ATUC ASKAP Update

Aidan Hotan

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CSIRO ASTRONOMY AND SPACE SCIENCE
www.csiro.au

ASKAP community engagement

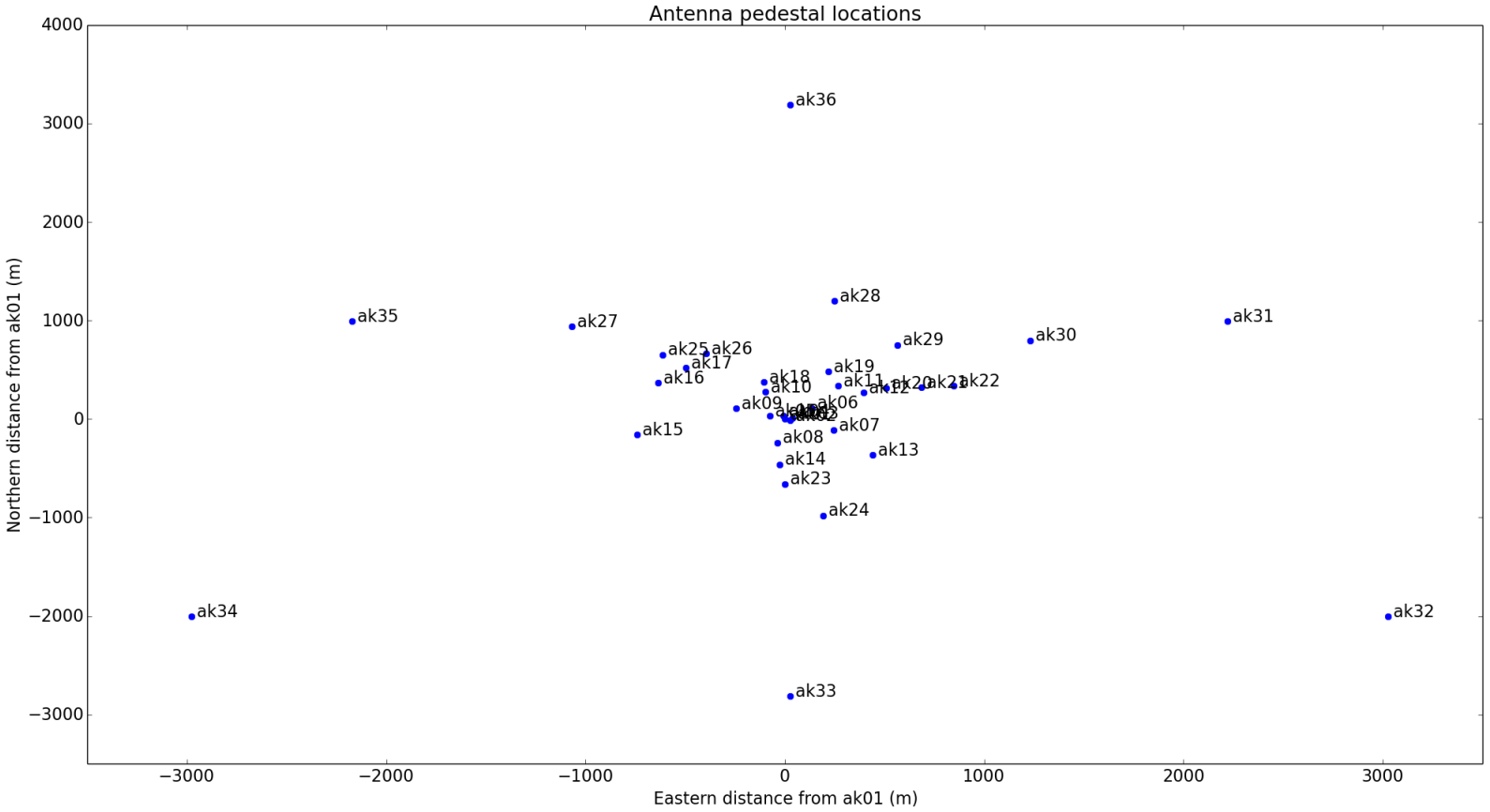
- In 2017 we have made an effort to improve communication of ASKAP status, development activity and timelines
- Early science forum, third Tuesday of every month
  - https://confluence.csiro.au/display/askapsst/Early+Science+Forum
- Commissioning update newsletters
  - https://www.atnf.csiro.au/projects/askap/commissioning_update.html
- Commissioning schedule
  - https://confluence.csiro.au/display/askapsst/Schedule
- We welcome ATUC's feedback!

