

# THE SKA

## *Takalani Nemaungani*

RICHARDS BAY, 20 FEBRUARY 2014



# President Zuma visits SKA Site

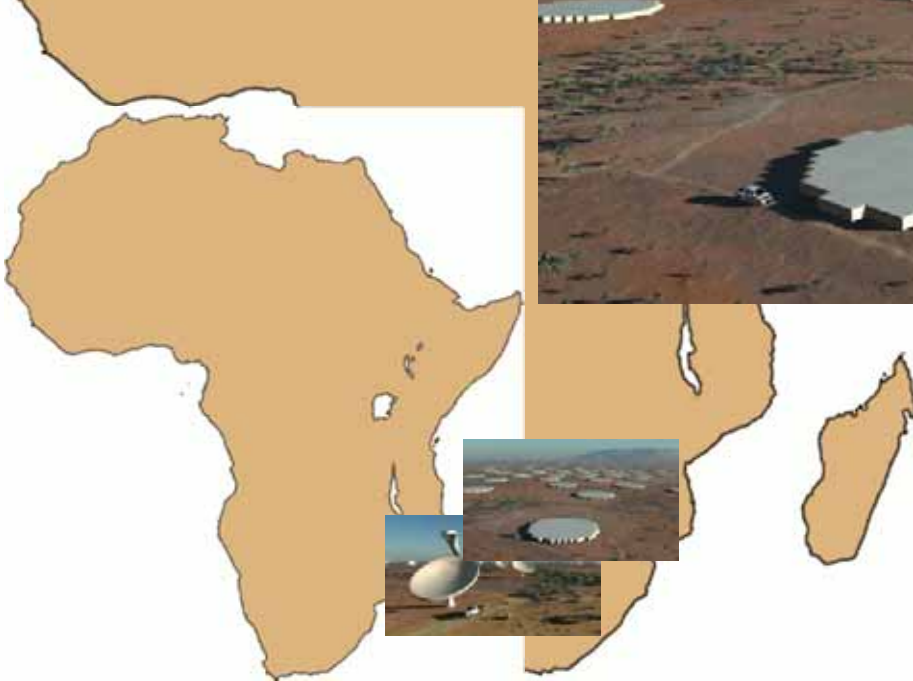


# The SKA – What is it ?



- It is a next generation radio telescope that will consist of 3 000 dishes and aperture arrays located in Africa and Australia
- African SKA partner countries include Ghana, Kenya, Madagascar, Mauritius, Zambia, Namibia, Mozambique and Botswana
- It is a prestigious, iconic, transformational, revolutionary, mega, flagship project, etc – the World Cup of Astronomy

