Contribution by

The Republic of South Africa

Innovation and Technology Development from Africa Astronomy

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The views presented here are the contributor's and do not necessarily reflect the views and the position of the United Nations or the United Nations Conference on Trade and Development
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• A new paradigm for Science and Development in Africa
• The Square Kilometer Array (SKA) and Africa
• Potential for Astronomy and Space Science to bolster African development
Nabta Playa in Egypt is an archoastronomical site predating Stonehenge by 1,000 years, built in 6th millennium.
- Required the development of new technologies
- “Solar powered”
A NEW PARADIGM

- Time is right for a new paradigm for development
- Africa should fully integrate the global economy
- Africa recognizing the need to have excellent science and technology capacity
- International business seeing major opportunities
- Very innovative applications on mobile platform etc.
Top 20 markets by % growth over 2008

- Honduras 48%
- Senegal 49%
- Côte d'Ivoire 43%
- Ghana 50%
- Nigeria 49%
- DR Congo 45%
- Sudan 45%
- Egypt 64%
- Yemen 45%
- Madagascar 90%
- Kenya 46%
- Tanzania 52%
- Uganda 95%
- Nepal 75%
- Vietnam 95%
- Indonesia 52%
- Afghanistan 104%
- Sudan 105%
A NEW PARADIGM

- Crucial role of iconic projects
- Raise the profile of science and technology
- Change perception that SET is for others
- Attract young people into SET careers
- Keep them or bring them back after post docs
- Strengthen research and teaching
- Brain circulation, not brain drain
SKA

- World’s largest radio telescope
- Nineteen countries
- €1.5 billion acquisition cost and €150-200 million per year for 40-50 years
- Pushing the boundaries of both science and technology
The SKA – The Next Hubble

- 1 Square Kilometre of collecting area.

- To be the most sophisticated radio telescope:
  - Requires the “SuperNet” (>100 Gbps).
  - Requires the faster computer yet to be built.
  - Requires 500 scientists/engineers working across 3,000 km.

- ~$2 Billion in infrastructural & ~$15 Billion in operations over 50 years.

- Once in a generation telescope that will excite future generations as the Hubble did.
The Quietest Locations in the World
Radio Noise Levels

Forte satellite: 131MHz
The African SKA Bid

A group of African astronomers dare to dream big!
SKA Africa Working Group

Annual meeting at DG level

Cape Town, 2009
SKA dishes
Opportunities

- IAU International Programme office in SA
- New astronomy courses started or starting in Nairobi, Maputo, Antananarivo, Mauritius
- Thirty-nine post docs, PhD, MSc, Honours students funded from SA SKA up to now
- Proposals to
  - Support universities and new courses as above
  - Extend PhD, MSc, Honours bursary programme
  - Extend technician training programme
  - Involve universities in Portugal, France, Morocco, UK etc. in teaching and research
Effect on Africa of SKA Short-listing in 2006

7 astronomy programs pre-site selection:
- RSA – 60 astronomers, 10 Universities and 3 national facilities.
- Egypt – 56 registered IAU astronomers.
- Nigeria – 10 registered IAU astronomers.
- Mauritius – Long astronomical history.
- Ethiopia, Morocco and Algeria

5 astronomy programs post-site selection:
- Burkina Faso
- Mozambique
- Kenya
- Botswana
- Ghana

Will they produce astronomers or bankers?
Effect on Africa of SKA Short-listing in 2006

- 4 countries with telescopes pre-2006 – RSA, Namibia, Egypt, Mauritius
- 6 New Astronomy facilities:
  - RSA – added XDM & KAT-7, C-Band All-Sky Survey (CBASS) and Precision Array to Probe the Epoch of Reionisation (PAPER).
  - Burkina Faso – Installing a 1m optical telescope.
  - Nigeria – Building a 25m radio telescope.
  - Ghana – converting a 30m telecoms antenna
  - Mozambique – beginning construction of 12m class radio telescope
- MeerKAT – Commissioning in 2013/14
- Proposed or constructing telescopes:
  - Mauritius – Low Frequency VLBI network.
  - Ethiopia – 2m class optical/IR telescope.
  - African VLBI Network – convert 30m telecoms antenna for geodesy/astronomy.
- Will they impact on unemployment figures?
Research Chairs

- Already two research chairs in radio astronomy
- Now five more – funded for 15 years at ~€300 000 each per year (includes post docs, PhDs etc.)
- At least three on the point of being filled by world-leading international astronomers and one by world-class engineer
Africa’s MeerKAT

MeerKAT telescope will be the premier astronomical facility until SKA
MeerKAT will be a world-class telescope

“The biggest interferometer in the world until the SKA is built”
MeerKAT science

- To start 2013
- 21 major proposals for total 10.5 years observing
- 700 astronomers in the teams (450 unique names), including 58 from Africa
Centaurus A - What we will get with MeerKAT

This is a well-known galaxy, already studied in the Northern Hemisphere.

MeerKAT will study many Southern Hemisphere galaxies, never mapped in detail at radio wavelengths -

Even galaxies born at the dawn of time.
C-BASS DISH AT KLEREFONTEIN

Oxford, Caltech, Manchester, SKA SA
African VLBI Network
MeerKAT Technology for the AfVN

Processor can be upgraded without having to redesign board. Africa and the World developing this technology to revolutionise computers.
Why Invest in Science?

- Africa needs technicians, engineers and scientists.
- Investment in R&D will:
  - Lead to greater job creation through innovation.
  - Lead to decreased reliance on foreign aid.
  - Lead to greater technology transfer.
  - Lead to growth in the economy and greater prosperity.
  - Directly support the fight against poverty.
Four reasons to invest in Science

1) Prestige – Improved view of Africa in the eyes of the World
2) Human Capital Development (HCD) – Projects directly provide very high skills development
3) Technology Transfer – Cutting edge facilities built in Africa
4) Economic Growth – Direct Foreign Investment in infrastructure
Encourage balance with economic interests

- Prestige
- Economic Growth
- HCD
- Technology Transfer

Astronomy Project
How do we achieve this?

- **HCD**
  - Encourage throughput of technicians, engineers, and scientists
  - Research, teacher & tech training programmes

- **Technology Transfer**
  - Develop industrial/research relationships
  - Invest in R&D spending

- **Economic Growth**
  - Seek out alternative uses of all infrastructure
  - Design infrastructure to maximise economic growth
  - **Encourage maximum collaboration – share with all partners**
Thank you

- Support collaborative development
- Develop global public-private-partnerships
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