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Report from the ALMA Scientific Advisory Committee
Face-to-Face meeting, JAO, Santiago
2014 January 31 and February 01

Alberto Bolatto (U. Maryland, Vice-Chair), John Carpenter (Caltech), Simon Casassus (U. Chile), Rob Ivison (U. Edinburgh, Chair), Kelsey Johnson (U. Virginia, Videocon, due to flight cancellation), Huib Jan van Langevelde (JIVE/Leiden U.), Jesus Martin-Pintado (CSIC Madrid), Raphael Moreno (LESIA Observatoire de Paris Meudon), Kentaro Motohara (U. Tokyo), Roberto Neri (IRAM), Nagayoshi Ohashi (Subaru Telescope), Tomoharu Oka (Keio U., Vice-Chair), Richard Plambeck, (UC Berkeley), Douglas Scott (UBC)

Executive summary

In what follows, ASAC makes recommendations regarding the ALMA proposal review process, communication to/from JAO, release of data prior to QA2 in exceptional circumstances, change request procedures, and mitigating the current data-rate limitations.

A persistent theme ran through several sessions of the first face-to-face ASAC meeting of 2014: the need for an ALMA Chief Scientist. While reflecting on its Charges, ASAC identified many key responsibilities for this role, including mentoring of more junior JAO science staff, scientific oversight of the observing queue, communication with the community, JAO scientific representative to the ALMA Development Steering Committee, as well as acting as the point of contact for VLBI issues/procedures, the fledgling Chilean ARC, the regional Programme Scientists, and ASAC itself. ASAC recommends that this issue be revisited.

ASAC has agreed to take ownership of the ALMA2030 initiative, a key part of the development roadmap.

ASAC strongly endorses and applauds the plan to return to regular 1-year cycles, and the pleasingly short timeline on which JAO aim to achieve this.

Finally, ASAC notes with regret the gender balance among members on this committee: 13 men; 1 woman.

I. Introduction

There was an unusually brief gap – less than 4 months – between the last face-to-face meeting of 2013 in Edinburgh, and the most recent face-to-face meeting in Santiago, which was held over a Friday and Saturday partly to reduce the cost of air fares. During that time, ASAC telecons on 2013 December 9 and 16 were used to prioritise commissioning activities – an Interim Charge from the Board – based on a document entitled “Priorities for CSV Moving Forward” provided by the then CSV Scientist, Stuartt Corder. ASAC stated at that time that it would revisit the balance between commissioning and science in March, when commissioning will slow down due to effort constraints. This Interim Charge became the first of five Charges discussed at the meeting in Santiago, along with some ad hoc items.

ASAC looks forward to having the opportunity to feed back its concerns to the ALMA Director at our next face-to-face meeting, in Charlottesville, probably in 2014 October or thereabouts. Alberto Bolatto (NA) will be the Chair for that meeting, having taken over effective 2014 March. The EA Vice-Chair will be Tomoharu Oka, with the choice of EU Vice-Chair pending the replacement of Rob Ivison on ESO’s STC and ESAC. ASAC nominates Dick Plambeck as the ASAC representative to the ADSC (this nomination has been accepted by the ADSC, and he is the representative starting in March).

II. JAO re-structuring and planning

ASAC was informed about the re-structuring of JAO. ASAC regrets the absence of a Chief Scientist. Many important roles could be envisaged for such a person: mentoring of more junior JAO science staff, scientific oversight of the observing queue, communication with the community, JAO scientific representative to the ALMA Development Steering Committee, as well as acting as the point of contact for VLBI issues/procedures, the fledgling Chilean ARC, the regional Programme Scientists, and ASAC itself. ASAC recommends that this issue be revisited.

ASAC was informed verbally (and briefly shown on screen) about the existence of a Director’s Council document containing the long-term observatory plan, and would like to have access to a suitably redacted version listing the high-level

milestones.

ASAC received representations from the ARCs, which desire greater involvement and more effective communication with both JAO and ASAC. ASAC proposes that this involvement is implemented through the Regional Programme Scientists who clearly need to be fully engaged by and with JAO and ASAC.

