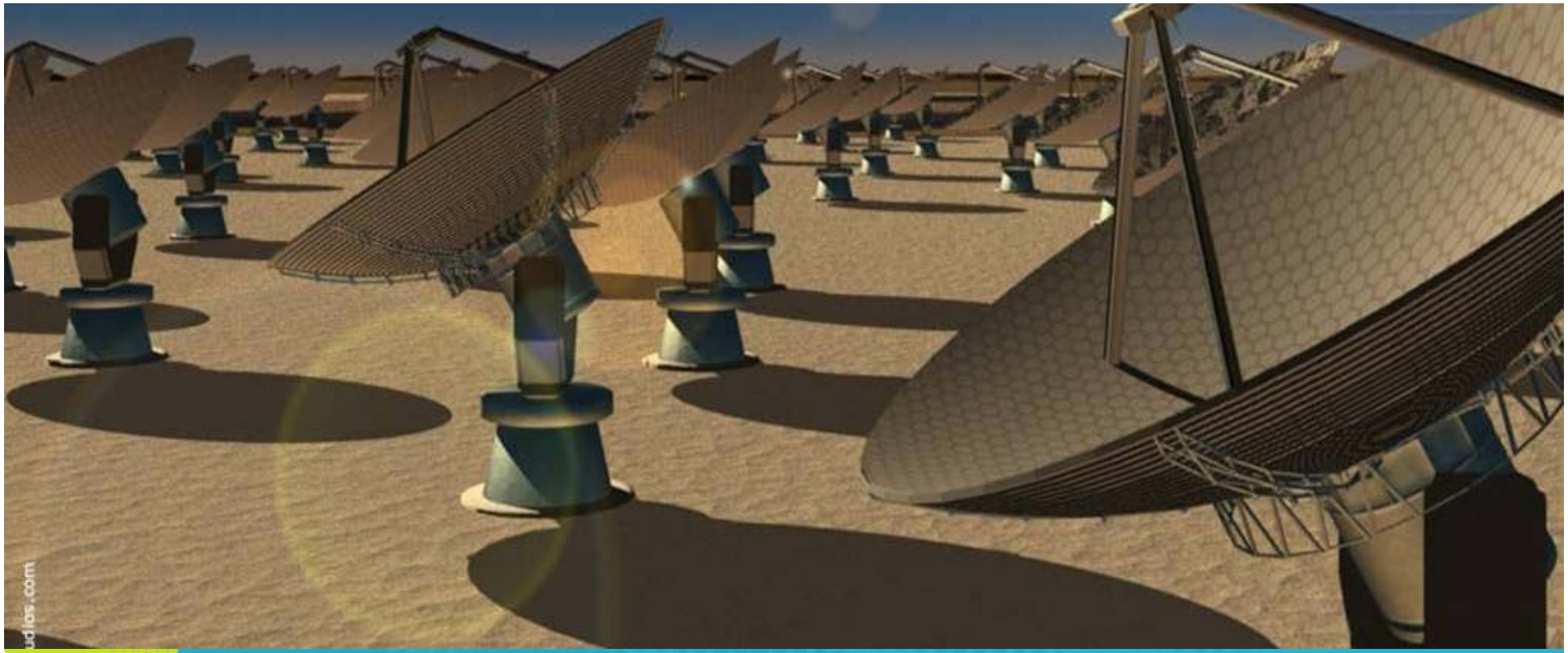


# ASKAIC update - November 2008

**Dr Carole Jackson**
**CSIRO Australia Telescope National Facility**

www.csiro.au

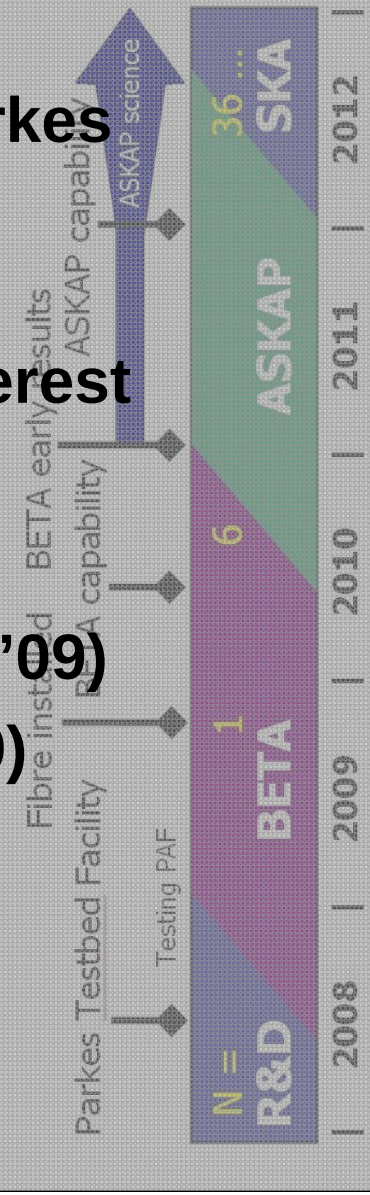
# Capability - what does ASKAP need?

*** A new Radio Telescope & New Observatory ***

- Site management & infrastructure – roads, power, optical fibre
- Project management – Build, maintenance, operations & scheduling
- Low-cost antennas
- Focal plane phased array (FPA) receivers (0.3 – 3 GHz)
- Low noise uncooled receiver components (‘receiver-on-chip’)
- High speed, low cost DSP
- Intelligent, self-monitoring control systems
- RFI mitigation techniques

# ASKAP Status: November 2008

- **Phased Array Feed testing on-going at Parkes Testbed Facility**
- **ASKAP Antenna contract signed**
- **Science Survey Teams Expressions of Interest**
- **In midst of Preliminary Design Reviews**
- **System architecture complete**
- **Native title negotiations on-schedule (mid ’09)**
- **Fibre contract(s) starting this year (late ’09)**
- **Environmental & heritage study done**




YOU ARE NOW LEAVING THE
MURCHISON RADIO-ASTRONOMY
OBSERVATORY
THANK YOU FOR BEING RADIO QUIET

# Australian SKA Industry Opportunities

## ASKAP as an SKA Pathfinder (PrepSKA)

- Has to demonstrate **SKA sub**systems & key technologies to TRL≥7

## Engage in early-phase R&D (co-investment or service)

- Demonstrate capability to international SKA community
- Develop skills in-house
- Foster strategic international relationships
  - Multi-national company engagement
  - Foster relationships in wider radio astronomy community – esp Canada, USA, South Africa & EU.

## Engage with Aus SKA Industry cluster activities –

On line Capability Directory

Networking, positioning IP & skills towards SKA

# Industry Engagement IPT - What's what now!

| | |
|---|---|
| Industry Opportunities Register | Published: Updates by Feb 2009: web only |
| Australian Industry Participation Plan | Launched on 11th November.<br>Describes how CSIRO will ensure Aus industry will be given every opportunity to become involved in ASKAP & MRO. |
| Industry Collaboration & support | ASKAP/SKA multi-stakeholder workshop for sustainable energy options.<br>Visits/advice from many ASKAIC cos |
| Briefing industry (ongoing): Briefs, news & Other events | Industry chiefs meeting with Minister Carr.<br>Industry visit to Parkes testbed: 17 Nov 08<br>News - ongoing - here we are! |

# MRO Project

**Status:**
- defined basic requirements for the two sites, including power,building space, roads, antenna power, etc
- worked with SKM on the submission to obtain PWC approval.

