ATUC Report (June 2016)

ATUC members in attendance: Paolo Serra, James Miller-Jones, Jo Dawson (secretary), Virginia Kilborn (chair), Katharina Lutz (student member), Stas Shabala, Vanessa Moss, Daniel Reardon, Willem van Straten (by phone).
Apologies: Stuart Ryder

1. Executive Summary

The ATUC has spent the majority of the meeting discussing the current budgetary constraints, and their effect on Australian radio facilities. ATUC appreciates the honest and open discussion from ATNF over these issues which enabled a frank discussion with the community.

ATUC received a large volume of feedback from the community, whose overwhelming opinion was that the closure of ATCA and/or Parkes before the upcoming southern-hemisphere next-generation radiotelescopes were fully operational would be a huge risk to the global community and the health of Australian radio astronomy. Both ATCA and Parkes are highly valued not only in Australia but also abroad, and there are very strong strategic, economic and scientific cases for keeping both of these observatories operational in the short-medium term, and even into the phase when next-generation facilities are in full science operations mode. Our report discusses some of the implications of the current financial issues, summarises the community feedback, and explores options for future funding of the observatories.

On another note, ATUC was disconcerted by the abrupt departure of Lewis Ball from ATNF, and we thank him for working closely with ATUC over the past 3 years. In particular we appreciated his genuine interest in the comments of ATUC and his efforts to take the recommendations on board.

2. Commendations

ATUC commends ATNF for:

- The first 36-beam image with the ADE PAFs
- Progress on the UWB low receiver, and the rocket PAF
- Signing the agreement for a 19-beam receiver for FAST
- Progress on unattended observing at ATCA
- CASDA progression and release
- Updates to the observing webpages which are much improved on the old sites
- ASKAP community busy weeks

3. Implications of the AAL-proposed distribution of NCRIS funding

ATNF is facing a challenge to keep the current suite of observatories operational in the face of delays in the construction of ASKAP, and the recent AAL budgetary proposal that no future astronomy NCRIS funding should be distributed to ATNF after the 2016/17 financial year. This would put the observatory under serious financial strain. While we recognise (as outlined in the Decadal Plan) that a new model of operation will be required to ensure longevity of the existing facilities, it will take some time to explore the possible options and transition to any new model. Thus, discussions should continue with AAL regarding a more gradual ramp down of funding, or some sort of bridging arrangement over the next few years.

Recommendation: ATNF should continue discussions with AAL about future funding allocations, in particular avenues for bridging funding while the ASKAP telescope is undergoing commissioning and to provide time for new operating models for the other telescopes to be implemented.

Risk Analysis

Given the possible threat of winding back or cessation of operations at Narrabri and Parkes, we recommend that ATNF perform a high-level risk analysis of what this would mean. Some of the key risks identified by ATUC include:

- The cessation or winding back of operations at Narrabri would lead to a risk that ASKAP science would not be fully realised (particularly for the polarisation and continuum surveys, which rely on the large bandwidth of ATCA for follow-up observations).
- The potential loss of existing facilities before their replacements are fully commissioned could lead to an erosion of the Australian user community. This could then lead to the loss of the technical and scientific knowledge required to fully exploit ASKAP.
- Parkes is an important test facility for advanced instrumentation (e.g., ultra-wideband receivers, next-generation phased-array feeds) that leads into SKA development, and it would be irreplaceable in this role. However, ATNF should consider the risk of ageing major mechanical systems (e.g. the elevation bearings) over the coming years, and what level of cost and risk that would entail.
- On a medium to long-term timescale, any loss of ATNF facilities and the associated technical expertise would place at risk Australia's leading role in the SKA, as well as affecting many university departments and their student training programs.

