Australia & the Square Kilometre Array

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Australia ASKAP Infrastructure Briefs
Sydney: 3 February 2009
Perth: 6 February 2009
Australia
Telescope
National
Facility

A Division of CSIRO

• The largest single astronomical institution in Australia (180 staff)
• Sydney HQ +3 telescopes in regional NSW
• Parkes (the ‘Dish’), Narrabri (Compact Array), and Mopra, near Coonabarabran.
• CSIRO ATNF is charged with design and delivery of the Australian SKA Pathfinder
The Challenges of Radio Astronomy

- **The signals are extremely weak.**
  - We need huge antennas to capture them
  - They need to be in special places

- **Astronomers ‘compete’ with noise**
  - From radio, TV, phones, machines, etc
  - From any equipment, motors, amplifiers, etc

- **Signals are buried in background noise**
  - Need smart techniques & computing power

- **Huge data rates**
  - Pushes boundaries in capacity & speed

- **Radio Observatories operate 24-7/365**

- **Pure research - receive signals only**
  - No defence role at all
The International SKA Project (What)

The Square Kilometre Array (SKA) is the next-generation radio telescope
Science goals require huge increase in sensitivity over current telescopes, large field-of-view, wide bandwidth → huge data rates and volumes

An International mega-science project
€1.5 billion+ total cost, with an operating budget ~€70M p.a.
Full operations by 2020 – lifetime of 50+ years

International consortium carrying SKA project
17 countries participating via international working groups
Funding split between the international partners

Opportunities for industry (International)
SKA requires range of technologies: specialised R&D, commercial off-the-shelf components, operations & maintenance, infrastructure

The SKA presents a unique opportunity for Australia to play a lead role in one of the 21st century’s greatest scientific facilities
Fundamental Science & the SKA (Why)

• **What is dark matter?**
  What is the other 20% of the matter in the Universe if not baryonic?

• **What is dark energy?**
  What is 75% of the Universe, where does it come from & how is it evolving?

• **Did Einstein have the last word on Gravity?**
  Strong-field tests of GR using pulsars & BHs

• **What is the origin & evolution of Cosmic Magnetism?**
  Radio astronomy is a unique probe

• **Are we alone?** (SETI)

“Connecting quarks with the Cosmos: 11 Science questions for the new Century” (M Turner et al) US National Academies board on Physics & Astronomy
SKA (Where): Australia candidate site

• Configuration
  • 125 stations (flexible)
  • 50% of total collecting area within core 5 km radius
  • 3000 km (Aus only) baselines, can extend to 5500 km with NZ

A proposed SKA configuration: Aus + NZ with SKA core sited in WA

Core at Boolardy, WA – population very very few!
SKA (Where): Australia candidate site

Key Australian strengths:

• Single country 3000 km E-W baseline
  +NZ extension possible to 5500km

• Excellent sky coverage

• Good overlap with other major facilities
  (Longitude & Latitude)

• Extremely low levels of radio frequency (RF) interference
  Stable, low population
  WA & Aus Govt commitment to protect area

• Strong radio astronomy community in Australia
  SKA highest priority

• Australian Government support - Commonwealth and State
  www.ska.gov.au

• Excellent Industry Support
  The Australian SKA Industry Consortium ASKAIC - www.askaic.com
Radio dark sky - A clear view to the early Universe

Detecting the first stars & galaxies in the Universe

Unpolluted by man-made radio signals = “dark sky”
Through CSIRO, the Australian SKA Pathfinder (ASKAP) Project will:
- Establish the new Murchison Radio Observatory (MRO) in WA
- Develop a new technology telescope - ASKAP at MRO
- Support other observatories at MRO
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ASKAP: MRO Observatory - CSIRO managed

Challenges & Opportunities

- No grid power: green power options for SKA
- RQZ: we must not ‘pollute’ our own site
- 24-7/365 operations
- Not a defence/secure site
- New observatory - get it right (for SKA!)
- Demonstrate Aus remote operations expertise
ASKAP Funding

Strong legacy of investment in SKA related R&D:

2001-2007 SKA-related R&D $10.5M + $10M (technology development)
2007+ CSIRO & Aus Government funding for ASKAP totals $111.5M

CSIRO investment $43.0M

NCRIS investment $14.6M

NPP –2007/08 Federal Budget to develop ASKAP May 2007 $51.7M

+ other minor coinvestments $2.2M
ASKAP opportunities

Australia is one of (only) 2 possible hosts for the SKA
SKA is exciting & will be huge… but

Australia is building ASKAP now!

