Where are we at? The Square Kilometre Array

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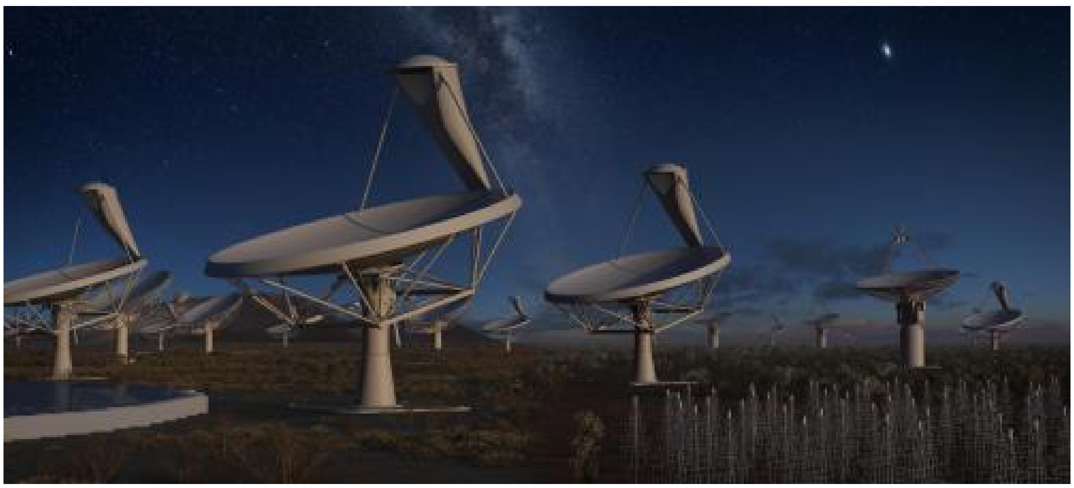

Artist's impression of the Square Kilometre Array (SKA) at night. Credit: © SKA Organisation

The low-down on the largest telescope in the world.

In 2012, you probably heard a lot about the Square Kilometre Array or SKA, particularly how Australia was one of the forerunners for hosting the SKA—the largest telescope in the world.

It was all very exciting. The world hadn't ended, and Australia had the chance to get some shiny new toys to play with.

Our country put forward a proposal to host the SKA and then … what happened?

This is the point for a lot of people where the SKA dropped off the radar. Now you might be hearing more about ASKAP or the MWA.

What are these? What happened to the SKA? Did we win? Have we built it?

Or maybe you've never even heard of the Square Kilometre Array!

So let's just take a step back …

The biggest telescope in the world

Since the late 1980s, people talked about building a telescope so big and so sensitive it could look back to the early universe. In the 80s, people were very interested in big bangs, only now they were out in space, not just part of a gravity-defying hairstyle.

In order to look back that far, we'd need a telescope with a whole square kilometre of collecting area.

But, while our fashion sense was improving, our technology was still lacking.

International panels were formed to get the ball rolling. By the mid noughties, they were ready to choose a home to host such a massive and powerful radio telescope.

Five countries put up their hands, but only South Africa and Australia were left standing.

And then there were two

Both countries busily got to work building prototypes for their proposal.

Australia chose the Murchison Radio-astronomy Observatory (MRO) for our site. This 12,600-hectare plot northeast of Geraldton was the perfect place for a powerful telescope. It boasted clear skies, was far from human activity and light pollution and was part of a radio quiet zone.

Australia used this site to build the Murchison Widefield Array (MWA) and the Australian Square Kilometre Array Pathfinder (ASKAP). MWA and ASKAP are radio telescopes which are basically like gen 1 of the SKA. A bit like a test run.

South Africa also built a telescope called MeerKAT. Same deal.

Both Australia and South Africa used their prototype telescopes as part of their proposal.

And the winner is …

Both countries invested so much in infrastructure for their telescopes, it was decided both deserved to host a part of the SKA.

But, wait, how does that work? Are we losing anything by splitting it up?

Who better to ask than CSIRO's own SKA project scientist, Phil Edwards.

Searching mid and low

Phil tells me we have nothing to lose by splitting the telescope, as the two parts actually have their own special role to play.

