



Report from the ALMA Scientific Advisory Committee

Face-to-Face meeting, Garching

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Membership of the ALMA Scientific Advisory Committee

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Executive summary

Charge 1: (Cycle 0)

The ALMA Project is in an exciting period with Early Science data becoming available, and (at the time of this writing) the first two papers on ALMA science released. This is also a critical time for establishing a positive relationship with the community while balancing the demands on the project during the transition to full science. The ASAC makes the following comments and recommendations:

- A Band 9 SV data set urgently needs to be obtained and released.
- Transparency and communication to PIs in data acquisition and handling needs to be improved.
- The speed at which data sets are released needs to be improved; steps might include revisiting the scope of QA2, and enlisting ARC staff and PIs.
- Cycle 0 should not go beyond its current 5-month extension.

Charge 2: (CSV, Cycle 1 Capabilities, Proposal Review Process)

The ASAC was pleased to see the progress from CSV in recent months, although we have a few key concerns. Both the call for proposals and the proposal review process for Cycle 0 have served as “learning experiences”, and Cycle 1 offers the opportunity to adjust policies and procedures. The ASAC makes the following comments and recommendations:

- Every effort should be made to increase the efficiencies (both hardware and software) that are currently major limitations in the observing process.
- The number of panelists per review committee should be greater than 6.
- The comments provided to proposers need to be improved; comments from secondary assessors should be mandatory.
- The project should be conservative regarding the offering of capabilities for Cycle 1 that are not fully tested.

Charge 3: (Development Program)

The ALMA Development Program is essential to the long-term scientific health of the observatory. The ASAC was pleased to hear of the progress made on this front by both the JAO and the Executives, including the formation of the ADSC with a draft ToR, and calls for proposals from all three executives. The ASAC offers the following comments and recommendations:

- The ASAC has created a “focus group” of three members (one from each region) to advise and assist the ASAC representative on the ADSC.
- In order to guide expectations of groups proposing projects to the ADSC, a Development Implementation Plan should be produced and disseminated.
- The ASAC endorses investment in the three Board-approved development initiatives (optical fiber link, Band 5, VLBI).
- A full and realistic impact study needs to be carried out for the proposed VLBI upgrade.

Charge 4: (Previous ASAC Recommendations)

The ASAC remains committed to and unanimously supports an in-depth evaluation and costing of efforts to increase the efficiency of power generation at the ALMA site. The ASAC offers the following comments and recommendations:

- The constitution of a working group on this issue is a major positive step.
- The proposed timeline for a full report to the Board in April 2013 is appropriate.
- This group should begin activities as soon as possible so as not to delay this process any further.

Charge 5 – Ad Hoc: (Evolving Role of the ASAC)

The ASAC currently serves as the primary channel for external scientific input into the ALMA project. However, as the ALMA project has begun the transition from construction to operations, the role of the ASAC may be similarly evolving, and the ASAC would like to review and assess the role and effectiveness of this committee given the rapidly changing nature of the ALMA project. The ASAC makes the following comments and recommendations:

- The ASAC will need to become more proactive and engaged with the ALMA project to be up-to-date on developments and concerns.
- The ASAC needs to be ready and committed to responding on timescales that are not aligned with standard telecons and face-to-face meetings.
- The ASAC would like to have an additional more direct line of communication with the Board (to whom the ASAC reports), both to avoid delays in information transfer as well as possible miscommunications.

I. Introduction

The ASAC met in Garching at ESO headquarters on the 22nd and 23rd of 2012.

The ASAC would like to thank the ALMA staff at ESO for coordinating this meeting, especially given the timing that corresponded to a vacation week for many people. We also express our gratitude to the number of staff who presented material, provided information, and attended the face-to-face.

The ALMA Board gave the ASAC four formal charges. In addition, the ASAC generated a fifth ad hoc charge, which is also discussed in this document.

The ASAC proposes to hold its next face-to-face meeting (Oct 2012) in either Santiago or Tokyo, to be determined based on the schedules of local staff at these locations. The subsequent face-to-face meeting will then be held at the alternate location.

