we should implement it.