# SKA in Africa and Australia



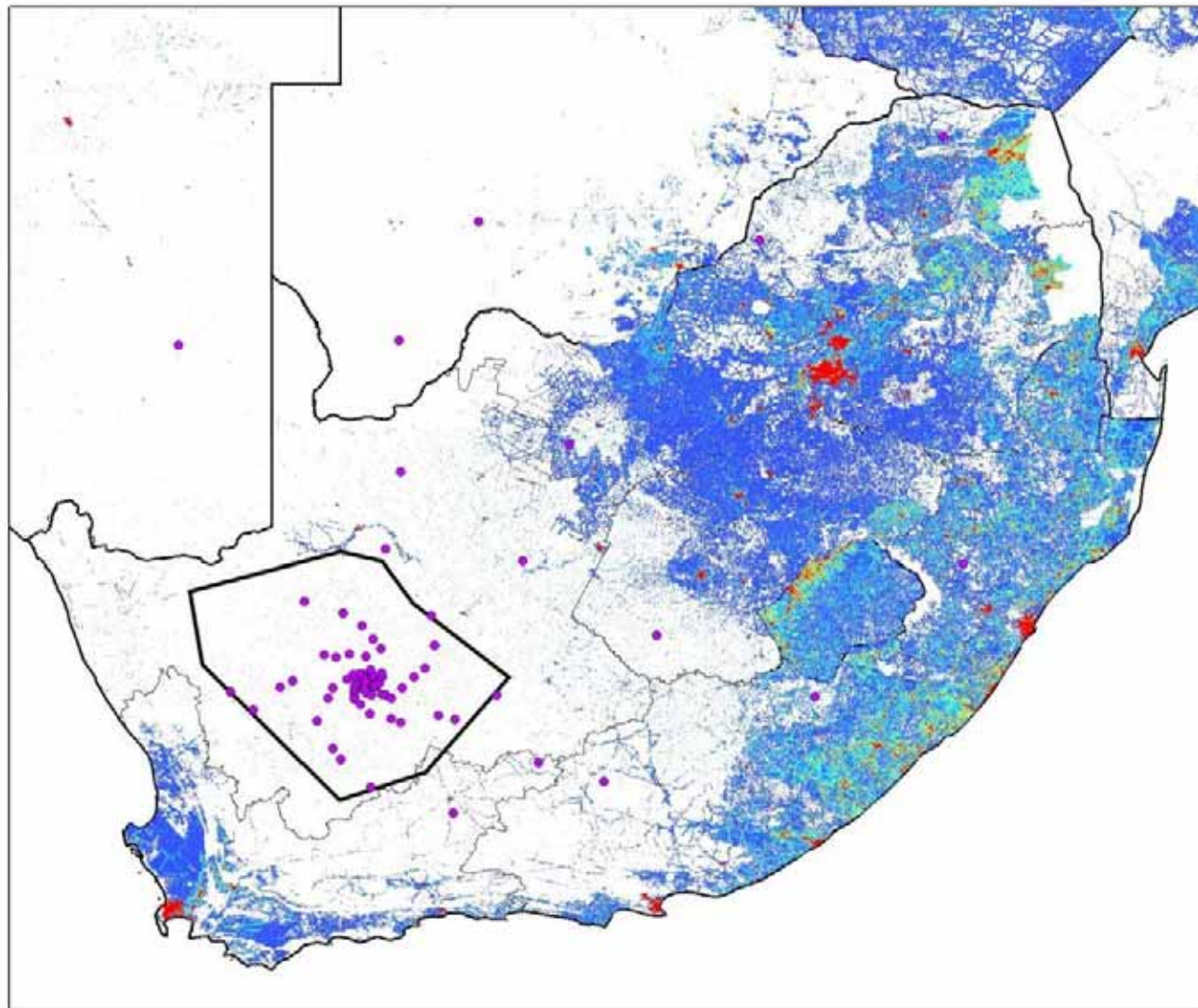


# The SKA – Why are we involved ?



- Taking advantage of our natural resource – clear southern skies and positioning, pristine sites with remote radio quiet zone (Karoo Desert, Northern Cape) .
- Building human capital, high-end skills and astronomy community – already attracting best astronomers and reversing brain drain
- Strengthening technological and innovative capacity (Big Data; High Performance Computing and other high tech industries)

# Radio Frequency Interference



## Legend

- SKA\_Configuration\_SPDO\_Dish\_Full
- AA1\_SPDO\_Version1
- AA2\_SPDO\_Version2
- KCAAAA1

## Population (per sq km)

### Value

- 0 - 4
- 4.000000001 - 14
- 14.000000001 - 29
- 29.000000001 - 47
- 47.000000001 - 68
- 68.000000001 - 91
- 91.000000001 - 116
- 116.000000001 - 142
- 142.000000001 - 169
- 169.000000001 - 197
- 197.000000001 - 225
- 225.000000001 - 255



Contact:  
Dr. Adriani Tiplady  
SKA South Africa  
17 Baker Street  
Rosebank  
2196  
South Africa  
Tel: +27 11 442 2434  
Fax: +27 11 442 2454  
Email: atiplady@sa-ska.ac.za

0 145 290 580 870 1,160 Kilometers

# SALT in Sutherland



# The SKA – Why are we involved ?



- Education and Science Promotion - Exciting project to attract young people into science and technology and keep them in Africa
- Socio-economic development (Job opportunities, Carnarvon town, construction, SKA office)
- A breakthrough for Africa in how we perceive ourselves and how others perceive us



# Pushing technology boundaries - Big Data



- Astronomy has always pushed the boundaries
- Technologies for SKA are innovative
- SKA >100 x the data traffic of the world-wide web.
  - An exabyte of data per day –  $10^{18}$  bytes
  - Exaflop computing speeds – current best is some petaflops. Equivalent would be  $\sim 10^8$  laptops
- Big Data creating entirely new industries which will be key in the global economy
- Use SKA to get young people into Big Data, wireless, signal processing etc.
- Africa can play a world-leading role in these new industries – SKA SA Big Data Africa programme

# SKA in Africa and Australia



# SKA Members and Cost



- 11 members – UK, Canada, Germany, Italy, Netherlands, Sweden, China, South Africa, Australia, New Zealand and India
- Costs
  - Pre-construction phase with €120 million committed
  - Phase 1 construction capped at €650 million
  - Phase 2 not yet designed: acquisition cost will probably be capped: about €4 billion?
- Ops and maintenance over ~40 years
  - About 7-8% of capex per year
- Costs to be covered by members of the SKA Organisation

# SKA site decision timeline



- Discussions started early 1990s
- Expressions of interest 2003
- Proposals December 2005
- Short list September 2006
- Site testing and planning
- Submit proposals (we sent 27000 pages of supporting documents) September 2011
- Recommendation for Africa February 2012
- Dual site decision April 2012



