Infrastructure for ASKAP and The Murchison Radio-astronomy Observatory (MRO)

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ASKAP Supporting Infrastructure

- Overview of the scope of the facilities and general requirements
- Overview of Procurement process
- Timeline
Infrastructure - definitions

ASKAP - the Australian SKA Pathfinder (the telescope we are building now)
- 36 12 meter antennas plus receivers, electronics etc
- circa $111M including MRO site developments, MSF etc.

MRO - the Murchison Radio-astronomy Observatory
- 126 sq km observatory within the Boolardy Station
- site for ASKAP and other astronomy projects (MWA, PAPER, CoRE, etc)

SKA - the Square Kilometer Array
- AU$2-3 Billion capital construction project to be sited in Southern Africa OR Australia
- choice to be made circa 2011
- NOT what we are building now

Boolardy Station - pastoral lease property with the MRO excised from it
- 3,467 sq km (346,748 hectares)

CSIRO - ATNF (Australia Telescope National Facility)- the organisation responsible for delivering ASKAP
1. Murchison Radio-astronomy Observatory (MRO):
   - Central Building
   - Antenna foundations
   - Access tracks to antennas
   - Power and fibre reticulation to antennas
   - Water/sewer etc
   - Fencing, security, storage etc
   - Power generation

2. MRO Support Facility (MSF) - in Geraldton, probably at the Geraldton Universities Centre (GUC)
   - Building

3. Boolardy Station Homestead
   - Homestead renovations and improvements

4. (A fibre link between MRO and MSF, including fibre, installation, repeater huts etc.)
What’s NOT included:

- SKA related (other than fibre link MRO to Geraldton)
- ICRAR (WA funded International Centre for Research in Radio-astronomy)
- ASKAP “instrument” - e.g. antennas, digital processing, computing, receivers
- Approvals (CSIRO has responsibility for major approvals required for the construction)
All approvals being managed by CSIRO - this includes:

- Environment Protection and Biodiversity Conservation Act (C'wealth 1999)
- Telecommunications Act (C'wealth)
- WA Environmental Protection Act
- C'wealth Native Title Act and the WA Aboriginal Heritage Act.
- negotiating an Indigenous Land Use Agreement with the native title claimants of the MRO site, consistent with requirements of the Commonwealth Native Title Act. Negotiations are being led by the WA Office of Native Title.
1. Murchison Radio-astronomy Observatory
Murchison Radio-astronomy Observatory
MRO - conditions

Access to site:
- paved highway, Geraldton to Pindar (130km)
- wide, good quality dirt Pindar to MRO entrance (220 km)
- some internal roads

Geotechnical:
- pastoral land - sand plains and hard pans
- good surface drainage to Murchison River in north and Roderick to the south
- isolated laterite breakaways and low granite outcroppings
- above the floodplain, local ponding only
- soil bearing suitable for simple footings (full geotechnical survey to follow)

Weather:
- what you’d expect - hot in summer, mild in winter, little rain (approximately 200 mm/year), low fire risk, inland from the cyclonic regions
MRO construction requirements

Building Code of Australia
Plus strong emphasis on:

Efficient energy use
- cost of electricity will be very high - demand side management
critical to containing operating costs
- cooling - possibility of using ambient cooling?
  - use of ground cooling
  - avoid cooling processes that go through too many energytransfer processes
- insulation etc

RFI:
- radio frequency interference (RFI) is a big problem for radioastronomy. Hence location here in WA.
- RFI for radio-astronomy is like bright city lights for opticalastronomy
- some rooms RFI shielded to minimise RFI transmission in andout of the facility. RFI shielding consists of material that will notpropagate EM waves - continuous sheet metals (steel, copper etc)
1. Central Building:

- minimal offices
- laboratories (electronics repair)
- store
- small mechanical workshop
- termination point for 42 fibre link to MSF
- termination point for 7,200 fibers coming from antennas!
- house digital systems
- operations control room
- kitchen, bathrooms, shower, first aid etc
- mechanical services

**Total:** around 650 sq m
MRO - Control building (artist’s concept)
2. MRO civil works:
- approximately 26 km of minimally invasive “access tracks” - allow construction trucks into antenna areas, maintenance vehicles etc
- trenching for power and fibre from central site to each antenna along these “access track” corridors
- pits, transformers etc as needed

3. Compound - includes:
- central building
- storage area (shipping containers)
- “carport” like high bay telehandler parking, vehicle shed
- water/waste systems
- adjacent to power generation system
4. Antenna mounting pads:

- antennas weigh approximately 25 tonnes

- “pointing” requirement on the sky, wind loads etc place a number of requirements on the antenna foundations (pads)

- design brief will be to meet these requirements for antenna using the minimal amount of concrete

- preliminary geotechnical survey done. More detailed (invasive borings) will be done as soon as permitted
MRO - antenna foundation (typical)
5. Temporary construction support facilities:

- accommodation (including eating, recreation etc) for all construction staff on site.

- construction compound for offices, equipment parking etc.

- concrete batching plant
CSIRO is committed to maximising the use of renewable power sources

Requirements:
- approximately 750 kW, 24 hours 365 days
- “medium” reliability
- major load is the digital electronics (50 - 60 %)
- load variations due to cooling load variations
- diesel + maximum renewable component
- RFI emissions to meet site standards
The provision of power at the MRO is a major challenge for project planners. Considerations of future power issues (costs, availability, carbon footprint) dictate that green power must be considered.

CSIRO is exploring a range of financial structures power purchase agreements, utility operated, build/own/operate, etc.

