

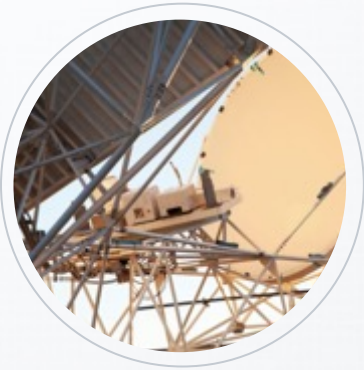


**SARAO**  
South African Radio  
Astronomy Observatory

# THE SKA PROJECT, SARAO and AVN

# SKA SOUTH AFRICA

SKA SA works to ensure that South Africa accomplishes its commitments and responsibilities in these various roles



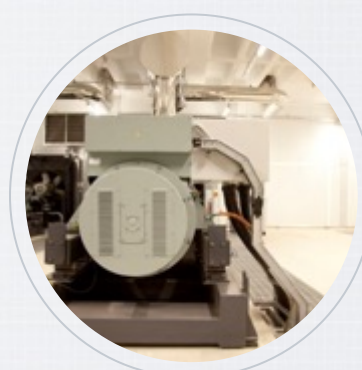
## MeerKAT

Construction of the 64 dish radio telescope  
Human Capital Development  
Operations of the MeerKAT Telescope