As a national facility, ATNF has always adopted an "Open Skies" policy at its telescopes. This has been extraordinarily successful, attracting talented scientists from all around the world to use ATNF facilities. The high fraction of international users is testament to the world-class nature of ATNF telescopes. This policy has improved the scientific output of the telescopes, brought some of the world's top scientists to visit or even work in Australia, and allowed Australia to maintain a leading role in the international astronomical community. This Open Skies model is also adopted by other world-leading observatories, including the VLA, VLBA and

GBT at radio wavelengths, and the space-based Hubble, Chandra, Fermi, Swift and XMM telescopes at optical and X-ray wavelengths. Australian astronomers have typically done well in competing for merit-based time on these facilities. However, many new large facilities such as ALMA and SKA are moving away from this model, and combined with political pressure this is prompting observatories such as NRAO to reconsider their policies. If Open Skies policies were to end, reciprocal bilateral agreements between countries could ensure continued access by Australians to overseas facilities, but this would require the continuation of a national facility with significant merit-based time to award. In such a scenario the loss of ATCA and Parkes would be compounded by the loss of reciprocal access to other world-class facilities, forming a double blow to the entire Australian astronomy community.

Recommendation: ATNF undertakes a risk analysis to understand the impact of loss of capability at any of the current radio facilities at the present time. This should address the effects on ATNF, the domestic astronomy community, as well as the global community and Australia's standing therein.

4. Feedback from the community

ATUC received more than 30 submissions from the community. Most were concerned with the funding situation and options for future ATCA / Parkes operations. As pointed out by one user, "ATCA and Parkes provide critical capabilities in addressing three of the six fundamental science questions posed by the decadal survey, and are supportive in addressing a fourth". Multiple responders commented that closing either facility would be "crazy" and "terrible". ATCA's unique capabilities were highlighted time and time again, including its broad frequency coverage and geographic location. Far from being a competitor to ASKAP, ATCA was seen as a complementary instrument, largely due to the much greater frequency coverage; because of this, ATCA is also complementary to ALMA. It was pointed out that both Parkes and ATCA are also key components of the only VLBI facility in the southern hemisphere. A large number of users also noted the risks in losing the technical and scientific expertise in Australia if ATCA/Parkes were closed, especially before ASKAP is fully operational. It was pointed out that it took a decade for Australia to develop interferometry capacity after ATCA was built, and that ATCA has served as a very useful training ground for many present-day astronomers. Many volunteered to write letters of support if they would provide ammunition in helping to keep ATCA open. They were willing to take a lead from ATNF in terms of when this would be most helpful.

Similarly enthusiastic support was received for Parkes, and it was highlighted in particular that Parkes Pulsar Timing Array observations must continue until at least ~2 years after MeerKAT becomes fully-operational for pulsar timing, to understand the systematics when switching instruments. Otherwise over two decades of work would be lost. The imminent upgrade to Parkes with the Ultra-wideband low receiver was also noted, which will reduce receiver-switching and hence operations costs in the future and will inform the best strategies for SKA pulsar timing.

Some funding suggestions were received from the community, including co-funding (e.g. Parkes as an educational telescope), cost recovery (e.g. for the MRO site development), and re-deploying travel funds (savings made by remote observers) to pay for telescope operations.

There was enthusiasm for a potential future GPU correlator for ATCA. Users requested more support for any new modes provided on the telescope. There was concern about the potential effect of budgetary constraints on completion of ATCA legacy projects. Some users were unsure about the “key scientific priorities for the observatory that will ultimately guide difficult decisions”.

5. ATCA Legacy Projects

The recent email suggesting the possibility of winding back or ceasing operations at ATCA has caused significant concern among the Legacy Project teams. The view of ATUC is that the phase of Legacy Project proposal submission and evaluation should proceed as planned, but that time allocation and scheduling should follow the principle that approved Legacy Projects must be completed.

Given the large number of EoIs (15) relative to the expected number of approved projects (2-3), the chances of getting ATCA time for a Legacy Project were always going to be low (~15%). Legacy Project teams that decide to submit a proposal implicitly acknowledge this low chance of success. Therefore, the current uncertainties about the future of ATCA do not have an immediate impact on the submission of Legacy Project proposals, and this process should proceed as planned.

