**ATUC Report to the Director - June 2015**

This meeting of the Australia Telescope Users' Committee was held at the ATNF Headquarters on 2-3 June 2015.

Attendance: Virginia Kilborn (Chair), Chris Phillips (Secretary), Tobias Westmeier, Stas Shabala, Evan Keane (via videolink), Paolo Serra, Emil Lenc (standing in for Minh/James) & Vasaant Krishnan (student representative).

Apologies: -- Minh Huynh, James Miller-Jones, Claire-Elise Green (student representative)

## Commendations and Successes

ATUC wishes to commend ATNF on:

- Innovation award for PAFs
- 3 science papers submitted for BETA
- 3 MKII PAFs shipped to MRO with 1 already installed on Antenna 29
- SOC and remote observing improvements, including the ATCA videos and PORTAL
- Bronze Pleiades award
- The decision to have a radio school this year
- The data reduction workshop being held in the first week of June

## Summary of Discussions from the ATUC Science Day

The ATUC hosted a science day on 1 June 2015, titled "The Future of ATCA/Parkes in the ASKAP/SKA1 era". Baerbel Koribalski and Jill Rathborne presented a draft paper titled "Science with the ATCA in the next 5-10 years and beyond", and due to this a large part of the meeting was spent discussing future science and strategies for the ATCA in particular. There were a number of ASKAP SSTs presenting plans for use of ATCA and Parkes. We summarise some key points from the meeting below:

- With the recent receiver and back-end upgrades at ATCA, the telescope is practically a new instrument;
- There are a number of elements that make the ATCA unique:
    - ATCA fills a frequency gap between ASKAP, MeerKAT and ALMA that is not matched by any other existing, or planned telescope in the world;

    - The wide-band capabilities and frequency coverage of ATCA are unrivalled in the Southern hemisphere and make it a formidable instrument for understanding the emission processes in astrophysical objects;
    - The flexibility of ATCA - ie, the quick drive times and frequency agility - mean it has the potential to have a large impact in the transient source space;
- ATUC believes there is the potential to increase the impact of science being done with ATCA by encouraging a smaller number of ultra-large surveys with the telescope, in particular those related to highly-ranked ASKAP Science Survey Projects.
- As noted above, given the flexibility of ATCA, there should still be time available for shorter high-impact projects.

The future high-impact science drivers for ATCA will be identified in the Koribalski & Rathborne document once it is finalised. Some of these drivers highlighted at the Science Day include star and planet formation in the Milky Way and nearby galaxies, transient sources and galaxy evolution.

Many of the talks identified a need for LBA follow-up from ASKAP surveys. Parkes is essential for zero-spacing for Wallaby, Emu and GASKAP. The Ultra-wideband receivers, and a permanent cooled PAF are essential to keep Parkes a cutting-edge instrument in the next 5-10 years.

We discuss more specific issues in subsequent sections in our report.

## Recommendations and Discussion from the ATUC Open Meeting

ATUC recognise the tight funding landscape that ATNF is operating under currently. We were very glad to hear the NCRIS funding has been allocated but have concerns for the long term future of funding the full instrument suite.

***Recommendation:*** *Encourage management to continue consulting with the community about funding implications.*

## 1. SOC and Remote Observing

Since the last ATUC meeting in November, there have been significant improvements made to the Science Operations Centre and the ATCA remote observing processes for which the staff

at CASS should be praised. The implementation of the ATCA portal, and reminder emails for upcoming observing was an excellent step and will help observers in managing their remote observing, whilst also ensuring the observations are being taken care of by appropriate observers. ATUC supports the initiative to have on-line video tutorials of particular aspects of the observing process, which will help observers and free up staff time for other matters.

***Recommendation:*** *Continue to develop on-line video tutorials, and link them into the documentation where possible.*

Feedback from Parkes telescope users is that they are very happy with the Parkes observing portal. In particular, the portal has fixed the issue that the remote observer does not necessarily know whom they are conversing with via the online chat, (as per some online feedback ATUC has received).
Some users commented that it would be useful to have a “per-hour” observer sign-up available in the portal, and that a “project view” would be useful for large projects.

