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ASAC Report to the ALMA Board

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ASCA membership and Face-to-Face meeting

ASAC membership had some changes; Prof. Karin Öberg came in and Dr. John Carpenter and Dr. R. Plambeck left.

ASAC Face-to-Face meeting was held at NAOJ, Mitaka, Japan on October 21st and 22nd, 2015 with all the ASAC members, except for R. Osten and R. Moreno. S. Casassus attended the meeting remotely. In addition, we had JAO Director, Deputy Director, and Observatory Scientist, and also three regional Project Scientists (L. Testi attended the meeting remotely).

First of all, we are please to see that Dr. John Carpenter is now appointed as Observatory Scientist. ASAC strongly hopes that Dr. Carpenter will make the communication between JAO and ASAC even more fluid.

We spent most of the time in the meeting to discuss the 5 charges the ALMA board prepared, while we also reviewed the current status of the implementation of the last ASAC report and Board actions from February 2015. We are pleased to see that the principle of not punishing proposers for duplication information that is not available at proposing time has been adopted into the new PRP document draft, and we are looking forward to the implementation of several recommendations concerning the face of ALMA (better tracker interface, improvements to the OT). On the other hand, it is unfortunate that the solution agreed upon for "stale data" (automatic delivery to PI "as is") is still to be implemented.

In order for us to have more effective discussions during the meeting, it is crucial that relevant documents, information, or presentations are made available as much as possible in advance of the meeting (ideally the previous week). It is unfortunate that only very limited information was made available in advance. This information did not include some documents that the ASAC was intended to have access to, according to its charges. Discussion with the JAO during the meeting made it clear that this was an unintended oversight. This is, however, an all too common problem at f2f meetings, which we hope the new Observatory Scientist will help mitigate.

Charge 1: ASAC will be presented with an updated version of the Principles of Proposal Review (PPR) document. This new document includes changes in line with the ALMA Trilateral Agreement of the Partners, and changes that reflect the more evolved operations state of ALMA since the version of the document from Cycle 0. The Board and ALMA Project welcome comments from ASAC on issues discussed in the document that would have an impact on the scientific output of ALMA. The PPR is meant to be a high-level, stable document, while the Proposal Review implementation plan will contain details that might vary from call to call.

The ASAC reviewed the Principles of the ALMA Proposal Review Process document draft in a group-wide discussion that included the JAO Director, Deputy Director, and Observatory Scientist. We applaud the open discussion that ensued, which enabled the open exchange of ideas. The JAO Director explained that the "principles" document is to be rarely revised, and it has a companion "implementation" document that changes from cycle to cycle and contains many of the details. Comments and inputs from ASAC are summarized as follows;

1. The ASAC observed that the current document contains a number of details that are probably better left to the implementation document (for example, §5.2 panels are specified to have "up to nine assessors").

2. Although the chief criterion for the selection of proposals is "scientific merit", the current version of the document is leaving its precise meaning open to interpretation. We recommend that a practical definition of what constitutes "scientific merit" be inserted into the Principles document. We suggest that the elements of "scientific merit" to be considered are:

    a. Is the proposal addressing key questions?
    b. Are the questions posed well defined and quantitative?
    c. Is there potential for a breakthrough?
    d. Is the study clearly outlined and justified?
    e. Is it original in approach or content?
    f. Is the proposal enabling further science? (for example, does it have archival value beyond its main goal?)

3. ASAC feels very strongly that the promise of releasing value-added products should be taken into account when determining the "scientific merit" of a Large Program, as clearly outlined in the ASAC recommendations for that category in past reports. This should be explicit either in the principles or the implementation document.

4. The definition of Large Programs, in §3.4, should clarify that the 50 hours are of 12m-array time, as it was the intention of the ASAC. It may be desirable, in the future, to offer Large Programs for proposals that make use solely of the Morita-array (ACA). But the ASAC recommends getting some experience with both Large Programs and ACA-only proposals before defining that category.

5. The ASAC recommends that the document explicitly clarifies that no normal proposals larger than the Large Program threshold should be allowed (that is, at this time ALMA should not accept normal proposals larger than 50 hours of 12m-array time).

