Executive Summary and Recommendations from the Report of the ALMA Scientific Advisory Committee: March 2002 Meeting

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ALMA Scientific Advisory Committee

R. Bachiller (Spain), A. Benz (Switzerland)*, G. Blake (USA, Chair), R. Booth (Sweden), L. Bronfman (Chile), P. Cox (France, Vice Chair), R. Crutcher (USA)*, N. Evans (USA), Y. Fukui (Japan, Lead Observer), M. Gurwell (USA)*, T. Hasegawa (Japan), D. Mardones (Chile), H. Matsuo (Japan), N. Nakai (Japan), J. Richer (UK), S. Sakamoto (Japan), P. Schilke (Germany), L. Mundy (USA)*, K. Tatematsu (Japan), M. Tsuboi (Japan), E. van Dishoeck (Netherlands), M. Walmsley (Italy), D. Wilner* (USA), C. Wilson (Canada)*, S. Yamamoto (Japan), M. Yun (USA)

Ex-officio members

S. Guilloteau (ESO), R. Kawabe (Japan), J. Mangum (NRAO), P. Shaver (ESO), A. Wootten (NRAO)

Other participants

R. Brown (NRAO), K. Chiba (NAOJ), Y. Chikada (NAOJ), T. Cornwell (NRAO), C. Cunningham (NRC), P. Gray (NRAO), K. Kohno (NAOJ), M. Ishiguro (NAOJ), N. Kaifu (NAOJ), R. Kurz (ESO), S. Miyama (NAOJ), K. Morita (NAOJ), T. Noguchi (NAOJ), M. Rafal (NRAO), S. Sakamoto (NAOJ), Y. Sekimoto (NAOJ), W. Wild (SRON)

* Not present at Mitaka meeting, but provided input to ASAC report.

1. Executive Summary

This report covers the developments in the ALMA project between September 2001 and March 2002, an important transitional period as ALMA moves into its construction phase. Overall, the ASAC notes the excellent progress being made in many areas that relate directly to the scientific capabilities of the array. The impending completion of the Vertex prototype and its relocation to the Antenna Test Facility at the VLA site marks a pivotal milestone in the Project, and the ASAC eagerly looks forward to our next face-to-face meeting in Socorro, NM. The very tight schedules that must be maintained for the European and Japanese prototypes are a cause for concern, however, since any delays will jeapordize the rigorous testing necessary to select a single design for the ALMA production antennas. The ASAC also emphasizes that the enhancements to the ALMA Project resulting from a participation of Japan in the Project are so valuable from a scientific point of view that all efforts should be made to allow Japan to become a full partner in a future 3-way ALMA Project.

The moment is fast approaching when final decisions have to be taken on the design of the production receivers, and impressive progress continues to be made in the prototype receivers, multiplier chains, and laser LO system. Still, a number of parallel efforts, including the possible fabrication of 'commissioning receivers', remain ongoing despite the fact that the selection of a single option for each band is needed by the end of 2002. Production plans, while moving forward, are far from complete. The ASAC requests to be involved in any necessary trade-offs between performance, reliability, schedule, and cost, especially in cases where they directly affect the scientific capabilities.

In the view of the ASAC, system engineering in general and calibration in particular remains an area needing more investment by the Project. The establishment of a Calibration Team is a welcome step forward, but we reiterate our recommendation that a single leader for this Team should be appointed along with a single member whose responsibility is evaluating the polarization behavior of the array. The scientific capabilities of ALMA are greatly impacted by work in this area, particularly on the phase correction schemes using the WVR receivers.

Concerning software, the progress with the AIPS++ test using Plateau de Bure millimeter-wave data appears to going well, though the final report will not be available until after the upcoming ACC meeting in Venice. The ASAC again suggests that the Software working group defines a core program to test both the pipeline and offline analysis software and obtain early user feedback; and requests the Project present a detailed management plan for the ALMA software effort, including a detailed timeline including milestones covering the construction phase through 2011, at our Fall 2002 face-to-face meeting.

