Response to the EVLA Advisory Committee Report on the Meeting of May 8-9, 2006

October 16, 2006

The NRAO Director and the EVLA Project Team wish to thank the members of the EVLA Advisory Committee for their time and hard work at the meeting and for the valuable advice which they provided. This document provides the responses of the EVLA Project Team to the Committee's comments and recommendations. The numbered items below correspond to the numbered comments listed in the Committee's report of June 1, 2006.

Management

1. Performance metrics of percent complete and percent spent were presented at the meeting for each WBS element of the project and the overall project. In the future, we will report other common performance metrics, such as cost and schedule variances and cost and schedule performance indices. These metrics will be used to extrapolate the time and budget required to complete the project. We recently completed our first attempt at developing performance metrics. Simple metrics, such as those suggested by the Committee, may also be monitored. For example, we are currently tracking EVLA antenna-hours as a percentage of total antenna-hours as an indicator of community acceptance.

   The EVLA project is nearing the midpoint of its lifespan, so it is important that the metrics we develop are both useful to the project and developed in a timely fashion. The staff available to develop the metrics is limited, so our analysis of earned value will not be as thorough or formal as that for a larger project, such as ALMA.

   The real cost savings of potential descope options were presented at the meeting. While other descope options may be possible, we have focused on those options we know are viable later in the project because the number of options will decrease with time. We will consider other descope options and estimate their costs. We will consult the user community before any descope options are implemented.

2. A risk and contingency analysis similar to, but not as detailed as ALMA's, will be conducted. As with the development of project performance metrics, the level of analysis detail will be determined by what can be achieved by existing personnel in the project office. The risks of correlator integration, software delivery, and lack of commissioning staff will be considered in the analysis.

3. A formal test, verification, and integration (T&I) plan is needed for the integration of the WIDAR correlator into the EVLA's monitor and control (M&C) system. A plan for integrating the prototype correlator into the M&C system is currently under development by the EVLA Computing Division. A test and verification plan for prototype correlator hardware has been developed by the DRAO staff in Penticton. Antenna subsystems are checked in a hardware acceptance test before the antenna is delivered to operations. The results of this test are documented. Similarly, an EVLA antenna must pass an operational checkout procedure before it can be used for astronomical observations. The hardware acceptance test and operational checkout procedure need to be formalized. A formal test procedure for verifying antenna performance will be developed by staff scientists. For EVLA hardware modules, we are developing quality assurance (QA) procedures which define the purpose of the module and describe the tests to be performed for verification of module performance. The QA procedures will be beneficial for long term module maintenance. Module installation procedures, which include definitions of inter-module cabling, are also being written. We do not anticipate the need for formal T&I plans in any other areas of the project.

4. The scope of an EVLA science advisory group has been outlined in a draft charter for an EVLA Science Advisory Committee (ESAC). The charter describes committee mandates, committee membership, terms of appointments, and frequency of committee meetings. The committee mandates include advising the NRAO Director and the VLA/VLBA Assistant Director on science priorities for the EVLA, participating in initial development and testing of scientific capabilities on the EVLA, and providing a conduit between the NRAO and the international science community in disseminating information pertaining to the status and progress of EVLA scientific development.

5. The priority designation of development items in Scientific Support Services (SSS) software area was explained at the meeting. The items determined to be essential to the project were designated as priority 1, important items were designated as priority 2, and desirable, but not critical, items were designated as priority 3. Priority 0 items were mentioned at the meeting simply to express our ongoing process to develop a finer gradation in the importance and urgency of priority 1 items, and as a risk mitigation for a situation where we are unable to augment current software staffing levels

   SSS deliverables were not explicitly defined at the beginning of the project, and their completion was assigned to the Observatory's Data Management Division, which has since been dissolved. To ensure that SSS deliverables are clearly defined, stable, and achievable within the project budget allocation, we have decided that only the priority 1 items will be requirements of the EVLA project. The priority 2 and 3 tasks may be undertaken by NRAO operations after the project is complete.

Hardware

1. EVLA project management is closely monitoring progress on the development and production of the correlator. Weekly telephone conferences are held to review correlator status, and semi-annual face-to-face meetings are held to address detailed systems integration issues. Over the summer of 2006, meetings were held to review the correlator environmental stress screening program and the correlator power monitor and control system. These reviews were well-attended by project staff. Despite our intensified monitoring efforts, the delivery of the prototype correlator has been delayed to January 2008 due to problems encountered in the fabrication of the correlator baseline boards. We will develop and document contingency plans that describe a longer period of transition-mode observing in the event the delivery or integration of the correlator is delayed further.