# SKA construction timeline



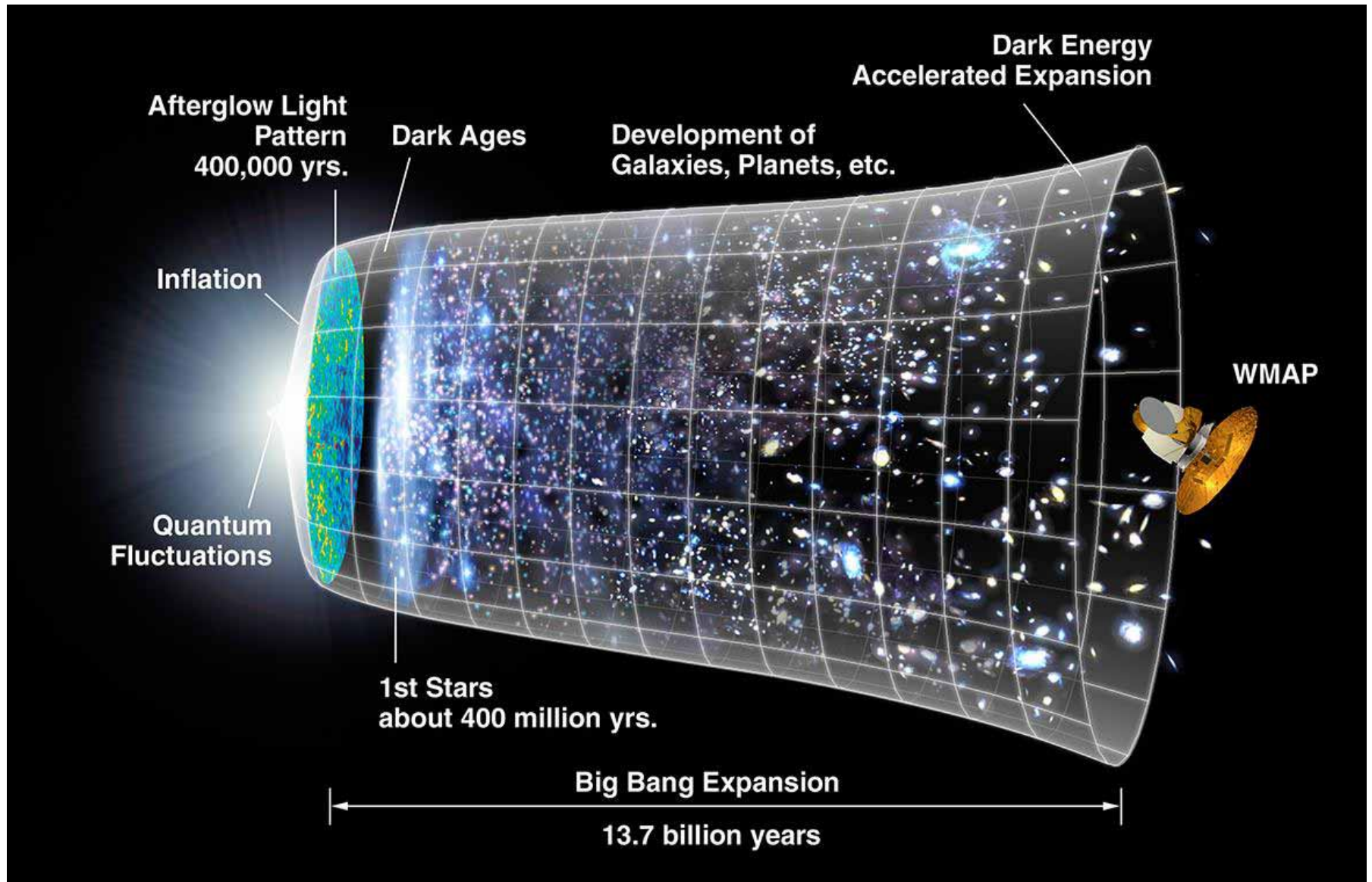
- 2013 – 2016 Pre-construction, detailed design
- 2017 Tender for construction of SKA1
- 2017 – 2020 Detailed design of SKA2
- 2018 – 2021 Construction of SKA1
- 2020 Early science with part of SKA1
- 2022 – 2027 Construction of SKA2

