EVLA Systems PDR Summary Report

The following is a summary of important points from theEVLASystems PDR Panel Report and from the response to that report.The PDR was a top level presentation of the EVLA design plans conducted on December 4 and 5, 2001, at Socorro. The purpose of the review was to answer 3 principal questions:

1. Are the top level performance requirements complete and adequate?
2. Have the correct design solutions been selected for study and development during the EVLA design phase: Are there important alternate solutions that are not being studied?
3. Has an adequate procurement plan been identified for the subsystem?

Members of the Review Panel attending were the following:
John Dreher, Allen Telescope Array
Richard Prestage, GBT Project
Dick Thompson, NRAO CDL
Steve White, GBT Project
Anthony Willis, Herzberg Institute
Rick Perley, Project Scientist
Jim Jackson, Hardware Systems Engineer
Gareth Hunt, Software Systems Engineer
Brent Carlson, Correlator Task Leader
Tim Cornwell, e2e Task Leader
Terry Cotter, LO/IF Task Leader
Steve Durand, Fiber Optics Task Leader
Dan Mertely, Receivers/Feeds Task Leader
Bill Sahr, Monitor and Control Task Leader

A. Computer

Management/hiring

The M&C software effort is lagging behind the hardware effort. Though we believe our estimates for the number of positions required are accurate, the delay is due to our inability - so far - to fill all positions. We believe the requirements for the positions as worded in the job descriptions are accurate since we have been able to identify and approach a number of interesting applicants. While we do attract the right people, we have trouble getting them to accept the position once it is offered to them. This is mainly due to the perceived unattractive location. We are continuing to recruit aggressively.

We are further addressing the circumstance that Design and Management are combined under one person. We agree this is an undesirable situation, and have been attempting to address this by off-loading certain management and administrative tasks from the lead designer to the Division Head. We also intend to delegate some of these tasks to other staff and new hires, as appropriate.

Computing power/WIDAR correlator

Computing Power will be of two kinds: A centralized fast machine (e.g. Beowulf cluster) for Correlator Backend processing, and a distributed system of Module Interface Boards (MIBs) to control the antennas and the correlator.

The Correlator Backend assembles the lags from the correlator baseline boards and performs the FFTs. We have hired a specialist to handle correlator backend issues. An initial requirements document has been written, and a design is under development. This person will serve as a hardware liaison between the WIDAR development in Penticton and M&C software development at the AOC. We are still recruiting for a software liaison between the WIDAR correlator and the AOC. This person will develop the software to monitor and control the WIDAR correlator. Though both persons would be based in Socorro, they would make frequent trips to Penticton.

General M&C

We don't think firewalls will be needed. Legitimate access by remote users is a requirement. We intend to work with the NRAO security team on this. During the transition, certain modes may not be available. It is not yet clear which, but surveying modes will probably continue to be fully available.

Operations software

Targets of opportunity and dynamical scheduling will have to supported on the timescale of seconds. This falls under both E2E and M&C. A detailed implementation of the EVLA alarm system will not be started until all requirements are gathered and the M&C design is complete. The various alarms to be supported will be identified in collaboration with operations. Our maintenance management system will be used to track failures.

We agree that the Ergonomics of operator messaging is important. We believe will are in good shape since the primary designer for the operator GUIs has a long history of development work for the VLBA.

Engineering Software

Selection of appropriate MIBs for the antennas and the correlator and a real-time operating system to run on these MIBs are ongoing. More specifications and clarification are needed for the antenna settling times and the use of the tech laptop to communicate directly with the MIBs.

B: e2e

Adequacy of computing hardware

It is planned to acquire a Beowulf cluster for the pipeline processing of EVLA data. The need for such a machine is documented in EVLA memo 25 which presents an analysis of the computing needs of the EVLA. This is dominated by the requirements for full-sensitivity, full-field imaging in the A configuration. We plan to regularly revisit this analysis to check on completeness and accuracy.

Adequacy of staffing for e2e

We continue to track the costing carefully. One point is that the number is comparable to other ground-based projects of similar scope. We expect to have a firmer handle on costs at the end of two development cycles, at which point we will hold a meeting of an e2e advisory group. Priorities will then be set to met the 65 FTE-years estimate.