## SKA Design Phase

Consortia led work packages



## The AVN

The African Partner country implementations and training



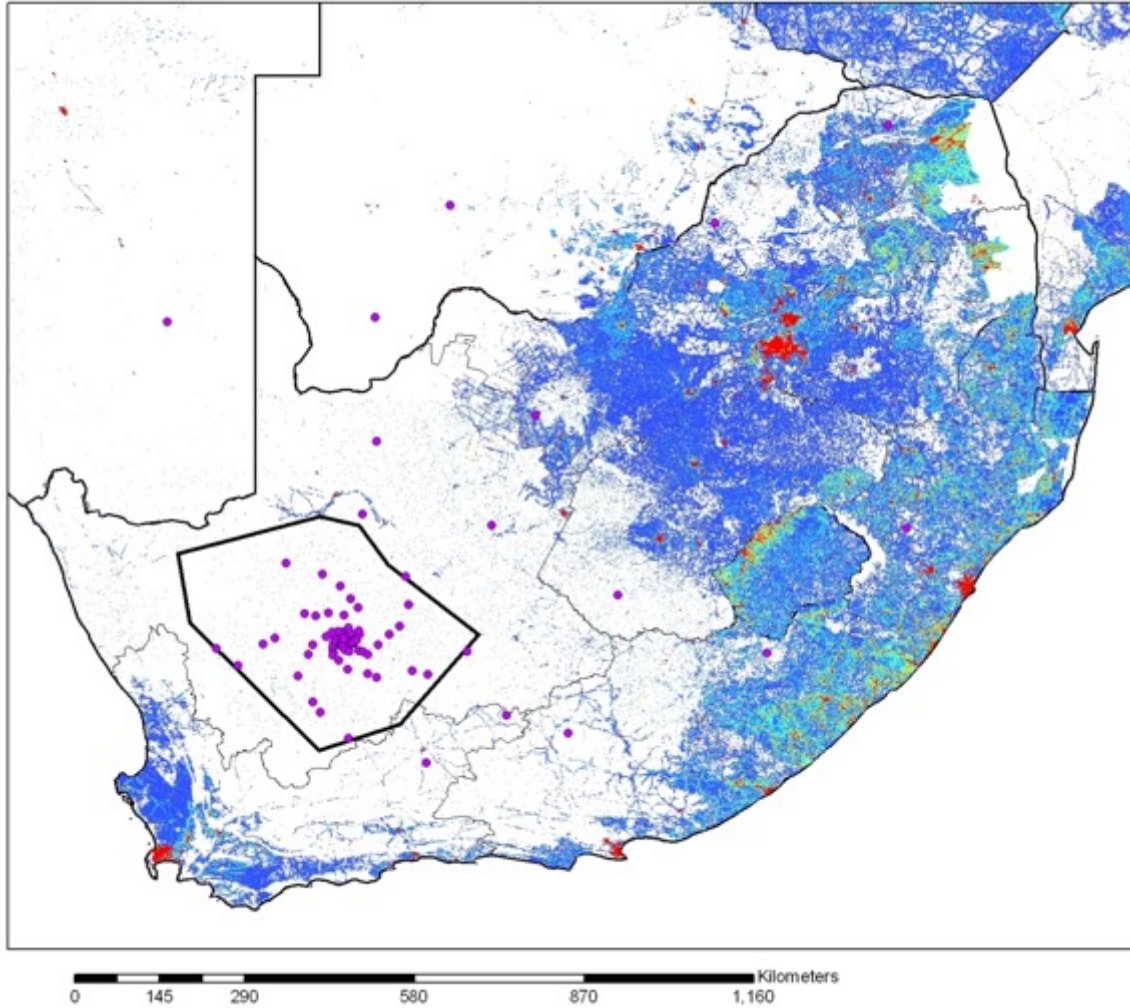
## SKA 1 MID Hosting

Site bid commitments  
AGA  
SKA1 Infrastructure  
MeerKAT Integration



# Finding a Site

Population density (proxy for RFI) and proximity to Infrastructure



Northern Cape  
4% population  
40% land area

KAT7





# MEERKAT

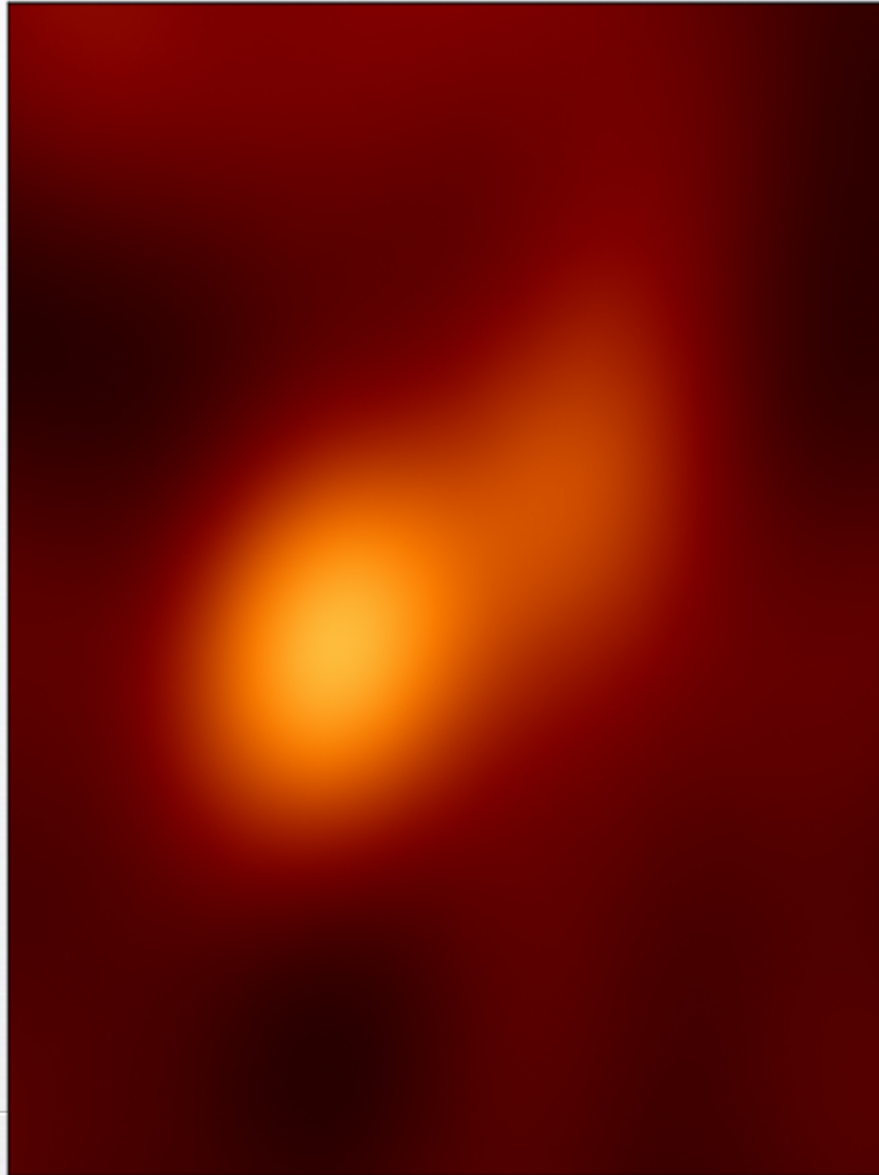


# MeerKAT Today

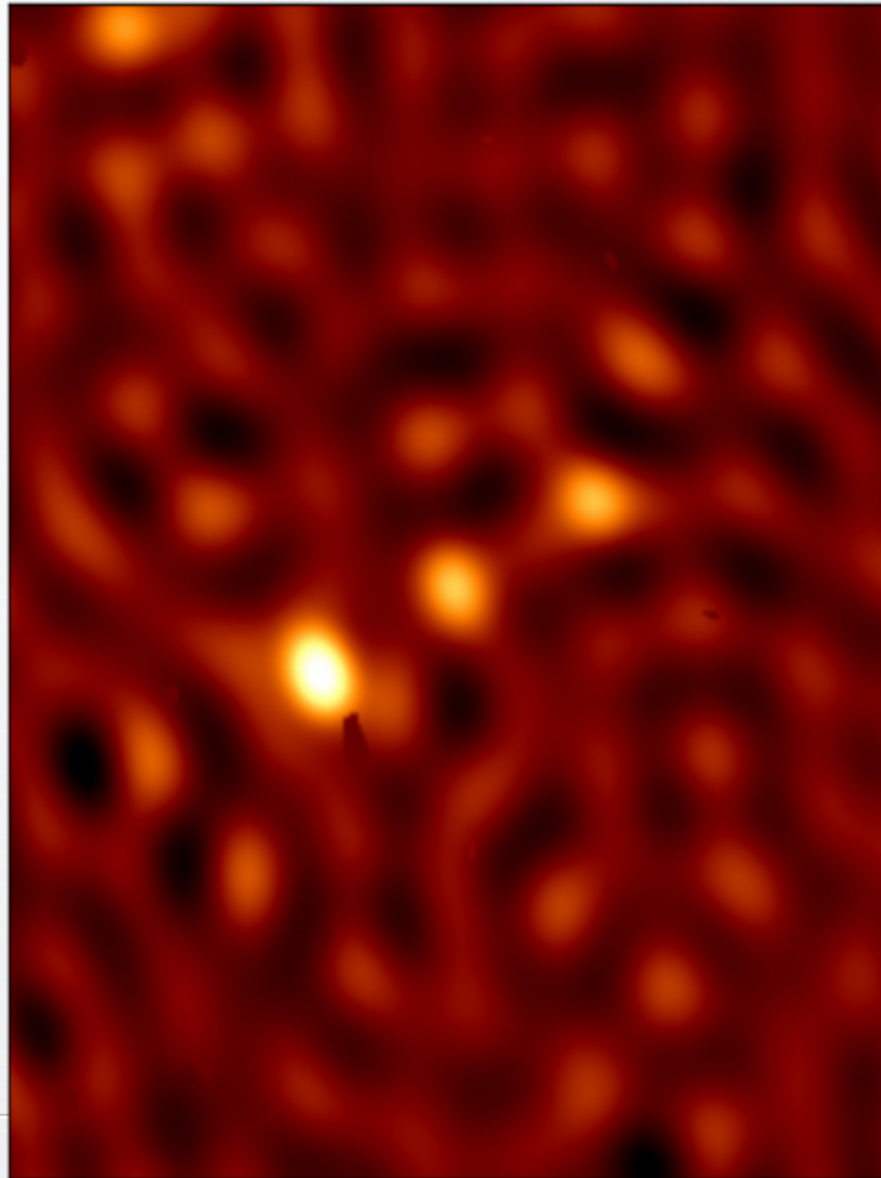
64 dishes on site



# KAT-7 image in 2012

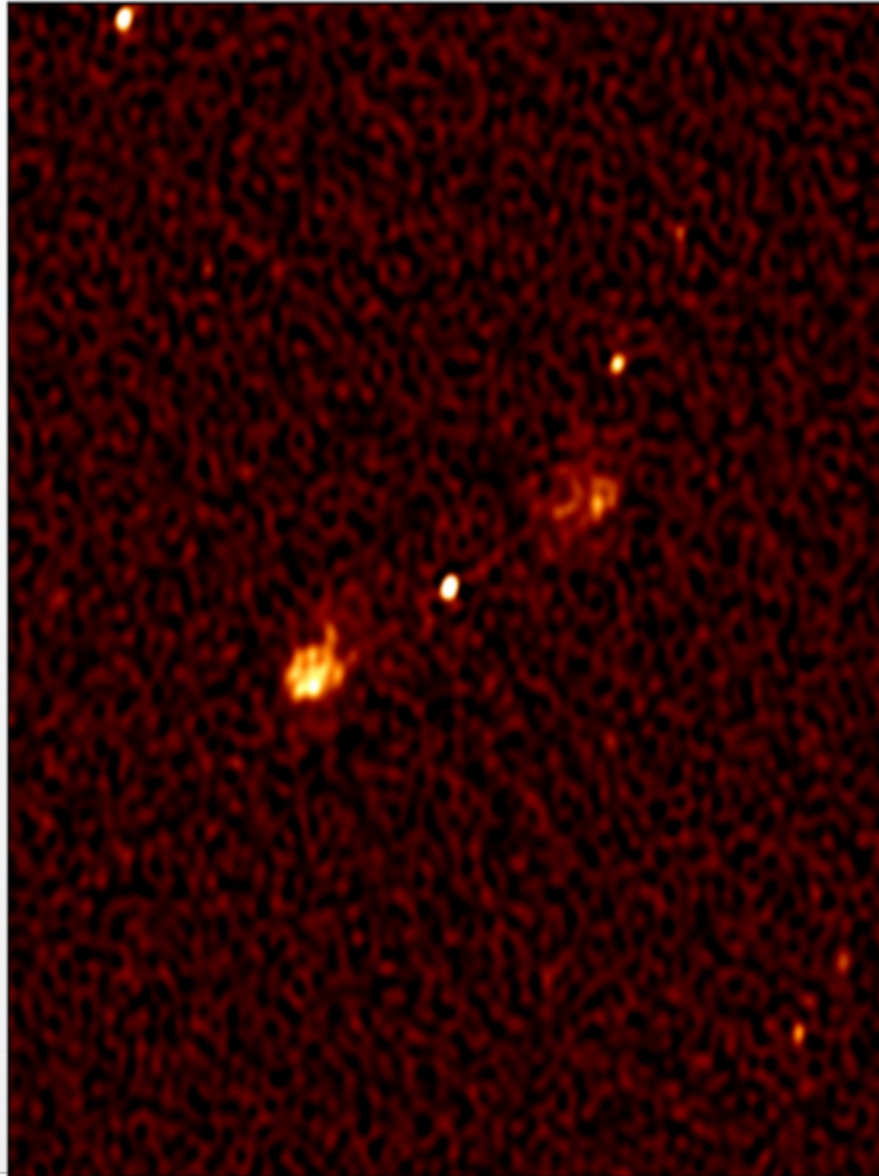


