Report from the ANASAC Face-to-Face Meeting at Univ. Maryland (15 May 2004)

Attendees: T. Beasley, A. Blain, C. Carilli, X. Fan, J. Glenn, M. Gurwell, D. Johnstone, L. Mundy, C. Wilson, T. Wilson, A. Wootten, M. Yun (chair)

Summary

This document reports on the ANASAC meeting held at the University of Maryland on 15 May 2004, following the North American ALMA Science Workshop. To help guide the focus of the committee, the role of the ANASAC primarily as a conduit between NRAO and the North American ALMA science community was discussed and defined. Key technical and scientific requirements for the ALMA early science and normal operations identified during the Science Workshop are discussed and summarized here as well. Lastly, Xiaohui Fan offers his unique "outsider's view" (non-expert's view) on the ALMA project and some ideas on how to reach the broader science community.

1. Introduction

The North American ALMA Science Workshop was held at the University of Maryland on 14-15 May 2004. Members of the ANASAC had actively participated in the organization of the workshop, and the presence of many ANASAC members at the meeting was deemed important, given the emerging role of ANASAC as a conduit between NRAO and the North American ALMA science community (see below). Since no formal report from the workshop was planned, a face-to-face meeting of the ANASAC was held immediately following the workshop to capture the key lessons and to produce a written report.

The main agenda items for the face-to-face meeting were:

1. to discuss and to define the role of the ANASAC;
2. to summarize key technical and scientific requirements for the early science and normal operations that are not adequately addressed in the project and to make relevant recommendations;
3. to review and comment on the current ALMA operations plan.

The committee discussions on the first two topics are summarized below. The third topic on ALMA operations plan was not discussed fully because the committee did not have enough time. A separate report will be produced based on the committee e-mail discussions.

2. Role of the ANASAC

After about a year of operation, it is appropriate to assess the role of the ALMA North American Science Advisory Committee (ANASAC). Thus far the role has been primarily to respond to issues raised by the NRAO Director. The committee members have further engaged in limited outreach to the community in response to specific questions regarding ALMA operations and helped run a successful ALMA Workshop.

The ANASAC is not meant to be a superset of the ALMA Science Advisory Committee (ASAC) and thus is not tasked with performing specific analysis of ALMA operations. Rather, the ANASAC is a conduit between the North American ALMA operations, specifically the NRAO Director, and the North American astronomical community. As such the main task of the committee is to speak to the community about ALMA-related issues and then respond on behalf of the community. Three important issues that need community awareness and response immediately are ALMA early science, the North American ALMA Science Center (NA-ASC), and funding for ALMA research.

As well as leading ALMA-related discussions with the community, the ANASAC can play a vital role in linking the community to the ALMA project. As a large, international, endeavor ALMA appears distant to many astronomers. Members of the ANASAC are a local, friendly interface to the ALMA project and should maintain a high visibility in order to provide community members with an opportunity to engage the ALMA project. Additionally, an informative ANASAC web page should be developed and made available to the NA community quickly. The ANASAC needs to be active in constructing and contributing the contents

of this page, which should include the member list and contact information, previous reports, past and future community workshop information, and links to useful ALMA presentations. (We understand that a placeholder page is already constructed under the official web page for the NA-ASC.)

Finally, the ANASAC members should play a vital role as representatives for ALMA. Although telescope completion is still a long way off, it is essential that ALMA maintain a high degree of visibility within the community and that the capabilities, and limitations, of the instrument be known. Planning for other telescopes and instruments must take into account the abilities of ALMA and the important synergy that may be possible. The NA-ASC will not have the staffing level to perform this task alone. ANASAC members will need to work closely with the NA-ASC to maintain and promote visibility for ALMA. While there are many methods by which this can be accomplished, it is clear that special sessions at general astronomical meetings, such as the AAS, and dedicated ALMA-related workshops, on topics such as mm/submm science, technical aspects of interferometry, software tools, proposal tools, etc., will be necessary. (This is one area where the project can learn some useful lessens from the Spitzer project. To educate the broader interested community members and to prepare them for their future ALMA experiments, MANY workshops should be planned at various locations in order to introduce to the non-experts mm/submm science, technical aspects of ALMA, tutorials of software tools, etc.)

The ANASAC has been successful over its first year in providing feedback to the ALMA North American operations. The recent science workshop revealed a strong interest in community members to be informed about ALMA and also to provide input on the direction of ALMA operations. The ANASAC should strengthen its role as a conduit between the community and the ALMA project in order to maintain and strengthen this vital relationship.