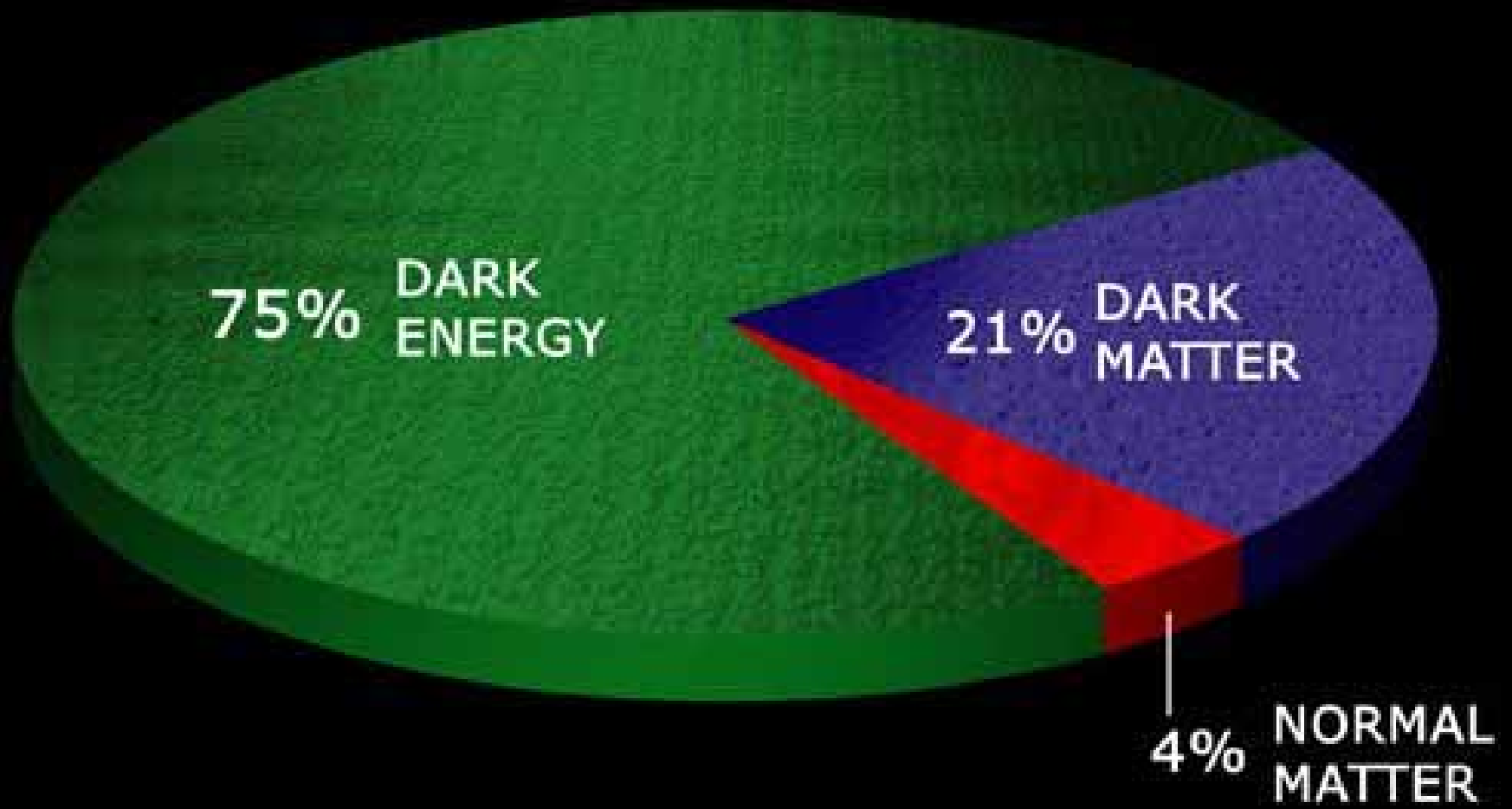
# Why the SKA?



- >50 times more sensitive than anything we have
- Science case
  - Probing the Dark Ages – how were the first stars, galaxies and black holes formed?
  - Galaxy evolution, cosmology and dark energy
  - Test general relativity using pulsars and black holes
  - Origin and evolution of cosmic magnetism
  - search for complex molecules, the building blocks of life, in space
  - Detect very weak extra-terrestrial signals
- And serendipitous discoveries!

# History of the Universe







# The SKA in Africa



**DECISION TO SUPPORT THE SQUARE KILOMETRE  
ARRAY (SKA) PROJECT ON THE AFRICAN CONTINENT  
Doc.EX.CL/584(XVII)**



The Assembly,

1. **ENDORSES** the recommendation of the Executive Council with regard to the Square Kilometre Array (SKA) Project provided for in the Report of the Fourth Ordinary Session of the African Ministerial Conference on Science and Technology (AMCOST IV), held in Cairo, Egypt, from 8 to 11 March 2010;
2. **ACKNOWLEDGES** the importance of science, technology and innovation emanating from the SKA Project in development of our knowledge-based economies and driving human capital development programmes;
3. **APPRECIATES** the efforts of the Republic of South Africa in coordinating Africa's bid to promote space related science and technology matters on the continent;
4. **ENDORSES** the African bid to host the SKA on the African continent, thereby providing the world with the unique instrument for frontier research and discovery, cementing Africa's commitment to contribute to global scientific excellence and enterprise;
5. **ALSO ENDORSES** the Republic of South Africa's bid to host, in collaboration with Botswana, Ghana, Namibia, Madagascar, Mauritius, Mozambique, Kenya and Zambia the Square Kilometre Array (SKA) Project on the African continent;
6. **CALLS ON** Member States, the Commission and the Regional Economic Communities to fully cooperate with the Republic of South Africa on this project by providing the necessary support to this bid;
7. **ALSO CALLS ON** Africa's development partners and the global scientific community to support the African SKA bid, both directly and in all relevant forums where such support would promote the success of the bid.