However, the following steps of time allocation and scheduling should be carefully planned in order not to waste the significant amount of time and effort that the successful teams will put into planning, executing and raising resources for the approved Legacy Projects. In particular, ATNF should take all possible actions to ensure that, once started, Legacy Projects are also completed. If this is not done, ATNF will have wasted a significant amount of telescope time to projects that, if only partially completed, will have limited legacy value, with negative consequences for the credibility and reputation of ATNF.

In order to ensure the completion of approved Legacy projects ATNF could consider increasing the fraction of time dedicated to a few Legacy Projects for the time the ATNF management is confident ATCA will remain open. This would be in line with the original proposal for instituting Legacy Projects (which was approved by ATUC), where it was suggested that 25% of ATCA time should initially be devoted to Legacy Projects but that this fraction could potentially increase in the future depending on demand, science quality, and feasibility. This issue should be examined more closely, with input from the TAC outcomes and in consultation with the user community. The agreed fraction should aim to balance the imperative to complete any Legacy Projects that ATNF commits to and the capability of ATNF to adequately support such large programs. It should also aim to retain an appropriate fraction of time for smaller (PI- and

student-led) programs, given that the original call for Legacy projects precluded those that could be replaced by a combination of smaller projects.

The execution of Legacy Projects would benefit from reliable unattended ATCA observing. Significant progress has been made (e.g., Twitter notifications) and is noted by ATUC. However, some key functionalities are still missing. This includes automated recovery after PMON wind stows, which could be made a priority between now and the start of the Legacy projects. To some extent, automated recovery of correlator blocks could be implemented too – although ATUC appreciates that this does occasionally require further checks on the data quality which can only be made by the observer.

Recommendations: The submission and evaluation of Legacy Projects should proceed as originally intended. ATNF should make every effort to ensure that Legacy Projects, once approved, are able to be completed, particularly if the continued operation of the ATCA comes under threat. While ATUC is in principle open to the possibility of increasing the fraction of time devoted to Legacy projects, this would depend on the quality of the proposals, and the community should be consulted further if particularly large adjustments are to be made. Regardless, care should be taken to ensure that the diversity of science areas from approved proposals (which is one of the key strengths of ATCA) remains well balanced across the full suite of Legacy and non-Legacy projects.

6. LBA implications

ATUC notes the importance of Parkes and especially ATCA (due to the limited frequency flexibility of Parkes) to the LBA. Tidbinbilla availability is limited, and also usually restricted to short segments, so cannot be relied upon for the long tracks typical of LBA schedules. ATCA and Parkes therefore provide the bulk of the sensitivity to the LBA. As the only VLBI facility in the southern hemisphere for the foreseeable future, the capability of the LBA must be maintained. Losing ATCA and/or Parkes poses serious danger to the VLBI component of the SKA, as the LBA is the only southern-hemisphere VLBI facility that could co-observe SKA targets. A loss of the domestic VLBI capability would lead to loss of critical expertise that would take decades to rebuild. Furthermore, a number of countries in the Asia-Pacific region (e.g. Thailand, Indonesia) are seriously considering developing a VLBI capacity. These are in addition to the already-existing Asia-Oceania VLBI network (Australia, New Zealand, China, Korea, Japan). All these dishes need a functioning LBA to co-observe with.

ATUC notes with interest the possibility of ultra-wide band receivers at Parkes and ATCA. The 4-12 GHz frequency coverage enabled by a GPU correlator at ATCA and Parkes UWB-high receiver is well-matched with the broadband receivers currently being commissioned on the AuScope VLBI array. Such wideband VLBI capability would enable a broad range of new science, allowing the LBA to study a range of fainter targets, such as those detected by the

upcoming ASKAP surveys. We encourage the ATNF to investigate a range of funding options (including seeking out suitable partners) to facilitate this.