Suitability of Glish for e2e

A concern was raised that the only users of Glish are connected with the AIPS++ Project, and that the AIPS++ Project bears the full responsibility for maintaining and documenting Glish. Glish is well-documented and maintained with only some minor and new features lagging in documentation. It would help to have another developer be cognizant of Glish internals. We expect to address this soon in the AIPS++ project. The AIPS++ Project continues to watch the cost/benefit ratio of the use of Glish and this continues to be positive.

Testing of e2e software by astronomers

It is planned that astronomers will be asked to comment formally on e2e capabilities at the end of every development cycle (9 months), and we also intend to implement closer interactions once some core capabilities can be demonstrated.

Connection of e2e to ALMA

DM is being given prime responsibility for post-processing and pipelines for ALMA. We also will be conducting discussions with the ALMA Archive group to see what commonalities can be exploited.

Possibility of e2e developmental delays similar to AIPS++

To avoid running into delays such as experienced in AIPS++, we are using only NRAO staff for the core capabilities, and we have adopted a new software development model ("spiral development") in which checkpoints occur early and frequently.

Necessity of data quality evaluation by computer rather than a person

A concern was raised that the data volumes expected for the EVLA mandate the use of smart algorithms for editing of visibility data. This is correct, but we expect that the algorithms do not have to be very smart since once the system is operating well, simple editing algorithms can be used. Experience with the VLA and VLBA supports this view. In any event, we expect to involve VLA scientists in the development of editing algorithms.

C. Hardware

Recommended improvements and additions to the Project Book that are planned or, in some cases, already accomplished:

Add specifications for polarization isolation, time resolution, gain flatness and phase stability acrossed the frequency band, band overlap, idfferences between pointing during night and day, time limits for stability,.

Provide a summary of desired, nominal, worst acceptable parameters with priorities into a single area of the document.

Add upgrading plans even if they are not part of the baseline plan, such as pointing, OTF mapping, servo, ACU, VOIP telephones.

Need an overall but detailed plan on dealing with RFI.

Amplitude stability for receivers.

Add a glossary.

Add a Table of Contents.

Selection of digital link.

In response to concern that the analog option for the data link may not have been adequately explored, the design team points out that the digital option was chosen for the EVLA project to take advantage of the considerable design work done for the ALMA project. Modeling showed the gain flatness and phase stability of a wideband analog link would not meet the ALMA specification, and so the digital option was chosen for that project.

Samplers

The need to provide adequate dynamic range and "headroom" in the RF design was emphasized in order to maintain a linear response in the presence of worst-case RFI and for solar observing. The selection of the ALMA design for the high speed sampler and an in-house design for the 8-bit sampler appear to be adequate.

MIB design

No compelling reason emerged to unify the M&C MIB designs between the antennas and the correlator. There was a sentiment expressed to avoid complexity and consequent cost in the antenna MIB so that the module could be applied more extensively.

Other details of the M&C design such as MIB chip selection, communication protocol, use of XDR, development of a "utility" or "backup" M&C control, and obsolescence of parts are deferred to the M&C PDR.

In response to concerns about the lag in M&C development, the M&C hardware PDR was moved up to March.

Fiber system

Provisions for an E array will be included, especially for the fiber optic cable layout.

Selection of a low dispersion fiber will be considered for the LO because of the possible impact of dispersion on round trip phase measurement.

Other fiber questions were deferred to the Fiber PDR.

Correlator

There was some question about the use of sinusoidal phase rotation instead of phase switching, but the current plans call for the former.

The selection of details like insertion force for the circuit boards and cooling appear to be adequate. Reasonable efforts are planned to minimize MTBF, a concern because of the large population of integrated ciruits.

There currently is not plan to support 80,000 km baselines with the WIDAR correlator.

Receivers

Better information for receiver temperatures, feed sizes, gain blocks, and OMT designs is deferred until the FE and Feeds PDR.

There is no plan for phase cal or "Iridium" filters at this time.

LO/IF

The need for isolators, the specification for phase stability, the need for a clean-up loop, concerns about round trip measurements, plans for time distribution will be discussed in the LO/IF PDR.

It was recommended that the IF system be built in two 4 GHz increments so that the cost of the additional 4 GHz. Though this plan does not seem workable, it can be addressed further in the LO/IF PDR.

D. General

The following additional documentation is planned:

Interface document
Time Lines
Observing scenarios
Goals for test antenna

For the panel,

Clint