



# ALMA BOARD

ALMA EDM Document	AEDM 2011-099-O
Distribution	<b>Ordinary Session</b>

**Subject:** ALMA Science Advisory Committee Report

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**Purpose of Document:** To provide the Board with the ASAC report following the October 5<sup>th</sup>-6<sup>th</sup> face-to-face meeting of the committee in Charlottesville

**Status:** For information at the November 15<sup>th</sup>-17<sup>th</sup> meeting

# **Report from the ALMA Scientific Advisory Committee Face-to-Face meeting, Charlottesville Oct. 5<sup>th</sup> & 6<sup>th</sup> 2011**

Membership of the ALMA Scientific Advisory Committee

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## **Executive summary**

The ASAC congratulates the Project on the start of Cycle 0 observations, an obvious major milestone for the observatory. This executive summary lists for each ASAC Charge the main points that are discussed in this report.

### **Charge 1 (Cycle 0)**

- There are still some risks for the observations of Cycle 0 projects. There is in particular an urgent need to observe a Band 9 Science Verification project.
- The ASAC urges the Project to define a clear plan for data reduction, including the definition of QA2, the role of the DSO and the ARCs, and the mechanisms to deliver data to the PIs.
- The ASAC strongly encourages the Project to invoke the “best efforts” aspect of Cycle 0 whenever necessary.

### **Charge 2 (Call for Proposals)**

- We discuss in turn the different aspects of the Proposal Review Process and suggest a number of improvements.
- The ASAC disagrees with the JAO’s plans to restrict, for Cycle 1, the Technical Assessment (TA) to accepted projects only. The ASAC feels that the TA should take place after triage, as in Cycle 0, but that its scope and role must be better defined.
- The ASAC suggests that the communication of the PRP mechanisms and results to the community be clarified.

### **Charge 3 (Progress towards Full Operations)**

- The ASAC is impressed by the Project’s progress, even if we are still worried by the very tight schedule leading to full operations, and the absence of any margin.
- The ASAC stresses the need to update the operation/maintenance plan.
- The ASAC recommends special attention be paid to the science time of the JAO staff.

### **Charge 4 (Plans for Cycle 1)**

- The ASAC endorses the JAO proposed timeline as well as the “best efforts” approach.

- The ASAC endorses the Cycle 1 main capabilities (32 antennas, 750 m baselines) and considers this array to be scientifically extremely appealing.
- The ASAC recommends that any new capability be validated by Science Verification projects before being proposed to the community. The ACA and polarimetry observing modes certainly deserve special attention.

**Charge 5 (Development plan)**

- The ASAC was pleased to see progress in defining the ALMA development plan. The ASAC urges the Project to implement the ADSC as soon as possible.
- The mechanisms to allocate Guaranteed Time must still be defined.
- A number of aspects of the VLBI proposal and its impact on ALMA construction must be clarified.
- On a longer timescale, a VLBI operations model must be defined.

**Charge 6 (Community expectations)**

- The community's satisfaction with the ALMA Cycle 0 process seems to be very high in all regions.
- The fact that all three ARCs made significant efforts in organizing tutorials and community days has been very much appreciated and is certainly a major factor in explaining the very high number of proposal submissions.

## **Introduction**

The ASAC met at NRAO headquarters in Charlottesville on October 5<sup>th</sup> and 6<sup>th</sup> 2011, only a few days after the official start of Cycle 0 observations. One of the very first (confidential) images obtained during those observations was presented to the committee, demonstrating the quality of the data and the excellent support provided by the JAO and the ARCs. The start of Early Science observations is an obvious major milestone in the ALMA construction, and the ASAC congratulates the Project for that achievement, which testifies to the excellent work and dedication of the ALMA staff all over the globe. The ASAC is fully confident the Project is making appropriate progress toward the delivery of a superb facility matching the high expectations of the astronomical community.

The ASAC would like to thank NRAO and the NAASC for the perfect organization of this meeting, as well as all the ALMA staff who presented material and/or attended the meeting. The committee unanimously agrees that the policy of holding alternate face-to-face meetings in Chile and at the regional science centers (Europe in 2012) is important to continue, as it provides a simple but very efficient way to keep a close contact with all major actors of the ALMA project.

The ASAC was given six charges by the ALMA Board, which are discussed in turn in this document. Charges 1, 2, 4, and to some extent 6, relate to the details of the proposal review process in Cycle 0 and Cycle 1+. To minimize repetition in our report and give this subject the focused attention it deserves, we are providing feedback on the proposal review process in a single unified response (see Charge 2).

