Vision for Astronomy in South Africa

Takalani Nemaungani
Chief Director: Astronomy
Dept of Science & Innovation

ASSA Centenial Symposium
SAAO, Cape Town
15 October 2022

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

2030 NDP

Development of Astronomy in SA

- Optical astronomy as the front runner
  - SAAO with about 20 telescopes in Sutherland – over 200 years anniversary and unveiling of heritage status in Oct 2020
  - SALT with significant investment ($36m) and bigger impact - official opening by President Thabo Mbeki on 10 November 2005 (17 years)
- Radio astronomy (SARAO)
  - HartRAO 26m dish initially built by NASA (1961) – 61 years
  - KAT7, MeerKAT and SKA and AVN - huge investment and huge impact (R6bn to date – 315 mEuros) – 2003 (19 years)
- Gamma ray - Participation in HESS telescope in Namibia and now CTA (Chile) – (20 yrs anniversary this year)
- Hosting regional & international offices: African Astronomical Society (2019), IAU-OAD (2011)

Strategy

Multiwavelenth Astronomy Strategy

Vision: SA as a global centre for astronomy science and facilities

Facilities & Instrumentation -Establishment -Maintenance -Hosting	**Science advancement**	**Human Resource Development** **(SKA HCD Programme & NASSP)**	**Socio-economic and commercial benefit**

Site Protection of Karoo Astronomy Reserve (AMA, AGA Act, Regulations) & Co-existence

Policy, Strategy, Funding Support & Stakeholder Management

Timeline - Astronomy in SA (1)

DATE	EVENT
1820	SAAO established
1961	HartRAO 'deep space station' built by NASA
1975	HartRAO handed over to the CSIR, converted to a radio astronomy observatory
1988	HartRAO became a National Facility operated by the FRD and in 1999 the NRF
1996	White Paper - '*important to maintain a basic competence in flagship sciences such as physics and astronomy for cultural reasons*'
2002	National R&D Strategy – '*We should develop scientific areas where there is an obvious geographical advantage such as Astronomy*'
2005	SALT, a specialised spectroscopic facility, was opened at Sutherland
2007	The Astronomy Advantage Area (AGA) Act no. 21 of 2007
2007	Astronomy Management Authority (AMA) unit established within DST
2007	NRF Astronomy Sub-agency established
2008	Ten Year Innovation Plan 2008-2018: astronomy covered in Space Sciences Grand Challenge
2010	NRF Astronomy Desk established
2010	NRF Institutional Review - recommends et.al. that different arrangements be adopted for the management of the Astro-Geoscience facilities and that these NFs be managed by a new agency (or agencies)
2011	National Development Plan 2030 - characterises Science, Technology, and Innovation as crucial for development

Timeline - Astronomy in SA (2)

DATE	EVENT
2012	South Africa (along with 8 African Partner Countries) awarded right to co-host the SKA
2013	National Integrated Cybersecurity System (DSI funded) Centre for High Performance Computing (CHPC), South African National Research Network (SANReN), and the Data Intensive Research Initiative of South Africa (DIRISA)
2014	Astronomy in South Africa: a Multi-Wavelength Long Term Strategic Plan (Astronomy Desk Working Group)
2015	Review of the NRF Astronomy Cluster as part of the 2015 Institutional Review
2015	National Strategy for Multi-Wavelength Astronomy (DSI)
2016	The Ministerial approval to merge the HartRAO and the SKA project
2016	Minister projects >R1billion investment in Meerkat and SKA
2016	South African Infrastructure Roadmap (DST) recognises astronomy investments made
2017	Minister declared SARAO as a national facility under the NRF
2017	SAAO and SALT observe the cataclysmic explosion of two colliding neutron stars
2017	HESTIIL Review that notes the significance of international cooperation including astronomy examples
2018	Strategic case and scoping for the South African National Astronomical Observatory
2018	MeerLICHT telescope launched in Sutherland
2018	SAAO declared a Heritage site
2019	White Paper on Science, Technology, and Innovation (recognition of the 4IR)
2021	SKA Observatory comes into force on 4 February – as a treaty organisation Construction formally begins in July

Astronomy – Investment Returns (1)

Returns on South Africa's investments in Astronomy

- Geographic Advantage (dark,clear,radio silence skies) –
  - ✓ Scientific outputs grown from below average to twice above the global average – global ranking increased from 33 to 21 as of 2014
  - ✓ Commissioning another scientometric review – to get SA to Top 10
- Size of astronomy community tripled over 15yrs from 60 PhD astronomers to over 200 and pipeline is increasing fast
- Significant HCD programmes through SKA Bursary Programme (R60m) and NASSP (R20m) – over 2 000 grants awarded in the last 15 yrs
- 6 astronomy Research Chairs awarded – to strengthen university programmes and training - assisted to attract international leading astronomers to develop local scientific capacity

Astronomy – Investment Returns (2)

- Technological returns – supporting local industry (infrastructure, manufacturing, services), innovations and commercialization
- Big data and 4IR – data storage, processing and transport. Cyberinfrastructure and techniques (Ilifu, IDIA, SANREN, DIRISA, etc)
- Socio-economic returns – community upliftment, job creation and growth of SMMEs - SALT Collateral Benefits Programme and SKA Programmes
- Outreach programmes - working with schools, science centres and Planetaria (Iziko, Free State, Wits, etc)

Astronomy – Investment Returns (3)