6. A minor wording change to the definition of A-ranked time to clarify that proposals are only rolled once to the next cycle would be desirable.

7. The ASAC notes that it has not discussed the implementation of multi-cycle proposals to any extent. In particular, it has not discussed the reasonable span of muti-cycle proposals, whether they are to be restricted to standard modes, or the mechanisms to review their progress (which should probably exist).

8. Although the ASAC agrees that feasibility should be a very important consideration for the "especial program" category, it highlights that it should also be a consideration for the acceptance of normal proposals, which should be both technically feasible and possible to schedule.

9. The ASAC notes that there are cases where the definition of "conflict of interest" is too broad. For example, when a technical assessor belongs to the same "department" as a CoI, but that "department" is very large (e.g., SAO-CfA or one of the Max-Planck institutes). Since this has the potential to produce many conflicted assessors and reduce the quality of the assessment we recommend that relaxing it by allowing the assessor in question to declare that it is not a real conflict of interest, if the panel chair approves.

A new, revised draft of the document was made available to the ASAC after the f2f meeting. The revised version incorporated most of our comments, except for recommendations number 2, 5, and 7 above. Comment #7 (implementation of multi-cycle programs) is a future action item for the ASAC, which we request to receive as a charge. We expect comment #5 (no normal proposals larger than LPs) to be incorporated into the document. Some form of comment #2 could probably be incorporated in the process in some way that is not necessarily this document, for example in instructions issued to the reviewers.

Charge 2: **With the Cycle 3 Proposal Review Process (PRP) recently completed, the JAO should present the ASAC with an analysis of the success and shortcomings of Cycle 3 proposal process, starting from the Call for Proposals through the PI notification stage. The ASAC should comment on the Cycle 3 proposal process and any planned or proposed changes to future cycles. Looking forward to Cycle 4, the ASAC will receive updated information on the Cycle 4 plans. Are there any issues in these updates that need further attention? Does the special proposal category (new to Cycle 4), including Large Programs and VLBI proposals, meet the expectations and needs of the user community? Are the changes to the duplication checking procedure sufficient for a smooth proposal submission and evaluation process? If not, ASAC should indicate any further updates to duplication checking that are indispensable for the Cycle 4 evaluation process.**

- ASAC feels that the Cycle 3 Proposal Review Process has successfully finished, however, there are several concerns, that;
    - Workloads on several panels are too high, which may risk equal outcome from each panel
    - ASAC recommends that the information/training of the chairs is strengthened to ensure that all panels follow the same guidelines.

- ASAC recommends an increase in the fraction of rank A proposals to about 50%.

- ASAC agrees with JAO's assessment that technical assessment of proposals before the APRC meeting should be restricted to proposals that request non-standard mode observations, large proposals and proposals requesting ToO (Target of Opportunity) observations.

- ASAC recommends that the special category of large proposals is *not* offered for ACA stand-alone in Cycle 4.

- ASAC agrees that mmVLBI is almost ready and 3mm observation should be offered from Cycle 4. However, some concern remains in 1mm observation. Also a document describing the mmVLBI operations plan should be prepared before Cycle 4 call for proposal.

Cycle 3 Proposal Review: ASAC applauds that the Proposal Review Process has successfully finished. However, ASAC has an impression that the workload on several panels appeared too high and risked unequal outcomes for projects in some areas. Several panels had to discuss more than 100 proposals at the face-to-face meeting requiring some panel members to read over 100 proposals. Based on personal experience of ASAC members the identification and handling of duplications required a large amount of time. Finally there seemed to be some confusion about certain procedures which risked them being applied inconsistently between ARPs (e.g. duplications, selection of proposals for rank A, final ranking). ESAC notes that only a modest amount of ACA time is associated with high-priority programs (A+B), while a similar amount is requested for filler projects (rank C). ASAC recommends that the information/training of the ARP Chairs is strengthened to ensure that all panels follow the guidelines evenly.