***Recommendation:*** *When the next update is made to the portal software is implemented, a “per-hour” observer sign up, and project view capability is added.*

ATUC received feedback from many Parkes users that they were pleased to see the rules regarding retraining at the telescope had now been relaxed.

One final note that ATUC received from several users is that whilst they appreciated the flexibility that the remote observing provided, they also still thought visits to ATNF and the SOC, and the interactions with the staff, were very valuable.

## 2. ASKAP

A major outcome of the recent process of SKA re-baselining is the “deferral” of SKA-survey. With ASKAP being the closest instrument with similar capability, this has important implications for the Australian community. If ASKAP is to be incorporated by the SKA organisation as a replacement for SKA-survey, ATUC stands ready to consult the Australian community on the terms of this arrangement. While this is a welcome development, Australia has made a significant investment in ASKAP (partially at the expense of other instruments) and the community must be compensated appropriately. ATUC suggests that apart from covering operation costs, any such arrangement retains an open skies policy, commitment to a clear upgrade path for ASKAP (including PAF development), and retention of ASKAP ownership by CSIRO. To maximise the impact of Australian science, ASKAP surveys should

also be completed before any transition takes place. Any negotiation should take into account the uncertain timelines associated with completing ASKAP surveys due to baseline configuration and PAF sensitivity.

ATUC also seeks clarification on the implications of this development for the ATNF strategic plan, which has until now had a strong ASKAP focus.

***Recommendation**: ATUC requests regular updates on the implications of deferral of SKA-SURVEY for ASKAP and other ATNF facilities.*

***Recommendation:** That ATNF places the completion of the ASKAP SSPs at highest priority when negotiating the incorporation of ASKAP into the SKA. We also request further information on the implications of the handover on ASKAP surveys in light of ASKAP's reduced performance (outlined below).*

***Recommendation**: ATUC suggests that if ASKAP operations are taken over by SKA, any resources previously allocated to ASKAP are used to upgrade and operate other ATNF facilities.*

***Recommendation**: That ATNF negotiates an open skies policy for ASKAP in the case that it is incorporated into the SKA.*

ATUC commends the engineering team for the roll out of MkII Phased Array Feeds. However, there are significant concerns about their performance. The effective Tsys appears 50 percent worse than expected, and 6 of the antennas will not have MkII PAFs. This would result in an overall increase in required integration time by a factor of 3 compared to original specifications. This has serious consequences for the feasibility of ASKAP science: for example, completing the top-ranked projects to specified sensitivity would have to come at the expense of lower-ranked projects.

***Recommendation**: ATUC seeks clarification on the actual performance of the PAFs, any available upgrade path, and implications for ASKAP surveys.*

## 3. Parkes

The installation of the EB500 RFI monitors at Parkes and ATCA has been very useful. These led directly to the SUPERB team being able to identify the source of the "peryton" signals, detective work that should be highly commended. The time-variable RFI environment is notoriously poorly known and this is now something which should now be measurable. Given

the ever-worsening RFI environment at all of the sites these monitors provides extremely vital information for a very modest price. Such a monitor at the MRO would also provide the first look of the time-variable RFI sky there.