ATUC also notes that tied array capability will be developed at MeerKAT on a short timescale (it is needed for pulsar work), and ATUC encourages the ATNF to prioritise a similar capability for ASKAP, as outlined in the original specifications, if needed at the expense of more incremental upgrades.

Recommendation: Every effort should be made to preserve the long-baseline capabilities in Australia, and ATNF should prioritise the tied array capability of ASKAP over less pressing developments.

7. Options for funding

Closure of ATCA/Parkes can not be considered at this stage for both strategic (Section 3) and scientific (Section 8) reasons. Every other possible option should be explored in detail first, including a review of the funding elements of ASKAP and continued negotiation with AAL over the allocation of NCRIS funding.

Although future telescopes will replace some of the capability provided by ATCA/Parkes (e.g. ASKAP/ALMA/MeerKAT for a fraction of the frequencies of ATCA; MeerKAT for pulsar timing), it is vital that Australia maintains this capability until complementary facilities are fully operational. Furthermore, the timeline over which some of these facilities will become fully operational is unclear, as is the amount of observing time that may be available for Australian researchers (particularly for MeerKAT). Finally, it is important to note the VLBI capability of Australia through the LBA will be devastated by the loss/reduction of Parkes and/or ATCA. In view of the risks outlined in Section 3, ATUC requests that ATNF dedicate significant resources to seeking alternate funding avenues, such that both ATCA and Parkes continue to operate in the short-to-medium term, with a substantial fraction of time available to scientists under the current merit-based scientific model.

Below is a (non-exhaustive) list of suggestions for alternate funding. ATUC also recommends that feedback and further suggestions are sought from the community. Initial options for long-term funding might include:

- Partnership with ESO: A model might be to trade ESO nights (including access to the VLT, i.e. a 8m class telescope) with ATCA and Parkes time. This would save money as less time on Keck would have to be purchased. The savings could then go into funding for ATCA and Parkes, i.e. the Australian part of the deal. ESO and ATCA/ Parkes are a natural match as both observatories operate in the southern hemisphere. A similar deal could also involve the Subaru community instead of the ESO community. It needs to be investigated how much interest there is in the ESO or Subaru community.

- External funding for ATCA: Making available some fraction of ATCA time for full cost recovery purchase similar to the “Breakthrough Listen” contract at Parkes could secure significant funding to keep ATCA a National Facility. However, ATNF should consider the balance of time between Legacy projects, sold time, and regular open-time projects as a national facility. Furthermore, some policy decision would be required as to whether or not merit-based projects and sold-time projects would be allowed to compete; to make time attractive to potential buyers, as few strings as possible would need to be attached.
- External purchase of ASKAP time: Much of the best science that can be done with ASKAP has been approved as the SSPs. If ASKAP data were not made publicly available immediately, this could make it more attractive for external buyers to purchase some of the remaining time.
- Leveraging external resources: Explore the possibilities for ASKAP science teams, ATCA Legacy project teams, international users, and the Australian radio community to bring in funds through grants, both domestic (e.g. LIEF) and international.
- Cost savings: Explore the possibility of cost savings from the DA program at ATCA, such as via moving this to a completely automated facility.

As interim funding options until a longer-term solution is found, the following could be explored:

- ATCA is technically able to get involved in SETI as well as Parkes. The Compact Array performs comparably well to Parkes at L band and even better at higher frequencies. Thus “Breakthrough Listen” Foundation may be interested in further collaboration.
- Significant philanthropic donations from private persons could to be encouraged (assuming that CSIRO can accept donations). This could include exploiting existing links with individuals that may trigger significant fund raising (such as Daft Punk; see below).
- Daft Punk did an album release party in Wee Waa in 2013, including an event at the ATCA site. Further events like this could generate additional income.
- Currently the visitor centre at Parkes is free of charge. Can the public be asked for gold coin donations? Some creativity around the process could help (e.g. an eye-catching collection box, a certificate about how people help to fund the telescope, ...). Mopra sold off gas clouds to raise funds.