Given the large fraction of (self-identified) resubmission (i.e. of rank B projects from Cycle 1 and 2) among the Cycle 3 scheduled rank A/B projects of ~33%, ASAC recommends to increase the fraction of rank A proposals to about 50% to limit the number of resubmission. This might hopefully mitigate the risk of in scheduling uncertainty caused by such a high fraction of resubmissions. An expected carry-over fraction of rank A proposals of 5-10% seems sensible to ASAC, however, ASAC welcomes the opportunity to refine this number after more detailed information from simulations becomes available.

In the Cycle 3 proposal review process the technical assessment of all the proposals resulted in a very low fraction of technically unfeasible projects. ASAC agrees with the JAO assessment that technical assessment should be restricted to proposal that request non-standard mode observations, large proposals and proposals requesting ToO (Target of Opportunity) observations.
As there is some uneasiness in the community about the process how the final observing schedule during the ALMA proposal review process is obtained, ASAC recommends that the procedure of the final ranking of the proposals at the ARPC stage is described for the community in the appropriate public document.

ASAC welcomes an opportunity to comment on recommendation from the ALMA proposal working group for improvements in the proposal review process.

Cycle 4 plans – capabilities/special proposals: Large programs are desired by the community – with some groups already starting to put in smaller but coordinated projects in the current cycles. In general ALMA now seems stable and efficient enough to allow for the execution of some large programs requesting 12m or 12m plus ACA(+TP) observations. ASAC feels that a single time limit to separate large from normal proposals of 50hr of 12m (regardless if Morita array time is requested) is best. A restriction that large program use only standard modes seems sensible at this stage. The severe under-subscription of the ACA in Cycle 3 will be mitigated by offering ACA in stand-alone mode in future cycles. As ACA stand-alone will be offered for the first time in Cycle 4, ASAC recommends that the special category of large proposals is not offered for ACA stand-alone in Cycle 4 to allow for an informed recommendation for Cycle 5 based on the pressure and nature of ACA stand-alone time requests.

Based on the information presented, ASAC was pleased to hear that mmVLBI observations appear (on technical terms) ready to be offered in Cycle 4. From the information currently available it seems that 3mm VLBI observations are ready to go ahead, while concerns remain regarding observations at 1mm. ASAC recognizes the high scientific potential of the 1mm VLBI capabilities and re-iterates that access of the full community to such unique capabilities should be ensured. ASAC is very disappointed about the lack of a document describing the mmVLBI operations plan. ASAC feels strongly that such a document that describes the procedure for mmVLBI observations, the time evaluation and allocation process should be available when mmVLBI is offered in Cycle 4. ASAC would welcome the opportunity to comment on such a document.

Further ASAC agrees with the priorities established for Cycle 4 that will likely result in offering also solar observations to the community.

Cycle 4 - Duplication checking: Based on the experience of several ASAC members in the Cycle 3 proposal review process, duplication checking was sometimes cumbersome and took a significant amount of time in the panels. ASAC applauds JAO's plan to establish a better duplication policy before Cycle 4. To provide more information of the duplication checking during the panel discussions, ASAC recommends that the 'resubmission' button in the OT should be active in Cycle 4 and that a box is added to the technical justification in the OT that allows the PIs to provide information why duplication (of archival observations) are scientifically justified.

Charge 3: As ALMA transitions from its Early Science phase to full operations, ASAC is asked to investigate and comment on the balance between science operations, enabling new EOC capabilities, and regular maintenance of the array:
a) Is the current balance of the fraction of array time dedicated to carrying out approved science programs *vs* implementing new EOC capabilities correct?
b) Are configuration schedules optimized for the greatest scientific return?
c) The documentation describing ALMA Steady State and Full Operations for the Operations Review Committee indicated a nominal schedule of 85% of the array elements (i.e at least 56) at a given time in use for science observations. ASAC should comment on the impact that this expected number of available array elements will have on the science output and efficiency of ALMA. The JAO will give ASAC access to ORR documents that are relevant to this charge.

- ASAC considers that the current and projected division between science and EOC time is reasonable. ASAC is also very happy to see the sub array capabilities have been implemented for testing of new capabilities.

- ASAC thinks that in steady-state operation the 3-year cycle could probably be an attractive option, and suggests that the question is revisited following consultation with the community at large. For Cycle 4 and 5, ASAC thinks that the two-year rotation schedule should be followed, with the longest baselines offered in Cycle 4 at complementary hour angles to those in Cycle 3.