**Charge 1 – The Committee is requested to review and comment on the progress of Early Science Cycle 0. This should include: progress with Commissioning and Science Verification; the outcomes of the Call for Proposals and the ALMA Review Process; the delivery of the scientific capabilities offered for Cycle 0; the performance of the ALMA hardware and software in the first stages of Cycle 0; and the performance of the JAO Department of Science Operations and the operation of the ALMA Regional Centers. [Note: The Board recognizes that Cycle 0 observations will have been underway for at most a week at the time of the face-to-face meeting of ASAC which may limit the ability of the Committee to address some elements of charges 1 and 2.]**

### *1.1 Commissioning and Science Verification*

Since the last ASAC meeting, the activities of the Commissioning and Science Verification (CSV) team were focused on improving the reliability and the calibration of the scientific capabilities offered for Early Science. Progress has been slowed down due to bad weather during the last months. Still, the CSV group has successfully delivered the scientific capabilities for Early Science Cycle 0 observations, and the ASAC congratulates the team for that important achievement.

The ASAC was also pleased to see the progress with the Science Verification observations, several very nice results having been released. The committee, however, notes with concern the **lack of Science Verification data for Band 9 and urges the Project to perform such observations as soon as possible**. To demonstrate ALMA's unique capabilities, it is important these data be made public. We therefore recommend observing a project from the list of Science Verification programs rather than a well-suited project approved for Cycle 0, as was suggested, as the data would be proprietary in the latter case. The ASAC also recommends that great care be taken in the selection of future SV projects from the list defined in early 2011, in the case of a conflict with an approved Cycle 0 project.

The ASAC insists again on the importance of **publishing as soon as possible an “ALMA works” paper** presenting the basic concepts and functionalities of the instrument and the first Science Verification results.

### *1.2 Cycle 0 observations*

The ASAC is very pleased with the smooth transition from CSV-only activities to the combined CSV activities and Cycle 0 operations carried out by the Department of Science Operations (DSO). The ASAC received presentations on the outcome of the Call for proposals and the status of Early Science Cycle 0. The ASAC acknowledges the outstanding response of the community to the Cycle 0 call for proposals, both in number and quality, as well as the project's efficient review of all submitted proposals. We discuss in more detail the Proposal Review Process in our response to Charge 2.

The ASAC is pleased that Early Science Cycle 0 observations have started on September 30th as scheduled, and that the ALMA project has delivered basically all the baseline scientific capabilities announced in the Cycle 0 Call for Proposals. The ASAC recognizes Early Science Cycle 0 as a major milestone in the project towards ALMA full operations and

congratulates the ALMA Project and the CSV and the DSO teams for their achievements. The ARCs should also be commended for the excellent community outreach and support in the proposal preparation phase.

The ASAC realizes that there are potential risks, which may imply that a significant number of high priority Cycle 0 projects will not be completed. In particular, **the revised array configuration schedule will have a major impact on the feasibility of Band 9 projects in extended configuration**, both because of adverse weather conditions and restrictions on the RA observable range. Other issues that the ASAC has identified at the early phases of the Cycle 0 observations, and recommends to mitigate, are the following:

- A somewhat low observing efficiency (33%) during the first Cycle 0 observations, due to large overheads and the number of antennas available for observations. The availability of antennas is expected to improve drastically if deliveries follow the plan. ASAC is concerned about the large overheads found in the early phases and recommends investigating their origin and implementing solutions to improve the observing efficiency.
- The long-standing issue of temporary power-supply reliability.

### *1.3 Cycle 0 & the community*

The ASAC finds that the procedure for scheduling successful projects is not clearly defined and **recommends that the DSO publicly clarify how Cycle 0 proposals are being scheduled.**

The ASAC notes the progress made by the DSO in the development of data processing and data quality assurance procedures. The ASAC however considers that the data processing for a substantial number of Cycle 0 proposals will be challenging for the DSO and the expertise in the ALMA Regional Centers will be required for their success. **The ASAC continues to be concerned about plans for the processing and quality assessment.** We had already in previous reports suggested that a reduced version of QA2 might be appropriate for Cycle 0, and we urge the Project to clearly define the scope of QA2 as well as the exact role and responsibility of the DSO and ARC teams, and the procedure to release the data to the PIs.

**As a global comment, the ASAC recommends that the ALMA Project properly manage community expectations by highlighting the “best efforts” nature of Early Science in Cycle 0.** The collective perception of the ASAC is that the spirit of this policy has become diluted within the community, and even in the Project. The ASAC recommends the Project should be empowered to invoke this “best efforts” policy whenever necessary to keep the appropriate balance between maximizing the efficiency of Cycle 0 observations and continuing on the route to full operations.

**Charge 2 – The Committee is particularly requested to consider whether there are “lessons learned” from the Call for Proposals and/or the start of Cycle 0, and if so, to provide recommendations to improve future cycles of ALMA operations. [Note: The Board recognizes that Cycle 0 observations will have been underway for at most a week at the time of the face-to-face meeting of ASAC which may limit the ability of the Committee to address some elements of charges 1 and 2.]**

ASAC charges 1, 2, 4, and 6 relate to the details of the proposal review process in Cycle 0 and future Cycles. To minimize repetition in our report, we are providing here feedback in a single unified response.

