

SASPO Oral representation to ICASA Hearing

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SQUARE KILOMETRE ARRAY



science and technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

Purpose of SASPO's Oral Representation



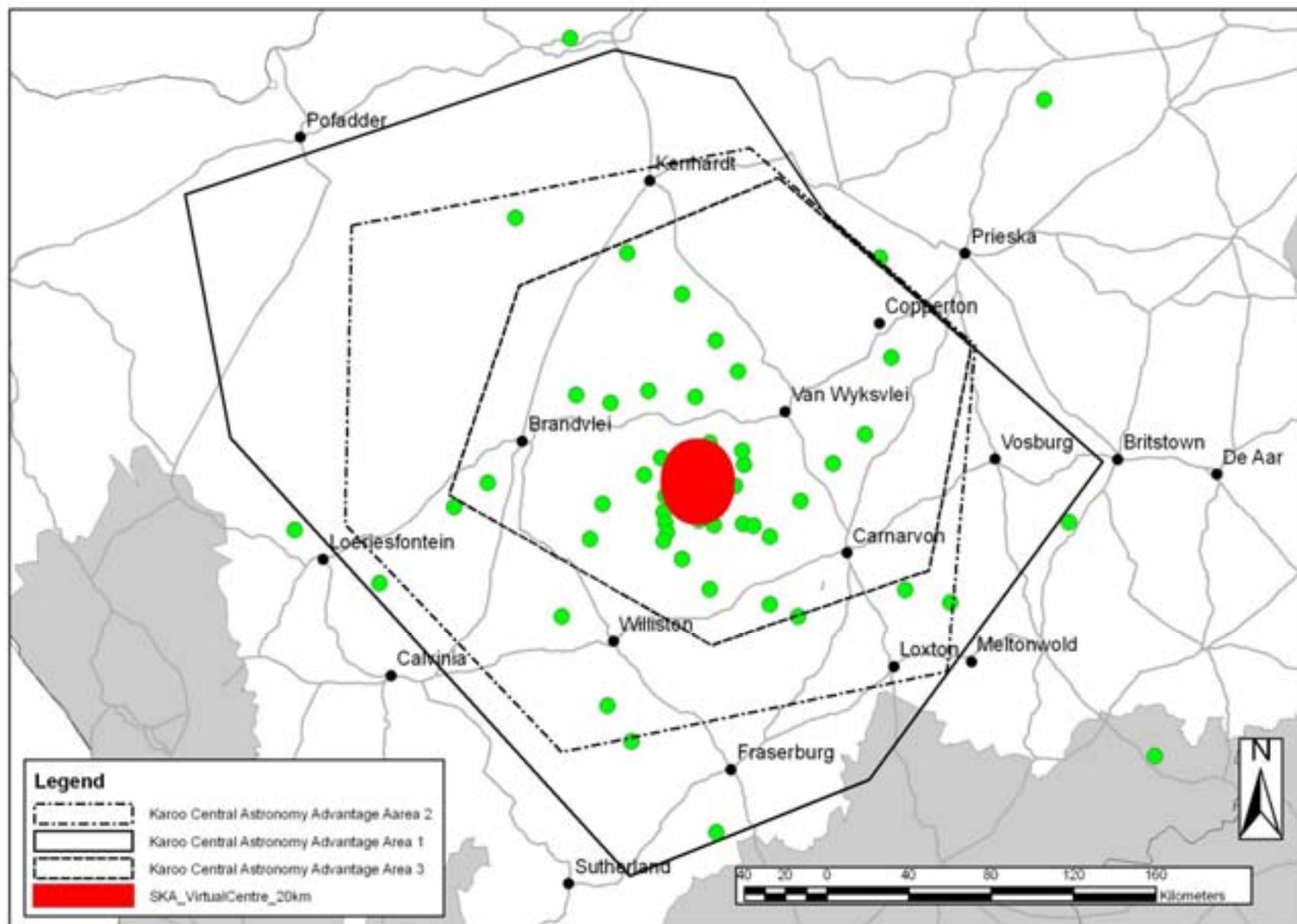
- Propose alignment of the management (and licensing) of radio frequency spectrum and the protection of radio astronomy within the Karoo Central Astronomy Advantage Areas (Karoo Central AAAs)
 - Licensing allows and Protection restricts spectrum use
 - Simplify and smooth spectrum use administration
- Provide a brief overview of:
 - Basic aspects for protection of the Karoo Central AAAs
 - Protection regulations to be made in terms of the Astronomy Geographic Advantage Act (AGA Act)
 - Proposed inserts in ICASA's Frequency Migration Regulation and Radio Frequency Migration Plan
 - Considerations for exemptions on restricted frequency spectrum
 - Update on SKA, and implications of dual-site solution