"In Australia, we'll be building SKA-low, which is the low frequency part of SKA," Phil tells me.

"And in South Africa, they will be building SKA-mid, which is the middle frequency range of SKA."

So what's the difference between the low and middle frequencies?

"Different frequencies are better for different kinds of astronomy," Phil says.

Objects in space radiate strongest at different frequencies, which means they're easier to spot with telescopes at the same frequency.

For example, if you wanted to study neutral hydrogen, you'd need to tune in to a frequency of 1.4 gigahertz. This frequency is too high for SKA-low, so it would be a job for SKA-mid.

It gets a little complex from here, but Phil tells me SKA-low's frequency aims to detect radiation from the early universe.

"For looking back towards the very beginning of the universe, we have to go to very, very low frequencies, and that's one of the strengths of SKA-low."

Looking back in time

Though my inner biologist hates to admit it, astronomy is kind of the 'people's science'. It's the one that seems to resonate with most people.

Remember how nuts everyone went over a big Moon? Imagine people's excitement when we start making discoveries with the SKA—which is designed to see further into space than ever before.

SKA-low's main job will be to look back in time.

"We can't look very far back with the current generation of telescopes," Phil admits.

"And so one of the goals [of the SKA] is to look back as close to the beginning of the universe as we can."

So how does looking out into space help you look back in time?

It's a question Phil is asked a lot. He chuckles as he tells me it's all to do with light.

"Radio waves are just another kind of light," he says.

"And one of the properties of light … is that light travels at a finite speed, which is approximately 300,000 kilometres per second."

Let's do some maths with our biggest light bulb—the Sun.

Our Sun is around 150 million kilometres from Earth. If light can only travel 300,000 kilometres per second, the Sun's light would take around 8 minutes to travel to Earth.

So if you looked directly into the Sun (don't try this at home), you wouldn't see the Sun as it is in that moment. You'd be seeing the Sun as it was 8 minutes ago.

Same goes for looking out millions of light years away in the universe.

"The further back we look, the longer the light has taken to reach us and so the older the object is that we're looking at," says Phil.

"Some people just study our galaxy. But those people doing cosmology, who are interested in the evolution of the universe, they are looking back as far as they possibly can."

What other cool stuff will it do?

The SKA is also hoped to help answer some of our burning questions about dark matter and dark energy.

And yes, it might even be used to look for extraterrestrials!

"The conditions for life seem as though they could/should exist elsewhere in our galaxy or somewhere in some other galaxy," Phil says.

"So yes, there are lots of people interested in using a big, sensitive radio telescope like the SKA to look for evidence of extraterrestrial intelligence."

Finding extraterrestrial friends

The easiest way to find aliens is to hope they beam us a message saying, "Hey, we're over here!"

But more likely we'll have to find them using the radiation their planet emits.

"The Earth is transmitting radio waves out into our galaxy, and that comes from radio stations, TV transmitters, airport radars," says Phil.

"We may see evidence of life on other planets just through the radiation they're producing from their own radio stations or airport radar, etc."

Sounds great, when can we start?

Phil tells me phase 1 of SKA-low will take about 7 years to complete. But they're still deciding on the final design.

"The design hasn't quite been finalised, but there are two designs," he says.

"One looks a little bit like a Christmas tree because it is small at the top and gets larger as it gets closer to the ground."

The other is based on adapting the design of the existing MWA.

Phase 1 won't be a full square kilometre of collecting area. In fact, we won't be able to roll out the whole thing for a while yet. If you want to build the world's biggest telescope, you've got to do it right. That's why the SKA is being built in stages, so we have the chance to tinker and test bits out before we go full throttle.

In the meantime, ASKAP and MWA are doing good research.

"The pathfinders—ASKAP and MWA and MeerKAT—will be doing a lot of good science in that time and helping shape the kind of science that will be done with SKA."

"So they'll be doing—in many cases—similar kinds of science, just not doing it with the sensitivity that we'll be able to do with the Square Kilometre Array."

Sometimes, the time it takes for these things to come to life means they drop off the radar for those out of the loop.

But I have a feeling the discoveries we'll make with the fully completed SKA will be well worth the wait.

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