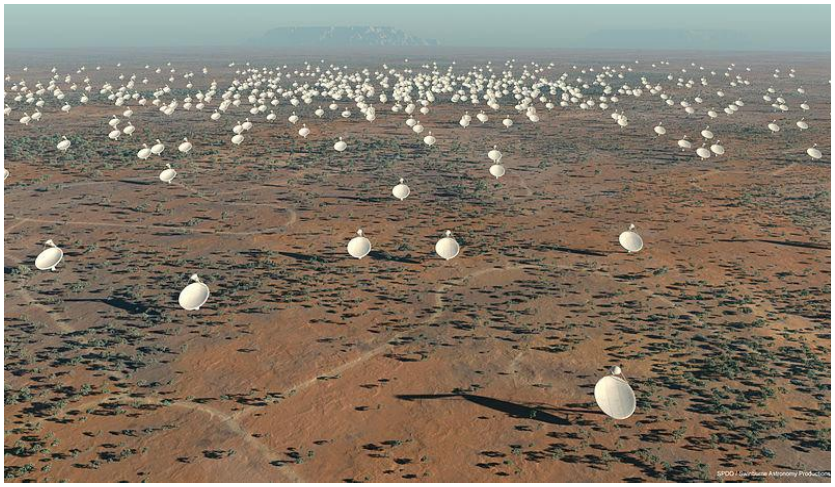
KM^2 ARRAY



THE DECISION

On the 25th May 2012, the Science and Technology Minister, Naledi Pandor announced that the Board of the consortium for the SKA had decided to build the array in two countries, South Africa and Australia.

About 75% of the construction would be in South Africa and 25% Australia.

SKA 1 & 2 LOW designs will go to The Australian/New Zealand consortiums and the rest to SA (SKA 1 & 2 Mid Arrays and SKA 2 AA).

Building of The precursors, ASKAP & MEERKaT, would start in S.A. in 2016 in the Northern Cape.

The project is expected to cost $2 billion, but could increased due to the split location. The SKA consortium would spend an estimated 100 - 150 million euro a year to operate and maintain the telescope.

This is a major scientific coup for South Africa and will serve as a key research advantage to the entire scientific community, and to Astrophysics and Cosmology.

THE DESIGN

This ambitious Radio telescope is the brainchild of radio astronomers from 20 countries. The Square Kilometre Array (SKA) will hopefully answer fundamental questions about the origin and evolution of the Universe.

It has to be large to provide the Resolution required.

Magnification is how much an image is enlarged under a microscope or telescope. Resolution is the amount of detail you can see.

If you magnify an image without increasing its resolution, it is empty magnification. A greatly enlarged blur is still a blur.

Resolution is usually expressed in terms of the minimum distance observable between two objects. The smaller the distance that can be seen between two objects, the better the Resolution.

The larger the apparatus diameter, the better the resolution. This is why optical telescopes are made as wide as possible. Many are more than 10 M in Diameter. And some have multiple mirrors, which increase the effective diameter.

Now light is a stream of photons, radio waves are also photons, and thus the resolution of radio- telescopes is enhanced the greater the diameter of the array.

The Jodrell Bank Observatory established in 1945 was the first efficient radio instrument. It stands in Cheshire, North-west England.

It is 76 M in Diameter and it is still in use.

There are several bigger instruments operating in various parts of the world.

The SKA will have a total collecting area of approximately one square kilometre.

It will operate over a wide range of frequencies and its size will make it 50 times more sensitive than any other radio instrument. It will require very high performance central computers and Internet links with a capacity greater than the current global Internet traffic.

Much of the research will be done online as is happening with the Large Hadron Collider.

It will be able to survey the sky more than ten thousand times faster than ever before, with receiving stations extending out to distance of at least 3,000 km from a concentrated central core
It will continue the radio-astronomy tradition of providing the highest resolution images.

The SKA will be built in the Southern Hemisphere, where the centre of our galaxy can be seen, and where radio interference is least.

Construction is scheduled to start in 2016 for completion by 2024

The SKA will combine the signals received from thousands of small **antennae** spread over a distance of more than 3000 km to simulate a single giant radio telescope capable of extremely high sensitivity and angular resolution.