ASAC continues to value the monthly telecons, but understands that progress reports rarely change on such a timescale and agreed to receive such updates every second month, while maintaining a monthly schedule for the telecons.

Moreno & Van Langevelde visited the ALMA site and were impressed by the technical advances, and the commitment of the staff. They noted some issues where internal communications were apparently not optimal, notably with respect to the restructuring. They encountered some frustration among the post-docs, who have few opportunities to get acquainted with or involved in the scientific results arising from their efforts.

III. Response to Charges

Charge 1: Following on from the interim Charge from December 2013, the ASAC should continue its scientific prioritization of the new capabilities lists that have been provided by the JAO. Comment on the balance of time given to implementing these new capabilities against time designated for Early Science from Cycle 2 and beyond.

ASAC noted considerable progress made during 2013 Dec through 2013 Jan on CSV activities related to preparing ALMA for Cycle 2 and improving observing efficiency.

Regarding the CSV timeline during Cycle 2, ASAC endorse the plan to suspend science observations during 2014 Sep-Nov in order to commission the extended baselines, which remain the highest science priority. A goal should be to release long-baseline SV datasets in most science categories prior to next proposal Call; ASAC and the ARP Chair should be consulted regarding selection of targets.

ASAC noted that APP science commissioning might be performed in July/Aug, good-weather months that are well suited for Band 9/10 CSV activities. Both

have high priority, so hopefully some balance can be found that allows both to go forward.

Efforts directed at implementing on-the-fly interferometry and APP/VLBI capabilities seem promising. ASAC is looking forward to being presented with OTFi example observations.

ASAC feels the CSV plan for Cycles 1-2 carefully balances critical objectives and staffing limitations. Despite difficulties related to the staffing, the plan to increase the fraction of time spent on science observations will bolster the scientific productivity of the observatory at a key time for the community.

The highest priority objectives for Cycle 3 are within reach, but are still not fully secure, e.g. number of array elements, availability of pads for the longest baselines, and road maintenance.

The committee reviewed the CSV plan for 2014/15 and recommended that given the limited availability of CSV staff effort, JAO should consider engaging with the regional centres to help characterise the bandpass and amplitude calibration stability.

ASAC recommends that JAO prioritise spectral line over continuum for Band 9/10. ASAC endorses line observations as highest priority, so side-band separation and high-spectral-resolution in polarization are given priority over total power continuum and wide-field polarization. After line enhancements and after total power, further priority should be given to Stokes V. The CSV team should implement, if possible, fast scanning operation for frequency switching, giving less priority to developing SD continuum capabilities and finalizing the OTFi observing mode.

Charge 2: Pursuant to standing Charge 2, continue to assess the status of Cycle 1 observations. For Cycle 1, are the data meeting user expectations, modulo the best efforts approach to early science? Are the data being released to the PIs in a timely fashion? Are adequate progress updates being communicated to the PIs and the community at large?

ASAC notes with relief that the power system has been stable for the past 3 months (two turbines are being used, temporarily) and commends the great progress achieved prior to the assembly of the Tiger Team. The root causes of all but one of the earlier power outages are understood. A protections study is now complete and the newly formed Tiger Team will review this.

A remote-start capability for inner array pads will be ready imminently, greatly reducing the time needed to get the array running after brief power outages. Leaking hermetic connectors on dewars are being replaced, when feasible. The missing protective earth wire has been installed for all inner pads. Regarding antenna availability: 62 antennas are at the AOS; on a typical night 27 x 12-m antennas are available; the number is trending upward; the hope is to have 40 available by the start of Cycle 3.

Needless to say, ASAC were relieved to see progress made towards delivering Cycle 1 science data. Between 30 Oct 2013 and 14 Jan 2014, six blocks of observations have been scheduled with 42% of successful executions, with an average of 27 x 12-m antennas and 9 x 7-m antennas. Of 196 Cycle 1 projects, 96 have been started, partial data were delivered for 31, and 14 are complete. The expectation, currently, is that 300 hr will be carried over to Cycle 2. ASAC feels this may be optimistic, but not dramatically so.