# 4-dish MeerKAT in May 2016

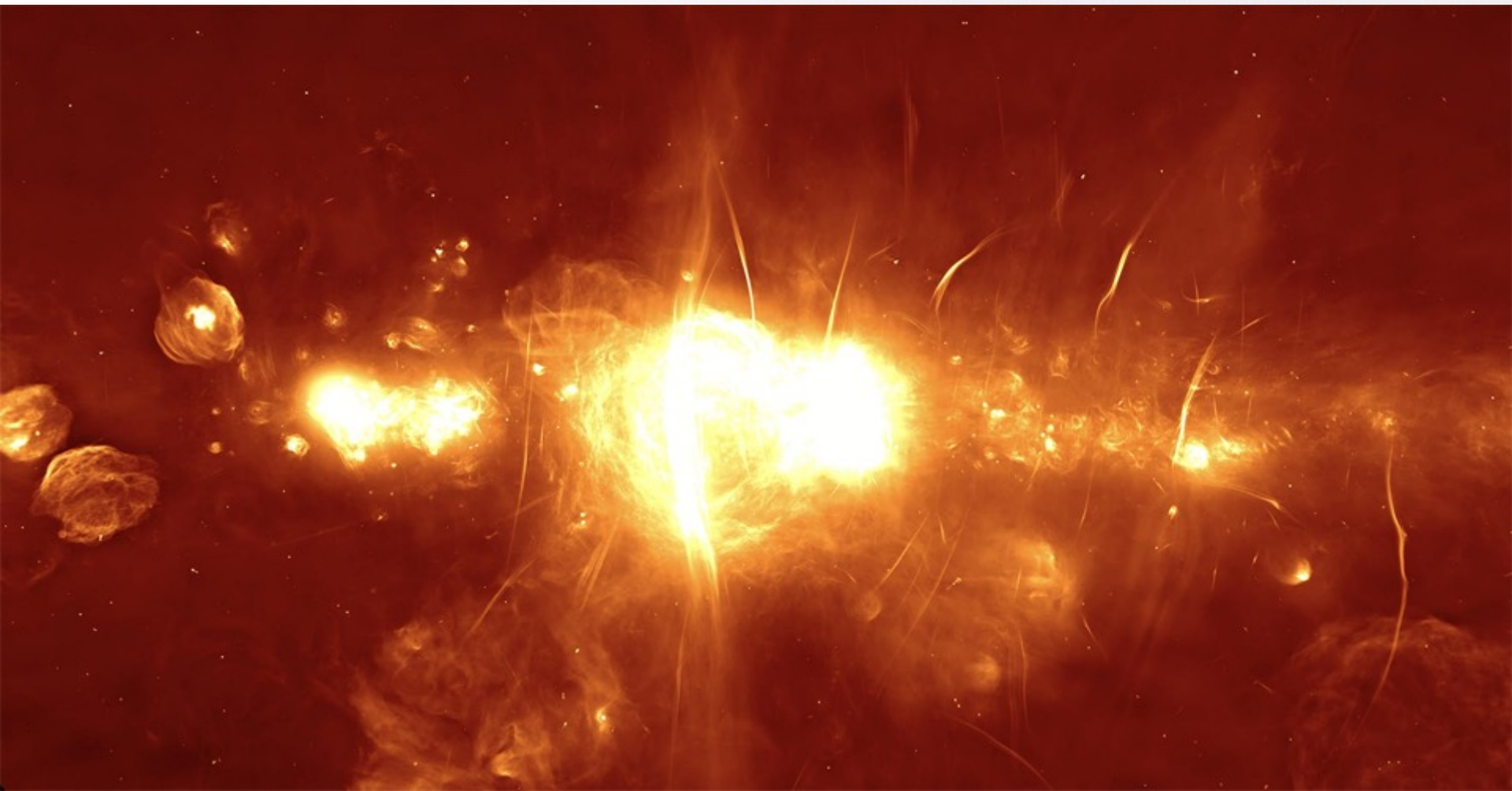




# 16-dish MeerKAT



# 64-dish MeerKAT



# SKA SA ECONOMIC BENEFITS

Impacts can be summarised as the following

## **DIRECT IMPACT**

Current organisations based in the Western Cape are already working with the SKA SA on various project items and the spend with this type of company is due to increase over the next few years.



## **DECREASED SKILLS GAP**

SKA South Africa and a number of Government led programmes with the participation of industry and institutions lead to an increase in skills development

## **INFRASTRUCTURE LED GROWTH**

SKA South Africa and a number of Government led programmes with the participation of industry and institutions lead to an increase in skills development





# TECHNOLOGY LOCALISATION

## The Financial Assistance Programme

Industry or institutions with appropriate existing expertise and interest were invited to apply for financial assistance on a shared costs, shared risk basis to participate in the Square Kilometre Array (SKA) Pre-Construction Phase.

The intention of the provision of financial assistance was to encourage South African industry and institutions to participate in the SKA Pre-Construction Phase work packages in order to gain expertise and skills in advanced technologies and to develop their international competitiveness, strengthening prospects of larger benefit to South Africa.

The SKA Construction Phase will provide opportunities for local industry participants and institutions via the international tender process.

# Maximising Local Socio-economic Benefits

- Development of direct interventions to maximise potential socio-economic benefits
  - Education; Health & Welfare
  - Local empowerment, skills training, optimisation of local business opportunities
- Status
  - Community Knowledge Centre launched
  - E-Schools program launched