2. The primary objectives of the on-the-sky tests (OTS) of the prototype correlator are to integrate the correlator with the EVLA M&C system, test and debug CASA data calibration software, and measure the RFI environment, notably at L-band. Correlator components will be adequately tested prior to the OTS, so we do not believe that the outcome of OTS will have an impact on the production of the final correlator. The objectives and details of the OTS will be documented in the T&I plan for the prototype correlator (see Management, item 3).

3. The data throughput and handling requirements of the correlator and EVLA M&C system are being determined in a joint effort by NRAO and DRAO. A data simulation may be carried out if such an exercise is deemed useful to the project.

4. Contrary to what is implied in the Committee's report, the sensitivity of the L-band receivers and the noise performance of the L-band OMT are two separate issues. The sensitivity of the interim L-band receiving system, as measured on an EVLA antenna, is better than expected at frequencies below 1400 MHz and slightly worse than expected above it. Since the wideband OMT has not been installed on an EVLA antenna, we cannot attribute the reduced sensitivity to problems with the OMT. We will conduct antenna measurements to understand the frequency dependence of L-band sensitivity.

   Improving the noise performance of the OMT is a high priority for the front end group, as recommended by the Committee. The OMT improvements cited in the Committee's report are being implemented as part of a well-documented plan to bring the final L-band receiver into production. The improvements to the OMT are nearly complete, and thorough on-antenna testing of the final L-band system is scheduled for completion in early November 2006. Following the Committee's recommendations, we have also expedited the development of a C-band version of the OMT. RF and cryogenic tests of this OMT are scheduled for completion in October 2006.

5. Recent tests of the round trip phase measurement system have been encouraging. We will continue with these tests, and we won't proceed with producing the final measurement system until its performance is found to meet specification.

6. The EVLA project is evaluating two different designs of the 4Gsps, 3-bit digitizers. The ALMA project developed one design based upon a custom digitizer chip, and the EVLA project is developing another design based upon a commercially-available chip. A prototype based on the EVLA design was recently completed and is undergoing preliminary tests. We will evaluate the two designs based on objective criteria. The EVLA design does require some additional development, but the ALMA design requires additional refinements so that it can be integrated into the EVLA data acquisition system and its cost is uncertain. There is no urgency to start production of the 3-bit digitizer because the majority of our astronomical and engineering tests can be completed with the 8-bit digitizers.

Software

1. As the Committee recommends, we are continuing to explore collaborations with ALMA's computing group in order to achieve significant reuse of ALMA software. We are installing the ESO/ALMA NGAS archive system to evaluate its applicability for EVLA. The software engineering staffs in the EVLA and ALMA projects are converging on a common Science Data Model. The scientific, technical, budget, and schedule advantages of different modes of collaboration have been investigated by the e2e Operations Division, and possible collaborations have been identified. The e2e Operations Division determined that reuse of ALMA's data capture software could be beneficial to the EVLA if ALMA was to provide temporary help in integrating it with EVLA software. The Division also determined that ALMA's proposal submission tool and observation preparation tool could be used by the EVLA, but only after significant revision of the tools by ALMA.

2. The e2e Operations Division was created about a month prior to the meeting. Defining the management structure of the Division and its interaction with the EVLA Computing Division (ECD) has been a high priority activity that is nearly complete. The ECD was recently reorganized under the leadership of Bryan Butler, and a new ECD organization chart showing the interaction between e2e Operations, Scientific Support Services (SSS), and NM Operations has been developed. The e2e Operations Division is bringing some e2e expertise and resources to the EVLA project as discussed in item 3 below.

3. During the meeting, we stated that additional personnel resources for SSS were expected to be devoted to the project as a result of the formation of the e2e Operations Division. Two software engineers, whose salaries were to be paid by

Observatory new initiatives funds, were to be assigned EVLA SSS tasks. We also stated that additional personnel resources may be funded directly by AUI. The realities of the Observatory budget, however, have tempered our ambitions to secure additional personnel resources for EVLA SSS. The e2e Operations Division is requesting a software engineer to work in Socorro on tasks specific to EVLA SSS. That Division has also hired a contract employee to work temporarily on a data processing pipeline, and is hiring another contract employee to assist with the Observatory-wide task of developing the data archive and establishing a compelling Virtual Observatory presence. The EVLA Computing Division is adjusting its priorities and task load to compensate for the manpower shortfall.

As recommended by the Committee, project contingency continues to be left with the project manager to address broader project/hardware issues.

