ATUC Report (November 2020)

1. ATUC members in attendance (all remote):

Ramesh Bhat (Chair), Cormac Reynolds (Secretary), Martin Bell, Michelle Cluver, Miroslav Filipovic, Bi-Qing For, Emil Lenc, Philippa Patterson, Nickolas Pingel, Ryan Shannon, and Yuanming Wang

2. Commendations for CASS:

- Renaming the antennas at the Parkes observatory to local indigenous names and *Murriyang* (Parkes) receiving national heritage listing.
- For the groundbreaking science achieved by the Parkes 20-cm multibeam receiver across a wide range of science over its lifetime.
- ASKAP marking an important milestone as a productive scientific instrument, with its 100th refereed publication.
- 500th reconfiguration of the ATCA, another milestone marking successful operations and scientific support over the past several decades.
- Effective response to the COVID-19 pandemic, and keeping all facilities operational and accessible through remote observing.

3. SKA

ATUC appreciates being briefed on recent SKA developments, including the signing of the SKA treaty, and the imminent foundation of the SKA Observatory. We look forward to future updates on the project progress and the impacts of the SKA on the ATNF.

4. Diversity and Inclusion

ATUC acknowledges and recognises the importance of the inclusion of incident statistics in the Director's report, as well as the small number of reported incidents in recent years.

Reflecting on comments from a previous ATUC report, it was noted that the Summer Vacation Students Programme has shown a major improvement in gender balance compared to the previous year. ATUC is interested to know if this is due to a change in strategy, or if an altered process was implemented. Additionally and related to that, if there is a strategy in place for maintaining a good gender balance moving forward. It would be helpful to see past and ongoing statistics from the programme.

ATUC appreciates the steps taken to address gender equity and bias in the proposal review and time allocation process on ATNF facilities, and supports ATNF's move towards anonymized proposals. The community expressed interest and broad support after Isabelle's presentation, but noted that there were some further considerations that may need to be taken into account. For example:

- Achieving complete anonymity is hard for reasons like size of the community, and proposers and institutional memory across continuing proposals;
- Student-related information is needed for practical consideration (e.g. timely completion);
- Taking into account the experience/expertise of the observing team; and
- Extending this analysis to include other cultural/ethnic diversity and difficulties.

ATUC recognises that advantages vs (potential) disadvantages will emerge from the (detailed) analysis, which makes this exercise incredibly valuable.

It was noted by more than one community member that the Parkes 3D movie currently being shown reflects a poor gender balance.

As part of CASS' ongoing commitment to diversity and inclusion, are there any aspirations or plans for recognition via the Pleiades or SAGE programmes? What steps are being taken to track successes and areas that could be improved?

Recommendation: *CASS to articulate the current strategy for encouraging diversity within the Summer Student program and provide a standing report for Vacation Internship gender statistics moving forward.*
Recommendation: *CASS to track the number of student-led and ECR-led proposals, as well as provide detailed gender statistics for each proposal round.*
Recommendation: *Consult ESO, HST, SARAO/MeerKAT on how blind proposal review is being implemented at other observatories and what their experience has been (lessons learned).*
Recommendation: *Improvement of gender balance and diversity being made a priority in forthcoming productions/outreach materials.*
Recommendation: *Standing report from diversity champion Kevin Ferguson, outlining the actions being undertaken by CASS to address any existing diversity and inclusion issues and whether there are plans for Pleiades or SAGE recognition.*

5. Radio Astronomy Technologies

ATUC was impressed by the excellent progress being achieved in the area of R&D, through the use of the Jimble and Bluering RFSoC boards for the BIGCAT and CryoPAF backends, and the

potential use of new technology, e.g. COTS digital backends and beamformer cards (based on ALVEO technologies and GPUs), for the new instrumentation that is under development. The scalability and versatility of these state-of-the-art technologies, as well as their low carbon footprint, make them highly amenable for wide-ranging instruments and telescopes, and hence a worthwhile investment. ATUC looks forward to hearing further updates related to the progress in these R&D efforts, an area where CASS has an excellent reputation and track record.

