EVLA Advisory Panel Mtg.
System Overview & Status

Jim Jackson, Hardware Systems Engineer
Antenna 13

- Feed cone installed
  - Metal covered plastic core honeycomb material
  - RFI tight at seams
  - RFI gasket at base
  - Open base for access to front ends
Antenna 13

- X-Band front end installed
  - Cooled down and ready for system testing
  - Will allow testing of:
    - T304 Main downconverter
    - L301/302 Synthesizers
    - Total power digitizers
    - 8-Bit digitizers
    - Data transmission system
    - Transition hardware
    - DC power system
Antenna 13

- Racks installed
  - LO/IF & ACU Racks
    - Commercial RFI racks
    - DoD “Tempest” rated (approx 55dB @ 5GHz)
    - All I/O signals filtered or on fiber
  - Suitability for production to be evaluated
Antenna 13

• Racks installed
  – Front end rack
    • Reuse existing VLA B/F-rack frames
    • Adding metal covered plastic core honeycomb covers
Antenna 13

• Racks installed
  – G & H–Racks
    • G-Rack houses DTS/Sampler modules
    • H-Rack houses Ethernet switch
    • NRAO designed RFI tight enclosure (approx 80dB up to 10Ghz)
Antenna 13

- Fiber optics installed
  - Two hybrid cables installed between pedestal & vertex room
  - Each contains 12 single mode and 32 multi mode fiber
  - Watch spring design for azimuth cable wrap
  - Round Trip Phase testing has begun to evaluate performance of fiber on the antenna and in the ground
Antenna 13

- New HVAC system
  - Designed to minimize RFI leakage of vertex room
  - Closed air system – air handler located completely inside vertex room
  - Uses chilled water from outdoor condenser unit
  - Can utilize cold outdoor conditions for energy savings
Antenna 13

- 48 VDC power system
  - Commercial bulk power products
  - Designed for telecom
  - 52.5 Amp cont. capacity
  - N+1 redundant design for reliability
  - Battery backup for 1 hour
  - Installed in “Tempest” rated RFI shielded rack in antenna pedestal room
  - Reuses existing Square-D “QO” breakers and panels
VLA Site

- **Fiber termination room**
  - All fiber from array enters the building and terminates in patch panels at this point
  - Satisfies electric code requirements for outdoor fiber terminating in the building
  - Distributed to control building patch panels from this point
VLA Site

- Correlator room fiber optic cable penetrations
  - RFI tight
  - Fiber penetration into existing correlator room
  - Ethernet fibers in penetration to electronics room
  - IF fibers in separate penetration under floor
VLA Site

- Fiber optic patch panels
  - LO, IF and M&C patch panels
  - Array re-configuration is accomplished at these panels
VLA Site

- Buried fiber optic cable
  - Burial on east and west arms complete ahead of schedule
  - Burial on north arm begins in October 03
  - Field splicing begins after burial completion
VLA Site

• Networking equipment
  – New networking equipment installed in control building and AOC for EVLA
Hardware

• Front ends
  – K & Q-Band
    • Modified VLA units
      – New block downconverter
      – Q-Band – Caltech post amp
      – K-Band – new feed mount
  – Ka-Band
    • In design
    • Caltech block downconverter due in December 03
    • Scheduled for installation early summer 04
Hardware

• Front ends
  – L-Band
    • Christmas tree complete at VLA site
    • Feed components in production at VLA machine shop (90% complete)
    • Transition front end prototype to be installed Nov 03
    • Final EVLA front end to be installed May 04
  – C-Band
    • Detailed designs in drafting
    • Christmas tree complete at VLA site
Hardware

- Front ends
  - Card cage
    - PCB’s in layout
    - Mechanical packaging in design
  - Integrated harness and LNA protection board assembled and in testing
Hardware