3. Summary of the Discussions following the Maryland ALMA Workshop

3.1. ALMA Science Center Core and Additional Functions ANASAC heard about the location of the NA-ASC in Charlottesville, for both the US and Canadian communities. It was clear that NRAO funds would be stretched to provide the expecting staffing requirements, even with re-allocation of resources within the Charlottesville site. The ANASAC considers that adequate support for the NA-ASC is essential to ensure the smooth commissioning and efficient utilization of ALMA. A document describing the scope and goals of the NA-ASC would be highly desirable. The ANASAC recommends that NRAO survey and consult the user community in establishing the priority list for the NA-ASC functions. Hiring NA-ASC staff with a broad wavelength experiences is recommended in order to bridge the cultural/technical gap facing the non-experts with other wavelength backgrounds.

The idea that the NA-ASC would provide modeling and interpretation aids in addition to its pipeline and observing support role was discussed. Universities and consortia of universities could be encouraged to provide such services, with subcontracts from NA-ASC (for example to carry out laboratory molecular astrophysics experiments or atomic theory calculations to support ALMA's exploitation).

While the overall workshop attendance was quite good, the number of participants from outside the traditional radio astronomy background was rather limited. ALMA project should make more efforts to advertise itself and its workshops to the broader community. The demand for and prioritization of non-core services should seek the views of a wider fraction of the community than were present at the Maryland meeting. A reminder seeking additional input from those attending the meeting should be sent urgently.

It was agreed that any decisions on the places and types of additional activity should wait until the amount of money available for operations at the ALMA site and NA-ASC is more clearly known. It is likely that NA-ASC "additional functions" will require additional funds beyond the current baseline plan. One of the key roles for the ANASAC in the near future is to assist NRAO in identifying and prioritizing the NA-ASC "additional functions" that are vital to the success of ALMA and to drum up support for such funding within the North American user community.

3.2. Commissioning visits The possibility of NA visitors going to the ALMA site to help with commissioning was discussed. The project reported that sabbatical-length visits for 2-3 months or more would be much more useful than short visits, which the project considered to be counterproductive. Longer periods in Chile would allow visitors both to be integrated into the operation and to build up the necessary knowledge to assist with commissioning. This belief in the limited value of short visits was supported by reports of the experience during VLBA commissioning.

The possibility of using ALMA operations funds to finance such trips was raised. The desirability of NRAO providing logistical supports (lodging in San Pedro and Santiago, for example) and providing information and travel coordination were also expressed. Another practical issue is that salary funding must be provided for sabbatical-type visits by astronomers for durations of 3-6 months for Commissioning and Science Verification. Otherwise, such visits won't be feasible for many astronomers.

An alternative possibility of allowing community involvement via visits to the North American ALMA Science Center in Charlottesville rather than to Chile was raised. A possible problem for this would be if data was shipped to NA-ASC rather than being piped in real time. The possibility of a real-time data link during commissioning should be investigated with a high priority, as many members of the community could find it difficult to travel to Chile for extended periods.

3.3. Early science The definition of early science and its relationship to commissioning and verification were unclear to the ANASAC. Three relevant expressions were heard at the Maryland meeting: 'demonstration science', 'science verification' and 'early science'. The relative definition and status of these categories were thought to be unclear.

'Science verification' was assumed to be lead by the ALMA project staff, possibly with outside teams of workers assembled by the project. The committee recommends that 'demonstration science' be replaced by 'outreach science', again carried out by the project to attract publicity and demonstrate the increasing capability of ALMA to the wide astronomical community and to the public.

As a working definition it was assumed that 'early science' was going to obtained after a general call for proposals to use a proto-ALMA. The committee thought that early science should not start before ALMA had 8 antennas, and that it should involve a guaranteed and clearly defined, but possibly limited suite of observing modes being made available to the community.

The general opinion of the ANASAC was that early science results should be compelling both scientifically and visually, and that early science should not stand in the way of or compromise the efficient commissioning of ALMA.

If early science requires supporting observations from space - HST, Spitzer & Chandra - then thought must be given to obtaining these data sooner rather than later, as these space facilities have a limited lifetime.

The frequency of calls for early science was discussed. A maximum frequency of every 6 months was considered to be sensible organizationally, and an annual call was perhaps more feasible. The ANASAC felt that new, additional calls should be not be issued unless the array grew substantially, perhaps by 6-8 new antennas, and that it is vital to avoid the buildup of a backlog of unexecuted observations in a queue. During the period for which a call is made it was thought to be important that the array's capabilities do not increase dramatically. If it did, there are risks that proposers would hold back their projects (either at phase I or II) to seek time on the more capable array later. The idea of commissioning sub-arrays seemed to be very compatible with this idea.