The LIEF process has proved extremely effective in delivering new cutting edge instrumentation to the ATNF telescopes. ATUC is pleased to note that the design and development work for BIGCAT and CryoPAF is progressing well, following the LIEF success last year. A LIEF bid to develop the UWH receiver is clearly the next logical step. In order to facilitate a stronger interest in such LIEF bids, it would help if the CASS EoI process is aligned with the EoI deadlines of potential partner Universities, to the extent practically possible. It is unclear at this stage if the proposed LIEF bid for UWH is going forward for submission this year. ATUC suggests that CASS develops the science case further in consultation with the wider community, and prepare for a stronger case next year in the event no LIEF bid is submitted for the coming round.

ATUC is pleased to learn that early prototyping activities and upgrades to telescope firmware are progressing in preparation for the planned coherent FRB detector, CRACO, a LIEF bid for which is currently pending. ATUC looks forward for updates on further progress from these early prototyping work.

ATUC was also pleased to note that the efforts around the LBA-Low development is progressing at some level, and discussions are underway with the MWA team, particularly on the prospects of using Blue-ring RFSoC technology for low-frequency stations (e.g. EDA2) beamformer. ATUC looks forward to hearing further updates on this front in due course.

In the context of the high-level roadmap presented at the last meeting, ATUC had suggested that CASS considers the organisation of a dual science and instrumentation day at a future ATUC meeting. Given the excellent progress being made with some of the related technologies (e.g. RFSoC), and their adoption for the next-generation instrumentation under development (e.g. BIGCAT and the CryoPAF backend), it seems timely for such a meeting to be organised in the coming year. This will help engage the wider community in related discussions, to guide the direction of future instrumentation development.

Recommendation: *ATUC supports the CASS approach and strategies for LIEF applications, and recommends that CASS align the related EoI process with the timelines for Universities to secure commitment through their internal process.*
Recommendation: *CASS to consider holding a dual science and instrumentation day - possibly attached to the ATUC October 2021 meeting.*

6. Data Archives

ATUC is pleased to hear of the recent updates to CASDA to enable improved querying, addition of new data types, support for CASDA events, performance increases and improvements to the user interface. The addition of bulk validation and release will help improve the SST workflow.

ATUC notes some specific feedback received from users regarding data download issues with ATOA. These include a large latency before data becomes available in the archive - this can be particularly problematic for NAPA science. Once data are in the archive, downloads are apparently limited to no more than 20 GB in any single download session. Furthermore, the download speed tends to be relatively slow (typically MB/s), which makes access to large amounts of data cumbersome and time-consuming. It has also been noted that data sizes will become significantly larger once BIGCAT is introduced and this will place an even greater load on ATOA. ATUC had previously suggested (at the April 2019 meeting) that consideration be given to migrating ATOA to CASDA, and would be very interested to hear about its feasibility.

ATUC also notes some feedback received regarding DAP downloads of pulsar data. Currently, the DAP only allows downloads on a per-collection basis. If a user requires data for a particular pulsar/source that spans many collections then obtaining those data is difficult. A request has been made for an interface in DAP that can take a list of unique file identifiers for download.

ATUC notes that downloads of spectra from CASDA/ATOA currently require downloading the entire band even when only a small portion of the band is of interest. This causes unnecessary excess load on networks, local storage and local processing facilities.

Recommendation: *Relevant members and users to liaise with ATNF to develop a list of use-cases to implement more efficient data downloads from DAP.*
Recommendation: *Investigate adoption of CASDA to host/query/access ATCA and ATCA BIGCAT data.*
Recommendation: *Consideration of a cut-out service for spectral data to avoid downloading excessive amounts of data when only a small portion is required.*
Recommendation: *Regardless of archival system, ATCA BIGCAT to retain the ability to give users fast initial access to data for transient or NAPA science.*

7. ASKAP

ATUC is pleased to hear of the excellent progress being made with ASKAP science, and the anticipated potential of ASKAP as a productive scientific instrument, marked by an important milestone with its 100 refereed publication. This includes high profile results in FRB science (e.g. recent Nature paper led by Macquart et al.), and the upcoming paper on the first RACS survey and the data release.

ATUC is pleased to note that ASKAP pilot survey Phase I observations have been completed and the release of SWAG-X test data. ATUC looks forward to the completion of Phase I data processing and SWAG-X spectral line data. RACS has proven to be a successful observatory project, in particular as a technical diagnostic tool and a valuable lesson for managing all-sky survey products. ATUC is aware of a potential issue with data processing efficiency for Phase II operation as well as issues with the current Phase I spectral line data products (e.g. continuum subtraction). Undertaking some suitable tests to streamline the Phase II survey operations will therefore be highly beneficial.