***Recommendation**: ATUC recommends that the RFI monitor data be archived for posterity to enable the science teams to determine the high time-resolution RFI environment, as a function of time.*

***Recommendation**: ATUC recommends that an identical RFI monitor be installed at the MRO to enable characterisation of the time variable RFI environment there, something which has currently not been studied.*

There is considerable confusion in the community over the planned timescales for commissioning the Effelsberg PAF on Parkes. ATUC is concerned that the quoted timescales are unrealistic, not least because commissioning timescales for new instruments can be very hard to estimate (cf. ASKAP) but also because the same team will also be involved in building the multi-beam receiver for FAST, the UWB receiver and (with a high probably at the time of writing) the correlator for SKA1-LOW. All of these projects currently have targeted completion dates in the second half of 2016 which the technology team identified as challenging to meet during the ATUC open day presentations. Furthermore there is not yet a plan for how the GPU-based backend will be developed. ATUC feels that there needs to be a solid plan for the GPU backend in place before the commissioning proceeds. A situation where the PAF is mounted and idle for weeks/months while GPU code is being written is obviously a waste of time which could be used for science using the existing receiver suite; such a situation should be avoided at all costs.

***Recommendation**: That the plan and timescales for commissioning the Effelsberg PAF be communicated to the community. This would involve writing up information presented in talks and discussions at the ATUC open day, which far exceeded the information provided in the OCT2015 call for proposals.*

***Recommendation**: That by the time the Effelsberg PAF is commissioned that there is a solid plan in place for developing the backend, so as to mitigate the risk of wasted science time.*

At the ATUC open day it was stated that the Effelsberg PAF would be available for scientific use during the APR2016 semester, and perhaps also a fraction of the OCT2016 semester, with access granted via the usual system of proposals. This is a welcome development which the ATUC thinks the community will be very interested in, despite the fact that *this* PAF may perform poorly in FRB and pulsar work in comparison to the MB-20 receiver (due to the ~2x

poorer sensitivity); it is clear that it is only through the use of a *cooled* PAF that we can reap the full benefits of this technology (~same sensitivity as the MB-20, but wider FOV, excellent localisation). The opportunity to use the first PAF installed on a large single dish will be a great opportunity for Parkes users, and no doubt prove a useful exercise on many fronts in preparation for a permanent cooled PAF in the future.

At the ATUC open day it was further explained that, as the PAF is not a National Facility, to make use of the Effelsberg PAF, proposals of sufficient scientific merit (as judged by the TAC) would also need to provide financial and human resources towards the development of backend(s). Given the interest that there will be in using this PAF for science, and the time needed for the community to acquire the necessary resources and to communicate with backend developers etc., ATUC feels that this information should be communicated to the wider community without delay, and certainly well in advance of the usual call for proposals for the APR2016 semester.

***Recommendation**: That the procedure for getting science access to the Effelsberg PAF in the APR2016 semester be communicated with the community without delay so as to give science teams sufficient time to acquire any relevant resources.*

Having consulted the wider user community ATUC feels that the 5-10 year plan for Parkes is not clear. ATUC acknowledges discussions on the future of Parkes held at CASS in the recent past, but feels that the outcomes of these discussions may not have been communicated to the user community. There is very strong support in the community for the preparation of a document outlining a 5-10 year plan for Parkes. Some of the key points this might address could be: (i) Solidifying the time-scales for the development and deployment of the Effelsberg PAF, and the UWB receiver; (ii) Setting goals for the planned “UWB high” receiver, which is strongly supported by the community; (iii) Setting goals for the future cooled PAF for permanent deployment at Parkes, which is also strongly supported by the community; (iv) The amount of deployment and commissioning time for the new receivers, and how this impacts upon the available science time over the next 5+ years; (v) The envisioned role of Parkes in the MeerKAT/SKA1 era. In preparation of such a document contributions could be sought from the major teams using the telescope: pulsar surveys, PPTA, magnetism, VLBI, etc. A consultation meeting of the main PIs and stakeholders might be a good idea as a first step.

***Recommendation**: A 5-10 year road map document be solicited and prepared for Parkes, as is currently underway for the ATCA.*

# 4. Australia Telescope Compact Array

ATUC welcomes the preparation of the ATCA 5-10 year plan, this is a critical step towards highlighting the need for the ATCA and also future directions in terms of developing capability with respect to science needs.