ASKAP hardware installation progress

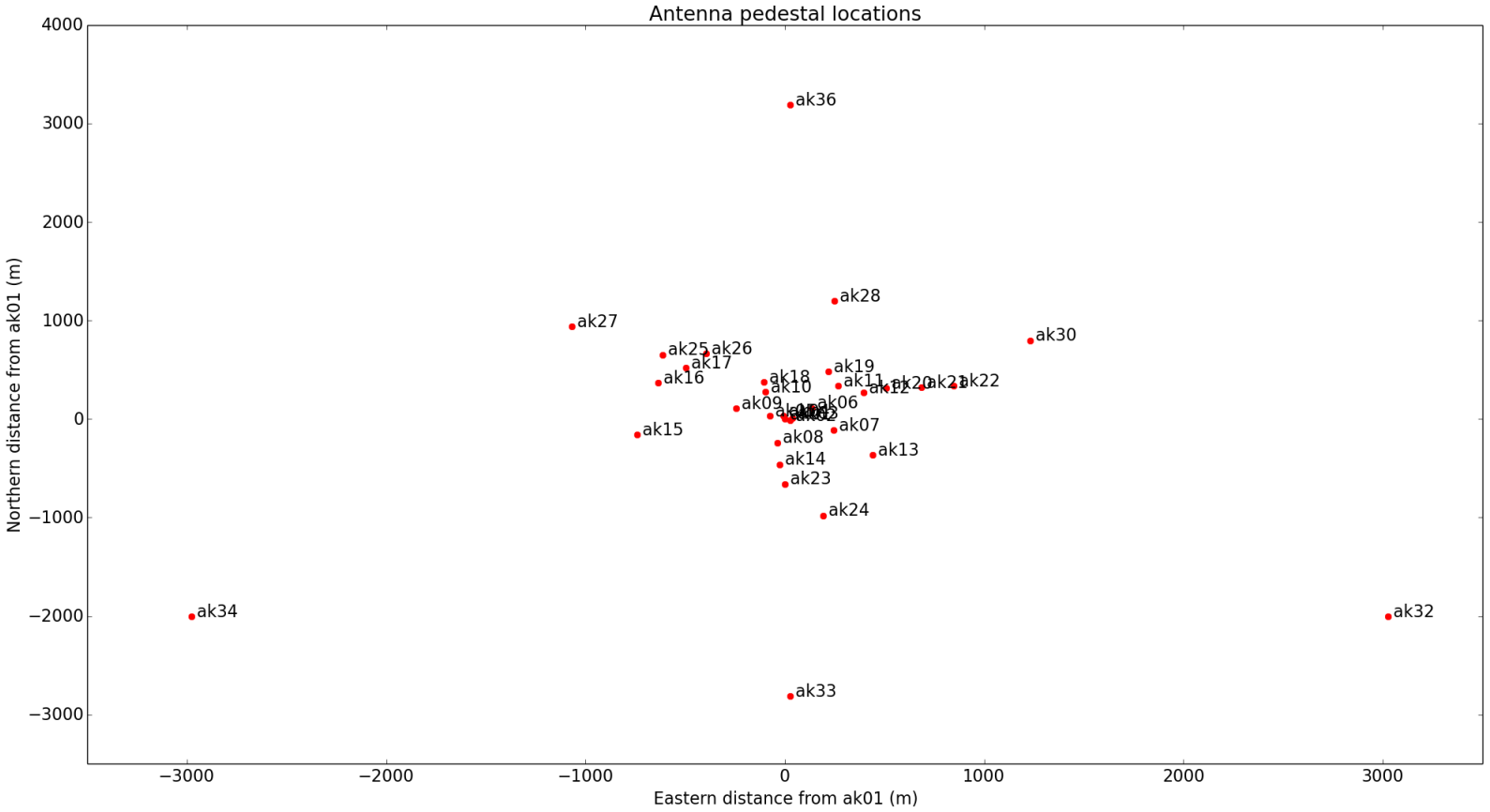
- 33 antennas have PAFs installed (most with ODCs)
  - Installation of the final set of 6 has commenced (ak29, 31 and 35 will be last)
- 24 antennas have working digital backend systems
  - This includes timing, digitisers and beamformers
  - Assembly of remaining components starts soon, delivery Q1 2018
- 5 correlator blocks installed (48 MHz each, total 240 MHz)
  - One additional block is being used as a test platform in Marsfield
  - The final block only needs to be partially populated