Recommendation: We request the allocation of ATNF resources (including FTEs) to form a working group that is dedicated to assessing and securing alternative funding sources, being guided by the risk and cost-benefit analysis recommended in Section 3.

8. Science cases

ATNF currently presides over an extremely scientifically productive suite of facilities, with almost 150 papers published in 2014 from studies with ATCA, Parkes, LBA, and ASKAP. ATCA, Parkes, and the LBA are currently responsible for 130 of these publications (with another 17 from Mopra). Were ATCA and Parkes (and hence the LBA) to be wound back or shut down, it would significantly impact the science output of ATNF until ASKAP was fully operational. Even

then, with 75% of ASKAP time going to large survey science projects, its key science results are likely to be several years down the line. Furthermore, as found with many other large facilities in recent years (the VLA and LOFAR being key examples), the 15 TB of data per day produced by ASKAP and going into CASDA could potentially throttle the rate of publication until users find a way of handling such enormous data volumes. Thus, the impact on ATNF's publication rate (and potentially therefore its KPIs) should be considered in the discussion over the future of its suite of science facilities.

ATUC emphasises that the case for continued ATCA/Parkes operations is scientifically indisputable. We endorse the statement made in the ATCA science case document (Koribalski et al.):

"ATCA is a mature, highly versatile, world-class facility, ready to play a major role in the ASKAP era and beyond. Its cutting-edge, broad-band instrumentation, exceptionally wide frequency coverage and Southern Hemisphere location make it a unique and powerful instrument, which fills a crucial niche that no other current or upcoming facility in the world can replicate. Major ATCA science drivers include (but are not limited to) galaxy formation and evolution, Galactic star formation, transients, and interstellar medium physics, and the facility is poised to make major advances in these fields via the upcoming legacy project programme as well as through its varied programme of smaller projects."

The continued operation of ATCA is also crucially important to the success of ASKAP surveys: targeted follow-up observations with ATCA vastly multiply the scientific value of ASKAP data, since ATCA provides the resolutions, surface brightness sensitivities and frequency coverage that ASKAP cannot. This again highlights that ASKAP can never be a satisfactory replacement for existing facilities; ASKAP and ATCA are highly complementary, and each enhances the scientific output of the other. ATCA must continue operations until at least such time as MeerKAT is fully commissioned for open skies observations.

The legacy project programme strengthens the case for keeping ATCA operating in the short-to-medium term. It demonstrates explicitly the high demand for the unique capabilities of the telescope, and emphasises its critical role in addressing a range of world-leading and high-impact science goals. Crucially, it sets clearly defined timescales in which ATCA must remain operational in order for science goals to be met, which can be leveraged when arguing for the necessary lifetime of the facility.

Parkes is an important test bed for new technologies, including for ASKAP and the SKA. While the "Breakthrough Listen" project is supporting a fraction of the cost of running Parkes, this telescope must remain available for this testing, as well as for existing science projects. Beyond this, Parkes pulsar monitoring must continue for at least ~2 years from the start of successful pulsar timing results with MeerKAT to maintain timing continuity with the existing ~25 years of data. This timing data currently leads the world in terms of sensitivity to the gravitational wave background in the nanohertz pulsar-timing band. Following the completion of the Ultra-wideband

receiver, this timing quality will improve greatly. Finally, the importance of Parkes as a technology testing site and as an educational tool for outreach programs such as the successful PULSE@Parkes project, will continue into the future.

Recommendation: The ATCA future science document provides an essential reference on the value of ATCA to the global astronomy community. A similar document may be of use for Parkes.