## 4.1 Operations

### 4.1.1 Future of CABB Support

The current CABB design is difficult to maintain and requires specialist capabilities to debug existing features (for example the reprogramming of failed correlator blocks) and even more so to develop new ones. At the moment, CABB is almost entirely being supported by retired members of the organisation in their own free time. These complications hold back potential improvements in operations (failure modes are difficult to work with and correlator mode changes are cumbersome) which could have resulted in cost-savings. These also limit future upgrade paths such as new correlator modes, bandwidth increases, and other novel back-end features. As CABB is at the heart of ATCA operations, it is of an urgent matter to determine a pathway to ensure there will be sufficient support for observers.

***Recommendation**: ATUC recommends that ATNF works on a plan to support and maintain the CABB backend in the longer term.*

***Recommendation**: The CABB 16-MHz zoom mode is crucial for spectral-line observations and should be made available as soon as possible.*

### 4.1.2 ATCA GPU Correlator

In maintaining a long term view, the ATUC was very excited to hear about the concepts of using graphics processor units (GPUs) as an upgrade for CABB. Initial investigations indicate that GPUs are accessible, powerful, versatile and cost-effective. This makes it a viable option to be considered.

***Recommendation**: A GPU upgrade shouldn't simply concentrate on replicating existing capability, but rather extend existing capability as the technology would allow the possibility for wider bandwidths, new zoom modes and other new functionality such as ultra-short dump times.*

### 4.1.3 Observing mode direction

At the ATUC open day several suggestions have been presented for potential operational modes of the ATCA in the future, including fast triggering for target-of-opportunity observations, the introduction of queue-mode observing, dynamic scheduling on time scales yet to be determined, introduction of automated observer support, and the introduction of an ASKAP-style service observing mode at the ATCA.

Fast triggering of the ATCA for target-of-opportunity observations, e.g. Fast Radio Bursts, could be difficult due to the need for setup and calibration. Switching from the current CABB system to a more flexible GPU-based backend could help making ToO observations viable. Alternatively, ToO observations could only be triggered if the array is already in a suitable mode - this may result in high-impact science outcomes.

***Recommendation:*** *ATUC would encourage ATNF to investigate the feasibility of rapid followup NAPA observations when the array is already in a suitable mode.*

Dynamic scheduling would benefit mm-band observations in allowing mm projects to be scheduled during brief periods of favourable weather conditions. A system similar to that at Effelsberg could be established, whereby two projects are scheduled in parallel and a decision is to be made by the mm project based on the weather forecast, e.g. 24 hours before the start of the observation. The increase in remote observing would facilitate such a mode and potentially allow more flexible scheduling models to be implemented. Potential risks of dynamic scheduling include its impact on projects that require observations to be carried out in regular intervals or at certain times as well as the possibility of “playing the system” with small observing blocks which are more likely to be scheduled.

***Recommendation:*** *Options for dynamic scheduling during the mm season should be investigated.*

Queue mode observing would involve executing projects according to a pre-determined queue and could also include dynamic scheduling. ASKAP-style service observing at the ATCA could be introduced in parallel to the implementation of ASKAP observing and would involve operators rather than observers carrying out the observations for a certain fraction of the time.

Automated observer support would have the aim of offering automated help to observers without the requirement of interaction with staff members. This would include computer-automated observing assistance, improved documentation and reusable observer

training material. Automated user support could be beneficial in situations of common system failures that could be easily addressed by the observer with guidance from the monitoring software and user documentation without the need for interaction with ATNF staff, for example the re-programming of failed correlator blocks.

***Recommendation**:*

- *The exact meaning of the terms "queue mode observing", "service observing" and "dynamical scheduling" should be clarified and communicated to ATUC.*
- *Automation of support generally welcomed if observing efficiency can be improved.*
- *Retaining the full science capabilities of the ATCA should take precedence over automation or operator-mode observing.*

As there is discussion about having more large projects these would be easier if some changes to ATCA observing would be implemented, including automated observer assistance and the possibility of "unattended" observing whereby the responsible observer would not be required to supervise the telescope after successful setup, but would instead be notified by the computer system of any potential problems and failures. In addition, recovery from certain commonly encountered problems could be fully automated, e.g. wind stows. We discuss this further in Section 4.2.