Finally, the ASAC wishes to express our deepest gratitude to Project Scientist Richard Hills and Deputy Project Scientist Alison Peck for their exceptional service and commitment to the ALMA project. We wish them happiness and success in their future endeavors.

II. Response to Formal Charges

II.1) Charge 1

ASAC will be provided with an update on the Early Science Cycle 0 execution and plans for completion. The Committee is requested to review and comment on the progress of Early Science Cycle 0. This should include: the delivery of the scientific capabilities offered for Cycle 0; delivery of the science data and user support from the ALMA Regional Centers; and effectiveness of communications with the global astronomy community by ALMA (including the ARCs). ASAC is requested to bring any recommendations or concerns to the attention of the Board focusing on recommendations that could help improve science outcomes.

ASAC is delighted to see the first science papers from ALMA and shares the excitement of the DSO with the completion of the first Cycle 0 programs. However, we also share their concerns about the low observation efficiency which necessitated an extension of Cycle 0 to the end of the year with the consequent delay in the call for Cycle 1 proposals.

We are anxious to see the delivery of a Band 9 science verification project, which would be very desirable prior to the Call for Cycle 1. It was always clear that interferometry at these short wavelengths would be very challenging and unexpectedly poor weather has not made matters any easier. We remind the

DSO that Cycle 0 programs are to be attempted on a best efforts basis and that there is little experience in assessing acceptable data quality in Band 9. With the large observational overheads and ambitious schedule, even with the 5 month extension, it is apparent that many Band 9 Cycle 0 programs may not be completed by the end of this year. Release of a non-optimal Band 9 dataset may not be ideal, but it may help manage community expectations.

The experience of ASAC members, confirmed by feedback to ASAC from the regional SACs and the general user community, is that the communication about Cycle 0 projects has been poor. The transparency of science operations and data handling policy, in general, should be improved. Many, possibly most, users have not received any information about the scheduling of their observations, or their data's progress through quality assessment, and attempts to obtain such information were unsuccessful until escalated to Board level. We suggest that the contact scientist informs the PI when their project has started rather than only when the project is complete. In addition, the contact scientist should have the authority to provide the PI with information about scheduling and the status of data reduction as s/he deems appropriate.

Subsequent to the F2F meeting in Garching, the ASAC has learned that a plan to communicate more effectively with PIs is currently being devised, and we are pleased to see the rapid response to this important issue. The ASAC would like to see and comment on a written version of the communication plan. We stress the principle of frequent and simple updates, and of putting as much of the communication load as possible on the nominated contact scientist at the corresponding ARC, so as to not increase the work load of the JAO personnel.

There has been very slow progress in the release of datasets to PIs, although we gather that the timescale for QA2 is trending down to about 20 days with a target of 14 days. The consensus of the ASAC is that the current working definition of QA2 (which includes imaging) may be overly ambitious for Cycle 0. We encourage a more streamlined process for quality assessment at the observatory and the release of individual schedule blocks to the ARCs. These are currently underutilized, despite widespread community acceptance of their role and their generally excellent staff, and their willingness to take on this responsibility. They should be enabled and encouraged to play a greater role in QA, and to liaise with PIs regarding partial data releases ahead of full project completion. In addition, highly experienced ARC staff should have the freedom to deviate from the "standard" reduction path when justified.

There was unanimous agreement that Cycle 0 should not go beyond its current 5-month extension, for the following reasons:

- The array is growing in sensitivity and new science capabilities.
- A long extension is incompatible with the 'best efforts' nature of Cycle 0,

which does seem to have been forgotten on occasion.

- The timescale between the Call for Cycle 1 proposals and start of observations should not increase beyond the currently estimated 6 months.
- The very high oversubscription for Cycle 0 implies a large potential user base who are increasingly anxious for an opportunity to obtain their first ALMA data in Cycle 1, and who already fear they are disadvantaged by their lack of success in Cycle 0 and hence their lack of access to state-of-the-art datasets in their field.