• Digitizers
  – 8-bit, 2 Gsps digitizer
    • Dual Maxim MAX104, each running at 1Gsps
    • first prototype assembled & currently in testing
    • Installed in DTS module
Hardware

- **Digitizers**
  - 3-bit, 4 Gsps digitizer
    - ALMA device under development in France
      - design review 16-17 October in Bordeaux, France
    - Potential alt source of high speed A/D’s (Atmel)
      - 8 bit, 2 Gsps, 3GHz BW A/D samples available
      - 8 bit, 4 Gsps, 4GHz BW A/D in development
        - This device could replace both EVLA digitizers
Hardware

• DTS/Sampler Module
  – Prototype module assembled and in testing
  – NRAO designed RFI tight module (60-80dB shielding)
  – All digital electronics contained inside module
  – Analog IF & clocks on coax
  – Digital optical output on fiber
  – Timing & Ethernet on fiber
  – Design common with ALMA
  – Live demo in lab today
Hardware

- **DTS Deformatter**
  - Module mounts to WIDAR station card
  - Contains:
    - Fiber optic receivers
    - Demux / Deformatters
    - Transition FIR Filter
  - PCB assembled, FPGA code being finalized & tested
  - Housed in temporary racks in present correlator room during transition
Hardware

- P301/302 DC/DC Converter
  - Prototypes assembled and running in lab
  - Using Vicor DC-DC converters - low noise, zero switching design
  - Extensive output filtering
  - Flexible design allows for various configurations
  - Design common with ALMA
**Hardware**

- **Converters**
  - **T301 – 4/P converter**
    - modules in assembly
    - bench prototypes complete & tested
  - **T302 – LSC converter**
    - modules in assembly
    - bench prototypes complete & tested
• **Converters**
  – T303 – UX converter
    • bench prototype complete & tested
    • connectorized chassis version in final assembly & testing
    • contract award for integrated version in process (vendor selected)
Hardware

• Converters
  – T304 – Downconverter
    • Bench prototype complete & tested
    • Connectorized chassis version for test antenna in final assembly & testing
    • Design in progress for integrated version
Hardware

- Synthesizers
  - L301 12-20 GHz prototype complete and functioning in lab (demo today)
  - L302 10.8-14.8 GHz electronics assembled, tested and awaiting MIB software
  - Both ready for thermal and RFI testing
  - Potential for future integrated assemblies
Hardware

• Reference generators
  – L305 / L350
    • Printed circuit boards complete
    • bench prototypes in testing and debugging
    • modules under development
Hardware

- LO transmission & round trip phase
  - L351/L352/L353/L304
    - proof of concept and data gathering tests being performed in lab and at VLA site
    - bench integration prototypes in testing and debugging
    - modules under development
Hardware

• Types I -VI Modules
  – Prototype designs complete
  – Most components fabricated and assembled
  – Initial RFI and thermal testing has begun
  – Designs also now being adopted by ALMA BE IPT
Hardware

- Bench integration
  - Most modules assembled in plate form for testing in lab
Hardware

- Antenna MCB H-Rack
  - installed in Antenna 13
  - contains Cisco Ethernet switch
  - Triplite 1 KVA UPS
  - M&C fiber termination panel
Hardware

• MIB
  – NRAO design
  – Low RFI design
  – FO Ethernet Interface
  – Uses Infineon TC-11IB microprocessor
  – Plan to use contract assembly house – Quoted price $700 ea
System Change
(since last meeting)

• New timing synchronization scheme:
  • free running in normal operation
  • 19.2Hz and 1Hz synchronized to array central time by a pulse encoded in 512MHz optical reference
    – pulse is sent by deleting 8 clocks from 512Mhz reference
    – pulse is detected at antenna LO receiver, resets counters in FPGA
    – does not interfere with main reference signals in antenna
  • sync pulse sent only on command from M&C system
  • synchronization loss detected using DTS data stream or timing data sent back from antenna
  • network time broadcast sets time at next 1 Hz tick
Questions?