### 4.1.4 Mid-week RFI

Several users were concerned about the 16-cm RFI environment at ATCA. The impact of this environment depends critically on the type of science being performed and also on the users' ability to use existing tools that have been made available. We note that there has been some confusion between the nature of the typical RFI environment (which can be effectively flagged) and that which occurs during mid-week RFI (which is catastrophic and unrecoverable). Similarly, there has been some misunderstanding with respect to what optimal parameters should be used with pgflag to flag data efficiently i.e. to avoid over-flagging.

***Recommendation**:*

- *A clear distinction should be made in ATCA documentation between mid-week RFI and the typical RFI environment at 16 cm and how to identify each regime e.g. using the RFI weather radar (which is an excellent tool). A clear strategy should be defined to mitigate mid-week RFI, particularly if it is known ahead of time when it may occur, e.g. changing to an unaffected band if the science is not affected or modifying the schedule (dynamic scheduling?) to avoid observing at 16 cm during mid-week RFI periods.*

- *Users proposing observations at 16 cm should be directed to a document or web page highlighting the 16 cm RFI landscape (particularly where RFI is typically an issue e.g. the lower end of the band) and the possible implications for particular observing modes. This is mostly a potential problem for polarimetric and spectroscopic observations.*
- *It would be instructive to provide examples for pgflag to help users efficiently flag data. Consideration of typical source types (e.g. calibrators, quiet fields, complex fields), bands (16 cm, 4 cm, mm) and correlator modes (continuum, spectral line) would be helpful. An online video tutorial may also work extremely well here.*

## 4.2 Large surveys

A question was raised regarding the best strategy to maximise the impact of the ATCA during the ASKAP and SKA 1 era: *Would it be beneficial to run mostly large projects or follow-up observations of ASKAP survey science projects?*

Large projects taking 1000's of hours are relatively rare at ATCA. However, they are appealing for a number of reasons. From an operational point of view they require less support and can free resources for other activities. From a scientific point of view they could complement – but should not replace – the excellent wide range of small projects typically carried out with the ATCA. Based on the ATCA Future Science document being prepared by Jill Rathborne and Bärbel Koribalski it is clear that there is strong scientific interest in large surveys with the ATCA. We think that these projects have the potential of high impact, although ultimately the TAC would have to decide on this.

Many of the large surveys discussed at the ATUC Science Day would be either precursors or follow-up's of ASKAP surveys. Therefore, we feel that the large, experienced teams required to run large ATCA surveys are essentially already in place. These teams will guarantee a rapid release of large survey data products (which should happen through appropriate online databases).

As noted, large projects are not frequently proposed for the ATCA. An important reason is that there are practical limitations in employing teams to effectively operate the ATCA for frequent, long periods of time. An effective way to support large surveys would be to have a system of automated alarms and notifications which allows unattended observing. Following the presentation by Jamie Stevens we understand that this system is very close to being implemented. We expect it to be in full operation in semester 2015OCT, when a number of large surveys may be starting.

***Recommendations**: We recommend the implementation of unattended observing as a major step towards enabling the execution of regular, large surveys on the ATCA. There are many software components of the ATCA which require user input and which can be automated, including the potential for automatic reprogramming of the CABB blocks.*

Based on the discussions at the ATUC science day it is possible that a number of large projects will be submitted at the 17 June 2015 proposal deadline. Therefore, it may not be necessary to decide now what fraction of ATCA time should go to large surveys. At this stage, encouraging the community to consider submitting such large proposals may be sufficient. Before the next call for proposals there could be a discussion about whether a more formal commitment to large surveys is necessary. We do highlight that the excellent, wide range of smaller ATCA projects is an asset that should be kept.