Three members of the ASAC were also science assessors in Cycle 0 ARPs, and one of them was on the APRC, which allowed the committee to have a thorough discussion of the Proposal Review Process. We thank the APRC chair, Neal Evans, who participated via video link in the ASAC meeting and provided a very useful summary of the Cycle 0 proposal review process. Overall, we wish to acknowledge the project's efficient review of the large number of submitted proposals. We discuss below in turn the various aspects of the PRP.

### *2.1 Call for Proposals*

The Call for Proposals clearly explained the technical capabilities, the “best efforts” philosophy, and the proposal review criteria for ALMA Cycle 0 observations. The Call however did not provide complete guidance on all points; some of this missing information (e.g., that break points would not be allowed in Cycle 0) was conveyed to proposers before the deadline via Helpdesk “knowledgebase” articles, although some (e.g., that program efficiency might be a reasonable consideration in assessing Cycle 0 proposals) was not. Important aspects on which the Call was silent because policies did not exist were limits on the number of sources and number of spectral setups per project.

### *2.2 Notices of Intent (NoIs)*

Although the ASAC expressed skepticism in our last report about the JAO's plan to solicit NoIs for Cycle 0 proposals, in hindsight it is clear that the large volume of responses was helpful in adjusting the JAO's expectations about proposal pressure. Repeating this exercise would probably be less useful for predicting the final number of Cycle 1 proposals than for predicting their scientific range (which may help the JAO identify new science assessors with relevant expertise). We therefore suggest that NoIs be solicited for Cycle 1 only if they ask each prospective proposer to check off one or more science keywords (not just one of the four broad science areas) describing his/her proposal. Another aspect that may be polled with the NoIs is whether proposers intend to use the ACA or not – this can help the Project to assess the pressure on the compact array (see discussion in Charge 4).

### *2.3 Observing Tool and proposal submission*

The ASAC is generally **pleased with the performance of the OT, and commends the hard work of the team responsible for developing it.** A few issues that caused problems for multiple proposers were promptly flagged by the project and will be corrected in time for

Cycle 1. Members of the operations team who supported the proposal submission process in the last month before the deadline also deserve praise. The crash of the server in Santiago in the last hour before the deadline was not anticipated, but the operations team responded quickly and gracefully with a one-hour extension (advertisement of which might have been somewhat better).

#### *2.4 Composition of review panels*

The ASAC feels that the quality of scientific assessment and community perceptions of its fairness will be best served if ARP membership is diverse in terms of science expertise, prior collaboration, and institutional affiliation, and reflects a balance of experience and a fresh perspective with respect to the ALMA proposal review. Based on these principles, we recommend that the number of assessors per panel be somewhat larger in future Cycles than it was in Cycle 0 (this will also stabilize triage decisions; see 2.5 below); that panels be shuffled from one proposal review to the next; that panel chairs and deputies be rotated between Cycles; and that assessors not serve for more than two consecutive Cycles. Recognizing that the JAO has already invited Cycle 0 science assessors to serve for a total of three Cycles, we suggest that some assessors might be invited to be off-duty during Cycle 1 or 2 and return in a future Cycle. This framework could be generalized to appointment of assessors for three years in a four- or five-year term (following the model of the European Research Council, in which grant review panelists are active in three alternating years over a six-year term). A panelist could still be called upon at short notice to serve as a remote assessor during his/her “off” year in the event of a larger than expected number of proposals. The ASAC endorses the JAO/APRC decision to publicly release the names of all Cycle 0 science assessors in a single undifferentiated list following the completion of the proposal review, and suggests adopting the same practice in future Cycles.

#### *2.5 Stage 1 of scientific review (triage)*

**The ASAC feels that triaging ~30% of the proposals is a reasonable compromise between minimizing unnecessary work and providing high-quality feedback** that will help build the community of ALMA users. We would prefer for more science assessors to grade each proposal during Stage 1, so that triage decisions are less susceptible to stochastic effects. Larger panels (see 2.4 above) would make this possible, as would the use of non-traveling “Stage 1 only” assessors. In any scenario, it is important that the assessors be required to submit a succinct comment that reflects the primary reason for the grade (even in the case of a poor grade). This will make it easier for primary reviewers to construct consensus comments, and eliminate the problem of triaged proposals that end up with little or even misleading feedback being conveyed to the PIs.

#### *2.6 Technical assessment*

The ASAC spent more time discussing technical assessment than any other aspect of the proposal review process. The committee was concerned by the absence of technical feedback given to the proposers, as well as by the report of at least two proposals wrongly rejected on a technical basis. In addition, the ASAC was informed that a number of highly ranked Cycle 0 proposals use a “snapshot” observing strategy that was not expressly forbidden by the Call for Proposals, but which leads to substantial overheads relative to OT-specific execution times. This “overhead bloat” threatens to impact the observatory's ability to complete its full complement of highly ranked programs during Cycle 0. **These findings lead to the general**



**comment that the scope and role of the technical assessment during the PRP must be more precisely defined in future cycles.**

The ASAC feels that complexity and efficiency issues should in principle have been taken into account during the proposal review (as these impact the cost side of an assessor's cost/benefit analysis). However, the ASAC was informed that technical assessors were discouraged from including comments to the science assessors about problems that did not rise to the “this program can't be done at all” level, leading to an unhealthy degree of self-censorship. **The ASAC considers this practice to be inefficient, and feels on the contrary that technical assessment should give valuable inputs to the science assessors, by indicating to them the exact cost of each project** (a cost that may be higher, but also lower than indicated in a proposal, if the proposers have not, e.g., selected the appropriate observing or correlator mode).