Basic aspects involved in providing protection for radio astronomy within the Karoo Central AAAs



- Dominant risk to radio astronomy results from interference from radio communication and electromagnetic signals
- AGA Act provides for declaration of geographical areas to be protected, and protective measures are prescribed through regulation
- Public consultation process prescribes registry to be maintained of interested and affected parties, who will be sent draft regulations before publication in GG
- Authorisation process is regulated, and provides for relaxation of protection requirements for essential radio communication services
- Protection of the Karoo Central AAAs requires restriction on use of spectrum, and transmission activities:
 - Exemption and consolidation of some spectrum for radio communication purposes.
 - Compliance with prescribed protection levels at the Karoo Core Centre (KCC).
 - Avoidance of saturation level RFI at any radio astronomy station.
 - Limitation of transmission EIRP's to 60 dBm max with reduction as required in the KCC direction.
 - All spectrum use & transmissions will require permits with defined protection conditions and RFI level assessment.

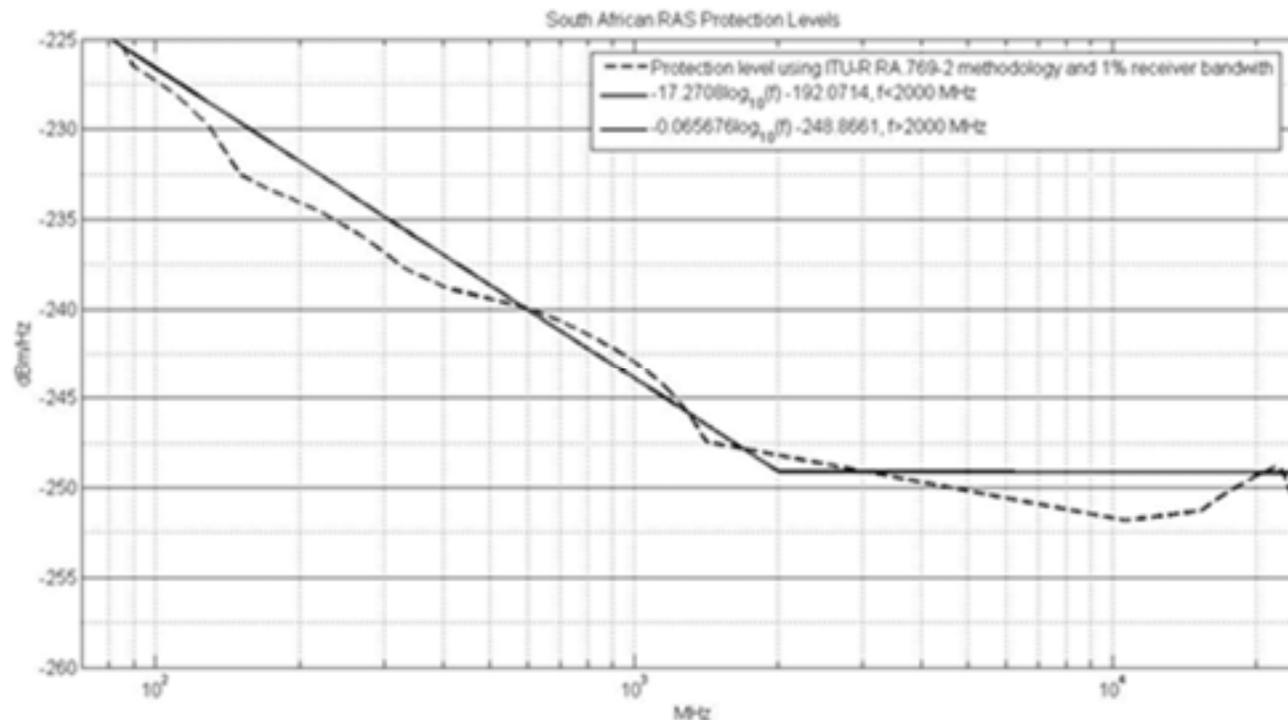
Karoo Central Astronomy Advantage Areas 1, 2 & 3