- ASAC notes that, in addition to direct sensitivity, high numbers of (12 m) antennas will be important for image fidelity. Quantitative data is needed to evaluate the impact of reducing the number of 12 m antennae below 50. In the meantime, ASAC recommends that achieving higher steady-state antenna participation than 85% is prioritized.

Q1: Is the current balance of the fraction of array time dedicated to carrying out approved science programs vs implementing new EOC capabilities correct?

ASAC is keen to see more science time, but finds that the current and projected division between science and EOC time is reasonable. Specifically dedicating up to 10% of the available array time to EOC in steady state operations is a sensible consideration for a large investments in development projects. ASAC is very happy to hear that the sub array capabilities are close to acceptance and that are already helping ongoing testing of new capabilities. ASAC advises to put a higher priority for developing these capabilities further to maximize its use for EOC not requiring the full array.

Q2: Are configuration schedules optimized for the greatest scientific return?

ASAC was presented two scenarios for configuration schedules, one for a two-year and the other for a three year rotation. The latter minimizes the down-time when going through 16 km baselines, but has the drawback that some projects could only be carried out every three years. ASAC thinks that in full operation the 3-year cycle could probably be attractive, but suggests to consult the community at large whether this would be acceptable, as the pressure on certain RA ranges is

unclear. For Cycle 4 and 5, ASAC currently thinks that the two-year rotation schedule should be followed, with the longest baselines offered in Cycle 4 at complementary hour angles to those in Cycle 3.

Q3: What is the impact of an expected 85% of array elements being available for PI science at steady state with regard to science output and efficiency of ALMA?

ASAC was presented with clear arguments why typically 5-6 antennae will be out full time and possibly another 3 during day time, leaving 60-61 elements in the array night time and 57-58 elements in the array full time. ASAC notes that this is higher than the goal of 85%. It should be noted that this analysis made no distinction between 12m or ACA elements. No analysis on how this number of elements impacts on science return was presented, but it is believed that, besides direct sensitivity, high numbers of (12m) antennas will be important for (future) high dynamic range imaging. ASAC would like to see continued priority for achieving higher element participation than 85% at steady-state.

In addition to inputs to the questions provided in the charge, ASAC was also asked to advise on the relative importance of EOC activities to focus on calibration (performance) improvement, efficiency improvement and new capabilities. ASAC advises that efficiency improvements are prioritized as much as possible without neglecting critical performance improvements. A 20% increase in efficiency, which should be possible with more optimal calibration schemes and other schemes, would be a large benefit for the project, potentially freeing several 100s of hours for PI science at steady-state.

Charge 4: Pursuant to standing charge 4, now that the first generation of Development programs are well under way, ASAC should give a preliminary assessment of their impact on the JAO. They should also comment on whether the projects have met or are expected to meet their initial specifications. As a follow-on to this charge, ASAC should also make a scientific prioritization of the new planned Development projects and remaining, unimplemented baseline capabilities. To help with this discussion the ALMA project (the AMT and the IST) will provide ASAC with lists, timelines and a cost assessment of these projects and capabilities.

- ASAC is pleased to see the excellent progress that is being made on the major upgrade projects. ASAC is also impressed by the strength of the development project networks and the good communication between Project Scientists and JAO.

- ASAC is pleased to hear that new observing modes, including mm-VLBI, solar observing and sub-arrays operation are close to delivery. ASAC, however, remains concerned about the implementation of ALMA mm-wave VLBI observations in future cycles, and strongly requests the opportunity to comment on a document that establishes the guiding principles for VLBI operation with ALMA.

- Although the committee's position is in consonance with Stuartt Corder's list of pending high-priority baseline capabilities, ASAC also sees the urgency of further clarification of the order of priority among remaining baseline capabilities (e.g. 90-deg phase switching) and improvements (e.g. spectral scans) to implement before the start of ALMA "steady-state operation" Cycle 5.