Looking ahead to Cycle 1, **the ASAC strongly disagrees with the JAO/APRC plan for technical assessment to be done only after science assessment and only for the most highly ranked proposals.** Technical feedback has two important audiences: the science assessors, who can incorporate it into their cost/benefit analyses, and the proposal PIs (especially if not traditional radio astronomers), who can learn from their mistakes. Depriving science assessors of any technical feedback will undermine the quality of their assessment, while restricting technical feedback to successful proposers will tend to give the most help to the members of the community who need it least. We note that other radio observatories perform technical assessments of all submitted proposals before their science assessments take place; for example, the unified EVLA/GBT/VLBA proposal review performs ~400 technical assessments per semester (i.e., ~800 per year), while three IRAM staff members perform ~750 technical assessments per year<sup>1</sup>. These numbers are not obviously off scale compared to the annual ALMA proposal load.

Refinement of the OT and deployment of version R8.1 of the control software may be able to eliminate some of the issues met in Cycle 0, e.g., the overhead bloat problems, but there are likely to be new complexities in Cycle 1 proposals (e.g., determining appropriate ACA integration times) that the OT will have trouble handling. Recognizing the JAO's concerns about workload, the ASAC makes the following recommendations for technical assessment in (at least) Cycles 1 and 2, when the capabilities of the array will still be evolving rapidly:

(a) The DSO should establish a distinction between a narrow “technical feasibility check”, whose scope can be limited so that it is not too time-consuming<sup>2</sup> and is focused on confirming a realistic execution time; and a more in-depth “technical assessment” that is appropriate for highly ranked proposals proceeding to the creation of scheduling blocks.

(b) Each proposal advancing to Stage 2 of the proposal review should be subject to a technical feasibility check before the ARPs meet. For each triaged proposal, the PI should be informed that a technical feasibility check was *not* done and given the opportunity to request one from an ARC staff member during a window before the release of the next Call for Proposals.

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<sup>1</sup> We thank Mark Claussen, Clemens Thum, and Jan Martin Winters for providing this information.

<sup>2</sup> Restriction of this check's scope might be facilitated by a standard "check all that apply" menu of options with which the technical assessors could structure their reports.

(c) Science assessors should be provided with all comments emerging from technical feasibility checks, although they should be instructed to treat them as not binding. PIs should also be provided with these comments.

(d) PIs of highly ranked proposals should be told that their proposals have been accepted “pending technical assessment” (similar language is used for HST proposals) and should have those proposals subjected to the in-depth version of the technical assessment.

For Cycle 3 and beyond, when the OT can be expected to have caught up with the increasingly stable capabilities of ALMA, and the user community will have had several cycles to gain experience in writing ALMA proposals, it may be safe to dispense with the initial round of feasibility checks. We note that HST performed technical feasibility checks on all proposals in early cycles, before switching to its current post-science-assessment model as its user base matured.

### *2.7 Stage 2 of scientific review (ARP and APRC meetings)*

The ASAC understands that inflexible software caused significant problems during the ARP and APRC meeting stages, but that CIPT has already received ample feedback on these problems. Cycle 0 experience has also revealed that **the transition from the ARP to the APRC review stage is a delicate one**. While the possibility of a one-day “intermediate merge” of the ranked lists for all proposals in a given science area by members of all of that area's ARPs (rather than just the relevant ARP chairs) is intriguing, the ASAC is concerned that this would defeat the purpose of having multiple panels from a conflict-of-interest standpoint. We encourage the DSO to use the Cycle 0 proposals to simulate an intermediate merge, and estimate what fraction of proposals would have triggered new conflicts of interest, before finalizing a decision here.

The ASAC views the Cycle 0 APRC's procedure for merging ARP ranked lists as a reasonable one, although in future Cycles with broader distributions in proposal execution time (and in particular, distributions that are likely to skew differently for different science areas), **the APRC should have the latitude to explore alternate merging strategies that may better optimize the observatory's science impact**.

### *2.8 Feedback to proposers*

The ASAC notes the JAO/APRC decision to provide proposers with more detailed information about how their proposals ranked than could be conveyed with an A/B/C/D grade alone. Indicating a percentile bracket is indeed more informative (and in many cases, more encouraging) than only assigning a low and identical grade to the vast majority of proposers. **Providing two percentile brackets, on the other hand, seems to have confused many members of the community, leaving them with the impression that ALMA proposals were reviewed by regional PRCs**. The Project certainly overestimated the community's understanding of the mechanisms and subtleties of the ALMA proposal review process. The ASAC therefore recommends the Call for Proposal should include a more detailed description of the overall time allocation process and the principles leading to the definition and execution of regional queues. It is important the community understand these mechanisms in order to maintain its confidence in the review fairness.