**Next steps:**
- Non-invasive geotechnical study (December 2008)
- Refining requirements specs for facilities (Nov - Dec 2008)
- Develop brief to design groups (Dec 2008)
- Engage (EOI, RFT, direct contracts) design and construction groups

Stakeholders:
- ASKAP IPTs
- SKA
- Other site users - MWA, PAPER etc

# MRO project: Power

**Power requirements:**

| | |
|---|---|
| **ASKAP:** | **613 kW** |
| **MWA:** | **120 kW** |
| Total: | 733 kW |

= 2 million litres of diesel - a tanker a week !
= $4m per year

**Generation**:
- as much “green” as possible.
- demand side management: 1 kW per year is $4,000 of diesel
    - capital cost versus operating costs
- working with a range of companies to investigate options:
    - PV solar, thermal solar
    - (wind, geothermal)
    - issues: energy storage

# ASKAP Computing strategy

- **Choose areas of innovation**
  - Synthesis processing
  - Parallel processing
- **Partner!**
  - ASTRON & other SKA-institutions
  - Industry
- **Be *conservative* in most areas**
  - *e.g.* use mature, stable EPICS as basis for monitor and control
- **Close collaboration with Science Teams**
  - Vital to get strategies, algorithms correct
- **Develop iteratively**
  - Sequence of increasingly complete solutions
- **Package science capabilities**
  - Science/Software Instruments
- **Release incrementally**

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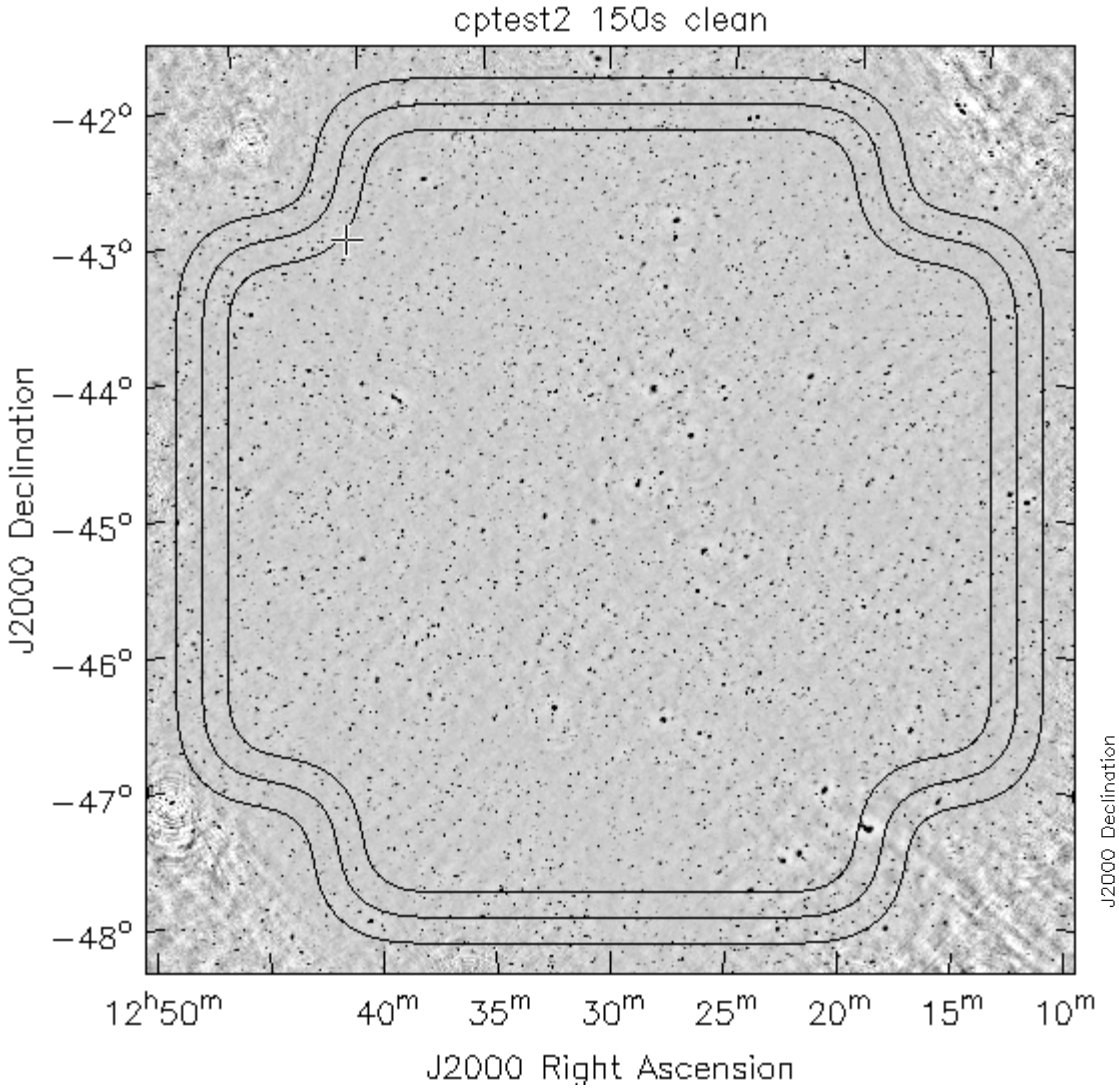
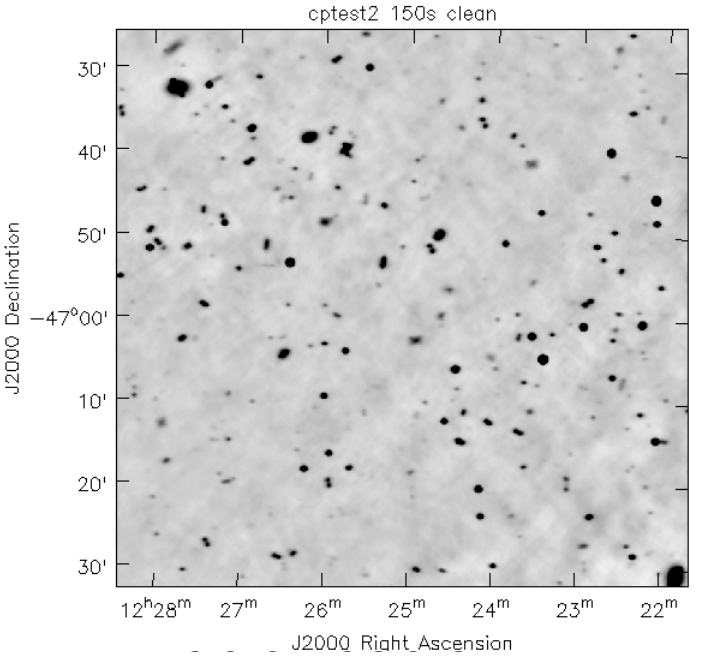
# CPTEST2: first parallel processed mosaic image