The developing proposal tools could be demonstrated usefully at every AAS meeting.

The difference between the NRAO 'open skies' policy and the closed ESO system were discussed. The general feeling was that international proposals increase the scientific productivity of NRAO facilities, and that an NRAO TAC was naturally unlikely to grant time to proposals with a large fraction of ESO proposers. Whether a formal policy is required at this stage was unclear, but these issues need to be considered carefully in the future as policies become more clear.

3.4. Data Reduction Funding The possibilities of extending support for users beyond the existing NRAO publication charges and student travel and support was discussed. The case for a simple, and unburdensome scheme to award research funding along with time on ALMA was generally considered to be a good thing, both to encourage participation in ALMA science from the wider astronomical community and to match the automatic support provided by ESO member countries. The data rate from ALMA may be so high that extra computing and storage resources are necessary for reductions and scientific utilization, as motivated the original scheme for data reduction funding from HST. The idea of funding for ALMA time was mentioned explicitly in the decadal review. A poll of the perceived requirements of the community would be valuable. The HST project sought such views prior to establishing their funding-for-time structure.

The level of any support should probably be modulated by the data volume and complexity involved. The HST system of detailed grant proposals along with Phase II submission is generally considered to be overly bureaucratic and a waste of everyone's time, investigators and STScI staff. A system with a lighter touch (the more recent Chandra system perhaps) would be preferable. The very simple Spitzer 'cash per

hour' system was generally felt to be too imprecisely matched to the community's needs. There was muted support for a $/hour support system, perhaps with a baseline of support.

The main concern with the ALMA data reduction funding idea is its possible impact on the funding of other NOAO and NRAO facilities and NSF grant programs for individual researchers. Parity with other national facilities may not be an issue as the exact funding route does not necessarily have to be through NRAO and could be administered directly by NSF. NSF could take a different approach to funding investigators using the "international ALMA" as a distinct new program. Several people voiced a concern that this new funding may have to come from the existing NSF budget and may fundamentally change the way NSF funds astronomical research in general. The funding system would affect US rather than Canadian PIs most strongly, and it is an issue that needs much more careful consideration.

The institution of a prestigious 'ALMA fellowship' either outside of or specified within the Jansky Fellowships was suggested, to coincide with the first availability of the proto-array. A concern was expressed that there are too many prize fellowships already. It was felt that guaranteed time should not be associated with these fellowships, and that candidates of the expected quality would have no difficulty winning time on ALMA in open competition.

3.5. Atacama Compact Array and Configurations The meeting illustrated a large demand for the ACA+TP, which might exceed the natural 1/3 of observing time allocated via this facility, especially for large scale Galactic mapping projects. Alternate schemes for obtaining the short/zero spacing information (e.g. JCMT, LMT) may need to explored.

The ANASAC suspected that the accurate cross calibration of ALMA and ACA could be difficult, and that a compact ALMA array might be necessary most of the time to ensure this.

The array reconfiguration process presented at the meeting sounded too inflexible. In particular it seemed that the maximum size of the array could coincide with the Bolivian Winter when coherence was likely to be relatively poor.

The incremental reconfiguration of the main array was also thought to be a potential handicap to uniformly calibrated wide-field mapping projects. Perhaps the capability to keep the array configuration fixed for periods of days to weeks while such projects were carried out would be necessary.

The desirability of a fixed long baseline for ToO observations of bright sources was also mentioned. Taking advantage of the superb sensitivity and calibration of ALMA, monitoring programs may become an integral part of ALMA science. A fixed uv-coverage is also favored by monitoring programs.

3.6. Future Workshops and community outreach The committee recommends a gradual but substantial increase in the effort by the project to motivate and to educate the future ALMA user community. It appears the broader astronomical community shares the excitement and the anticipation for the new scientific capabilities promised by ALMA, but it is also perceived to be technically challenging and foreign. A concerted campaign to communicate its capability and scientific uses to the broader user community is clearly needed. A good balance between expectation and deliberable capability should be maintained in this process for the long term credibility of the project.

