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Australian Square Kilometre Array Pathfinder – Fast Facts

CSIRO Astronomy and Space Science

The Australian Square Kilometre Array Pathfinder (ASKAP) is a world-class radio telescope currently being constructed by CSIRO in the Mid West region of Western Australia. Once completed, it will be one of the most powerful survey radio astronomy instruments in existence.

What is ASKAP?

ASKAP will be a next-generation radio telescope incorporating novel receiver technologies and leading-edge ICT systems. It will be made up of 36 antennas, each 12 metres in diameter, working together as a single instrument. It will be capable of high dynamic range imaging using novel wide-field-of-view phased array feeds.

ASKAP, as well as being a world-leading telescope in its own right, will provide an important test-bed for the future Square Kilometre Array (SKA) project.

What is the SKA?

The SKA project is a proposal by the international community to develop a future radio telescope that will have capabilities far in excess of even ASKAP. The SKA will have a discovery potential 10,000 times greater than the best present-day instruments and will be one of the largest and most ambitious international science projects ever realised. It will help to answer fundamental questions about the evolution of the Universe. Australia and New Zealand are one of two regions shortlisted to host the SKA, the other is Southern Africa. A decision on which region will host the SKA is expected in 2012.

Why Build ASKAP?

The ASKAP telescope will be able to detect hundreds of times more galaxies than current radio telescopes, helping us to understand how galaxies have formed and evolved. It will help us to understand how our own Galaxy has developed, and its current structure.

It will also be a world leader in the study of pulsars, transient radio sources, and magnetic fields in space, helping to cast light on fundamental physics and processes at work in the Universe.

Why is ASKAP Special?

The design of ASKAP is unique among radio telescopes. Its antennas feature three-axis movement and will use 'phased array feeds' (or 'radio cameras') rather than 'single pixel feeds' to detect and amplify radio waves, a development being pioneered by CSIRO in conjunction with colleagues in The Netherlands, Canada and the USA. These attributes mean that the telescope will survey large areas of sky with unprecedented sensitivity and speed.

Where will ASKAP be Located?

The cluster (or array) of ASKAP antennas is currently being built at the Murchison Radio-astronomy Observatory (MRO), a remote outback region of Western Australia.

This follows the signing of an Indigenous Land Use Agreement (ILUA) with the Wajarri Yamatji Claimant Group.

This region is ideal for a new radio observatory because the population density is very low and there is a lack of man-made radio signals that would otherwise interfere with weak astronomical signals.

The remarkably radio-quiet MRO is also Australia and New Zealand's candidate core SKA site.

When will ASKAP be Built?

Construction of ASKAP began in January 2010 with the first ASKAP antenna now built. All 36 antennas and their technical systems are expected to be completed by 2013.

> Three newly constructed CSIRO ASKAP antennas pictured at the Murchison Radio-astronomy Observatory in Western Australia, October 2010.

Powering ASKAP

CSIRO plans to develop full scale, clean energy technologies for the Murchison Radio-astronomy Observatory and for ASKAP's support computing facility, the Pawsey High Performance Computing Centre for SKA Science based in Perth.

Solar power generation technology will help power the Murchison site and the nation's largest direct heat geothermal demonstrator will be developed to help cool the Pawsey Centre supercomputer.

As both sites will have high electricity demands, the ability to reduce and feed that demand using on-site geothermal and solar renewable energy technologies will provide multiple benefits including a reduction in energy costs and carbon emissions.

Engaging with Industry

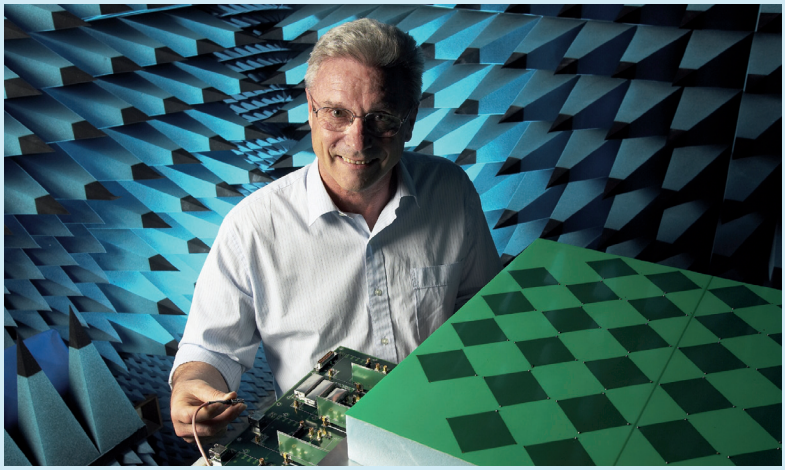
As CSIRO moves through the design, development and construction phases of ASKAP, industry is playing a crucial role in the delivery and ongoing support of technologies and infrastructure.

The *ASKAP Industry Opportunities Register* outlines the telescope's technology and infrastructure needs and is updated regularly online.

> CSIRO's ASKAP antennas at the Murchison Radio-astronomy Observatory in Western Australia.

What is a PAF?

Phased array feeds (PAFs) are receivers or 'cameras' with many separate, simultaneous beams for detecting radio waves. They allow telescopes to have a much wider field-of-view, and to scan the sky more quickly, than alternative technologies.



> Dr John O'Sullivan with a prototype of the revolutionary phased array feed for ASKAP. Credit: Chris Walsh, Patrick Jones Photo Studio.

The register is just one avenue by which the ASKAP project engages industry. Others include regular briefings and tender updates as well as early phase research and development collaborations.

Industry collaborations have already enabled significant progress in technical areas such as computing architecture and low noise amplifier design.

Past, Present and Future

CSIRO is a pioneer and world leader in radio astronomy research with a long and illustrious history backed up by the development of novel and ground-breaking instrumentation at radio, microwave and optical wavelengths.

CSIRO's division of Astronomy and Space Science currently operates radio telescopes at three observatories near the towns of Parkes, Coonabarabran and Narrabri in New South Wales. These radio telescopes are known collectively as the Australia Telescope National Facility. The facility is used by Australian and international scientists to conduct outstanding astronomical research.

ASKAP will provide Australian and international astronomers with another world-leading radio astronomy observatory. It will be operated by CSIRO as part of its National Facility.

The bulk of the first five years of ASKAP's operation have already been allocated to ten major international projects looking for pulsars, measuring cosmic magnetic fields and studying millions of galaxies.

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