While it is encouraging to note that the imminent update/refresh to Pawsey will help solve the ingestion/processing interdependence, it does not appear that the overall disk space issue would likely be solved. ATUC would be interested in more details regarding possible strategies on how disk space will be handled during the processing of Phase II surveys. Ironing out the data product issues well before rushing into Phase II survey observations would help ensure the smoother conduct of these key programs and their successful delivery and completion.

Recommendation: *ATUC recommends CASS to liaise with ASKAP Science Survey teams and help them iron out the data product issues before rushing into Phase II observations and to assess the impact of required tests for the start of Phase II observation.*

Commensality

ATUC recognizes the need for commensality, given the absence of a split-band mode and 10+ year estimate projected for the completion of ASKAP surveys, assuming 100% efficiency for telescope operations. The workshop held in August 2020 presented various commensality scenarios, which, as ATUC understands, are being currently discussed amongst the SSTs and will be trialed during the Pilot Phase II surveys.

ATUC would be interested in information pertaining to commensality and the leading strategies that are being considered, based on discussions that took place at the SST PI meeting in December. ATUC would also like to seek some clarification on the expectations for the fractional availability of open access time on ASKAP, especially considering the time pressure introduced by non-commensality.

Recommendation*: CASS to clarify the commensality strategies that are being considered following the SST PI meeting, and expectations of the fractional availability of open time on ASKAP, given the time pressure anticipated from potential delays.*

ASKAP split-band mode

ATUC was pleased to note the proposed development of a split-band mode led by a “tiger team”. The split band mode is important for various SSPs, such as GASKAP and DINGO, and may also benefit other surveys such as RACS and VAST. The mode would enable the entire RFI

free portions within the band $0 < z < 0.43$ to be observed in a single observation. This will both decrease the telescope time required by spanning the full frequency range relevant to HI emission science, as well as significantly increase the HI science utility of any observation undertaken. For the DINGO project, the implementation of a split frequency mode would also result in a much more streamlined survey strategy, with a single split frequency mode serving both the Deep and Ultra-deep portions of the survey. The Ultradeep fields becoming a simple continuation in integration time over the Deep fields, would also bring in significant additional flexibility in terms of the choice of the fields and depth.

The implementation of a split-band mode is also vital for completing the GASKAP survey within a reasonable fraction of the originally planned timeline. The current single IF mode requires the HI and OH components of GASKAP to be treated as two entirely separate projects for the purposes of time allocation for Pilot Phase II. A working split-band mode would allow for simultaneous observations of HI and three out of the four 18-cm OH lines, which would also dramatically reduce the telescope time and streamline the observing strategy for the eventual full survey. For RACS/VAST, observing with a wider frequency range in a single epoch will be useful for spectral index determination and increased sensitivity.

Recommendation: *CASS to report back on the feasibility and timeline of the split-band mode after it has been evaluated by the proposed tiger team, and to clarify how the implementation of split-band mode would impact the full survey's timeline.*

8. ATCA

ATUC awaits with great anticipation the development of the new correlator for ATCA, BIGCAT, and was pleased to receive an update on the project at the open session of the meeting. The BIGCAT development team requested ATUC feedback on a number of design considerations. While some feedback is provided below, the ATUC notes that a wider community consultation will be beneficial to ensure that all key operational modes are considered and/or implemented, including, for example, modes that are not currently available in CABB. The ATUC further noted that a one-day meeting/workshop is being planned in early 2021 to review the related design and science requirements. This workshop will provide the opportunity for ATNF to define the key observing modes for BIGCAT.

Recommendation: *CASS to invite a scientifically diverse range of potential ATCA users to attend the 2021 workshop and help finalise science requirements for BIGCAT.* ■

ATUC discussed a number of features and modes required for BIGCAT, however feels it is more appropriate to provide some general feedback on design considerations at this stage, rather than commenting on the specifics of modes, especially given that the design workshop is due to be held in early 2021.

Recommendation**:** *CASS to consider the following features when designing BIGCAT.*

- *Low-latency follow-up modes (like the low-latency triggering currently available).*
- *Pulsar/VLBI tied-array beams.*
- *Higher spectral frequency than 0.6 kHz (precise value to be determined, based on user feedback).*
- *The ability for both automated observing (made possible by easier reconfigurability of the system), as well as interactive observing modes to enable observer training.*
- *The ability to mitigate radio frequency interference, which would be important given the wider bandwidths.*

ATUC also discussed various options for the data format for BIGCAT, and felt that, in general, the users are likely to be less concerned about the format of the data and more on the ability to calibrate and image the data, and to deliver scientific outcomes. Bearing this in mind, ATUC is more inclined to advocate some general principles while making an informed choice on the data format.