II.2) Charge 2

ASAC will be provided with an update of the status of CSV activities on planned Cycle 1 capabilities and plans for the Cycle 1 Call for Proposals, Proposal Review Process and for performing the observations. ASAC is requested to bring any recommendations or concerns to the attention of the Board.

II.2.a: CSV

There has been clearly much progress and many highlights in recent months as evidenced in the clear, detailed presentations given to ASAC on construction by W. Wild, and CSV status from R. Hills. We especially commend the JAO for quickly identifying potential appointees to the new roles to be created to replace the Project Scientist and Deputy Project Scientist.

Nevertheless, **there are two points that are cause for concern**, in the opinion of ASAC. In particular, the reliability of hardware (especially with antenna components), and software problems (especially latency issues), continue to cause significant time loss, and are the limiting factors in pacing the progress of CSV and Cycle 0 operations. The main concern of ASAC is that these reliabilities do not seem to have improved significantly since the time of our last report, as evidenced by the typical number of antennas operating during observations, as well as the low observing efficiency. These problems pose a significant risk to the successful completion of CSV and normal observations. **ASAC strongly endorses the project target goal of reducing the software overheads** to the natural limits imposed by the hardware, and **encourages the project to allocate sufficient resources** to realize this goal, preferably before the start of Cycle 1 operations.

The ASAC noted that the schedule of this meeting did not allow further discussion on two important related issues: the operations budget and the long-term maintenance plan. We have also been informed that the problems with the archive noted in past meetings have been solved, and although we had no time available in this meeting to review the archive operations. We wish to thank the

project for the response to those concerns. The ASAC looks forward to hearing about, and discussing, these issues in the next face-to-face meeting.

II.2.b: Cycle 1 Call for Proposals and Proposal Review Process

The baseline plan is to implement 12 ALMA review panels, each with 6 members.

The ASAC strongly feels that 6 members per panel are too few. This is based on the experience with Cycle 0, as well as the experience of several ASAC members who have served in panels in other telescopes (e.g., Spitzer, Hubble). Panels with only 6 members have two fundamental weaknesses: 1) they often suffer from missing expertise to judge particular proposals, 2) strong personalities among the panelists will more easily dominate the discussion. In order to accomplish the increase in panel sizes without unduly increasing the number of reviewers **we recommend merging panels to constitute 2 panels of 9 reviewers where there are now planned 3 panels of 6 reviewers, and expanding the number of reviewers in other cases.** An additional benefit of merging panels is that more proposals are directly judged against each other rather than being merged later.

In the current plan proposals are assigned to 1 primary assessor and 3 secondary assessors during the first stage of their evaluation (triage). Written comments are required from the secondary assessors only for scores less than 3 or greater than 8.

The ASAC strongly feels that secondary assessors should always provide written comments. The current scheme offers a perverse incentive to secondary assessors to assign scores between 3 and 8 so that written comments are not necessary. Even if this were not the case, **returning a proposal with comments provided by only one referee should be avoided,** because it reflects poorly on the evaluation process. Indeed, in the report given to the ASAC by Paola Andreani based on the survey of ALMA users, one of the main areas in which the users expressed dissatisfaction was that of feedback from the proposal review process. Thus increasing the quality of reviewer comments should be a high priority in the next proposal review process.

The ASAC was presented with several triage scenarios to estimate the number of proposals that each referee will need to evaluate. The members of the ASAC feel comfortable with ~30% of proposals being triaged.

The ASAC was presented with the proposed procedure for “resurrecting” a triaged proposal. In this plan, requests are reviewed by the PHT Lead

Astronomer for recommendation to the APRC Chair, who then makes a final decision. Experience shows that it is very important to keep open the possibility of bringing back proposals that could have been triaged due to errors or misunderstandings, and we encourage keeping the procedure as simple as possible.