- Horizon Power have commissioned their hybrid station and are now supplying the MRO with electricity
  - The large EMC-supplied 1MW Solar extension is still being commissioned

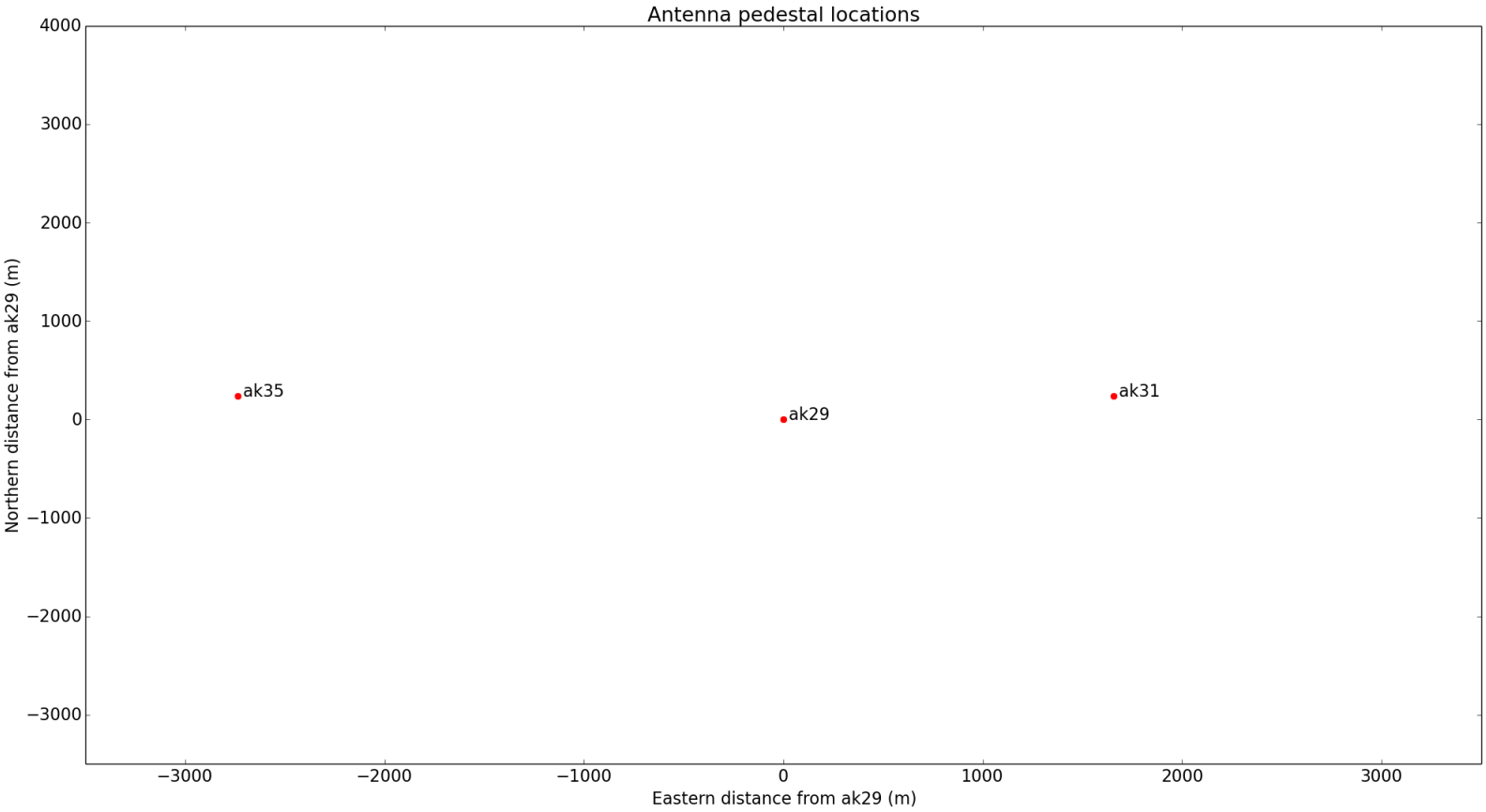
Antenna pedestal locations



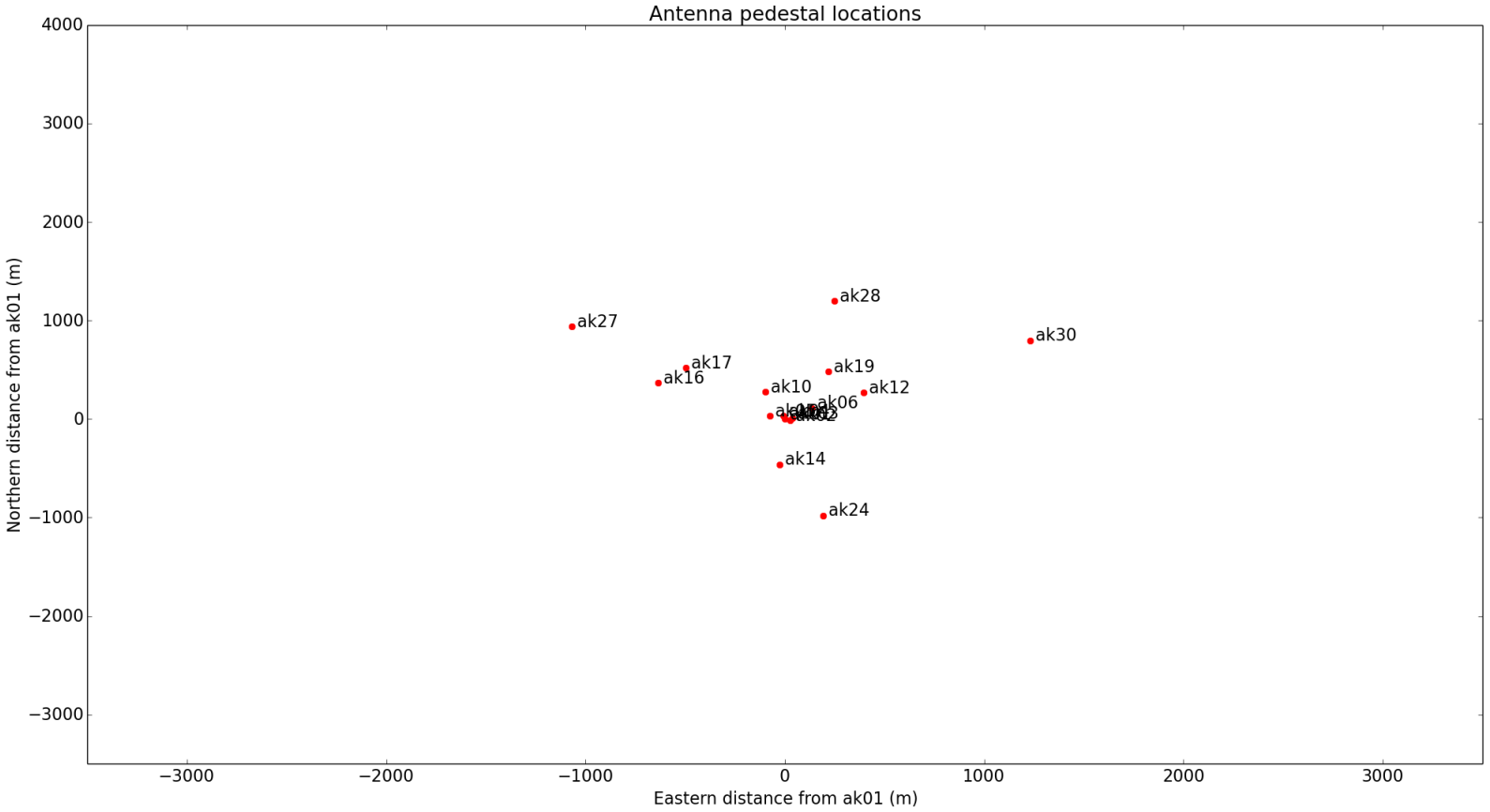
Antennas with PAFs



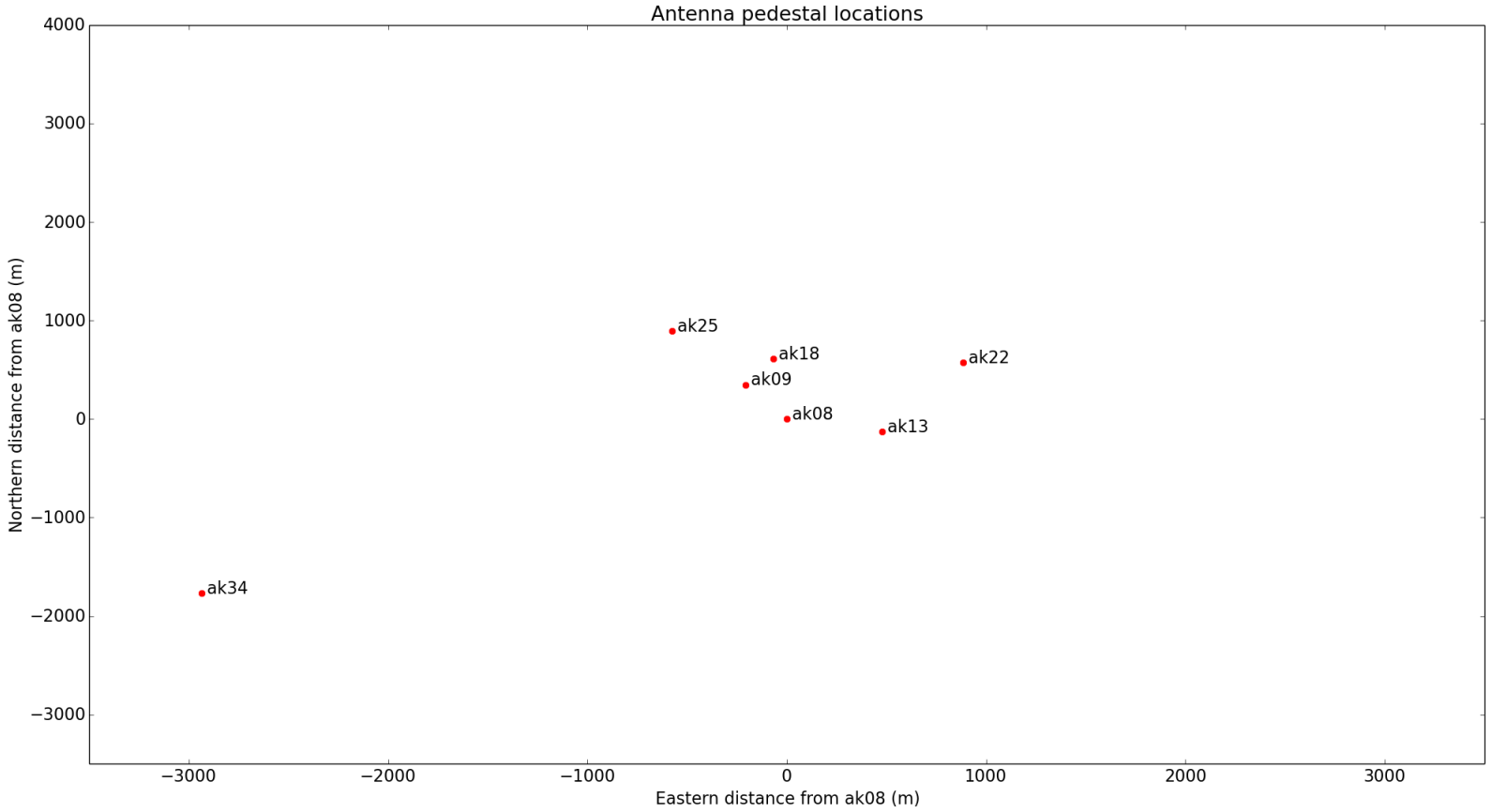
Antennas without PAFs



Antennas in the main imaging array



Commissioning / CRAFT array



ASKAP commissioning report

- Acceptance tests of individual antennas await new hardware
  - 31 PAFs have been powered up and soak tested at the MRO
  - Signal integrity and routing checks complete where possible (needs beamformer)
- Improvements made to PAF control and power systems
  - Control and monitoring firmware updated to prevent under-voltage trips
  - PAF transformer taps changed to address gain modulation found by CRAFT
- Major firmware updates to improve correlator download stability
  - Low-level alignment and data streaming problems identified and fixed
- Ingest pipeline development continues
  - Multi-file output implemented, can record 240 MHz of bandwidth
  - More work required to scale beyond 12 antennas (recent progress looks good)