# African Partner Working Group

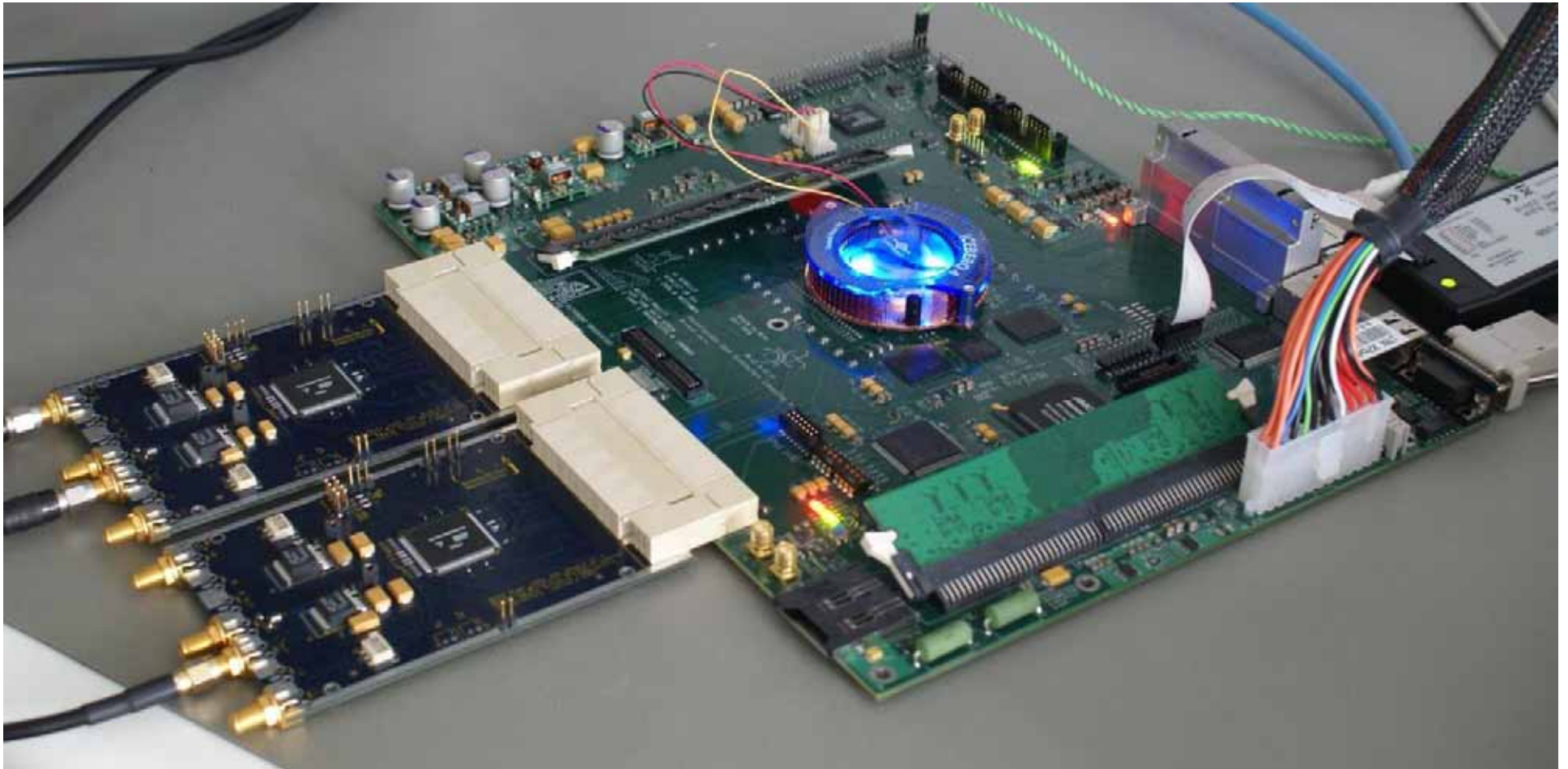








# DBE: CASPER / ROACH



# CASPER / ROACH





# All-weather landing strip on site



Above and Right: Slurry layer underway on all-weather landing strip



# Grid Power & Data connectivity



**Above: Upgrade of Karoo substation  
from 5MVA to 10MVA capacity**



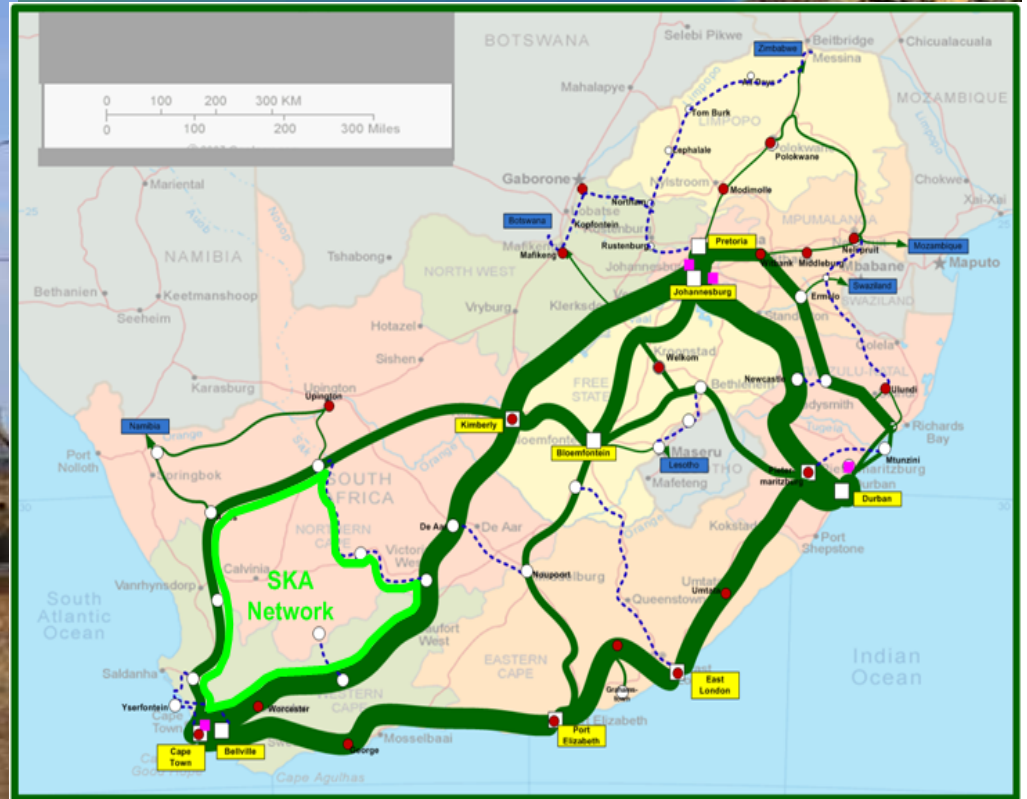
**Above: 33kV grid power line and  
optic fibre cable to site (100km  
length)**