- Opportunities in advanced infrastructure (power, communications, …) as well as civil and related construction
- Local knowledge, and “runs on the board” from ASKAP important
- Possible major role for industry in facility operation
  - Delivery and operations models for SKA to be investigated
- Frontier technology development

Primary reference - Australian SKA Pathfinder Industry Opportunities Register
www.atnf.csiro.au/projects/askap

ASKAP Infrastructure costs ~$30M
Protecting the MRO

- **MRO - observatory grounds (120 km\(^2\))**
  - Full/self-control: Managed by CSIRO

- **Boolardy Pastoral Station (3467 km\(^2\)/856,835 acres)**
  - CSIRO held and operated

- **Mineral Management Area (80 km radius) - State**
  - Controls for non-licensed radiators

- **Section 19 - State**
  - Embargo on new mines in the region

- **ACMA RALI September 2007 - Commonwealth**
  - (Aus Communication & Media Authority Radiocommunications Assignment and Licencing Instruction)
  - “FCC Radio Quiet Zone” protection

- **Additional State/Commonwealth Legislation being pursued**
Protecting the MRO - notify everyone!

YOU ARE NOW LEAVING THE MURCHISON RADIO-ASTRONOMY OBSERVATORY

THANK YOU FOR BEING RADIO QUIET
ASKAP development: status Feb 2009

MRO development

• MRO Site Native title & surveys on-schedule
• Site acquisition will complete early/mid 2009
• MRO Construction - starts imminently ....e.g.
  - Antenna foundations,
  - MRO support buildings
  - 750 kW green power
• Geraldton - MRO Fibre optic link contract(s) start 2009
  (to complete Q1 2010)

ASKAP telescope technical developments

• Phased Array Feed in test/development now
• ASKAP Antenna contract signed - 1st antenna arrives Dec 2009
• Science Survey Teams have proposed their observations
• ASKAP System architecture is complete
High-dynamic range, wide field-of-view telescope

- Number of dishes: 36
- Dish diameter: 12 m
- Max baseline: 6 km
- Resolution: 30"
- Sensitivity: 70 m²/K
- Speed: $1.5 \times 10^5$ m⁴/K²·deg²

- Observing frequency: 700 – 1800 MHz
- Field of View: 30 deg²
- Processed Bandwidth: 300 MHz
- Channels: 16k
- Focal Plane Phased Array: 192 elements (96 dual pol)
ASKAP - what now?

Today’s session - overview brief on MRO infrastructure plans
Ant Schinckel: ASKAP Project Manager
Q&A session: Feedback welcome

Then, keep up-to-date with project news & Opportunities:
Australian SKA Pathfinder IOR - V2.1 (on web)
SKA Industry emails (infrequent, major announcements)

ASKAP - www.atnf.csiro.au/projects/askap
Aus SKA www.ska.gov.au

Register with Australian SKA Capability register:
Project connect: http://www.skacapabilities.com.au

~Monthly auSKA Newsletters
Australian SKA Industry Capability Directory

Criteria for listing your company:
1. You must be able to demonstrate an "in-house" ability to provide products or services relevant to the Square Kilometre Array (SKA) project.
2. Do not list products or services that you contract out to other organisations.
3. You must be prepared to provide information to the Department of Industry and Resources (DoIR) in relation to your directory listing. DoIR reserves the right to modify or suspend any listing.
4. You must be able to demonstrate that your organisation is a commercially viable business:
   - Demonstrate sound technical and commercial management practices.
   - Demonstrate the solvency of your business.

SEARCH
Search the directory by company, location or keyword.

REGISTER
Register your company for inclusion in the directory.
For step-by-step instructions click here or please contact Tristan Morell on (08) 9222 0983.

DoIR will verify your registration before it is included in the public directory. Verification takes 1-2 business days.

NEWS

CONTACTS

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