**In addition, the ASAC recommends that the actual message sent to the proposers be very carefully defined, as it represents a very important communication channel with the community.** The ASAC discussed the pros and cons of including one single percentile bracket instead of two, as well as the need to take into account large proposals (with co-PIs from different regions) in Cycles >1. In the end, the ASAC concluded that the key information to be conveyed to a proposing team depends on a project's status: relative ranking compared to other projects if a proposal is rejected; odds of getting actual observing time if a proposal is successful.

The ASAC notes a few inconsistencies in the JAO's communications with Cycle 0 proposers, which should be avoided in future Cycles. The Call for Proposals specified that each proposal would receive an A/B/C/D grade, which the post-review emails might have included (alongside the helpful percentile brackets) but did not. The Call also explicitly mentioned that abstracts of accepted projects would be made public only after the completion of the programs, a policy that has been changed by the post-review email. The project's "Outcome of the Proposal Review Process" news item misleadingly reports that all proposals were technically assessed, which is not true (the ~30% triaged proposals were not). **The ASAC recommends those– and other similar– policies be very clearly defined in subsequent Calls for Proposals and followed by the PRP.**

### *2.9 Possible biases*

The ASAC discussed concerns raised at the regional level that the scientific assessment of Cycle 0 proposals might have been biased (a) by the JAO's sensible appointment of many assessors with strong interferometric experience, which may have produced somewhat incestuous review panels, and/or (b) against JAO and ARC staff members, for whatever reason. We judge that there is no evidence of either bias, and that indeed (quoting the APRC chair) "affiliations were checked at the door." Any residual community perception of (a) can be minimized by the steps suggested in 2.4 above. With respect to (b), the ASAC has asked the JAO to investigate whether proposals Pled by JAO and ARC staff had a lower than average success rate; if they did, we suspect the most likely explanations are the high functional load borne by ALMA staff, and perhaps their greater realism about Cycle 0 capabilities relative to proposers who sketched out less practical but more enticing science.

**Charge 3 – ASAC will receive updates on matters related to the completion of the full construction program of ALMA, including schedule, budget and the build-up of operational capabilities. ASAC is requested to comment on these topics inasmuch as they relate to the scientific capabilities, and bring any recommendations or concerns to the attention of the Board.**

The ASAC received presentations on the status of ALMA Construction, on the progress and status of Commissioning and Science Verification, on ALMA software (primarily on the data archive and related archive queries), and on the Operations and Maintenance plans. The ALMA Project should be congratulated for the significant progress made in the past months. The ASAC is fully confident the Project is making appropriate progress toward the delivery of a superb facility matching the high expectations of the astronomical community.

The ASAC also recognizes the excellent, though very recent, hirings to lead positions in the JAO. The new project manager, Gary Parks, gave a preliminary analysis of Construction priorities by video presentation. His views on controlling the schedule, budget/cost, and quality assurance are steps in the right direction, and the ASAC looks forward to hearing the final results of his study in the next ASAC meeting.

**The ASAC was pleased to see the progress in archive related hardware, testing, and even more in developing flexible archive queries tools.** This committee had flagged this last topic in several previous reports and was very pleased by recent progress, although we stress the need for a rapid deployment at the OSF (and, if possible, in some form to prospective Cycle 1 proposers). However, the ASAC also notes that in the week previous to our face-to-face meeting, both the ANASAC and the ESAC had their independent meetings and received radically different presentations on the status of the archive, which suggests a significant communication breakdown. While the ASAC absolutely understands the complex nature of this large international project, this very complexity necessitates the need for all partners to have a clear and up-to-date understanding of the project status.

#### *Main concerns*

Several problems, clearly identified by the ALMA team, do exist, and it seems that most of them are currently being addressed by the ALMA staff in an appropriate way. The main concerns, brought up by the ALMA staff, and echoed by the ASAC are:

(a) The risk of schedule slippage: at this point, the critical component appears to be the antenna production rate. The ASAC is concerned that the current schedule and budget is based on the assumption that the production rate of antennas is a steadily rising curve until completion in 2013. In the best case – i.e., this prediction turns out to be true – some extra planning is required to boost AIV activities to match the increased production rate, and to terminate all partial AIV acceptances. We also note with concerns that the CSV staff level will start to decrease as early as 2012.

(b) There has been a delay in bringing online the permanent power supply: clearly this is a complex issue and the ALMA team is working hard on meeting the current deadline. While the ASAC heard about the timeline for bringing online the permanent power supply, there was no sign that any study on power saving measures (in terms of both generation and consumption) had been conducted.