The SKA will also have a very large field-of-view and operate at frequencies from7 0 MHz to 30 GHz

The SKA will transform the exploration of the Universe.

It will be built in stages and in different arrays:

SKA-low array - An array of simple dipole antennas to cover the frequency range from 70 - 200 MHz. These will be grouped in 100m diameter stations each containing about 90 elements.

SKA-mid array - This is likely to be an array of "tiles" to cover the medium frequency range from 200 to 500 MHz. The 3 metre x 3 metre tiles will be grouped into circular stations, 60 m in diameter.
Dish Array - several thousand dish antennas to cover the frequency range 500 MHz to 10 GHz.

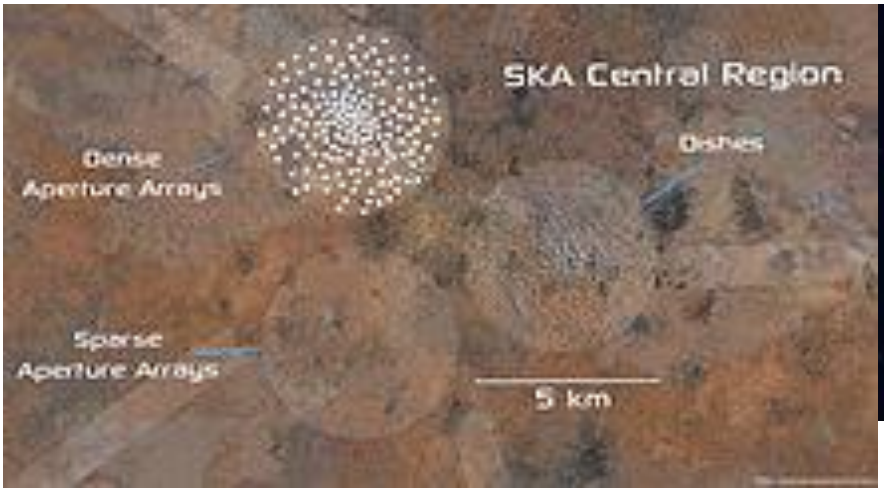
The area covered by the SKA - extending out to ~3000 km - will comprise three regions:

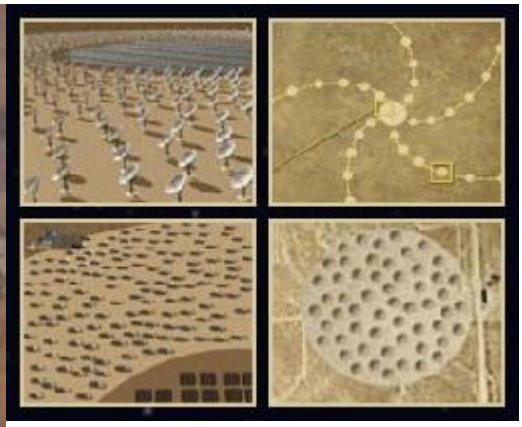
1. A central region, containing 5 km diameter cores of dish antennas, SKA-mid stations, and SKA-low antennas. This central region will contain approximately half of the total collecting area of the three SKA arrays.

2. A mid region extending out to 180 km. This will contain dishes and pairs of SKA-mid and SKA-low stations.

In each case, they will be randomly placed within the area with the density of dishes and stations falling off towards the outer part of the region.

3. An outer region from 180 km to 3000 km. This will comprise five spiral arms along which dishes, grouped into stations of 20 dishes, will be located. The separation of the stations increases towards the outer ends of the spiral arms.





The South African SKA would stretch to **Ghana** and **Kenya** ...

THE PURPOSE

A number of key science projects have been selected to be undertaken by the SKA and are listed below.

Extreme tests of **general relativity.**
Galaxies, cosmology, dark matter, and dark energy
To provide observational data to fill the gap of the **"Epoch of re-ionisation"**—the dark ages; between 300,000 years after the **Big Bang** when the Universe became transparent, and a billion years later when young galaxies are seen.
By observing the primordial distribution of gas, the SKA should be able to see how the Universe
gradually lit up as its stars and galaxies formed and then evolved.
Cosmic magnetism.
Transient radio phenomena caused by extraterrestrial life.

Peter Joubert