ASKAP Commissioning Update, December 2019

In this issue, we wrap up ASKAP's first year of operations, describing progress on pilot surveys, system development and plans for next year.

The year in review

This year, ASKAP commenced the transition from its commissioning phase to its operational phase.

Since February 2019, we have had the capacity to use all 36 antennas as part of the array and our goal has been to demonstrate the scientific capability of the telescope. There is still a need to conduct tests, investigate issues and verify upgrades as we will be improving the system for many years to come. However, commencing operations means that more than half of the scheduled time on the array will now be dedicated to observations that deliver science outcomes for the community.

During the year, we conducted test observations that demonstrate ASKAP's surface brightness sensitivity, snapshot capabilities, wide field of view and extremely rapid survey speed. We also commenced the first round of pilot surveys, designed to test observing modes and survey strategies for the large-scale survey science projects. Many of these test observations are available on CASDA for everyone to download and we hope to release ASKAP's first rapid all-sky continuum survey early in the new year.

In recognition of our progress this year, we will drop "commissioning" from the title of this newsletter in 2020.

Pilot survey progress

Pilot surveys have been the highlight of the year for many of ASKAP's science teams.

The EMU pilot survey is the most advanced, with all fields having been observed at least once and 9/10 successfully processed. One field has been re-observed due to poor data quality and the latest image awaits release. The other 9 data sets have all been through quality control and are now available on CASDA.

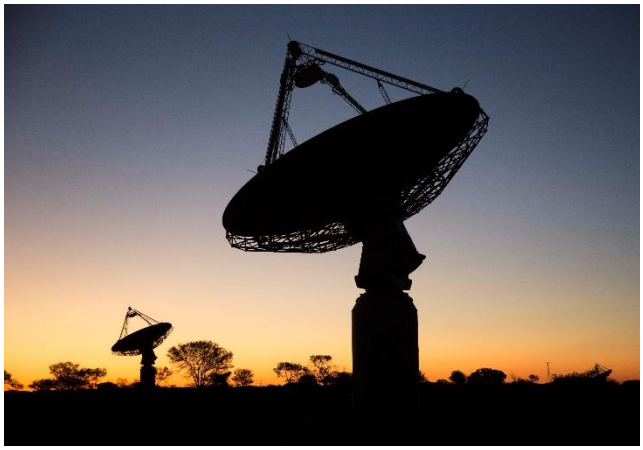
CRAFT have been making good use of time between other projects and have also detected their first fast radio burst in commensal mode. Localisation of FRBs with ASKAP was one of the main science highlights of the year!

WALLABY's Hydra field has been observed, representing roughly 1/3 of the full pilot allocation and initial imaging results look promising. The Eridanus test field is also on CASDA, awaiting validation and release. Two epochs of the VAST multi-epoch survey have been observed and the first has been processed and should be uploaded to the archive soon.

POSSUM's 10 nominated fields have been observed, but processing has been on hold while we incorporate leakage calibration into the imaging pipeline. This is now complete and undergoing final acceptance testing. A small number of FLASH fields have been observed as well.

GASKAP and DINGO have not received any pilot data as we are still working on test observations for these teams. GASKAP depends on zoom modes with higher spectral resolution and these still suffer from the missing channel problem that was largely eliminated from the standard correlator mode earlier in the year.

Several international meetings have already been scheduled to bring together science team members working on pilot survey data. Early reports indicate that the pilot surveys are making new discoveries and we look forward to the exciting results that will be published!



Next steps

Once the first pilot surveys have been processed and archived, we will seek feedback from the science teams that includes revised details of their full survey strategy. This will be used to construct a detailed plan for survey operations, weaving different surveys together into commensal observing modes where possible. The plan will be submitted to an external review panel for assessment before observations commence.

Given the time that the review process will take, it is likely that a second round of pilot surveys will be conducted in 2020 to test more advanced aspects of the various survey strategies, including opportunities for commensality. Our goal is to keep data flowing while gearing up towards full scale operations as soon as possible.

ASKAP in Shanghai

The Square Kilometre Array pathfinder and precursor telescopes were called upon to give feedback on their commissioning experience at the recent SKA meeting in Shanghai, titled "Concluding our past, realising our future". The full system design for SKA phase 1 was revealed for the first time, along with plans for commissioning and operations.

Feedback from the pathfinders was unanimous in its conclusion that commissioning is a lengthy and complicated process that begins during construction and continues all the way through to operations, requiring good communication and plenty of opportunities for feedback. The need for early integration and testing of prototype components came through strongly, as did the benefit of conducting science observations as soon as possible. Science observations are the ultimate test of any telescope and getting data into the hands of the science community early can help to identify issues.

ASKAP system description paper

Now that ASKAP construction is complete and science observations are being done on the full system, there is a strong need for a refereed publication describing the technical capabilities of the telescope. This paper is now in the final stages of drafting and will be submitted early in the new year. It should be used in conjunction with the previously released science observation guide.

ASKAP-X system demo

The end of the year also sees the conclusion of the first ASKAP-X program increment – three months of effort to address outstanding issues and improve the ASKAP systems in preparation for survey operations. At the end of the increment, we held a project-wide demo event which described specific examples of progress.

These included improved start-up procedures to minimise delay jumps across phased array feed ports, identification of common failure modes from the on-dish calibration process, availability of more detailed monitoring of phased array feed power quality and implementation of leakage calibration in the image processing pipeline, which is needed to process POSSUM's pilot survey.

Along with planned improvements, the team also accomplished many tasks based on emerging operational needs or the availability of new hardware, such as commissioning the new ASKAP storage buffer at Pawsey. This process has highlighted the need for better isolation between the ingest and processing areas, which will feed into the design of an upgraded ingest cluster, to be procured as part of the Pawsey refresh.

One of the major system-level achievements of this program increment has been establishment of standard procedures for development testing on the telescope, software releases and post-upgrade verification. Many aspects of the control system and image processing software already use a continuous integration system, and this will be expanded with additional tests in future. All teams are switching to the git version control system, which will improve development workflows. We have seen that testing of upgrades and fault tracking on the live system is still essential. Many of the issues we face arise from the scale of the instrument and cannot be reproduced in a test environment.

The transition to operations has been occurring at the same time as the first program increment and coordinating teams across different sites and time zones remains a big challenge for the project. Training more of the team members to run science observations as acceptance tests is proving a good way to broaden understanding of how the full system works.

Acknowledgements

The ASKAP team has worked extremely hard this year, beginning with a push to complete construction and integration of all 36 antennas, then flowing into full operations for the first time. We greatly appreciate the efforts of everyone involved. We expect to see a flood of new science from ASKAP in 2020 and will continue to report highlights here. Best wishes to everyone!

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