

EVLA

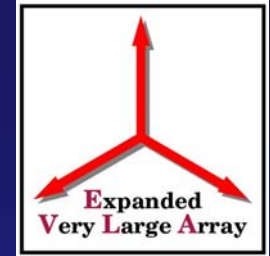
Advisory Committee Meeting

System Status

Jim Jackson, Hardware Systems Engineer



System Status Overview

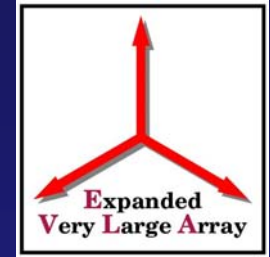


- June 2006 Advisory Committee report
- Antenna status
 - Outfitting
 - Retrofit items
- Front end status
- Phase stability
- Electronics
- Digitizers
- Other system highlights



System Status

Responses to 6/06 Adv Comm.

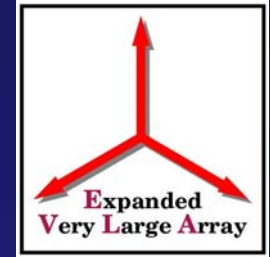


- *L/C Band OMT schedule and testing*
 - L-band OMT first article production components in testing
 - C-Band OMT prototypes built and in testing
- *Round Trip Phase system schedule and performance*
 - On antenna tests late 06 / early 07
 - Expect RTP measurement to meet project requirement
 - Issues with reliability and repeatability
 - New PCB's and firmware to address hardware instability issues
 - New design being tested in lab and system
 - Ready for production by January 2008
- *Digitizer schedule*
 - Contract awarded 8/31



System Status

Antennas

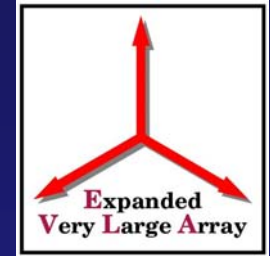


- Antenna outfitting
 - 11 Antennas turned over to operations
 - 12th Antenna turnover expected by end FY07
 - Now accomplishing one antenna every two months
 - L,C,X,K and Q bands available with 4 IF's
 - 4/P bands available on most antennas
 - Tests and evaluation on-going
 - Voice over IP (VOIP) phones working and in use



System Status

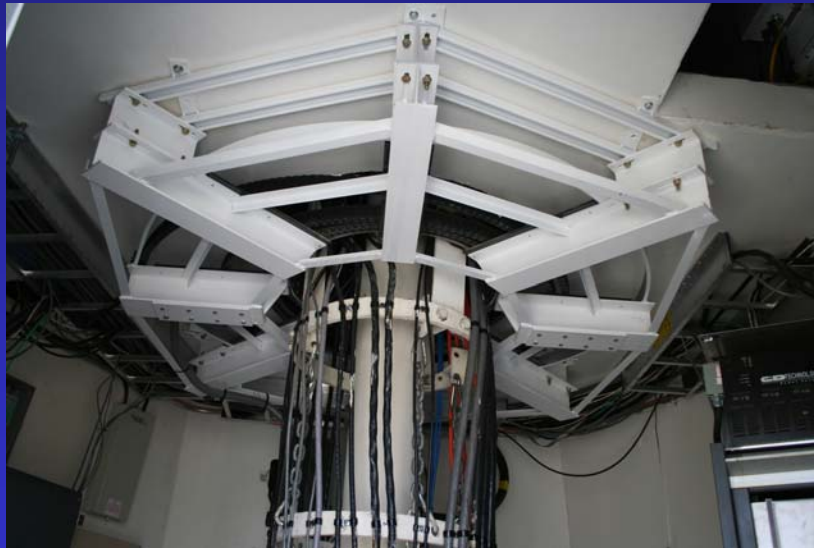
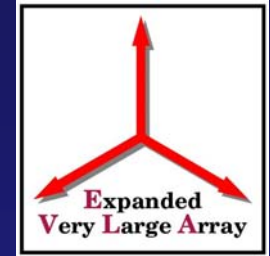
Antenna Vertex Room





