EVLA Production and Maintenance

Steven Durand presenting for the Electronics Division
Electronics Division
Manufacturing Goals

• Out-source board assemblies
• Build modules in-house as needed
• Facility is ready for production
• Electro-Static Discharge (ESD) protected facility
Outsource Circuit Cards
Board Vendor Provides:

- Fully assembled boards/cables
- Some assemblies tested
  - *Flying probe tests*
  - *NRAO test fixtures*
- Just-in-time deliveries
- VLBA Site Techs building some cables and small module assemblies
In House Module Assembly

• Goal is to produce 28 identical antennas
• Small quantity builds, 5-10 at a time
• In-house module assembly and test
• Same team that built the prototypes
• Good job scheduling production
Electro-Static Discharge Prevention Program

- 12 ESD stations including floor mats
- ESD totes & parts bins
- ESD shoes & wrist straps
- Humidity controlled facility
- Staff training
In-House Assembly Support

- Complete in-house board assembly
- Reflow oven
- X-Ray machine
- Environmental chamber
- Secure storage
Quality Tools

- Shaker table
- Environmental chamber
- EVLA test rack
- Real-time monitoring
- Red/Green tag procedures
Quality Assurance Program

- Formalized written QA procedures
- Bench test fixtures
  - LabView test programs
- MainSaver maintenance software
- Collecting reliability data
Production Time Table

• Maintain the 6 antennas per year rate.
• Track funding profile
• Time to complete production
  – 24 months to build LO and DTS modules
  – 36 months to outfit the remaining 16 antennas
  – 56 months to design & install the receiver suite
Electronic Modules Currently in Production

- D301-4 DTS Module – excluding 3-bit digitizer
- D305 Optical Wavelength Division Multiplexer
- D351 DTS De-formatter
- F317 Front End Controller
- F320 Front End Transition Module
- L354 LO Driver
- L355 Digital Timing Distributor
- L300 Synthesizer Reference Generator *
- L301 12-20 GHz Synthesizer *
- L302 10.8-14.8 GHz Synthesizer *
- L304 LO Reference Receiver
- L305 / L350 Reference Generators
- L351 Offset Generator
- L353 LO Transmitter

*Minor mechanical retrofits anticipated
Electronic Modules Currently in Production (cont.)

- M301 Converter Interface
- M302/M303 utility modules
- M304 Module ID
- P301 LO/IF Rack DC/DC Power Supply
- P302 Utility Rack DC/DC Power Supply
- T301 4/P Converter
- T302 LSC Converter
- T303 UX Converter
- T304 Baseband Converter *
- T305 Baseband Converter - Digital
- ACU/FRM Interface
- Power Distribution Board for Antenna Racks
- Main Shielded Equipment Racks
- -48 VDC Power System
- Front End Card Cage

* Minor mechanical retrofits anticipated
Electronic Modules
Not in Production

- P350/P351 Power supplies
- L352 Round Trip Phase measurement
- D301-4 DTS Module, 3-bit digitizer
Continuity of Operations Plan

- Hardware Redundancy
- Maintenance Plan
- Real Time Alarms
- Remote Monitor & Control
Hardware Redundancy

- Central rack power supplies
  - *P350 modules are installed in pairs*
  - *5 pairs power the central racks*
- Antenna -48Vdc power supplies
  - *5+1 redundant*
- Antennas are repaired by swapping modules
  - *Spares are stored at the VLA*
Slot ID is Functional

• Modules of each type are identical
  – *Slot ID defines function*
  – *Hot swappable, rack stays powered*

• Modules are identified using slot ID
  – *Ea14-L302-1*

• Serial number and software version are also available from each installed module
Cold Start Requirement

- Power cycle causes automatic restart
- Personalities load from server/EPROM
  - Deformatter tests
- Remote monitoring and reset/resync
  - Antenna level initialization screen
Real Time Alarms

- Four severity levels:
  - Immediate Action
  - Antenna Rule
  - Maintenance Request
  - Informational Report

- Adjustable high and low trip points
Increasing System Level Availability

- 1) Build a few prototypes
- 2) Field systems (10+ antennas)
- 3) Trend system reliability
- 4) Integrate findings and enhancements
- 5) Repeat 3-5
Availability

Goal is to reduce the impact of hardware failures.