Following up on earlier ACC requests, the continued discussions of scientific operations formed the core of the ASAC face-to-face meeting. The concept of the Regional Support Centers (RSCs) was further defined, and an initial examination of possible roles for the community in evaluating ALMA observing proposals was conducted. No specific recommendations on how the review process might occur are made, but this report does outline the pros and cons of various possible options, which we hope will be helpful to the ACC. As a result of these deliberations and the unique reliance of ALMA on a dynamic scheduler, the ASAC does recommend in general that time accounting and establishment of parity among the partners be separated from the proposal review process, and that the ALMA agreement adopt some flexibility in the precision within which and the timescale over which the allocation to any partner must balance. No matter the mechanism used, the concept of stringency is clearly important to ALMA, and so the ASAC recommends that the Project work with it using existing site data to begin to assess the statistics of stringency on various timescales.

2. Summary

The major ASAC recommendations are summarized below. These are in the order discussed in the text and not in any priority order. More detailed recommendations can be found in the section referenced by the major recommendations.

1. The ASAC has the following Receiver recommendations:

   – The Project baseline specification should be 2SB receivers below 370 GHz, but given that only a small loss of flexibility results the IF bandwidth could be limited to 4-8 GHz. The baseline specifications remains DSB with a 4-12 GHz IF bandwidth for band 9.

   – The ASAC recommends that a downselect of the various options be undertaken by late 2002, and requests to be involved in the process.

   – The fabrication of 'commissioning' receivers, while important for testing, should not distract the Project from the critically important main receiver production.

   – The ASAC requests at our next face-to-face meeting a report from the Project on total power stability along with an updated plan for the production, integration, testing, and implementation of the production receiver bands.

2. The ASAC gladly notes that the 2G Correlator group is now considering alternative designs, per our recommendations. We encourage the group to continue its work involving European, Japanese, and North American teams toward the selection of an optimal "Unified Design" architecture, and suggest that the detailed design, precise cost estimate, and production plan for the 2G correlator be available to the Project before the end of 2002.

3. The ASAC applauds the formation of a Calibration group within the Project, but recommends that a well-defined leader and a dedicated person for polarization issues be identified to lead this process.

4. The ASAC has the following recommendations on Software issues:

   – A better understanding of the resources of the Software team and the current management plan of the entire data analysis project is needed, and the ASAC requests a presentation on these issues at our next face-to-face meeting.

   – The formal results of the "audit" of AIPS++ with PdBI data (due in April 2002) should be carefully examined for their scalability to ALMA, and should be used to review the entire software effort for ALMA in 2002.

   – We reiterate that the Software working group should define a core program for both the pipeline and offline analysis. Such a core program would be a significant milestone and would allow a first user feedback.

5. The ASAC supports the decisions of the Configuration CDR and welcomes the new leader of the Configuration team, John Conway

6. The ASAC continues to consider Science Operations in detail, particularly the likely interfaces between the observing community and the observatory, and has the following major recommendations for the submission and review of proposals:

   – The ASAC recommends that time accounting and establishment of parity among the partners be separated from the proposal review process, and that

– The ALMA agreement adopt some flexibility in the precision within which and the timescale over which the allocation to any partner must balance. Alternatively, time accounting could be weighted by the stringency of the proposed observations.

– Accordingly, the ASAC recommends that the Project work (with the ASAC) to define stringency more precisely and use existing site data along with projections of array performance under various conditions to assess the statistics of stringency. The latter analysis should consider a wide range of timescales.

7. The ASAC reiterates our earlier recommendation that the Regional Support Centers (RSC) should be responsible for support of the observer, from proposal preparation through data reduction and analysis. They may also provide data portal and software development. They should be operated with an international and collaborative spirit.

   – Each RSC should have a core functionality provided by the ALMA observatory. The partners may choose to add other functionality from their own resources outside the ALMA project.

8. The ASAC applauds the successful arrival of ASTE at its observing site in Pampa La Bola, and recommends that testing of the ALMA prototype receiver cartridges under the realistic conditions offered by this telescope begin as soon as is feasible.