System Status

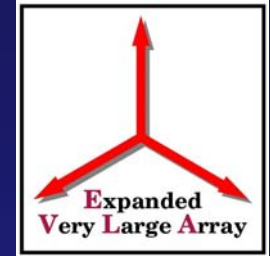
Antenna Pedestal Room





System Status

Antennas



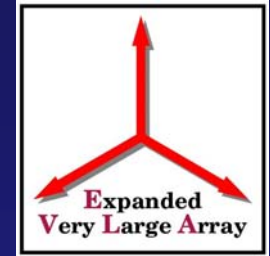
Retrofit Items on early EVLA antennas

- Antennas 14 and 16 have prototype LO hardware
 - Software compatible so doesn't affect observing
 - Retrofit in CY 2008
 - Simplest approach is to swap out racks (1 week downtime/antenna)
- T304 Automatic Level Control (ALC)
 - Currently only on IF AC in all antennas
 - Will add IF BD in CY08 by simple swap of modules
 - No downtime required – done on maintenance days
 - Lack of capability having minor effect on observation
- T304 Gain Slope Equalizers
 - Will add by swap of modules (at same time as ALC where possible)
 - No downtime required – done on maintenance days
 - Lack of capability having no effect on observation – for WIDAR and 3-bit mode



System Status

Antennas



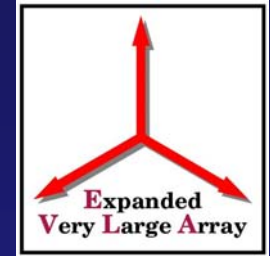
Retrofit items on early EVLA antennas

- 3-Bit Digitizers
 - PCB's added to D301-304 modules in each antenna
 - Will also add additional M&C and diagnostic functions
 - May implement subtle change in transmission protocol
 - Install beginning summer 2008
 - No downtime required - simple swap of D30X modules on maintenance days
- M302/M303 Utility Modules & J-Boxes
 - Retrofitted to 10 antennas over duration of project (2 weeks downtime req.)
 - Used for antenna monitoring and maintenance over network
 - Adds capability to monitor cryogenic compressors & HVAC
 - Eliminates dependence on old copper twisted pair line
 - Lack of capability doesn't affect observing
- Add 3rd and 4th L302 Synthesizers
 - Only required for WIDAR correlator
 - No downtime required - done on maintenance days



System Status

Front-Ends



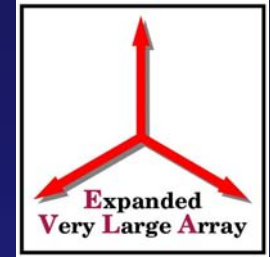
Front Ends

- 4 Band
 - Complete – Using existing VLA receiver
- P-Band
 - Complete – Using existing VLA receiver
- L-Band
 - Horn complete and in production
 - Prototype OMT and receiver in use on antenna 14
 - First article production OMT in lab testing
- S-Band
 - Feed horn built and tested – production contract awarded soon
 - Prototype receiver being developed
 - Wideband OMT being developed - will use scaled down version of L-band
- C-Band
 - Horn complete and in production
 - Interim receiver in production (final receiver minus wideband OMT)
 - Prototype OMT in testing



System Status

Front-Ends



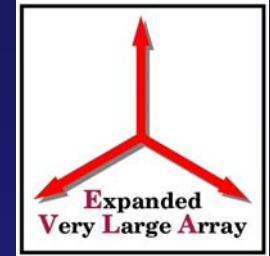
Front Ends

- X Band
 - Currently using existing VLA receiver
 - New X-Band receiver will be last to be developed
 - New X-Band feed designed, tested and in use on antenna 24
- Ku-Band
 - New feed horn to be developed
 - New receiver to be developed – will be based on K-Band design
- K-Band
 - Using existing VLA feed and receiver
 - Added block converter and modified LO/IF chain
 - In production
- Ka-Band
 - Horn in production
 - Receiver development underway
 - Prototype in lab testing
- Q-Band
 - Using existing VLA feed and receiver
 - New MIMIC post amp and block converter