CSIRO is enthusiastically committed to a renewable energy solution, and indeed sees it as an opportunity to showcase sustainable power solutions for the SKA.

Options include (but are not limited to):
- design and construction of a CSIRO owned and operated power plant;
- independent company provides power to MRO on a long term power purchase agreement model (“utility” style);
- other?
- Not included in current tender process
2. MSF - MRO Support Facility (Geraldton)
MSF - background and functional requirements

Need to minimise:
- staff at the MRO site (remote operations of the observatory)
- equipment at the MRO site (due to the high operating costs associated with providing power and service for equipment there).

Provide Geraldton based space for:
- the imaging supercomputer
- base for observatory staff who will reside in Geraldton and travel to the MRO as needed.
MSF - scope

Brief:

- few offices
- small reception area (public relations/outreach)
- laboratories (electronics repair)
- small mechanical workshop
- “supercomputer” facility
- termination point for fibre link from MRO
- connection to the outside world via fibre
- operations control room
- bathrooms, shower etc
- mechanical services as needed
- parking

Total: around 800 sq m
MSF - Geraldton building (artists concept)
3. Boolardy Homestead precinct

Two aspects:
1. Scope of work at Boolardy homestead to support pastoral activity:
   - homestead changes required for safety, maintenance, etc.
   - other buildings as needed

2. Component associated adjacent to homestead to support observatory activity:
   - for accommodation of visiting CSIRO and other staff technicians, engineers, scientists.
   - around 4 - 6 people, with occasional peak loads of 12
   - refurbishment (heritage status) and additions.

Common to both:
- water and waste services
- power generation
- communications (fibre cable MRO to Geraldton will pass by)
MRO - Boolardy Homestead location

CSIRO PROPOSED ASKAP RADIO TELESCOPE
LOCATION DIAGRAM - BOOLARDY STATION

CSIRO ASKAP: Australian SKA Pathfinder
Boolardy Homestead
4. MRO - MSF Fibre link

AARNet top-level design completed June 2008
- ~ 320 kilometres
- requires 3 telecommunication shelters (approx 80 km spacing) for repeaters
- ~ 42 fibres in an HS-1 or 2 sheath
- G-655 fibre
- Probably 40 channels/fibre, 50 GHz spacing (10 or 40 Gb per channel initial h/w)
- Approximately 1 kW/hut power requirement

Tender for construction contract to be announced when route access closer to completion.
5. Procurement, Packaging and Timelines I

Procurements will be done in accordance with Australian Federal Government Procurement guidelines.

Typically, procurements expected to be over AU$250,000 will be pursued via a value-for-money approach with a formal RFT via the AusTender system.

Smaller contracts may be pursued via quotations in accordance with Federal procurement guidelines.

Where solutions are less clear (possibly due to technical innovations, research components etc), a request for EOI may be pursued via AusTender.

Note that the Design and Construction packages will be separate, and within each of these, there will be packaging options to allow companies or consortia to bid for one or more of the relevant packages.

Relevant web sites - at the end.
Design Packages:

1. MRO to include:
   - compound and central building
   - access tracks, trenching, fibre/power distribution
   - water and waste
   - Antenna foundations
   - etc.

2. MSF - building

3. (Boolardy Station Homestead)

4. (Power generation)

Four design packages - 1 and 2 will be released via AusTender in March 2009. 2 and 4 to be handled separately. We are seeking expressions of interest for 4.
ASKAP Construction

CSIRO, ASKAP
(Prime Contractor)

Procurement -
Tender process

Technical Systems
- Antennas
- Analogue Systems
- Digital Systems
- Data Transport
- Power Generation
- etc.

Infrastructure
(General Contractor)
(to manage contract and site)

Subcontractor
Subcontractors
Construction packages:

1. MRO: - central building
   - access tracks, trenching, fibre/power distribution
   - water and waste
   - antenna foundations

2. MSF - building

3. (Boolardy Station Homestead upgrades)

4. MRO - MSF fibre link

5. (Power generation)
## Timelines

<table>
<thead>
<tr>
<th>Start Date</th>
<th>Event</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>February 2009</td>
<td>Complete development of briefs</td>
<td>High level requirements</td>
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<tr>
<td>March - April 2009</td>
<td>Design procurement(s)</td>
<td>Signed contracts</td>
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<tr>
<td>May - Aug 2009</td>
<td>Detailed design - some completed early</td>
<td>Final Designs for construction</td>
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<tr>
<td>Sept - Oct 2009</td>
<td>MRO and MSF Construction procurement(s)</td>
<td>Signed contracts</td>
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<tr>
<td>August 2009</td>
<td>Commence Boolardy upgrades</td>
<td>Homestead improvements</td>
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<tr>
<td>November 2009</td>
<td>Start of some components of infrastructure</td>
<td>1 antenna pad late November</td>
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<tr>
<td>Late 2009</td>
<td>Begin remainder of construction (MSF, Boolardy)</td>
<td>Full construction deployment</td>
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<tr>
<td>Late 2010</td>
<td>Complete all ASKAP infrastructure construction</td>
<td>Construction complete</td>
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Relevant links:

Information on CSIRO in general:
http://www.csiro.au/


CPG procurement policy FAQ:

Register area(s) of business interest, and be notified of the opportunities -AusTender:

The CSIRO annual procurement plan can be found on the Austender site:

Register with the Australian SKA Capability register:

Accreditation required with Federal Safety Commissioner for construction contracts over $3m:

Compliance required with the National Code of Practice:
Thank you

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ASKAP and SKA web sites: http://
www.atnf.csiro.au/projects/askap/
http://www.auska.org/
http://www.skatelescope.org