4. Algorithm development within the Observatory is carried out by a collaboration called the NRAO Algorithm Working Group (NAWG). A number of external collaborations have also been formed. For example, research in multi-frequency synthesis and wide bandwidth imaging is being carried out in collaboration with scientists at the ATNF, and multiscale deconvolution algorithms are being explored in partnership with astronomers at the Rochester Institute of Technology. Additional collaborations have been formed with scientists at the University of New Mexico, the Naval Research Laboratory, the Long Wavelength Array project, and the Radionet group in Europe. We recognize the staffing shortfall in algorithm development, and are attempting to alleviate that shortfall with the numerous collaborations cited above. We appreciate the Committee's recognition of Sanjay Bhatnagar's work.

5. A top level design document for the M&C system is in progress. Interface control documents already exist for all EVLA hardware modules, the module interface service port and data port, and the module interface software framework. The M&C interfaces to the correlator will be documented in a correlator T&I plan (see Management, item 3). Staffing limitations will dictate that we develop interface documents for other software components of the system on a prioritized basis.

6. RFI issues are continually considered within the project as evidenced by routine measurements and suppression of RFI from electronics modules, modifications to receiver designs, and numerous technical memoranda on post-correlation RFI excision techniques. The station boards in the WIDAR correlator have the capability to detect time-variable RFI, and the correlator system design provides the flexibility to add post-correlation RFI-excision in the correlator backend (CBE) computer. A major part of the prototype correlator tests will be the determination of the RFI environment so that relevant RFI mitigation methods can be developed. We were remiss in not including RFI issues on the meeting agenda negotiated with the Advisory Committee chair this year, but we will include this topic in the agenda for the next meeting of the Committee.

Rick Fisher's reassignment to be the Observatory's Technical Leader for R&D may adversely impact the Observatory's overall ability to conduct research in RFI mitigation. However, his reassignment does not detract from the project's RFI mitigation efforts because he was not working on them.

7. A plan entitled "Moving CASA into the User Domain" was written on March 23, 2006 to describe how CASA can be tested in the user community over the next few years. The plan shows NRAO-external testers evaluating CASA with known data sets in 2006 and using CASA to reduce their own data sets in 2007. The plan is very ambitious, and its impact on the NRAO scientific staff is being reevaluated prior to the plan's implementation. As part of this evaluation process, a joint ALMA/e2e Operations/NM-Operations appointment for a scientific lead of CASA testing has been made. We will investigate other mechanisms for involving the user community in CASA testing. We will provide an extensive demonstration of CASA at the next Committee meeting.

8. We appreciate the Committee's recognition of our efforts to pursue archive solutions consistent with technologies used elsewhere in the radio astronomy community.

Operations and Commissioning

1. A draft EVLA Operations Plan was completed and distributed shortly before the meeting. The plan is intimately related to the ALMA Operations Plan to be submitted to the NSF in October 2006, and will be reviewed more closely within the NRAO and with its user community over the next year. An in depth review of the plan will be presented at the next meeting of the Committee.

2. Funding has been identified for a postdoctoral fellow to perform antenna commissioning tasks. The job description was prepared, and the position vacancy has been advertised.

3. We are implementing the recommendation to hire EVLA commissioning scientists within the limits of Observatory funding. The requirements for EVLA commissioning scientists were identified in the draft EVLA Operations Plan. Since the scientists will be part of New Mexico Operations, the Assistant Director for New Mexico Operations is developing the hiring plan based upon input from select members of the scientific staff and the project manager. A proposed hiring plan for two scientists and two postdoctoral fellows in FY2007, which specifically identified the duties and skill sets of the individuals, was presented to NRAO upper management. Budget limitations restricted the number of people we could hire for commissioning activities to two. Position vacancies have been advertised for a scientist and a postdoctoral fellow (as described in item 2 above).

4. We will require special skills of an EVLA commissioning postdoctoral fellow, and we will identify and recruit select individuals through NRAO's current postdoctoral programs. In consideration of the recent recommendation to fold ALMA's postdoctoral fellowship into the Jansky fellowship program, a special program for EVLA postdoctoral fellows will not be established.

5. Engaging the user community in test observations will benefit the commissioning of the EVLA, particularly after the arrival of the WIDAR correlator when observations need to be made to test, verify, and optimize data calibration methods. We will solicit commissioning assistance from our colleagues. The very first outside users of the EVLA will need to come to Socorro for their observations to facilitate interaction between staff and users and to use the prototype analysis paths for their data reduction. In some instances, assistance from the user community in test observations may help alleviate the staffing shortages we have identified for commissioning scientists.