System Status

Phase Stability

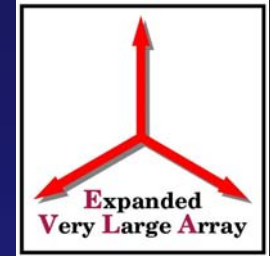


- Phase Stability
 - Two primary effects have been noticed
 - Phase changes with ambient temperature & season
 - Phase changes with antenna elevation angle
 - Both first noticed in scientific observation
 - Both verified and localized with specially designed lab and/or on-antenna tests
 - Both seem to be thermally induced
 - Neither seems related to fiber optic system
 - Expect to be able to meet project requirement



System Status

Phase Stability

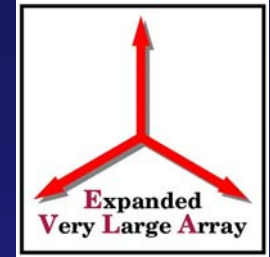


- Change with ambient temperature
 - Primarily due to HVAC control and vertex room air circulation
 - Being corrected by fine tuning HVAC system control algorithms and adding air circulation fans in vertex room
 - May also need to temperature stabilize receiver enclosures and heliax cables
 - Can be accomplished by adding ducting from HVAC blower
 - Worst case - may need to add second blower on upper level
 - Expensive and difficult to retrofit
 - Not considered high probability
 - Slow but constant progress – effects vary seasonally



System Status

Phase Stability

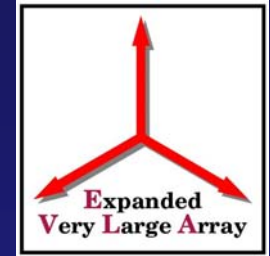


- Change with antenna elevation angle
 - Primarily due to internal thermal performance of some modules
 - Iterative testing and modification of modules in antenna and lab
 - Pinpointed problem to a few specific modules
 - Slow process – effect is small and difficult to measure
 - Current solutions involve mechanical changes to modules
 - L300 Comb Generator and T304 Downconverter
 - Add thermal mass to critical components
 - L301 / L302 Synthesizers
 - Replace certain thermally sensitive cables inside of modules
 - May need to examine T302 LSC Converter
 - Worst case - may also require adding two PLO's to L300
 - Expensive
 - ALMA had to do this but has more difficult spec.
 - Not considered high probability



System Status

Electronics



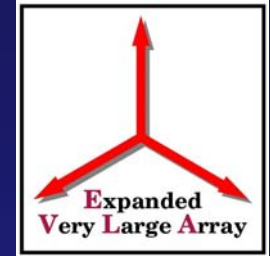
Modules/Sub assemblies in final design

- P350/P351 DC/DC power supply
 - PCB Mod to support N+1 redundancy
 - Includes power distribution board
 - Ready for production by January 2008
 - L352 LO Round Trip Phase Meter
 - Issues with reliability and repeatability
 - Affects use of higher frequency bands
 - New PCB's developed – integrated motherboard
 - New design being tested in lab and system
 - Ready for production by January 2008
 - 3-bit digitizer PCB(s) for D30x
 - Chip contract awarded
 - Production should begin summer 2008
- In final testing
- In final testing