In general, **ASAC recommends that the JAO improve the clarity in PI communications.** One example is to include the ranking percentage of the proposal in both the overall pool as well as the regional pool with very careful language. Another example is to use the phrase “not accepted” in place of “unlikely to be observed”, which we think is unclear and raises false expectations. The ASAC also **recommends the JAO publish the detailed explanation of the PRP** in order to promote the transparency of the process among the user community. The communication from the observatory to the PI should also make clear that (in the current Cycle 1 plan) rejected proposals have not been technically assessed. We recommend that there be explicit mention that a technical feedback for a rejected proposal can be requested from the relevant ARCs by the PI. We think this is an important step to promote the broadening of the ALMA user base.

The ASAC wishes to highlight the important principle of obtaining a full CSV dataset demonstrating a new capability before it is offered to proposers. In particular, **we recommend that the project be conservative** about offering not fully tested capabilities in Cycle 1. To avoid some of the problems experienced with the execution of Cycle 0 and to maximize the science payoff of the observations, the ASAC wishes to stress **the importance of incorporating realistic overheads into the OT.** To this end, the ASAC would like to see an updated version of the OT with the new capabilities to be offered in Cycle 1 incorporated before the Cycle 1 call for proposals.

In order to avoid raising false expectations in the community, as well as to promote a realistic scientific evaluation of the proposals, the ASAC recommends that the likely amount of time available for Band 9 observations as well as the total number of hours anticipated for Cycle 1 **be explicitly mentioned in the call for proposals.** Furthermore, the Call for Proposal needs to be very explicit regarding the conditions under which the ACA will be offered for use in Cycle 1, as well as the imaging dynamic range and the constraints on maximum and minimum baselines for which combination is possible or desirable. ASAC supports the plan of limiting the longest baseline offered in combination with ACA to 500m to ensure there is sufficient UV overlap filling in the short spacings for the 1 km extended configuration in Cycle 1.

The ASAC also wishes to stress the importance of using the scientific payoff per observing time invested as one of the criteria used to evaluate

proposals. Any operational restrictions on the min/max size and number of Cycle 1 proposals should be addressed in the Call for Proposals. Consideration should be given to balancing the fraction of high-priority programs at high frequency (e.g. Bands 7 and 9) with the fraction of time expected to be available at these frequencies.

II.3) Charge 3

ASAC will be provided with an update of plans on the ALMA Development Program, especially with regard to the scientific priorities, the initial projects identified by the Board in November 2011 to be developed into specific proposals, and the response to the calls for expressions of interest by the North American and East Asian executives. ASAC is requested to bring any recommendations or concerns to the attention of the Board.

The ASAC emphasizes again the critical importance of the ALMA Development Program to the long-term scientific health of the observatory. The committee was pleased to hear the steps made toward the implementation of the Development Program. **The ASAC acknowledges the progress made in the constitution of the ALMA Development Steering Committee (ADSC), and stresses its critical importance for the coherent implementation of the ALMA Development Program.** The ASAC was pleased to see a draft of the Terms of Reference (ToR) governing the ADSC and to hear that the membership of this committee has been specified. **We were also pleased to see that the ADSC ToR includes a non-voting membership of an ASAC member, and we are looking forward to providing scientific advice to the ADSC.** To this end, ASAC has established a small "focus group" of three ASAC members, one from each region, who will assist the ASAC representative on the ADSC. As described in the ToR, the ASAC chair will be responsible for nominating the representative to the ADSC. The additional regional representatives in the focus group will be chosen by consensus within the ASAC.

The ASAC heard reports on the current status and planned activities of the ALMA Development Program from the three regions. The ASAC was pleased to see that all the Executives have already issued a call for proposals, which is a key milestone toward a coherent ALMA Development Program.

The EU Development Program

Wolfgang Wild presented the status of the EU Development Program. The program is in a very advanced stage with six studies already underway, and three of them, including Band 5 pre-production, are near completion.

The NA Development Program

Al Wooten presented the status of the NA Development Program. The call for Studies was issued at the end of the year and the selection process by an external review committee is underway. There was an excellent response from the community with 21 proposals submitted covering a wide range of topics and involving groups from the three Executives. It is expected that the selected studies will be finalized by the end of this year.