# Optic Fibre Network



Above: Carnarvon Point of Presence (POP) station (SANReN/SKA interface)

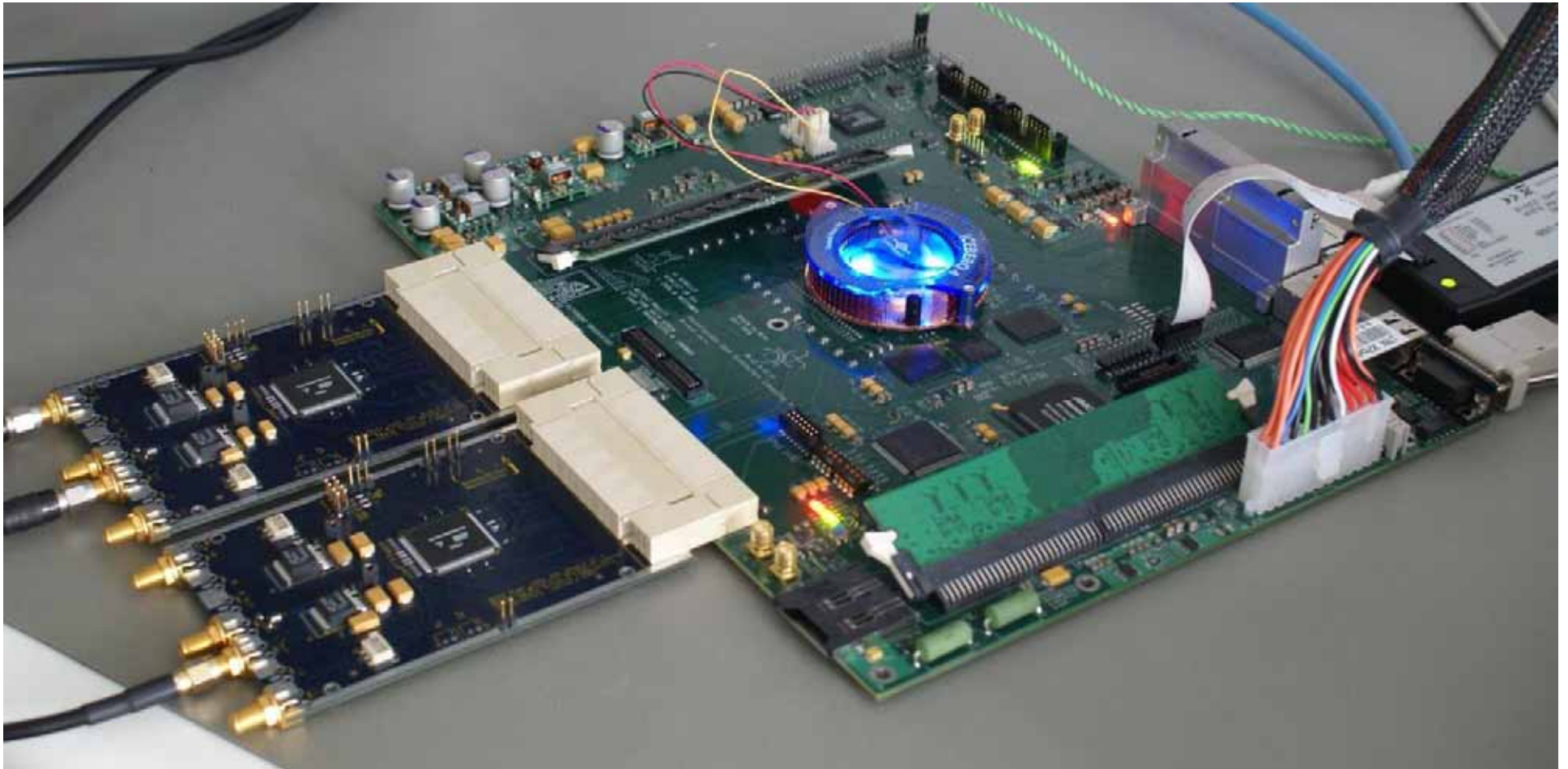


Above: Broadband InfraCO terrestrial backbone





# DBE: CASPER / ROACH



# 30-m class antennas in Africa



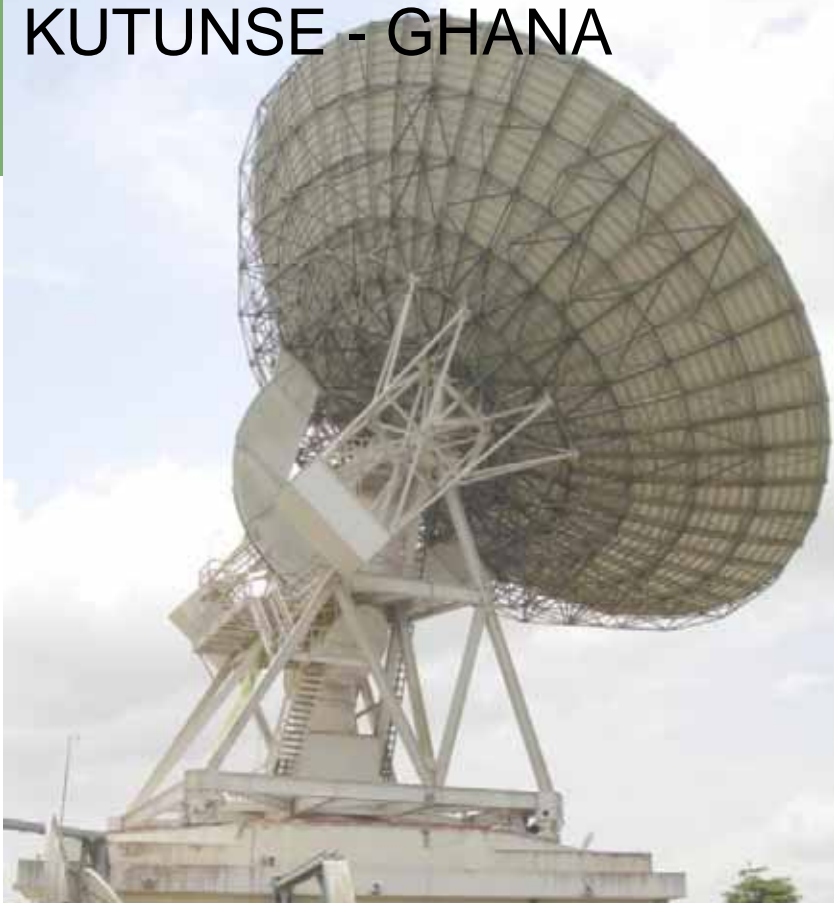
Image IBCAO  
© 2010 Cnes/Spot Image  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

©2010 Google

Contributes to excellent science with European and other VLBI networks. Very exciting science - looking at physics very close to black holes.