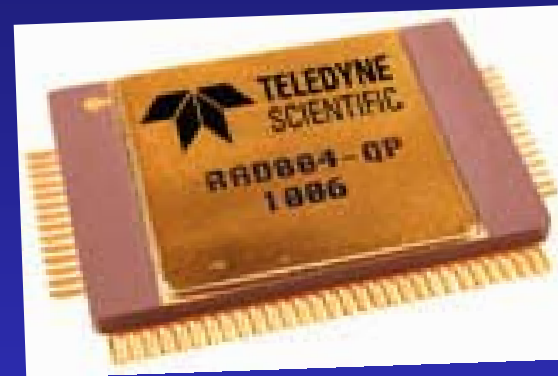


System Status

3 Bit Digitizer



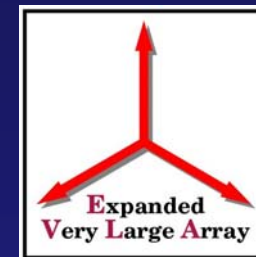
- Competitive bid
 - Sampler chip/set
- Selected on
 - Price (inc. cost of implementation)
 - Specification compliance
 - Availability
 - Support
- Three qualified vendors bid
 - ST Microelectronics (ALMA device)
 - Teledyne Scientific (formerly Rockwell)
 - E2E (formerly Atmel)
- Contract awarded to Teledyne 8/31/2007
 - 6 engineering samples in 7 months
 - 280 production parts in 7-18 months





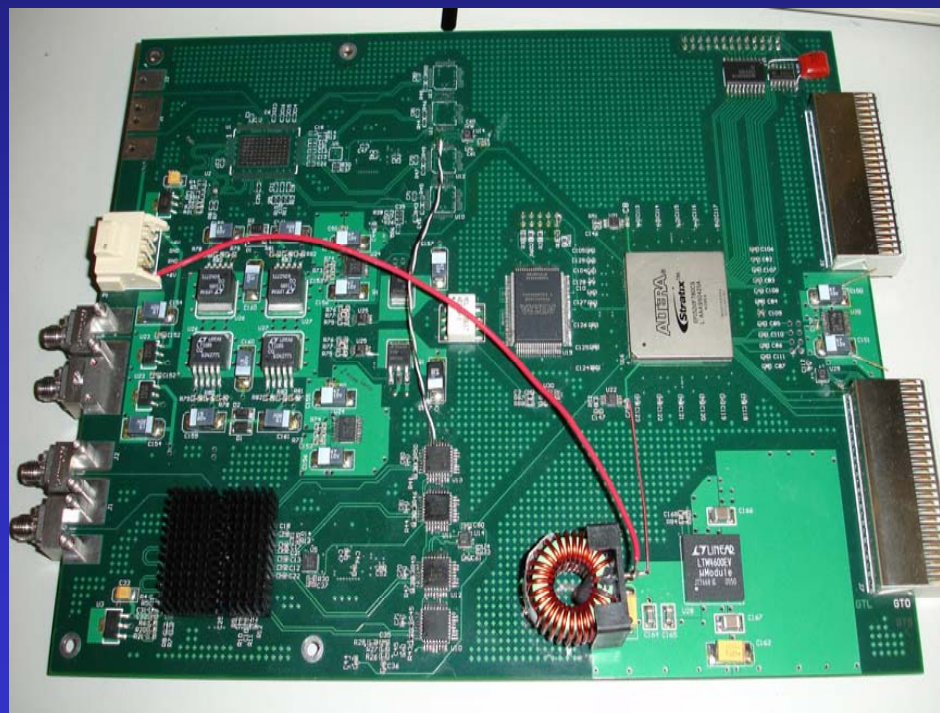
System Status

3 Bit Digitizer



Teledyne Digitizers on NRAO/EVLA PCB

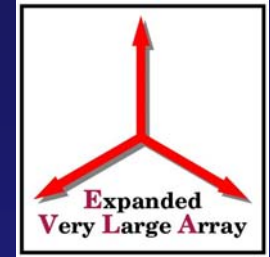
- Tested in DTS Module by EVLA project
- Used to evaluate EVLA 2-4 GHz signal path and gain slope equalizer





System Status

Other System Highlights



- New shielded room for WIDAR correlator installed & RFI tested
 - 48VDC power system installed and tested
 - HVAC, alarm and fire suppression installed and tested
 - Fiber, network and computing infrastructure being installed now
 - Will be ready well in advance of WIDAR correlator delivery
- Cryogenic compressors & Scott-T boxes in production
- Antenna HVAC systems purchased
- Feed cone assembly in production
- Azimuth fiber cable wrap in production
- All fiber optic cable in the ground and terminated
- Fiber optic termination room complete
- Control building fiber M&C networking in place



Questions?