***Recommendations**: We recommend further discussion of the ATCA large survey strategy before the call for 2016APR proposals.*

### 4.3 The fate of mm receivers

We note there there have been deliberations about shutting down operations of the mm receivers of ATCA as a cost saving measure. This is partly to do with concerns over maintenance of the aging hardware as well. The projection is that we can expect losses of around 1 antenna per year from this issue. This is an indication that a long term strategy for renewal needs to be in place. Suggestions include investigations into receiver upgrades, or maintenance of the current infrastructure. Millimetre observations make up of a large proportion of observing time particularly during the winter sessions. This is a clear indication that the community is interested in preserving the millimetre capabilities of the ATCA. This capability also fills a frequency gap between the SKA and ALMA. Costing of decommissioning the mm receivers shows low savings (~$30,000), and might even be similar to removing other bands, therefore there seems to be no clear advantage in removing ATCA mm capabilities.

***Recommendation**: The ATUC would like to see that full mm receiver capabilities be maintained.*

***Recommendation**: With the fiscal situation of the mm receivers in mind, moving the 6 km antenna to the 3 km track does not seem appropriate to the ATUC. There are also a high number of proposals for the 6 km array configuration.*

## 5. Long Baseline Array

ATUC notes that the Science day highlighted the number of ASKAP projects which require the LBA for scientific follow up. The SKA VLBI science case also specifically talks about

co-observing with LBA. It is important ATNF maintains a capable and well running LBA. This includes continued upgrades to wider bandwidth, flexible high frequency receivers at Parkes and continued access to Mopra and Tidbinbilla.

***Recommendation**: CASS continues to support the LBA, including upgrades to wider bandwidth and continued access to Mopra and Tidbinbilla.*

## 6. Mopra

ATUC was pleased to see the Mopra "rescue" plan presented by Michael Burton and is encouraged to see the possibility for continued scientific operation. Mopra still has an important role to play in mm and VLBI science as it provides the only "short" VLBI baseline in the LBA, and losing it would result in the number of LBA e-VLBI capable telescopes becoming sub-critical.

***Recommendation**: ATNF gives all practical support to the LIEF grant led by Michael Burton.*

Michael reported that the plans includes 1 month of "open time" for the astronomical community and asked for feedback on how the proposals are rated. ATUC welcomes this inclusion.

***Recommendation**: ATNF TAC offers to review Mopra proposals on behalf of the Mopra University consortium, if they request it, through the existing OPAL system. Such an arrangement would be the simplest for the user community.*

## 7. Tidbinbilla

ATUC warmly welcomes the increased frequency coverage at L and K bands. Discussions at the ATUC open day revealed that clarity is needed on the exact fraction of time available as part of the Host Country Agreement, and how it is scheduled. Experience of the community suggests that last minute scheduling of short blocks is the norm, however setting aside longer blocks as far in advance as is practicable would benefit a number of scientific applications.

***Recommendation**: The minimum amount of time available with Tidbinbilla, both within the LBA and as a single dish, for proposals under the Host Country Agreement be reported in the regular call for proposals, each semester.*

## 8. Other Issues

Update on gridzilla/livedata after the polling (note poll was done by Ettore)

## 9. Feedback from the reply to the previous report (November 2014)

Thanks to the director for feedback on the previous report. We comment on one item below.

9.1 ATUC made a recommendation that “Extension of the re-qualification period for a year following each successful new observing session (in the absence of major changes to the system)” should be implemented for ATCA. ATUC recognises the balance that needs to happen between observer flexibility and ensuring high-quality observations, however the committee still believes this is a reasonable recommendation, particularly if we are moving towards a smaller number of large projects on the telescope.

***Recommendation****: The re-qualification requirements for ATCA observers is re-assessed, particularly given the efforts in improving the remote observer experience for ATCA, and the automation advances being implemented by Jamie Stevens.*

## *10. Date and Format of the next meeting:*

The next meeting will be held in Nov/Dec 2015, with exact date TBD.