The EA Development Program

Masao Saito presented the status of the EA Development Program. The EASAC endorsed the implementation of six studies with different priorities, including Band 1 development and pre-production plan, initial study of Band 11, and the VLBI capabilities. Band 1 with the collaboration of partners from NA and Chile is considered to be the highest priority. The propose timeline aims to pass the Preliminary Design Review in summer next year.

The ASAC also notes the proposed change of the frequency range for Band 1, from 31.3-45 GHz to 35-50 GHz. The original frequency range was defined roughly 12 years ago, but it was not carefully determined from either a scientific or technological point of view. The original specification is also challenging because Band 1 cartridge needs to use a lens that will add substantial amount of noise. The original frequency range is also observable by the Jansky VLA (JVLA), but this newly proposed frequency range for ALMA Band 1 will cover frequencies higher than 45 GHz where the antenna efficiency of JVLA degrades significantly. Therefore, the proposed change of Band 1 frequency range will make the ALMA and JVLA more complementary to each other and will expand the overall science capabilities around this frequency range. The ASAC endorses this change from the scientific point of view.

The ASAC acknowledges the progress made by all executives toward selecting and funding design studies for enhancing the scientific capabilities of ALMA. **ASAC recommends that the design studies should be phased between Executives to provide project designs at similar levels of maturity. We feel that at this stage most of the studies are in very early phases of development, and thus it is premature for the ASAC to consider specific priorities.**

The ASAC revisited our discussion of the possibility and implementation of guaranteed time in exchange for development initiatives. While we find that the existence of such a system is in the best long-term interest of the observatory, we also find that the implementation as described in the “Principles for ALMA Development” document is lacking in specific important details. The ASAC recommends that the principle of “science first” should not be compromised. Specifically, any guaranteed time science must be assessed within the ARPs in

an identical way to standard proposals. We further recommend that guaranteed time projects not be permitted to “block off” specific targets of interest, and that a maximal amount of guaranteed time per contributing group be defined. As groups from around the world consider participating in the Development Program, it is imperative that the policy on this issue be clearly and publicly articulated. **To this end, we recommend that a “Development Implementation Plan” be drafted and communicated as soon as possible.**

The ASAC was informed about the budget of the Development Program for 2012-2016. ASAC feels that the level of resources for the next five years should allow the ALMA Project to establish an “ambitious” coherent ALMA development program bringing a significant enhancement of the ALMA scientific capabilities.

The ASAC discussed the projects identified by the Board to be developed into specific proposals: the optical fiber connection OSF-CALAMA, the full production of Band 5 cartridges, and VLBI capabilities. These three projects are considered to be at different stages of development/maturity. However, the ASAC supports the investment in these programs, and endorses the plan to pursue these initiatives as high priority.

Optical Fiber connection OSF-CALAMA

The proposed connection will have an important impact on improving the transfer of the data between the OSF and the JAO with the potential to increase the efficiency of data processing. **ASAC considers this project to be suitable for development toward an implementation plan.**

Full set of Band 5 cartridges

The ASAC received a presentation from Robert Laing on the status of Band 5 development and a plan for its full production. The design, development, and preproduction of 6 receivers has already been funded by the EC FP6 Program. All the cartridges fulfill the ALMA specifications, four of them have been integrated in ALMA frontends, and one has been delivered to the AOS. Following the original scientific cases for ALMA Band 5 now enhanced by the potential of detecting the main cooling line of the ISM (C+) at very high redshift (6-15) and previous ASAC recommendations, there is a strong sentiment on the ASAC that this project should be given a high priority. ASAC discussed the proposed plan for the full production of Band 5. The production plan involves the expertise and the production/testing facilities of several key groups that have already finished/are now finishing their contribution to the ALMA construction, and it is critical for them to have new projects defined as soon as possible. **ASAC considers the Band 5 production plan robust and very timely and recommends to be developed into a detailed proposal for its implementation.**