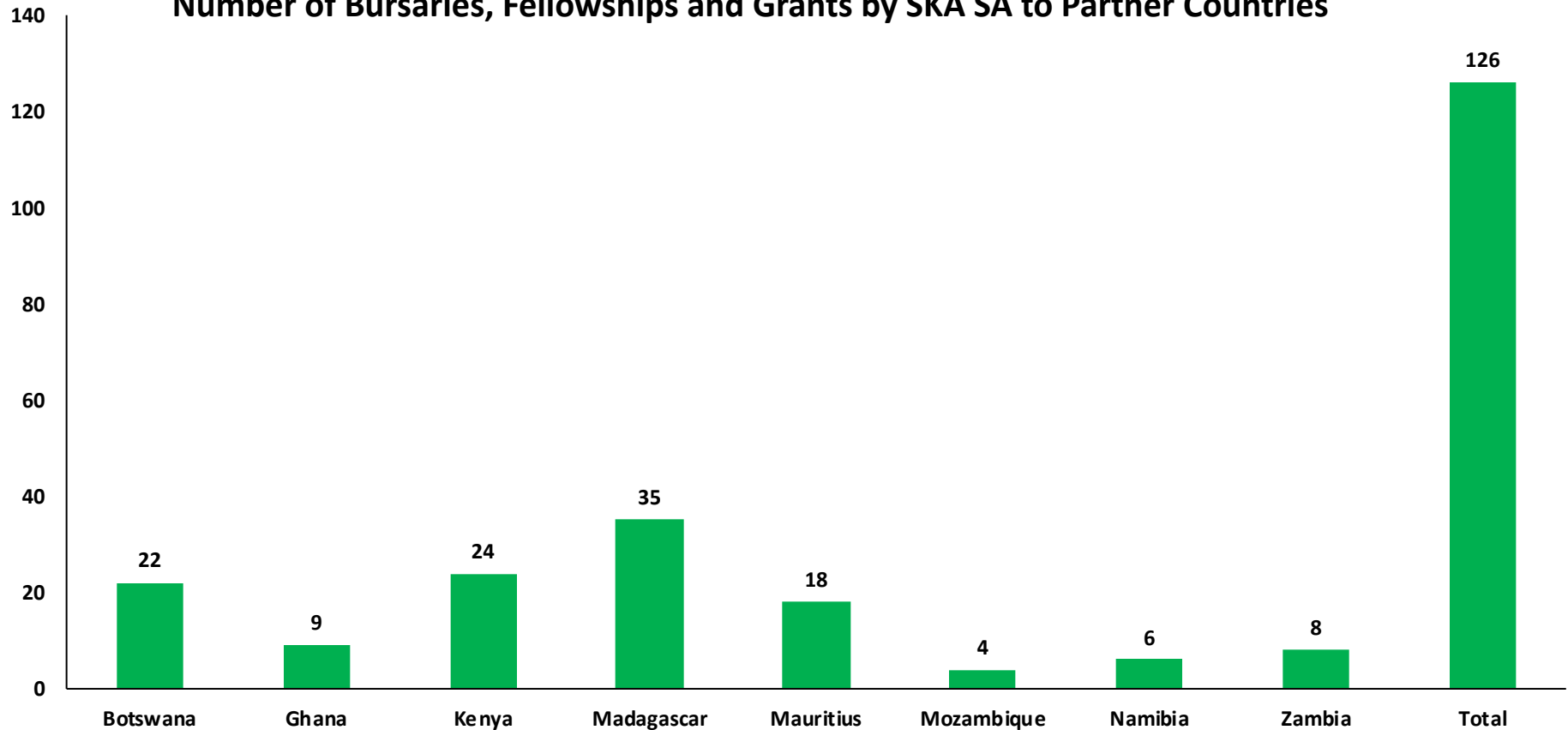
# Human Capital Development





# Human Capital Development

**Number of Bursaries, Fellowships and Grants by SKA SA to Partner Countries**



# SKA DATA PIPELINE

MeerKAT data link from site to Cape Town is currently 100 Gb per second (approximately 10 000 times larger than a 10 Mb ADSL line to you home )

This is due to grow to tens of Terabits per second for the SKA Phase One

## **Data Rate coming off the telescope**

The dishes generate 2 Tb per second

Equivalent of watching 5478 digital TV stations at the same time

## **Data Processing**

Signal processing usually reduces data to information

For MeerKAT the data rate is increased before it is reduced .. Up to 15 Tb per second

## **Multicasting**

Unique to MeerKAT

The telescope allows multiple scientists concurrently (multiple science missions on the same instrument)

Leverages an ethernet technology called IP multicasting



# The AVN

## The African VLBI Network

This project aims to establish self-sufficient radio telescopes in all of the SKA SA African partner countries; Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia.

This will be achieved through the conversion of redundant telecommunications antennas into radio telescopes, new-build telescopes or establishing training facilities with training telescopes.