Because of the anticipated configuration schedule and the higher priority given to some Cycle 2 proposals, ASAC notes with concern that a number of Cycle 1 proposals that require arrays C32-1, C32-2 and C32-3 may not be completed until the end of 2015.

Communication with the PIs and the community at large is not yet at the level requested at the last face-2-face meeting. E-mail notification of progress with observations and processing are planned for the start of Cycle 2. Plans to improve communication more generally are addressed in Charge 5. Data are being released to PIs in a timely fashion, but see later comments re: QA2.

Charge 3: With the Cycle 2 deadline still fresh in everyone's mind, and the proposal evaluation underway, the ASAC should comment and make an initial assessment of the Cycle 2 proposal process. Were the OT, archive and server performances robust? Is the necessary information on duplications and Cycle 1 completion outlook being provided to the ARPs and APRC? With the increase in proposal volume and perhaps also complexity (due to the new bands and observing modes) is the workload on the ARPs reasonable? The ASAC is very welcome to suggest ways to improve the submission process for Cycle 3 and beyond. In particular, since many of the terms of many of the current ARP and APRC members will end with the Cycle 2 PRP, ASAC should make an assessment of the scientific expertise and diversity of the membership for future cycles.

They should suggest names for potential panel members, including those who may have theoretical/numerical backgrounds, as well as those from other observational wavelengths.

Like everyone else, ASAC was very pleased at the high number of proposals received for Cycle 2, and impressed with the ability of the system to handle them: 1382 proposals appears to be the highest number ever dealt with by an astronomical observatory. There were no major concerns from the community about the server performance or the proposal process in general. Generally, users were happy with the Helpdesk and the CASA simulator.

However, there were certainly many comments about details of the Observing Tool, some fraction of which are probably due to poor or late communication between JAO and the OT team; these represent some lessons to be taken away for Cycle 3:

- A common complaint was that the OT was not flexible in the way that time requirements for calibration were handled;
- Logistically, there were problems with the editor in the OT, e.g. difficult input of data for large surveys. The editor also did not allow symbols in the technical justification and the font was very obviously too small;
- The availability of information about accepted proposals was adequate for helping to avoid direct duplication between Cycle 1 and Cycle 2, though it is unlikely that the ARP will have the time or the tools to check;
- It was previously requested by the ASAC that information be supplied to the ARPs about partial duplications, in order to help them judge scientific priorities. It is unfortunate that this has not been possible on the required timescale. This clearly needs to be achieved for the Cycle 3 review process. It is desirable that duplications are handled directly in the OT for Cycle 3.

The workload on the ARPs, although certainly not trivial, seems reasonable. There was a suggestion that the number of proposals in Category 1 ("Cosmology") might justify a third panel. The counter-argument is that this would result in similar proposals ending up in separate panels, rather than being tensioned against one another. This latter point is perhaps a bigger issue. ASAC recommends that the triage fraction be revisited before new panels are created.

ASAC is happy with the current composition of the ARP and APRC bodies, and

supports retaining the same diversity in terms of science areas, expertise, gender and regions. ASAC is collecting names for new members and will provide them to JAO.

The current expectation is that 300 hr of Cycle 1 will be carried over into Cycle 2. This should mean that the panels are able to assign close to the full amount of time expected for Cycle 2.

ASAC questions the wisdom of having a 5-6 week gap between the deadline for written assessments and the panel meeting. An inevitable consequence is that their proposal assessments are not fresh in the minds of the assessors at the panel meeting, compromising the quality of the scientific debate. Since this is mainly driven by the desire to avoid JAO staff giving technical assessments to triaged proposals, ASAC recommends a different approach: ALL the proposals should be technically assessed, in parallel with the scientific assessments. This will provide the weakest proposals with technical feedback, which may be sorely needed. Although the technical assessors will have 30% more proposals to review, they will be able to do so over twice the timescale. Because of the extra demands, it is understood that this might necessitate a somewhat "lighter touch" technical assessment.