VLBI capabilities

ASAC notes that the implementation of VLBI capabilities is a common element in the Development Program of the EU, NA, and EA Executives. In our previous face-to-face meeting ASAC discussed in detail the proposal presented by Shep Doeleman (MIT) on a possible VLBI upgrade. We stress again that the VLBI upgrade is scientifically compelling and should be considered also as high priority. However, in order to proceed, a full and realistic impact study needs to be carried out in order to define the details of the collaboration between the Executives and with ALMA. There will be necessarily demands on the ALMA staff, both at the JAO and in the regional centers, and especially in the correlator and software areas. These demands seem to us to be ill defined at this stage, and likely underestimated. Also, the needs for the commissioning of this observing mode must be properly assessed – e.g., amount of time, associated “down time” on the array, status of/rights on the data. **The ASAC strongly recommends again that the VLBI proposal be merged into a standard framework established by the ADSC, and proceed through the “standard” path for potential development projects. ASAC also stresses again that on the longer term, the model of future ALMA VLBI operations needs to be defined.**

II.4) Charge 4

As a standing charge, ASAC is invited to comment on the response from the project to previous ASAC recommendations.

The ASAC remains committed to and unanimously supports an in-depth evaluation and costing of efforts to increase the efficiency of power generation at the ALMA site. To this end, the ASAC is very happy to see that the project is taking steps to arrive at a detailed costing including projected savings of adding combined cycle capability to the power generators. Furthermore, we were pleased to hear at the Face-to-Face that Lewis Ball has begun the process of constituting a working group to investigate potential energy alternatives. We endorse the timeline presented to the ASAC with the goal of a report being provided to the ALMA Board in April 2013, allowing this committee a full year to carry out its investigations. However, we encourage this working group to begin their activities as soon as possible, so as not to delay this process any further. The ASAC stands ready to assist this process wherever appropriate.

II.5) Charge 5 – Ad hoc: Evolving Role of the ASAC

The ASAC would like to review and assess the role and effectiveness of this committee given the rapidly changing nature of the ALMA project.

The ASAC currently serves as the primary channel for external scientific input into the ALMA project. Over the last year, as the ALMA project has begun the transition from construction to operations, unanimous consensus of the committee members is that the role of the ASAC may be similarly evolving. In particular, the timescales involved in the decision-making process are often shorter than the “standard” ASAC timescales of monthly telecons and bi-annual face-to-face meetings. Since the Science IPT is no longer functioning as a body to provide the project with quick-turnaround scientific feedback, ASAC can provide such input whenever the project sees a need for this.

In order to provide well-thought out scientific advice, we have found that in many cases we have not had sufficient time to consider and debate the benefits and drawbacks of a specific course of action (e.g. the ASAC had 24 hours to consider the proposal to extend the Cycle 0 timeline by five months). On the opposite side, we also recognize that if we are provided information too early, it may well become outdated before the ASAC’s recommendation is formally solicited.

A complicating issue is that the ASAC Terms of Reference make it clear that ASAC formally communicates through the Board, while in practice ASAC's main communication has been with the JAO. While it is clear that the ASAC and the JAO need to have an on-going and open dialog, the current scenario often requires the JAO to translate ASAC’s advice to the Board, and the Board’s position to the ASAC.

The ASAC discussed these issues at some length during this face-to-face meeting, and we came to the following recommendations:

- The ASAC would like to become significantly more proactive in its role. In particular, the committee would like to schedule either pre- or post-telecons after the standard monthly telecons in order to discuss any issues that arise in greater depth. The committee also made a commitment to providing timely and complete feedback to queries from the JAO that occur between standard telecons and/or meetings.
- The ASAC would like to have a more direct line of communication with the Board, both to avoid delays in information transfer as well as possible miscommunications. While we are sensitive to the role of the ASAC being limited to scientific advice, we recommend that an ASAC member (chair or vice-chair if chair is unavailable) be invited to participate in parts of the Board telecons when ASAC-appropriate issues are to be discussed.