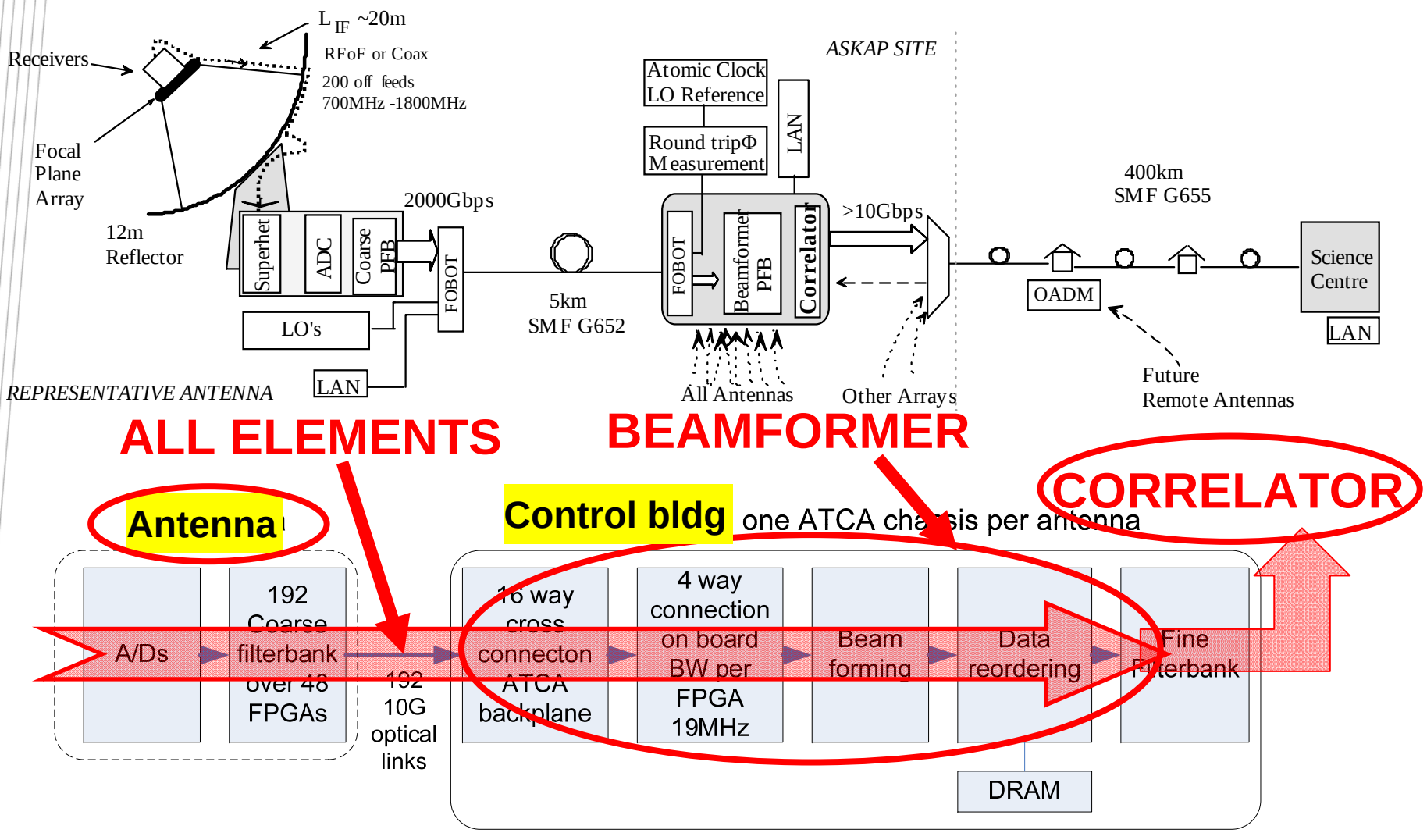

- **Run on 8 node Sun v20z cluster**
- **Data simulated and imaged using CONRAD**
- **Linear mosaic using**