(c) The lack of well-defined operations and maintenance plans, and their impact on the operations budget. Michael Thorburn gave the ASAC a preliminary presentation on these points, and the ASAC looks forward to hearing about the final results of his study at its next meeting. **This aspect is especially important in view of its impact on the operations budget, which may have to suffer further cutbacks, and thus on the scientific efficiency of the array.**

(d) The delays caused by the recovery time after snow storms this winter (July-August). Given that such storms are not uncommon at the ALMA site, and that significant delays could be caused by relatively small issues such as access to electrical cabinets buried in the snow, it is highly recommended that some immediate winterizing of critical elements is carried out, for example, building of snow barriers/fences, elevation of critical electrical equipment, construction of drainage run-offs, and the acquisition of mechanized snow removing equipment. As mentioned by the Project Scientist, snow-proofing the full system would be a big undertaking. A study to identify the most critical components should be made, and the feasibility of using ALMA development money to commence the snow-proofing of these most critical components could be looked into.

#### *ALMA events*

The JAO plan to untie the ALMA inauguration from the 50-antenna level, for logistic ease, is supported. A date close to the first quarter of 2013 appears reasonable, though aiming for a non-winter and non-Bolivian-winter date is recommended.

The ASAC also supports the JAO's plans to organize a scientific workshop in Chile on ALMA Early Science results, and strongly favors that option over each Executive's organizing a regional meeting. We do not consider it necessary to tie this meeting to the ALMA inauguration and therefore suggest selecting a date towards the end of 2012. Also, we suggest a Scientific Organizing Committee be set up as soon as possible.

#### *Science time of JAO staff*

The ASAC considers it important that the on-site and Santiago ALMA astronomical staff maintain a strong scientific program if they so wish. This is critical to maintain a high motivation in the staff and the attractiveness of future positions in Chile. Several avenues could be considered including, but not limited to, a) periods of science leave in astronomical institutes in the ALMA community; b) more face-to-face time of Santiago-based staff with the general user community, e.g. at CASA or OT workshops, which can encourage inclusion of these staff as co-Is on community proposals; c) strong encouragement for JAO staff to analyze and publish SV datasets (following their public release), where their familiarity with the data products would put them in a strong competitive position.

**Charge 4 – ASAC will be provided with an update of the implementation plan of the ALMA Proposal Review Process for full scientific operations, and an early outline of plans for Cycle 1 observing. The Committee is requested to comment on these topics and bring any recommendations or concerns to the attention of the Board.**

The ASAC was presented the plans for Cycle 1, both in terms of operations and capabilities offered to the community. As noted above, we do not discuss here the Proposal Review Process – see our response to Charge 2.

The ASAC endorses the JAO plan to double the time offered to the community as compared to Cycle 0, as well as the timeline leading to a submission deadline end of March 2012, and the idea to move immediately to a one-year cycle period (next deadline in March 2013). An annual deadline that is close to, but not identical to, ESO and NOAO semester deadlines should actually enhance prospects for multi-wavelength observing programs.

When discussing the capabilities to be offered to the community for Cycle 1, the ASAC was concerned that the JAO plans may be too ambitious. The ASAC recommends that the “best efforts” philosophy from Cycle 0 be continued through Cycle 1, and that the Project should focus on offering a limited suite of well tested observing modes rather than a longer list of less characterized capabilities. As a consequence, we agree with the proposed policy that highly rated Cycle 1 projects not observed in Cycle 1 should not be transferred to Cycle 2.

#### *Cycle 1 capabilities*

The ASAC concurs with the main Cycle 1 capabilities, as proposed by the Project, i.e., 32 antennas, four baseline receiver bands, same correlator modes as in Cycle 1 (with increased flexibility). There is little doubt that Cycle 1 ALMA will already be a fantastic instrument leading to new, exciting scientific results.

- The goal to have 32 antennas offered for Cycle 1 seems both realistic and scientifically extremely appealing. ALMA Cycle 1 would already be the largest ever aperture synthesis array, operating more antennas than the VLA.
- Maximum baselines: 750 m was perceived as an excellent trade-off between scientific output and operational complexity. Larger baselines (1.5 km) can be considered as a second goal. The ASAC notes that the plan to have a continuous reconfiguration scheme may not be well-matched for Cycle 1, as the difference in terms of maximal baselines between the most compact and most extended configurations is not so high. As a consequence, the projects' distribution as a function of baseline length may very well end up being double-peaked rather than flat, implying in turn a configuration scheme closer to the Cycle 0 operations. The ASAC suggests preparing for different reconfiguration scenarios and making final choices when the Cycle 1 projects have been selected.
- ACA & Single-dish observations: the ASAC considers these new capabilities as very important to drastically improve the image quality provided by ALMA. **The ASAC urges the Project to study as soon as possible –with a Science Verification project and imaging simulations– the observing and processing techniques needed to optimally**

**combine the data from the main and compact arrays.** While this has already been done with other instruments, the combination of two such datasets is not a straightforward process, as many parameters must still be adjusted. Most notably, the relative integration time between ALMA and the ACA remains to be defined. A ratio of 1:1, although simple from a scheduling point of view, may very well not be optimal, a longer integration time with ACA being necessary to match the main array sensitivity. This in turn impacts the number of projects that can be accepted for the ACA (see our suggestion to have the NoIs ask proposers whether they intend to use the ACA or not). **The ASAC considers that, for Cycle 1, the ACA:ALMA relative integration time should be a fixed parameter but urges the Project to determine this value with care to optimize the scientific output of the instrument.**