Continued presence of the ALMA project at AAS meetings, along with discussion and demonstrations of the Observing Tools (OT) should take place. Conferences and workshops that explore the synergy between current and future NASA missions (Spitzer, SOFIA, JWST) and ALMA as well as with the ground-based OIR facilities are natural ways to draw in a larger and broader community of users and theorists. A "cheat sheet", similar to those produced by the Spitzer instrument teams, would be very useful for all users (experts and non-experts).

The generation of DSRP-based outreach materials should be considered, along with the better organization and updating of the ALMA web site. It was noted by several people attending the star formation working group session that the DSRP talk by Claire Chandler was exceptionally good and informative.

3.7. Other Issues Importance of the VLBI capability was emphasized by several participants of the workshop.

Responding to the ALMA questionnaire distributed by Al Wootten, the planetary science working group identified the Band 1 (30-50 GHz) as the most important band for their science projects – the probing depth of planetary surfaces is about one observing wavelength.

Several participants who are not experts of radio astronomy pointed out that the "Band" designation is confusing and puzzling and should be replaced with the frequency or wavelength designations.

4. A View from Outside (by X. Fan)

I would like to share some of the general impressions and thoughts I have after attending the ALMA workshop, and talking to some of the participants, especially those who are not expert radio astronomers.

Among the participants, there were probably four or five optical/IR astronomers who are not radio experts, and one theoretical cosmologist. This is probably not a reflection of the overall interest from non radio astronomer, but rather a result of how this workshop was advertised in the community.

My general feeling after talking to my non-radio colleagues is that there is a lot of enthusiasm for ALMA. There will be a large fraction of the community extremely interested in ALMA science. However, there is also a considerable barrier between the optical/IR astronomers and ALMA, mostly technical, and to some degree cultural. One of the most important legacy of ALMA, and I think one of the most important tasks of ANASAC, is whether or not we can bring in the vast talent of non-radio astronomers to use ALMA. In this regard, there are two important roles that ANASAC can and should play: (1) to help non-expert to understand the scientific capability of ALMA; and (2) to help make the technical transition easier.

A few specific ideas to suggest:

- **ALMA fact book/sheet**. It will be useful to have an ALMA fact book or a fact sheet for non-experts so that *everyone* can start planning the kinds of science ALMA will enable all of us to do. It should have a collection of numbers such as sensitivity, resolution, frequency bands, FOV, bandwidth etc. It should also describe some specific examples of astrophysics ALMA can do. This will be a good way to start getting the attention of non radio astronomers and get them begin to think seriously about how ALMA would impact their research.

- **Workshops**. ALMA-related workshops for non-experts have been suggested. An important reminder is that this is still too early to get too technical. I doubt most people will be serious about spending a lot of time learning interferometry before the first call for proposal is issued. But ALMA sponsored or supported science conference or workshop on ALMA related subject are clearly needed, with titles like "Galaxy formation in the ALMA era", or "New frontiers of submm and mm astronomy". It would be even better if these workshops and conferences are closely related to other current facilities such as Spitzer, SOFIA etc. A special AAS session about science opportunity with ALMA would be good. Now is the time to draw people to think about science, and it is too early to think about data reduction yet.

- **Supporting observations in other wavelengths**. One participant told me that she (an optical astronomer) is already planning observations in anticipation for what ALMA will do later. Those HST/Spitzer proposals mentioning ALMA should be looked upon favorably during reviews. Because we won't have HST or Spitzer by the time ALMA is operating fully, and ground-based observation sometimes takes years to complete, now is the time to start planning special ALMA related observing programs, especially in space, by the broader community.

- **Getting theorists involved**. The one and only theoretical cosmologist present at the meeting had a mild complaint that he did not hear much about comparisons to cosmological simulations or semi-analytic models during the workshop. We need to have cosmological simulationist to think about predictions for HCN at z=8. There are tons of papers about galaxy formation science with JWST by theorists. There are far fewer (if any) ALMA cosmology theory papers.

- **Software**. The software development should keep non-experts in mind. If ALMA software tools can share some of the features/functions HST or Spitzer softwares have, that would make the transition easier. As an observer, I do not believe that a black box is what most people want. To do real ALMA science, people will need to have some real understanding of submm astronomy and interferometry. There is no way around it. I hope that all the software development will attempt to lower the barrier so that people can get into ALMA easily. And ANASAC has a role to play to make sure this is the case.

It is the unique science ALMA will enable that will attract non-experts to work with ALMA. Changing wavelength and learning interferometry would be a considerable investment for any new users. But in the end people will go where science is (partly because sooner or later money will go to where new science is). ANASAC should be the champion of promoting ALMA science, which I think is the ultimate way of reaching the broadest community.