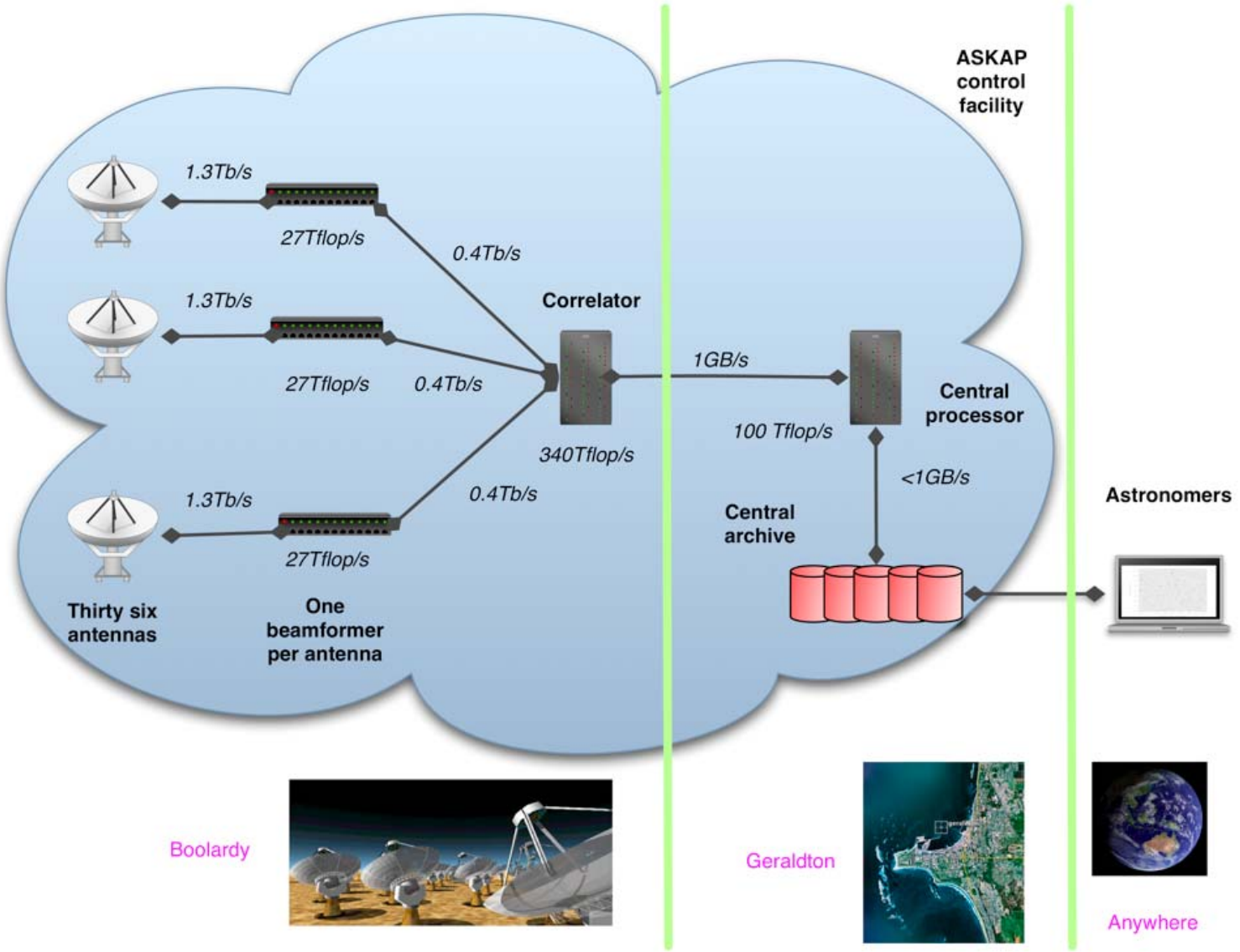

y

?