Other capabilities or observing modes are also proposed by the JAO and have been discussed by the ASAC. **The ASAC proposes as a general principle that any qualitatively new capability be thoroughly tested with an SV-like project before being offered to proposers.** This especially includes:

- Band 4 or 8. The ASAC suggests that the limited number of cartridges should be installed on the ACA, in order to provide the compact configuration required for commissioning and possibly scientific observations.
- Solar observations.
- **Polarimetry. This is a very complex observing mode and even the basic goal of offering it for continuum/single field observations looks ambitious at this point.** A SV project (the ASAC suggests Orion A as a target) should be used to determine what (if anything) should be offered in Cycle 1.
- Single dish continuum observations (fast-scanning). This is technically very challenging, and the ASAC suggests assigning it a rather low priority.

**Charge 5 – A set of draft principles which will govern the ALMA Development process will be provided to ASAC. In addition, the Executives will provide reports on initiatives taken in the regions to identify possible development projects that may be pursued within the program, and may report on progress of initial scoping and or design studies. The Committee is requested to comment on these topics and particularly to consider and report on priorities for ALMA development projects.**

The ASAC recognizes the critical importance of the ALMA Development Program to the long-term scientific health of the observatory. The committee heard reports from each of the Executives on their current and planned activities. However, while a number of activities are underway, we generally find the progress on the design studies is still not sufficiently mature – consequently, we do not feel it is currently appropriate to consider specific priorities.

As in our previous report, we concur that future development should be driven by enhancing the scientific productivity of the observatory (either through direct enhancements to capabilities or indirectly through cost savings and efficiency), and we stress that in many cases these increases in productivity may come from improvements to *infrastructure*. Specific improvements to infrastructure that have been discussed by the ASAC include targeted “winterizing” of key hardware components at the AOS and implementing more cost-effective energy production methods.

The ASAC was pleased to review the Board-approved “Principles for ALMA Development Program” document. The ASAC supports the general framework described in that document; however there are specific issues that we would like to bring to the Board's attention. First, **we are concerned with the overall slow progress implementing the Development Program**, which could foster frustration and negative feelings in the community, result in redirection of funds, and of course delay important upgrades. Several key groups 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. We also wish to stress that the constitution of the ALMA Development Steering Committee (ADSC) is critically important, and should be made with the utmost care and consideration. We find that the relationship between the ASAC and the ADSC is not well defined in the current document and needs to be formally clarified. We suggest that the ADSC include a technically minded ASAC member ex officio.

The ASAC discussed 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.**



## *VLBI upgrade*

The ASAC received a presentation from Shep Doeleman on a possible VLBI upgrade by a international consortium led by the MIT. There is a strong sentiment on the ASAC that this project is scientifically compelling and should be given a 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 ALMA and that consortium for the construction and deployment of this equipment. 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 suggests that these aspects and other VLBI-related policies be spell out in a Memorandum of Understanding between the JAO and the proposing team.

**The ASAC strongly recommends that the VLBI proposal be merged into a standard framework established by the ADSC, and proceed through the (as yet undefined) “standard” path for potential development projects.**

On the longer term, the **model of future ALMA VLBI operations remains to be defined.** This observing mode is drastically different from normal ALMA operations, which raises several questions that must be properly addressed. This includes, e.g., the following points.

- How the VLBI proposals will be selected and scheduled, considering that this must be coordinated with other facilities.
- The need for specific VLBI sessions implies that, in practice, VLBI proposals will have a different scheduling queue compared to normal proposals.
- The VLBI data correlation will not be performed by ALMA, hence raising the question of the commitment (wrt ALMA and the community) from the groups performing that action.
- Data reduction software and the support/commitment provided by ALMA to the users must be carefully studied

**Charge 6 – ASAC is requested to report on the astronomy community’s expectations of and satisfaction with Early Science Cycle 0, and more generally on ALMA’s interactions with and provision of information resources for the general community.**

Our response to the Charge 2 on the Proposal Review Process reflects inputs from the broader astronomical community. Here we provide additional feedback from each regional partner.

*6.1 East Asia*

The proposal submission process in Cycle 0 went smoothly in the East Asian region. This can be viewed as a natural outcome of the elaborate preparations for user training and user support by the EA ARC. Despite the difficult situation in Japan after the earthquake disaster in March, the EA ARC held seven tutorials on the OT in May and June for the user community, providing good opportunities to prepare proposals and to master use of the OT. Community soundings by the EA ARC and EASAC after proposal submission have shown that most proposers are satisfied with the usability of the OT and the ease of submitting proposals to the archive.

According to the EA ARC, there were only a few complaints about the response from the science panel to proposers. Some unsuccessful proposers, however, expressed a desire to hear more detailed information about (i) points to be improved for resubmission in a future Cycle, and (ii) specific weaknesses relative to successful programs with similar scientific scopes.