Beamforming system development

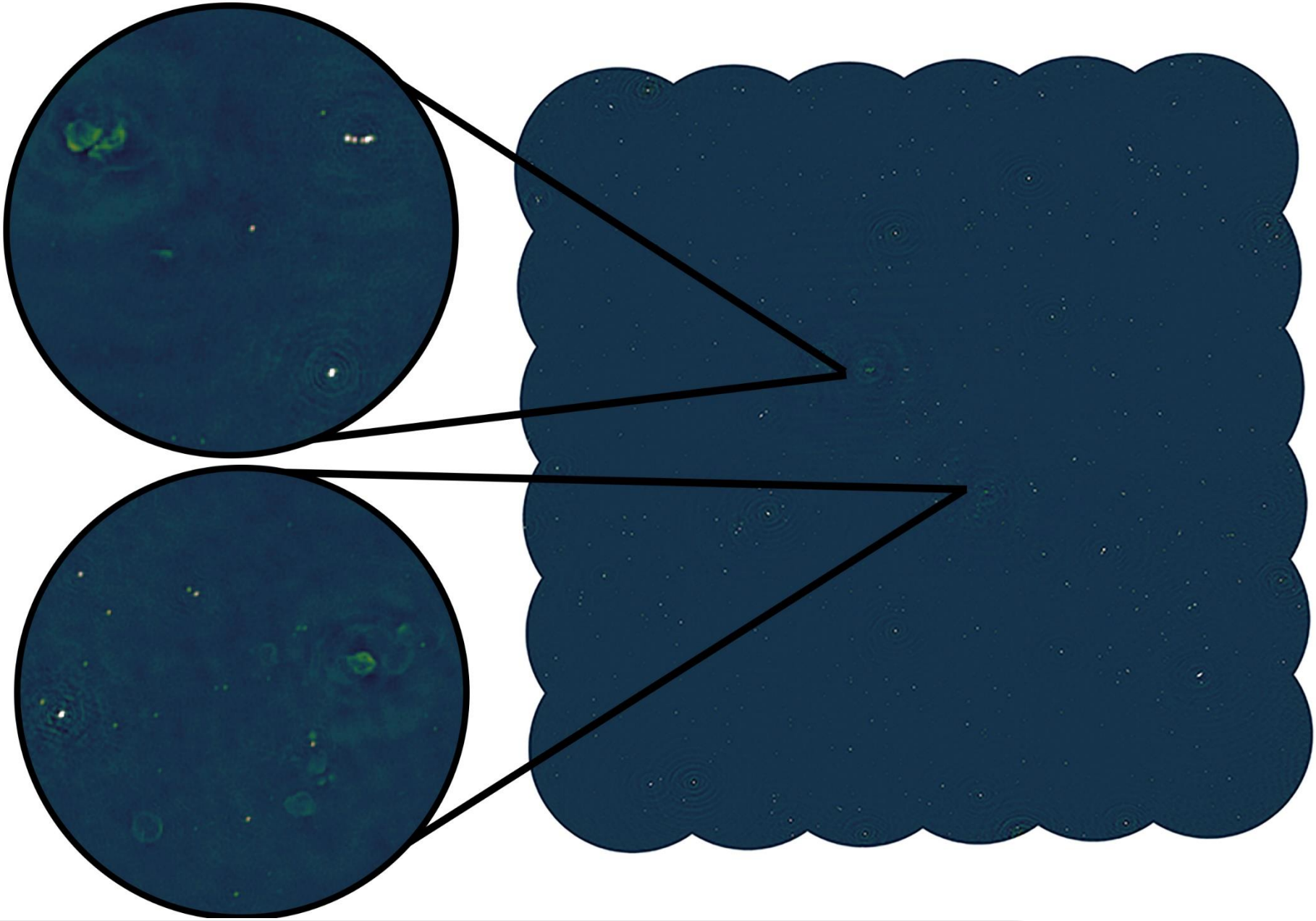
- The unique flexibility of our phased array feeds comes at the cost of increased complexity in operations

- An ACES working group is helping the computing group to develop a software management framework for beam weights
  - Offering pre-defined “footprints” and ways to build new ones
  - Availability of a standard Max S/N automatic beamforming system
  - Development of additional algorithms with alternative optimisations
  - Association of beam weights with on-dish calibration data for stabilisation
  - Use of ODC data to remove X-Y phase
  - Association of beam weight metadata with science data archive
  - Automatic reporting of beam quality using various metrics