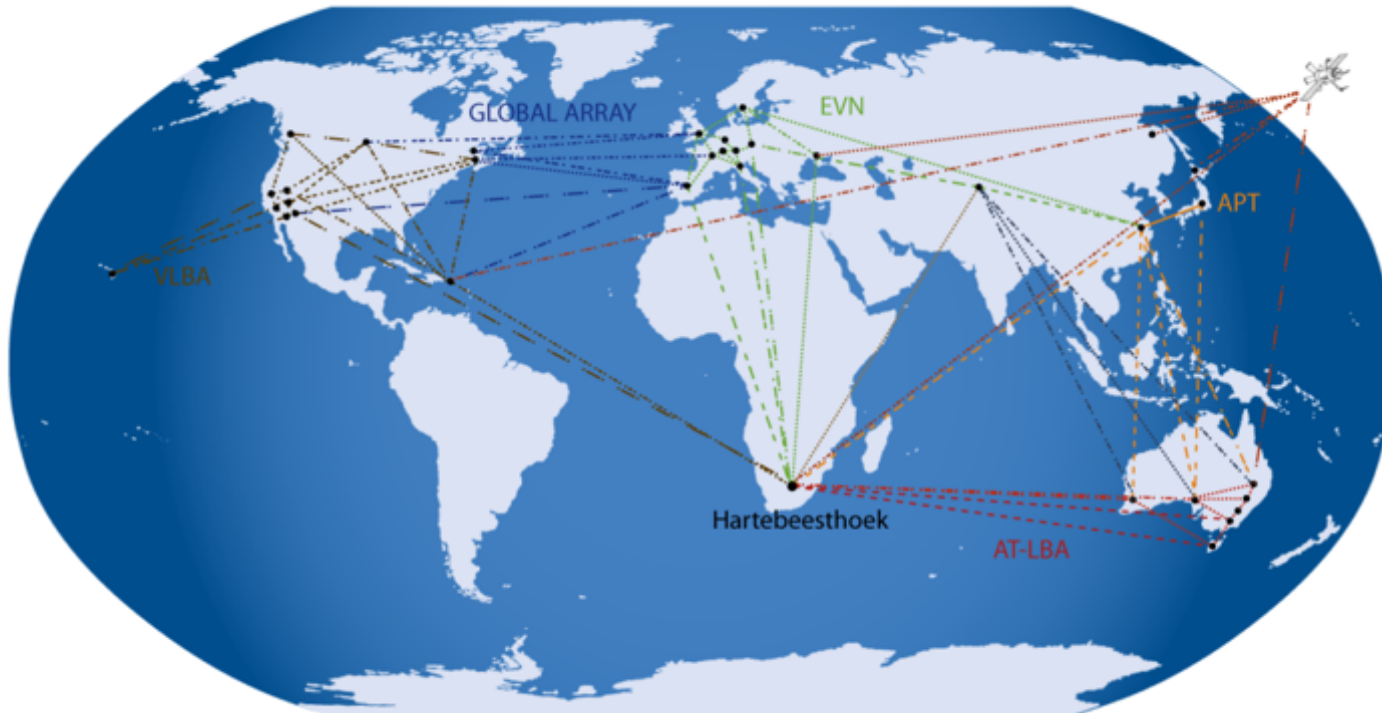
# African Working Group Meeting – August 2017

Signing of the AVN Memorandum of Understanding



# African VLBI Network

- Project launched to implement new antennas or convert obsolete satellite telecommunication dishes in Africa into radio astronomy facilities
- Result will be the creation of a VLBI network to complement the European VLBI Network (EVN) and SKA as well as improve existing global VLBI network UV coverage and performance



Existing  
Networks



# First Conversion: Nkutunse - Ghana





# African Partner Countries: Status

- Botswana
  - 2 dish training interferometer
- Mauritius
  - Four sites assessed
- Madagascar
  - Institute being established
  - Site infrastructure rehabilitation
  - HPC delivered
- Kenya
  - Coordination committee established
  - Site assessed
- Zambia
  - Site secured
  - HPC installation
- Mozambique
  - HPC installation and training
- Namibia
  - HPC installation and training
  - Site assessed



# The African Programme

- The African VLBI Network (AVN)
- The African Colocation Programme
- AVN Training Partnerships
- Bursary Programmes
- Internships and Graduate Programmes
- Communications and Science Engagement
- Big Data Africa Programmes
- Engineering and Technical Skills Programmes



# The African Programme and the AVN

## THE VISION

The AVN project aims to:

- Develop a network of VLBI-capable radio telescopes on the African continent
- Transfer knowledge and technology and develop the necessary skills in participating countries in Africa to operate these telescopes independently
- Bring new science opportunities to participating countries on in a short time scale
- Enable participation in SKA pathfinder technology development and science