9. Impacts on ASKAP

ATNF has consistently indicated that ASKAP is its top priority and that it is committed to ensuring the success of the SSPs, implying that the bulk of the budgetary cuts would have to come from elsewhere. As the dominant line item in the budget, ATUC requests that ATNF consider whether there is any potential for some fraction of the savings to come from the ASKAP construction or operations budget. Options that could be examined might include leveraging the resources of the SSP teams to help with commissioning and operations, reducing the level of user support or data products provided by the Observatory, or even (in a worst-case scenario) delaying or scaling back the roll-out. While these would all be far from ideal scenarios, the high level of concern in the community over the possible scaling back of ATCA and Parkes operations implies that ATNF will need to seek the best possible balance between the capabilities that it is able to offer across its full suite of telescopes.

Recommendation: ATUC would like ATNF to consider what savings could be made with regards to ASKAP in light of a full risk and cost-benefit analysis.

10. Instrumentation/technology developments

ATUC supports the continued investment in the Ultra-wideband (UWB) low receiver development for Parkes. The project has contributions from multiple institutions, accounting for ~60% of the direct costs; a successful ARC LIEF grant accounts for ~40%, and Swinburne University manages additional external funding. The prototype feed development has already resulted in a patent for CSIRO. UWB-high is an important next step to this first investment, offering exceptional high-frequency coverage which is essential for the highest pulsar timing quality in the best pulsars (which will ensure that the Parkes Pulsar Timing Array remains a world leader in its sensitivity to nanohertz frequency gravitational waves), and wideband VLBI. The GPU correlator at ATCA is another exciting possibility that is likely to find enthusiastic support within the community.

It is important that the CSIRO continues developing new technologies for future telescopes such as the SKA. Parkes is currently an important testing site for first-generation phased array feeds (PAFs), and will need to continue for the next-generation cryo-cooled and rocket PAF systems, whose development is strongly supported by ATUC. Next-generation PAFs are crucial for the

long-term development of the SKA. Furthermore, enhanced development of these world-class instruments can continue opening doors to sales options to international observatories.

Recommendation: In terms of prioritising future instrumental developments, ATUC recommends that ATNF seek wider community input to determine which of these would have the largest and most valuable impact. Prioritisation could also be made with regards to which upgrades successfully acquire funding via external sources.

11. Facilitating ongoing collaboration between groups within and external to CASS

ATUC thanks ATNF for their positive response to questions raised in the previous report about inter-site synergy, particular with regards to the ATNF facilities that have most recently transitioned into remote operations. We look forward to the detailed response to be provided by ATNF that will provide clarification of the policy for site visits (including associated expenses) so that we can forward this information to the astronomical community. While it is good to hear that some staff and observers have successfully visited and worked at sites over the past six months, ATUC advises strongly that the circumstances under which this may occur be made as clear as possible to the wider community who are not aware that this can be organised.

We highlight the importance of encouraging interaction between the various ATNF-related groups (astronomy, engineering, computing) both at remote sites and internally within the Marsfield site. This is vital in the context of continued innovation and instrumentation development at CSIRO, maintaining staff morale across the dispersed sites, and ensuring the capability of facilities to match the science being conducted, as well as maximising the efficiency with which ASKAP Early Science can begin to take place. Site visits can provide the context for positive and useful interactions between astronomers (including students) and site operations staff, specifically at Narrabri, Parkes, Perth and Geraldton. We acknowledge the greater difficulties around Boolardy visits, but recommend a few trips a year organised for interested parties (particularly internally) before full operations commence. This would need to be done in a manner that would minimise any impact on commissioning or observations, and (in light of the current budgetary situation) to minimise costs. It would also be good to see stronger communication between CASS and the indigenous community of the Murchison, and a reflection of this in further interactions between the two groups on a regular basis.