# ASKAP System Architecture



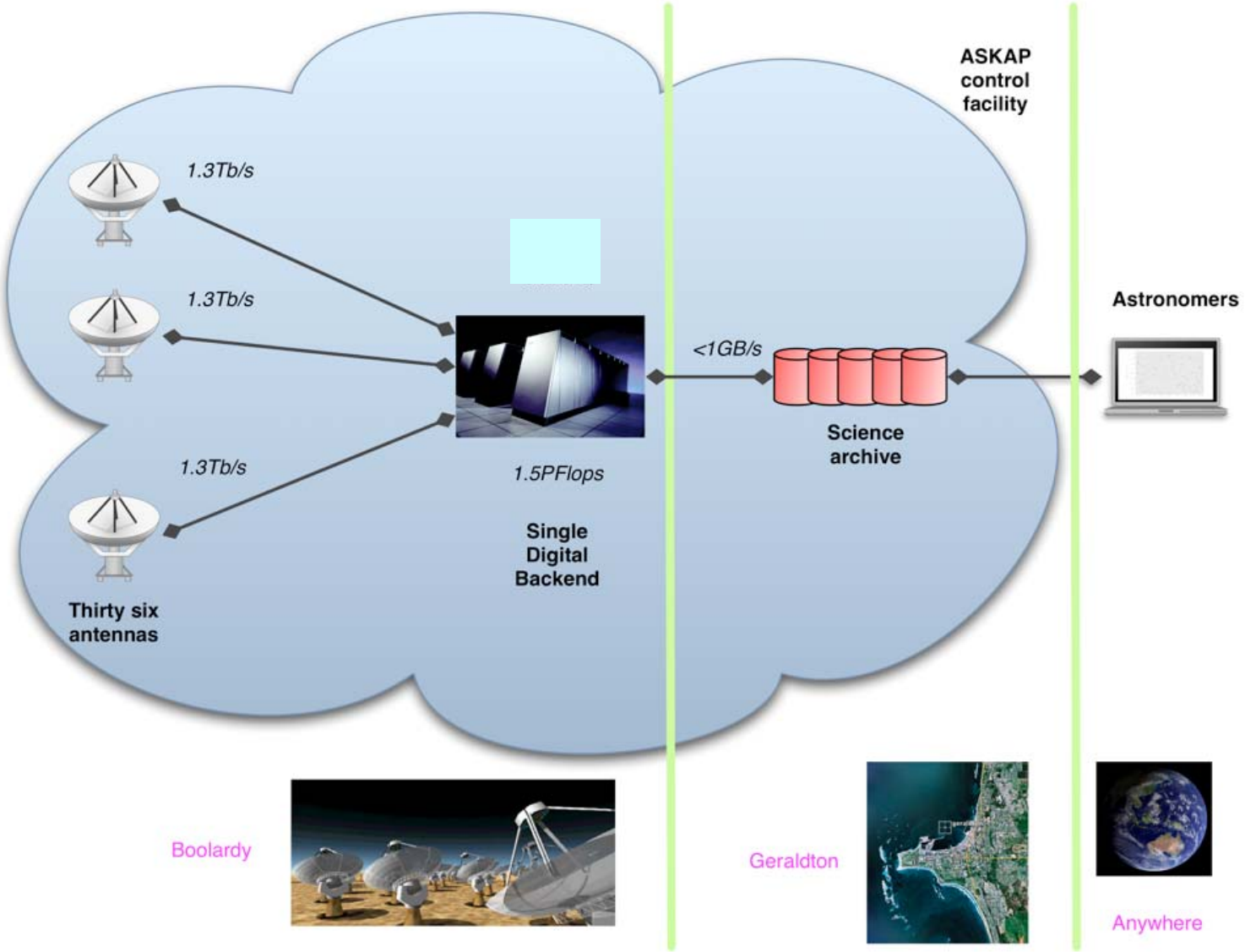
# ASKAP data flow, processing, and storage



# ASKAP & Imaging Innovation

- **Telescope = imaging from measurements of E-field**
- **Standard approach to ASKAP**
  - Antenna+PAF->Beamformers->Correlator->Inverse FFT Box->Image
- **Another approach**
  - Antenna+PAF->Massive solver of linear equations->Image
- **Or**
  - Antenna+PAF->2 Petaflop Black Box->Image
- **…. better still**
  - Antenna+PAF->2 Petaflop Black Box->Science result
- **…. and so finally….**
  - SKA->few Exaflop Black Box->Science result

# Single Digital Backend



# Single Digital Backend

- **Unique concept**
  - Beamforming, correlation, imaging, science analysis in one computer
- **Breakdown of processing for ASKAP**
  - Summing to form multiple beams on the sky: 1.0 PFlop/s
  - Correlation to form cross-correlation of beams: 0.3 PFlop/s
  - Imaging and science analysis: 0.1 PFlop/s
  - Low computational complexity
- **Beamforming, correlation currently performed in specialized FPGAware**
  - 50 racks for ASKAP, ~ 5,000 for SKA?
  - For SKA, integration, scale, complexity will be killers
- **Advantages of computer-based processing**
  - We buy the hardware readily integrated and assembled by someone else,
  - Linux operating system, complete with compilers, debuggers, profilers, etc.
  - We can contract outside for hardware and software support.
  - There is an easy (although not free) upgrade path.
  - We program it using a high level language and tools.