Charge 4: ALMA Development Plan. The regional project scientists and the JAO will provide ASAC with materials, such as summaries, status updates, and other information of the completed and ongoing Development studies and projects. ASAC should assess the scientific merit of these studies (e.g. discuss the uniqueness for ALMA, the advantages and drawbacks of each capability, etc.). ASAC input will serve as a basis for further dialogue regarding the ALMA Development Plan. ASAC should also comment on the scientific priority of the approved development projects relative to CSV and science activities.

ASAC was presented with summaries of the current development activities by the three regional Programme Scientists.

With two projects and one study ongoing (Band 1 prototype, Artificial source, Band 11 science case), discussions are ongoing in **EA** about possible future developments.

In the **EU**, besides the ongoing production of Band 5, six studies were approved

1. Advanced design and prototype for B2+3 receiver;

2. Develop faster digitizer design;
3. Upgrade for cryocoolers;
4. Enhanced data analysis software;
5. mmVLBI operations concept;
6. Solar use science cases and requirements.

Besides the ongoing APP, and Enhanced bandwidth, **NA** accomplished its second call for studies and its first call for projects. The calendar for the next calls is Q4/2014 and Q1/2015, to be coordinated with EU if possible. ASAC was presented with brief summaries of the science goals for NA development projects, including funding awarded, and deliverables.

NA Studies:

1. Advanced solar observing modes;
2. Second generation Band 10;
3. Second generation Band 6;
4. Models of community science tool development;
5. A millimeter camera for single-dish;
6. Calibration algorithm refinements.

NA Projects

1. Design, construction, and testing of Band 2 prototype;
2. Band 3 deflux system for improved gain stability;
3. Expansion of central LO to 5 subarrays;
4. Data mining toolkit;
5. Next generation ALMA viewer.

ASAC was concerned about its ability to address the Charge in a meaningful manner in the absence of sufficient information. In future instances and as a matter of normal procedure, ASAC would like the regions provide substantial information beyond Power Point summaries, enough time in advance for its ingestion and discussion.

ASAC is of the opinion that – based on the summary information presented – these development projects represent areas of improvement identified in previous ALMA development discussions and reports. ASAC notes efforts to coordinate development projects between regions (e.g. monthly telecons of programme scientists, meeting on Band 2 development in March). Nonetheless, there is room for improvement with further coordination on data mining and visualization, on solar efforts, and mmVLBI.

ASAC notes progress and planning regarding commissioning of APP and remarks on the need for the JAO to develop a VLBI model as APP moves forward.

ASAC was informed of the progress with the report “Pathways to Developing ALMA” being written by the ADSC ALMA Development Working Group, constituted thus: Alberto Bolatto (Chair), Leonardo Testi, Daisuke Iono, Alwyn Wootten, Stuartt Corder. Its draft report is attached, under the agenda.

ASAC accepts responsibility for putting together the part of the report dedicated to the long-term scientific picture, known as ALMA2030, together with the ADWG. A sub-committee was constituted: Rob Ivison (Chair, TBC), Jesus Martin-Pintado, Nagayoshi Ohashi, Simon Casassus, Kelsey Johnson, Douglas Scott. This report will be fed back into the full ASAC + Programme Scientists to create a development roadmap.

Charge 5: ASAC should suggest ways to improve and optimize general communication from the Observatory to the community. Are additional mechanisms needed to provide science and status updates to the user?

ASAC looks forward to the implementation of the JAO plan to improve communication relating to progress with observing and strongly endorses the e-mail notification of any changes in project status. ASAC recommends that the user interface to the project tracker is made more intuitive, displaying the summary of the status of every Science Goal; whether it is in the observing queue (or stating why it is on hold); how many hours of QA0 have been obtained; how many more hours before QA2, etc. ASAC would like to see the availability of additional information suggested by the NA community to be implemented, e.g. current array characteristics, near-term configuration schedule, status of observations, data processing and data delivery. We recommend that other regions should provide similar inputs.