ATNF, through its close ties with the facilities it operates, provides a unique opportunity for students, postdocs and faculty to actively engage with functional radio telescopes and obtain hands-on training. ATUC on behalf of the wider community feels that the ATNF should make maximum use of this increasingly niche advantage in the era of worldwide remote telescope operations in order to stay highly attractive to the next generation of students and postdocs, as well as ensuring this experience and knowledge is carried on to future radio astronomy. In the previous ATUC report, we provided details of suggested contexts for this kind of hands-on training (e.g. internships/residencies at the telescopes, student/supervisor trips, schools/workshops), and some of our members are happy to work with ATNF in order to make

these a reality, particularly for the Parkes/Narrabri sites. We would advocate for a user-pays models that is cost-neutral to ATNF.

Recommendation: ATUC asks that ATNF provide and disseminate detailed information on opportunities to visit/work at telescope sites, including costs and scenarios where this would be allowed.

12. CASS Radio School and Data Reduction Workshops

ATUC made the suggestion last time that Parkes could be involved in the radio schools by alternating between being on site at Narrabri and on site at Parkes (with the fundamentals of both single-dish and interferometry covered at both schools but some variety in talks based on location). Given ATNF's current commitment to running one radio school internally every 2 years, we suggest that the radio school in addition alternates between Parkes and Narrabri, such that within a 3+ year PhD a student could (depending on the exact start date) have the opportunity to attend radio schools at both telescope sites.

This would likely boost attendance of the schools significantly, given the focus would be slightly different, the speakers would vary somewhat and there would be the attraction of a different influential radio astronomy location. Given the uncertainty around the telescope's funding, we propose holding an ATNF radio school at Parkes this year if at all possible, and assuming that a pre-organisational survey to potential attendees indicated that there was enough interest to justify holding the school. If ATNF chooses to pursue the option of hosting a radio school in collaboration with a university/external body, ICRAR might be an obvious institute to approach, to enable students in WA to more easily attend.

Recommendation: We recommend that ATNF engages ICRAR in a discussion regarding the possibility of hosting a radio school out of sequence with the traditional CASS Radio School. We also suggest the scenario of alternating between Parkes and Narrabri to be explored further by ATNF staff.

13. Key CASDA Stage II goals (as in full plan)

ATUC was asked the question *"Given restricted funding for CASDA stage II – What priority order would ATUC give to the CASDA Stage II key goals?"*

Whilst a comprehensive answer to this question would likely need a cost-benefit analysis (which is beyond the scope of this committee), in general ATUC would prioritise support of the SSPs above other features of CASDA. In this regard, ATUC would suggest Item #2 as the highest priority, although the top-ranked SSPs should be consulted to check whether they agree with this assessment.

1. *Support ASKAP 1-d spectra and time domain data products*

Note: It may not be practical to store these data products (for short timescales). ATUC was not clear what a 1-d spectrum data product is (or rather, how it would differ from the data products mentioned in #2 below).

2. *Support ASKAP images, cubes, spectra, time series, cross-matched catalogues etc provided by Science Survey Teams as ASKAP 'post-archive' data products*

This is the most likely to be of use to the top-ranked SSP proposals

3. *Extend CASDA to include legacy data products (images/ cubes/ spectra/ catalogues) from surveys taken with the Australia Telescope Compact Array and Parkes radio telescope.*

This would add value to the legacy projects, but may not be within the budget.

14. Other issues

The ATUC appreciates the new and improved observatory websites. However, we have noticed that the drop-down menus of the ATNF home page ("ATNF Home", "About ATNF", "Facilities", etc.) don't work on all mobile devices, e.g. the default Android Internet browser on Samsung tablets.

Recommendation: Observing websites should be tested on multiple platforms.

It is also very difficult to get contact details for ATNF staff. The "Staff List" (http://www.atnf.csiro.au/people/staff_list.html) only gives names and groups, but does not provide phone numbers or usernames. This information would be very useful to users, particularly given the large amount of remote observing that now takes place.

Recommendation: ATNF should include contact information for key staff on their website (with access restricted to those with CSIRO logins if preferred/required).