- Pan-African development – strengthening institutional and human capacities - African SKA Partner Countries, DARA and AfAS.
  - ✓ AVN - Ghana Radio Astronomy Observatory
  - ✓ Development in Africa through Radio Astronomy (DARA) - Co-funded by SA and UK's Newton Fund - Conducting workshops and training programmes in data analytics
  - ✓ Big Data Africa Programme – CHPC rollout of High Performance Computing and training programmes
- Internationalisation and partnerships
  - ✓ Hosting several international telescopes/instruments in the Karoo and Hartebeeshoek / FDI
  - ✓ Sutherland (MeerLICHT, ATLAS, PRIME, etc)
  - ✓ SKA site (HERA, MeerKAT Extension, SKA, etc)
  - ✓ Attracted more than 20 international astronomy conferences and won the rights to host the 2024 IAU General Assembly
  - ✓ Participation in HESS/CTA, Rubin Observatory, etc
  - ✓ BRICS Astronomy

Evolution of Astronomy - Policy Framework

- White Paper, 1996: *"It is also important to maintain a basic competence in flagship sciences such as physics and astronomy for cultural reasons….."* *- Astronomy and Astrophysics have been maintained and expanded as a flagship basic science area*

- National R&D Strategy 2002: "*We should develop scientific areas where there is an obvious geographical advantage such as astronomy,……"* *- The Astronomy Advantage Area (AGA) Act no. 21 of 2007, Multiwavelength Astronomy Strategy, Astronomy Management Authority (AMA) within DSI have been established to develop the astronomy sciences and protect the geographical advantage*

- TYIP 2008-2018: - *"The development of a space technology programme provides an opportunity to use satellites to conduct astronomy observations from space (Telescope mounted satellites)……"* *- This has not been pursued to date…*

  - *"We should become the preferred destination for major astronomy projects and associated international investment in construction and operations"* *- SA (and Africa) has become an emerging hub for astronomy with projects such as SALT, MeerKAT/SKA, AVN and HESS. Other telescopes include HERA, MeerLicht and several small other international infrared/optical telescopes in Sutherland*

  - *"We will have constructed a powerful radio-astronomy telescope and used it for world-class projects"* *- Construction of MeerKAT is complete and doing great science while SKA is underway*

New Era - Policy Framework

- 2019 White Paper and the unfolding process on the finalisation of the Decadal Plan.
  - ✓ The review study conducted by NACI recommended that the DSI retains the science missions including astronomy – as the review has shown that the specific focus on and funding of these fields has produced demonstrable gains in scientific knowledge output, human resource capabilities and infrastructure. The continued support of science missions needs to ensure that mission-related outcomes are incorporated and measured over time – to further develop them into world-class domains .

New Era - Policy Framework

- The Department through the Government Technical Advisory Committee (GTAC) is currently reviewing the astronomy institutional landscape in consultation with NRF, SAAO, SARAO and key stakeholders – in line with the 2017 Ministerial Budget Vote directive by former Minister Pandor – the outcome of this process will be communicated in future once the process and decisions have been made.

- Directive made by the Minister Pandor's commitment during the 2016 Budget Vote Speech, "This financial year a strategy on multi-wavelength astronomy will be finalized, consolidating optical, radio and gamma ray astronomy facilities under a single astronomy sub-agency in the NRF. In support of this consolidated approach, I have approved a recommendation from the NRF to merge the Hartebeeshoek Radio Astronomy Observatory and the SKA project into a new South African Radio Astronomy Observatory".
- .

New Era - Policy Framework

- Minister Pandor's 2017 Budget Vote, "I have directed my department to explore the possibility of creating a South African Astronomy Observatory as a consolidated single national astronomy institute. I hope we can conclude this phase of our plans prior to the completion of SKA phase 1 in 2022"
- The specific HESTIIL Report proposal : 'Astronomy observatories: It is proposed that the South African National Space Agency (SANSA) legislation be changed to make it a schedule 3B organisation, and to incorporate both the South African Radio Astronomy Observatory (SARAO) and the South African Radio Astronomical Observatory (SAAO) in such a way that these form a new organisation where the role of each is clearly defined and respected but without any duplication.' - this option has been excluded by GTAC

New Era - Policy Framework

- A draft Astro-tourism Strategy has been developed jointly with the Department of Tourism
  - ✓ Premised on creating more awareness of protecting dark skies and radio silence
  - ✓ It's a national strategy across all provinces – Kruger National Park (star gazing initiative)
  - ✓ Projects include updrage of visitor centre at SAAO Cape Town and new facility in Carnarvon
  - ✓ Planetaria (Naval Hill & Boyden Observatory, Iziko Museum, Wits Planetarium, Sutherland Planetarium
  - ✓ Vredefort Dome, Tswaing Crater, etc

2024 IAU General Assembly

- To be hosted in Cape Town at the CTICC in 2024
- 3 000 astronomers
- NOC led by NRF/IAU-OAD and AfAS

Collaboration with ASSA

- Outreach and public engagement
- Tapping into ASSA resources – knowledge, passion, experience, newsletters and books
- Several discoveries of comets and stars – for example the discovery of Proxima Centauri by Robert Innes (self taught astronomer)
- Publications - Monthly Notes of the Astronomical Society of Southern Africa (*MNASSA*), annual handbook Sky Guide Africa South (SkyGuide)
- African Science Stars Publication and AfAS Newsletter
- Membership model
- Conferences/Exhibitions – Scopex (Rosebank Military Museum) – Astronomy Town Meeting/AfAS Conference
- Amateur societies network in Africa /AfAS


THANK YOU