Community interest in ALMA seems to have deepened greatly after the Cycle 0 proposal review, partly because there are several non-radio (optical/infrared/X-ray) astronomers who successfully obtained observing time with highest priority. The ALMA session held on September 19th in the fall meeting of the Astronomical Society of Japan, for example, was packed full with nearly 200 attendees. In this session, both the results of the Cycle 0 proposal review and prospective capabilities in Cycle 1 were announced. A majority of potential users clearly expressed their preference that a significant fraction of observing time in Cycle 1 should be devoted to programs with small or medium sizes, in order to enlarge the number of “real” users. This approach is consistent with the JAO's plan not to schedule any large programs in Cycle 1.

*6.2 Europe*

Over the past two years ESO has coordinated a series of ALMA science synergy meetings. A goal of the meetings was to broaden the ALMA user base by showing how ALMA observations complement and enhance data from other major facilities, such as Herschel, future ELTs, and the VLT interferometer. These meetings have been well attended, with 100-200 participants per conference.

At a more “working level” the European ARC and ARC-nodes coordinated many tutorial meetings in 2010 and 2011 for preparing the community for Cycle 0. The list taken from the EU ALMA web page at ESO includes more than 20 events, all over Europe. The community resonance on these meetings has been very positive, and ESAC has commended the ARC and ARC-nodes on an outstanding job in informing the ESO community about the opportunities

of ALMA Early Science and to prepare them adequately to write good observing proposals. That the community was well-informed and ready for the start of Cycle 0 is evident from the large number of proposals submitted from the European region.

The ESAC has heard mostly positive feedback from the community on the Cycle 0 process. In particular, there is positive feedback on the OT functionality and user-friendliness. The ARC and nodes experienced very few problems prior to the proposal deadline, and there were very few Helpdesk tickets issued in the days immediately before the deadline. The ESAC is pleased with how well the ARC-ARC-node information exchange has worked. This system has turned out to be an extremely efficient way to get all necessary information about ALMA out to the community, since the users could turn to multiple sources when they had questions about ALMA Cycle 0 capabilities, the proposal submission process, or use of the OT. There is an undocumented feeling that many scientists new to radio interferometry felt very at ease turning to their “local” nodes for initial support.

Regular meetings and telecons amongst the ARC and the nodes and a dedicated 3-day retreat for all people involved in the European ARC network have been invaluable for optimizing this information exchange. The ESAC strongly urges ESO to continue to support such retreats on a regular basis in the future.

### *6.3 North America*

In the months leading up to the Cycle 0 deadline, the main mode of communication between the NAASC and the community was a series of 23 “Community Day Events” in the U.S. and Canada (3 at the NAASC itself, 4 in association with conferences, and 16 at institutions that provided some of the speakers and logistical support). These CDEs were a tremendous success, reaching over 800 astronomers in total (many not traditional radio astronomers) and improving the community's understanding of how to use the OT and CASA simdata tool. Feedback from participants was almost uniformly positive (e.g., “I have been involved in many such sessions for Spitzer, and I have attended a number of the Herschel data workshops, and I would rank this week's ALMA workshop among the best that I have seen”). The ANASAC has asked the NAASC to compare its list of CDE participants with the final list of ALMA proposers (successful and otherwise) in order to provide an additional metric of impact, noting as well that for Cycle 1, the best way to advertise ALMA may be to ensure the prompt release of high-quality Cycle 0 data.

The ANASAC also strongly supports the NAASC's plan to ask each successful U.S.-based proposal PI how (s)he plans to support the analysis and publication of the relevant Cycle 0 data, as the “double jeopardy” imposed by the need to write separate proposals for observing time and grant funding remains a significant concern in the U.S. community.

**Charge 7 – As a standing charge, ASAC is invited to comment on the response from the project to previous ASAC recommendations.**

The ASAC is generally satisfied with the response from the project to our previous report. However, there are a few key points that we wish to reiterate (several of them have already been discussed in our responses to the other charges).

First, we find that the **current sample of southern calibration sources remains insufficient**. In particular, we note that a preliminary list of potential calibration sources has already been assembled by experts within the project and made available to the JAO, but has not yet been implemented into the OT database and thus is not being used in Cycle 0 Phase 2.

In our previous report, we also recommended that clear guidelines for the technical assessment be produced along with an explanation of what is expected in the technical justification and how the technical assessment will be used in the proposal review. The ASAC hasn't seen a clear description of how the TA is/should be implemented. We have discussed that point in our response to Charge 2.

Finally, we wish to restate that the ASAC remains committed to our previous recommendations regarding **increasing the efficiency of power generation for ALMA**. In our previous report(s) we recommended that a working group be established to investigate potential energy alternatives, which was subsequently approved by the ALMA Board. To our knowledge, there has not yet been any action on this issue. In order to have maximal cost-savings impact, potential solutions related to power generation need to be identified, evaluated, and costed as soon as possible.