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# Computing: Industry engagement

- **Strong interest from industry in SKA (and ASKAP) computing**
- **In computing issued request for help on key processing element**
  - Convolutional resampling
- **Many replies**
  - IBM - Collaborative agreement : Cell, Blue Gene, System S
  - CRAY - Collaborative/research agreement embed FPGA
  - Intel provided equipment, analytical help
  - Other interactions - SGI, Sun, etc
- **Net result**
  - Rapid advances in our understanding
- **Many ongoing interactions**
  - Number of meetings with vendors at Supercomputer 08 in Austin
- **Will issue Call for Expressions of Interest for SDB**

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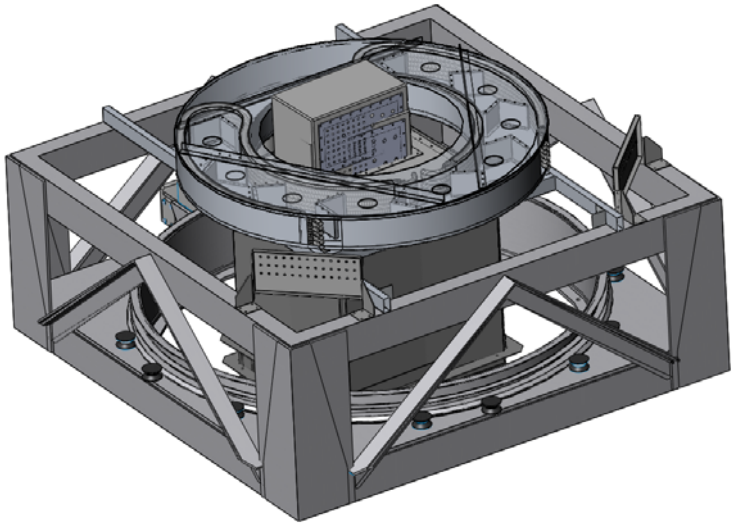
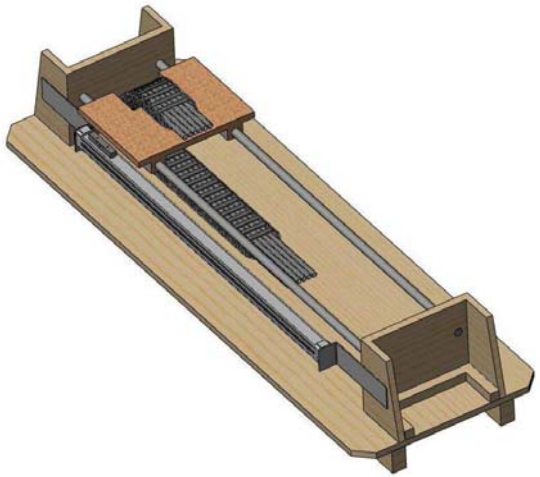
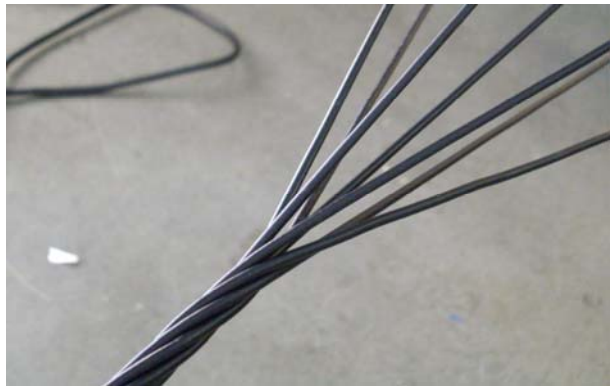
# ASKAP developments (Antennas -FPA support)







Cable wraps and cable assemblies;

- Lightweight - compact
- High cable packing density
- Mechanical life testing

# ASKAP Antennas

ATNF team involved in design consultation & ensuring technical specification is delivered (RTM)

- On track for CDR Dec 08, PPR Mar 09: 1st antenna Nov 09

ASKAP IPT supporting work

- Detailed model/analysis of the cable management systems
- Detailed design/modelling of the cable wraps - esp polarisation axis
- Detailed definition of the antenna control system

Other:

- Implementation of pedestal systems & services (including air cooling)
- Implementation of FPA cooling system

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