Each African Partner Country (APC) site will address:

- HCD and skills development
- African technology infrastructure and science goals
- And potentially; innovation, industry development and revenue streams

In order to provide:

- Sustainable revenue for programmes and ongoing operations
- Employment opportunities in Radio Astronomy, technology areas, Data Administration and management skills
- Value added data solutions (Industry partners)



# African Colocation Programme

## The Vision

African VLBI Network

African Satellite Infrastructure

African Data and Fibre  
Network

African Science Infrastructure  
Network

African Ground Station  
Network

# African Colocation Programme

## Each African APC Site addresses:

- HCD and skills development
- African technology infrastructure and science goals
- Industry development and revenue streams

## By hosting one or more of the following:

- Ground station: Receiving and transporting data
- Data Processing infrastructure and cloud services
- Colocated science instruments
- COMRAD airborne and marine passive RADAR network
- Security: Anti-trafficking, Anti-poaching
- Radio Astronomy instrumentation
- Space Based Augmentation System (SBAS) infrastructure
- Satellite capacity

## In order to provide:

- Sustainable revenue for programmes and ongoing operations
- Employment opportunities in Radio Astronomy, technology areas, data administration and management skills
- Value added data solutions (Industry partners)

# African Colocation Programme

## Infrastructure and Civils

Grant funding

African Partner Country and AVN

### Science Research Instrumentation

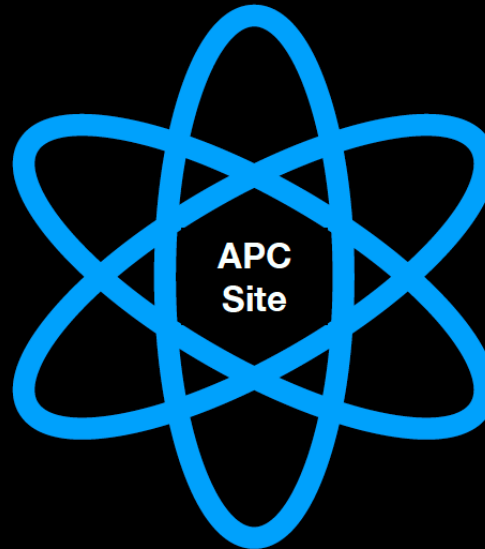
Institutional collaboration

Grant funding

### Passive Radar SBAS

Development funding and industry collaboration

Revenue Generating



## Radio Astronomy Telescope

Grant funding

African Partner Country and AVN

## Satellite Ground Station

Development funding and industry collaboration

Revenue Generating



## Satellite Constellation

### Data Facility

Development funding and industry collaboration

Revenue Generating



1	2	3	4	5	6
Random data	Central data	Ground Station	Gov. Value Add	Priv. Value Add	Sovereign
Government Departments buy data independently from several suppliers. Many times these data sets are duplicated And are inconsistent	Government Departments should centralize data Buying data from a defined set of suppliers Managed by one department Ensure continuity Share data across all Dept.	Government should own ground station infrastructure and processing capability = Save on delivery time, save hugely on cost and delivery time	Supply value add services to Government Providing up to date data for Agricultural, environmental, smart city, Mining, forestry, Ocean monitoring Security	Supply Imagery and value add services to industry / Private sector. Contractors Agriculture Mining forestry Fisheries Developers	Join a virtual constellation have access to several satellites develop and own a satellite Develop and Own value add services Become sovereign !
Huge cost	Bigger volume bigger saving	Near real time delivery	Near real time delivery	Near real time delivery	Real time delivery
Example Standard @ \$14/km <sup>2</sup>	Volume Standard @ \$10/km <sup>2</sup>	Save on external data processing and shipping \$5/km <sup>2</sup>	Save on external data processing and reliance on 3 <sup>rd</sup> party providers	Earn substantial income after cost = create sustainability	Data is almost 100% free, big income, create sustainable jobs

Funding Model

**THANK YOU**





science  
& technology

Department:  
Science and Technology  
REPUBLIC OF SOUTH AFRICA



NRF

National  
Research  
Foundation



SKA South Africa, a Business Unit of the National Research Foundation, is supervising South Africa's involvement in the SKA on behalf of the Department of Science & Technology.

## Contact information

**Carla Sharpe**

Business Manager

Email: [carla@ska.ac.za](mailto:carla@ska.ac.za)