ASKAP operations report

- Early science was planned for an array of 12 antennas operating at full bandwidth (300 MHz) with 36 beams
  - We are now recording with up to 240 MHz of bandwidth (10 sec cycles)
  - Several “validation” targets have been observed since firmware updates
  - Observations of spectral line target fields continue
  - Continuum observations are progressing towards larger regions of sky

- These data are still being actively investigated by working groups
  - The main focus is on understanding and improving the science data pipeline
  - Joint effort by all SSTs in conjunction with the CASS SDP team and ACES



ASKAP operations report

- CRAFT have been able to use an incoherent filter-bank mode (without the correlator) to do single-dish fast transient searching
  - Using the “commissioning array”, where antennas are introduced and tested before being connected to the correlator

- Fast transient observations have also uncovered several issues with the ASKAP system that are being fixed
  - 300 Hz gain modulation
  - Clipping of strong signals

- This project has had high scientific impact and large technical benefits – highlights the need to adapt to opportunities

Science data pipeline development

- Much activity has been devoted to improving the ASKAP science data pipeline using the observations that we have in hand
  - This has been a joint effort between SSTs, ACES and CASS computing group

- The initial parameters were tuned for 48 MHz NGC 7232 data
- These parameters do not work well on other fields / bandwidths
  - Impacts all SSTs – since continuum subtraction is critical for spectral line

- Some examples from the last few busy weeks:
  - Flagging algorithms either too aggressive or miss obvious RFI
  - Taylor term imaging has trouble converging
  - CLEAN thresholds need to be based on measured parameters

CSIRO ASKAP Science Data Archive

- The first early science data was released to CASDA in July 2017
  - 48 MHz bandwidth NGC7232 field, continuum only
- CASDA supports staged upload of additional data products
  - Need to add spectral line data, polarisation, etc.
- Other data will be released – after image quality improvements
  - Quality control metrics are in place for continuum, under development for spectral line and polarisation
- Community use and feedback is critical
  - Development cycle will end this year, with reduction of resources

Finding the path to full ASKAP operations

- Full scale operations will require iteration to perfect
  - This includes input from the science teams, feedback from early science and analysis of future pilot survey data
- The current early science plan only covers 12-antenna operations
  - Jumping from 12 to 36 antennas is a massive change in scope
- We will need to run pilot surveys with increasing capability
  - For example, using online frequency averaging to record 36 antennas and 36 beams with a modest data rate for continuum science
  - SSTs may wish to consider what sort of expanded pilot surveys would be useful for both scientific and technical studies

Scheduling and planning

- Apr 2018: ADE-18 (array release 3)
- Dec 2018: ADE-36 (array release 4)
  - Commencement of “full science operations” in a form to be determined

- Jun 2019 - Integration and verification of “extended modes”
  - Full polarization, 10” postage stamps, transient and zoom mode imaging
  - In reality, some of these will be early as it makes sense to integrate soon
  - Around this time, guest science project observations may commence

- Survey speed likely to be 30-50% slower than original specification
- Commensal observing may pose more challenges than expected
  - Particularly if the observing strategies / configurations vary by project

ASKAP survey plan review

- It has been several years since the SSPs were originally reviewed and several circumstances have changed
  - Changes encompass both scientific progress and system parameters
- We need a review process that delivers rankings or grades that can be used to allocate and schedule instrument time
- The Terms of Reference for the review have not yet been finalised but will require all existing SSPs to submit a revised project plan
- There will not be an open call for new proposals

ASKAP survey plan review

- The review is expected to take place mid-2018

- Before the review, CASS will publish revised ASKAP specifications
  - This includes our best estimate for Tsys/n
- When the ToR have been determined, we will issue a call for revised project plans, allowing 2-3 months for SSPs to respond
  - CASS will host workshop(s) to assist SSPs in matching the revised ASKAP specifications to their science goals
- Once revised plans have been received, CASS will constitute a review panel with international expertise under the TAC
  - This panel will review the revised project plans, providing grades and guidance that will allow allocation of telescope time

- The Terms of Reference and process will be informed by the recent MeerKAT review of LSP projects

We acknowledge the Wajarri Yamatji people as the traditional owners of the Murchison Radio-astronomy Observatory site

Thank you

CSIRO Astronomy and Space Science
Aidan Hotan

t +61 8 6436 8543
e aidan.hotan@csiro.au
w www.csiro.au/askap