Recommendation: *CASS to consider the following principles when deciding on a data format for BIGCAT.*

- *A well motivated data format is best designed by software engineers.*
- *Data format should be able to interface with either CASA or miriad.*
- *The data format should not preclude science objectives (i.e. it should be possible to analyse data mid-observation to search for transients, etc.).*

Legacy surveys

The legacy surveys promise to deliver important data sets and scientific outcomes for ATCA. As such they require large time allocations and operational support, potentially impacting access to other users. ATUC notes that there were no major updates on the status of the ATCA Legacy Surveys other than their time allocations.

Recommendation: *ATUC requests that an update on the legacy surveys be provided at the next meeting, including a) progress updates, b) publications, and c) plans for data releases.*

9. Parkes (Murriyang)

ATUC is pleased to learn about the renaming of the Parkes 64-m radio telescope to a local indigenous name *Murriyang*, and commends local Parkes staff (in particular Stacy Mader) for championing the project. ATUC is further pleased to hear that Murriyang has also received a national heritage listing. The Parkes radio telescope (Murriyang) obviously remains a central facility of the ATNF. With the UWL now fully commissioned, Parkes has become a sought-after instrument for broad-band studies of a diverse range of objects and astrophysical phenomena. ATUC notes that there has been a gradual increase in the usage of Parkes with the UWL being

deployed. The construction of the new Phased Array Feed receiver will usher in a new era of wide-field studies with Parkes, particularly in areas such as pulsars, FRBs and other transients, as well as spectral line studies.

ATUC acknowledges wide-ranging groundbreaking science achieved by the Parkes multibeam receiver over the past two decades. The investment in the multibeam receiver technology has proved extremely worthwhile, as it even led to sibling instruments for Arecibo and FAST, which produced similar wide-ranging science including high-profile science in Nature papers on FRB science (e.g. recent publication led by ATNF postdoc Rui Luo). ATUC looks forward to equally exciting science to be delivered by the newer technology CryoPAF, currently under construction.

ATUC notes that continued access to Parkes will benefit from further broadening of its user base and ensuring that Parkes does not become a niche instrument.

ATUC was pleased to read the Parkes Science Case that has been submitted to ATSC. Given the proposal for a UWH receiver in the near future, the science case (and the LIEF bid) would jointly benefit from a more considered view of high-frequency science.

Recommendation: *A science case for high frequency observations (including large projects) to be further developed and discussed amongst the community.*

Use of facility names

The Parkes radio telescope (and two other telescopes on site) have been given indigenous names as part of NAIDOC week, as noted in the commendations. There are also discussions with respect to giving indigenous names for other sites. While the community supports these namings, it is unclear how best to use these names in scientific and popular communication.

Recommendation: *CASS to provide advice on how (and when) to refer to telescopes when communicating results (in refereed publications, popular media, and social media etc.)*

10. LBA

An update on LBA and related activities (including developing a science case for LBA-Low) was requested in the April 2020 ATUC report. In response, CASS noted that the practice has been to provide annual updates on LBA. CASS had further indicated that an update will be presented on LBA-low at the current meeting. However, no updates were provided.

Recommendation: *ATUC requests an update on LBA and LBA-Low plans at the 2021 May meeting.*

11. User Feedback

CASA and BIGCAT

If CASA will be the default tool for ATCA (BIGCAT) data reduction then in-depth tutorials on how to perform ATCA data analysis using CASA will be essential.

A number of items of feedback relating to the questionnaire sent out by the BIGCAT team were received by ATUC and forwarded directly to the BIGCAT project scientist, Elizabeth Mahony.

DA observer training

It would be useful to revisit the current strategies for DA observer training to ascertain how they can be tailored to remain effective in future, and any suitable amendments that may have to be made to the related policies. Among the points to be considered are:

- The Compact array remains an important instrument for training Ph.D. students;
- Online observer training has been a great success and should be continued;
- Allow flexibility to DA from Narrabri, Marsfield or Perth, as this will bring added value and benefits;
- In general, allow as much flexibility as practically possible; and
- Online lectures (video) training for DA - e.g. simulation/recording of real situations (block drop-off etc.)