ASAC is pleased to see the excellent progress that is being made on the major upgrade projects, including full production of the ALMA Band 5 receivers, ALMA Phase Project, JAO/AOS optical fiber network for high speed communication from ALMA to the World, ALMA Band 1 receivers, and installation of magnets and heaters to Band 3 receivers. The committee is pleased to see that projects are proceeding smoothly according to the plans. ASAC is also impressed by the strength of the development project networks and the good communication between Project Scientists and JAO, despite regional differences in the funding and project management structure. ASAC is ready to be informed about related SV observations (e.g. for Band 5), which generate public data release.

ASAC is pleased to hear that new observing modes, including mm-VLBI, solar observing and sub-arrays operation are close to delivery. All these modes are crucial to the efficiency of the ALMA observatory. ASAC remains concerned about the implementation of ALMA mm-wave VLBI observations in future cycles, and strongly requests the opportunity to comment on a document that establishes the guiding principles for VLBI operation with ALMA. ASAC endorses development work to implement science operations with sub-arrays and is pleased to provide input and recommendations to consider for process improvement.

ASAC views the developments of the Bands 1 and 2 receivers as high priority projects, as they are seen as an integral part of the ALMA baseline capabilities. ASAC is also pleased to see that studies (i.e., initial R&D, follow-up studies and small upgrades to the ALMA system) seem to proceed well in all regions, and that some (e.g. high-speed digitizer development) are consistent with

visions outlined in the "ALMA 2030" roadmap document. There are few areas in which development studies are ongoing in more than two regions (e.g., Band 2(+3), data analysis software, etc.). ASAC concurs that such approach is intended to help promoting regional development/science activities and is likely to be the most effective way to deliver the latest and best technologies for future upgrades of ALMA. However, to avoid a waste of resources and time, and duplication of efforts, the committee thinks the ALMA project should also seek to promote a more joined-up approach on some developments across JAO and the EA, EU and NA partner regions. ASAC also encourages development project teams to assess long-term maintenance load and positive/negative impacts on JAO already at the level of the feasibility study.

Although the committee's position is in consonance with Stuartt Corder's list of pending high-priority baseline capabilities, ASAC also sees the urgency of further clarification of the order of priority among remaining baseline capabilities (e.g. 90-deg phase switching) and improvements (e.g. spectral scans) to implement before the start of ALMA "steady-state operation" Cycle 5. ASAC also supports the idea of calling for a workshop to address this issue, and recognizes the need to balance the best possible science return against manpower investment. The EOC activity for solar observations, where in-kind contributions from all the regions have worked quite well, may be a good example for fulfilling a new capability.

Charge 5: Looking back at the key science goals of ALMA, ASAC should discuss and comment on the basic performance and function of ALMA at the end of Cycle 2. Is the array performance living up to user expectation at this stage of the project? Is it already able to fulfill some of the key science goals and specifications for ALMA? Are there areas for improvement? The ASAC should comment on the ALMA project list of annual performance goals and metrics that will become the basis for measuring progress as ALMA transitions to steady-state operations.

ASAC appreciates the efforts to try to provide performance metrics, although it is clear that more could be done (e.g. to define fidelity and stability) and further information would be good to have (e.g. the depth behavior using the repeat quasar observations).

Discussion of the Key Performance Indicators was also useful, and these appear to be appropriate measures for assessing performance during each cycle.

It was good to hear a coherent description of the various efficiency savings that could be made from various kinds of calibration (amounting to perhaps 20% for repeated SBs). ASAC agrees that studying this in more detail might make a good future development project.

For cycle 3, the effective science time represents 50% of the allocated time for science. The weather downtime is about 15%, full array calibration is 10-15% and the system stability downtime is 20%. The total technical and calibration downtime (i.e. full array calibration and system stability) is therefore 30-35% of the allocated time for science. ASAC continues to fully support the group at JAO dedicated to decrease this technical and calibration downtime (operator interface improvement, cut down overhead, system stability). For full operation, it would be good to achieve the goal of technical and calibration downtime of about 15% (as expected). Such goal would mean an effective science time of 70 %.

ASAC additionally raised the issue of resolving the problem with incompatible versions of CASA, particularly in order to make the archive useful in the long term. While appreciating that this is not entirely a JAO issue, it needs to be solved by someone within the ALMA project.