ASAC acknowledges the publication policy for the abstracts of approved proposals. Some other ways to improve were suggested:

- Ensure the information disseminated by JAO and ARCs is clear and consistent;
- Reorganize Science Portal to improve access to the relevant information;
- Release frequent (at least quarterly) Science Portal updates of

planned configuration schedule, update project completion estimates, observing progress plot;

- A newsletter, although this did not meet with unanimous approval.

Ad Hoc Charge: Band 1.

ASAC was pleased to see progress with the Band 1 science case. A detailed science case for Band 1 has been recently updated (arXiv:1310.1603v3, Di Francesco et al., relating to molecular gas in high-redshift galaxies, SZ effects, proto-planetary disks, ISM, chemistry). We note that the science team needs to consider impact of CMB on detectability of CO(3-2) at high redshift (da Cunha et al.)

Most of the requests from the ALMA Board to the band 1 team are within revision (e.g. plan, budget, schedule, project plan submitted to external review, justification of science versus cost and with other facilities). All key components have been down-selected in a meeting held in Taiwan during 2013 January. The Preliminary Design Review was passed in 2013 July and 2014 January. A Project Plan Review (Science Value versus Cost) will be held in 2014 March.

The prototype development (including testing) will end of 2014. After successful testing of a prototype receiver (CDR) and a successful review of the project plan, the ALMA Director is expected to recommend approval for production of the band 1 cartridges for ALMA.

Ad hoc Charge: Change request policy.

Users have expressed concern that reasonable changes they have proposed relating to their observing programmes have been denied, following the current policy. Although the fraction of such instances is lower than anecdotal evidence might suggest, ASAC would like to review and possibly suggest some changes to the document "Phase II Process and Change Request Procedures". ASAC suggests that this be formulated as an ASAC charge

Ad hoc Charge: Cycle 3.

ASAC strongly endorses and applauds the plan to return to regular 1-year cycles, and the pleasingly short timeline on which JAO aim to achieve this. It is likely that 2000hr will be offered in Cycle 3, as in Cycle 2. The list of likely capabilities will ensure continuing high demand. The proposed schedule/timing for

notification of PIs about success/failure of their proposals by September is acceptable to all regions

ASAC recommend that the end-to-end time envisaged for the Call process (currently ~8 months) be compressed, preferably by delaying the Call. This will allow more PIs to receive data prior to Call.

Ad hoc Charge: Data-rate limitations (OT issues warning if >12 MB/s).

ASAC thanks Erich Schmid for a clear discussion of the data-rate. It appears that the current limit was set some years ago, and that the current infrastructure could support a continuous data rate of 64 MB/sec, but additional network and storage capacity would be required if it were desired to make use of this data rate. ASAC believes that increasing the data rate (by taking the steps below and/or by purchasing additional network and storage capacity) would increase the scientific value of ALMA data – for example, by allowing detection of unanticipated spectral lines. Data sets could be smaller, or additional channels/integrations could be accommodated, with some relatively small changes:

- data could be stored in 16-bit (rather than 32-bit) format, by capping the values of the 2 noisy end channels in TDM data;
- normally FDM data are Hanning smoothed, but the redundant channels are kept; this could be made a user-selected parameter;
- online WVR corrections could also lengthen integration times, reduce data rate.

Ad hoc Charge: Release of raw data prior to passing QA2.

Once observations are completed, QA2 and the release of data to the PI is now happening on a reasonably fast time scale. Even faster data release will be possible when the pipeline is ready.

ASAC recognizes the importance of a fast and reliable pipeline, and recommends investing effort in the detection and reporting of problems during data processing. The reporting of errors during pipeline processing is crucial for reliability - some users may be unable to recognise that problems have occurred.

There are cases when a dataset does not pass the QA2 assessment because of insufficient sensitivity, requiring more data collection. In some instances,

because of scheduling constraints, it may take several months before completion. In these cases, early release to the PI (before the additional observations are obtained) may optimize the science output from ALMA.

We note that in these circumstances, the observatory has offered the option of pre-QA2 release at the expense of program termination (no further observations). We do not agree with this policy.

ASAC is in unanimous agreement that there are certain circumstances where PIs should have access to their data before it passes QA2. ASAC suggests that this question be formulated as an ASAC charge.