# KUTUNSE - GHANA





# GHANA TEAM AT KUTUNSE



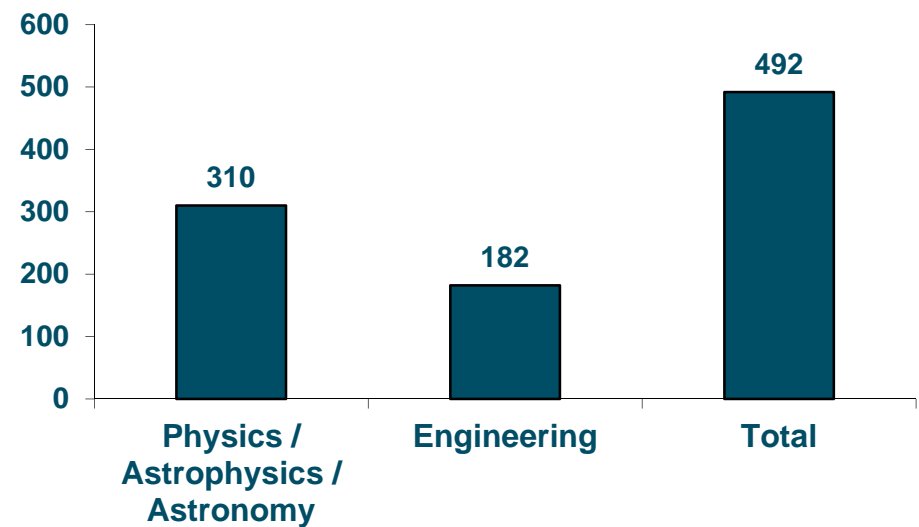
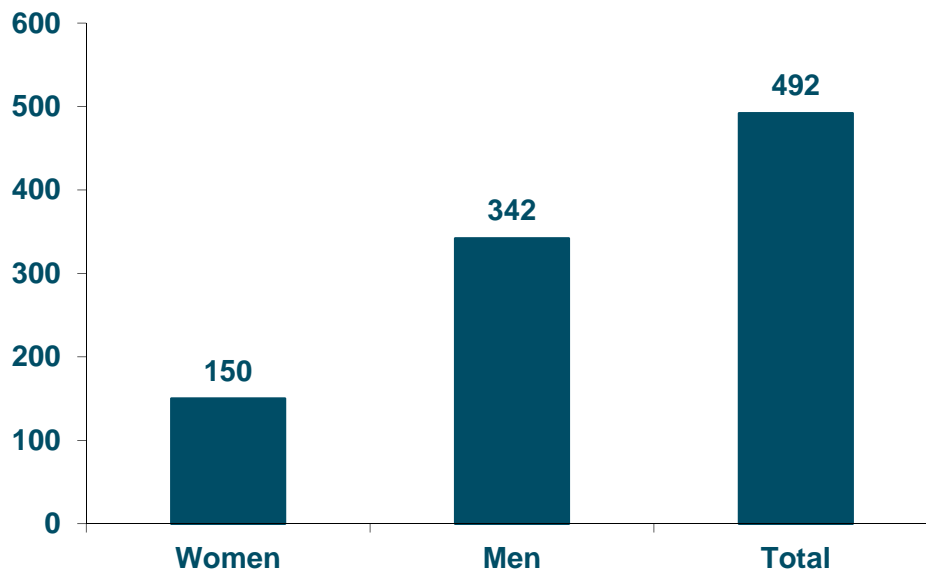
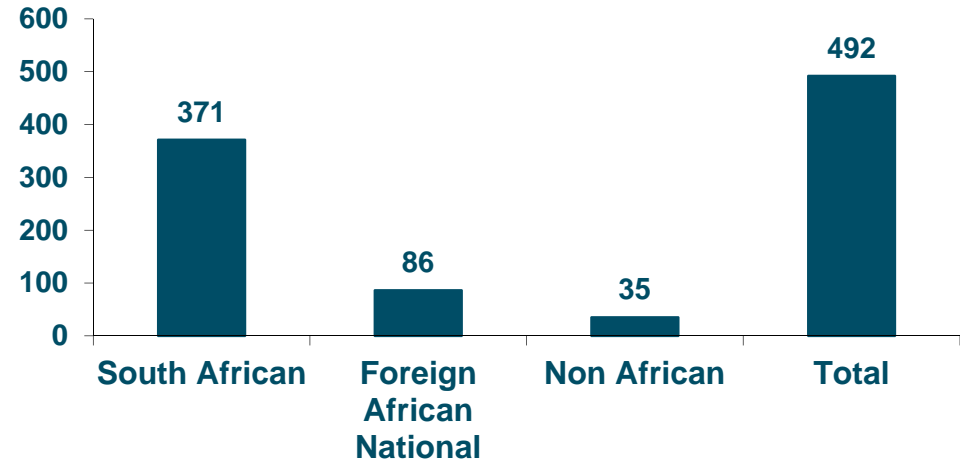
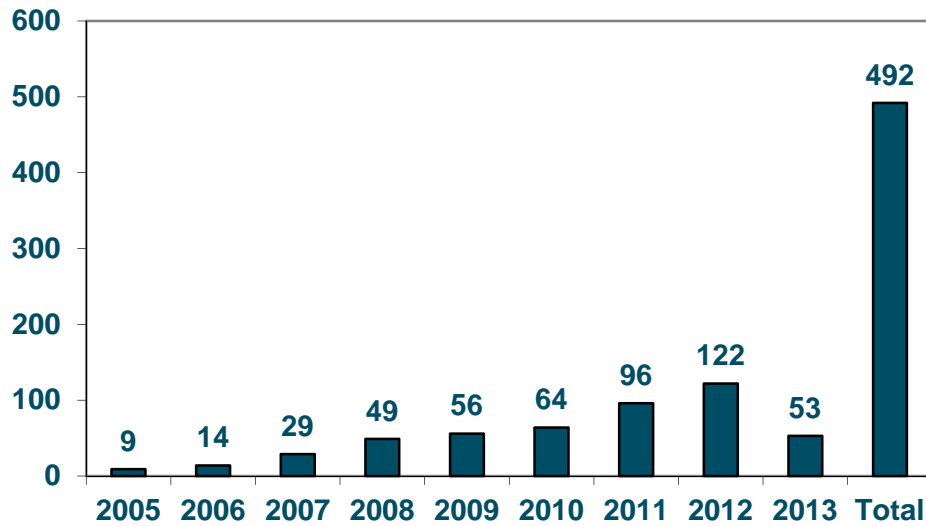
31 July 2013

# Africa HCD Workshops





# Human Capital Development



# PhD and MSc graduates



SKA SA-supported students who graduated with a Masters or Doctoral degree from 2005 to 1 April 2013

Doctoral students: 33

Masters students: 92

# Teacher training







2014/03/10



# Local Outreach through CSI



## Carnarvon High School Cyberlab

- 35 computers, equipment and software donated by USAASA and Microsoft South Africa to the value of R1million
- Optic fibre link to the school provided by Optic 1
- Teachers trained and Mathematics, Physical Science and ICT subjects conducted in cyberlab
- Science Laboratory equipment has also been donated to schools in Carnarvon and Williston



•Cyberlab: Carnarvon High School



# Local Outreach through CSI

## E-technology roll-out

- SKA SA has established a partnership with Intel South Africa
- 350 laptops to be rolled out to 5 schools in Carnarvon, VanWyksvlei and Williston
- Mobile Science equipment carts to be rolled out to these schools
- Intel will be providing support and teacher training
- Curriculum for all grades will be included on laptops and available for teachers to use in class



•Intel teacher training: Carnarvon



# Tourism Initiatives



- Establishment of the Visitors Centre in Carnarvon
- Consider a study on astronomy tourism potential (3 planetariums, SALT, HartRAO, HESS, etc) and international trends
- Infusing the SKA in your branding for South Africa

[www.ska.ac.za](http://www.ska.ac.za)



**THANK YOU**