Protection for radio astronomy within Karoo Central AAAs (1 of 3)



- South African Radio Astronomy Services (SARAS) Protection Level Regulations published in GG35007 on 10 Feb 2012



- SARAS [dBm / Hz] = $- 17.2708 \log_{10}(f) - 192.0714$ for $f < 2$ GHz.
- SARAS [dBm / Hz] = $- 0.065676 \log_{10}(f) - 248.8661$ for $f > 2$ GHz.
- The values of (f) are to be in MHz
- The protection levels are to be applied at specified geographical locations

Protection for radio astronomy within Karoo Central AAAs (2 of 3)



- Regulations for spectrum use and transmission activities (1year compliance period):
 - Spectrum from 100 MHz to 10 GHz restricted
 - Exemptions, subject to possession of permits with specific conditions
 - Consultation with ICASA and public consultation
 - Spectrum from 10 to 25.5 GHz to be restricted at a future date, with exemptions.
 - Existing transmissions in 100 - 200 MHz continue (subject to permit conditions)
 - Two TV channels in UHF TV-band to be exempted (subject to permit conditions)
 - Conditions for permits for any transmissions within the Karoo Central AAAs
 - EIRP's limited to 60 dBm
 - RFI at any radio astronomy station limited to -120 dBm/Hz (saturation)
 - RFI at KCC limited to protection levels (as specified in Regulations)
 - Exemptions for essential services if necessary

Protection for radio astronomy within Karoo Central AAAs (3 of 3)



- Administrative Procedure Regulations for Central AAAs
 - Procedure and technical criteria for evaluation and assessments, compliance and exemptions that deal with essential and non-essential services
 - Service is not essential when a functionally and feasibly suitable alternative exists
- Regulations Restricting Electromagnetic Interference (EMI) w.r.t. electricity generation and distribution
 - May not exceed protection level at 20 km distance around KCC and at any RA station.
 - No line of sight to RA station for top position of wind turbine blade.
 - Electricity distribution: 6 km for < 66 kV & 16 km for ≥ 66 kV.
 - Permit required for new infrastructure with an assessment submitted with the application
 - Provision for relaxation of requirements and separation distance, dependent on detailed technical reports and measurements to be supplied by applicant, and consideration of local conditions



SASPO Submission to ICASA

Summary of proposed inserts into Draft Radio Frequency Migration Regulation & Radio Frequency Migration Plan to ensure alignment



- Draft Radio Frequency Migration Regulation
 - Item 3 – Principles – Migration may be required in in Core and Central AAA’s terms of AGA Act
 - Item 4 – Process – South Africa specific requirement within Central Astronomy Advantage Areas in terms of AGA Act
- Draft Radio Frequency Migration Plan
 - Section 1 – Introduction – Requirement for restriction of frequency spectrum use & South Africa specific allocation plan within astronomy advantage areas
 - Section 2 – Review of legislation and regulations – Requirement for compliance with specific sections of the AGA Act regarding restrictions, or conditions, for frequency spectrum use and conducting activities capable of causing radio frequency interference and the requirement for ICASA not to issue licences that will cause radio frequency interference.
 - Section 3 – Principles governing frequency migration – Details on the requirements for frequency migration in the Karoo Central Astronomy Advantage Areas to be prescribed in regulations made in terms of the AGA Act for protection of the declared areas
- Drafts for the proposed inserts were provided in the written representation made (additional slides with the drafts are also available)

General Comments : Frequency bands that may be exempted within the Karoo Central AAAs (pertaining to Sections 4 and 5)



- Frequency bands to be protected for radio astronomy purposes within the Karoo Central AAAs
 - 100 MHz to 10 GHz as soon as regulations are promulgated (2013)
 - 10 to 25.5 GHz from a date to be announced.
- Frequency bands that may be exempted to use within Karoo Central AAAs
 - 100 to 200 MHz – Existing transmissions may continue subject to acquiring permits
 - 238 to 400 MHz – Two consolidated bands (BTX & MTX) with required capacity for public trunking, rural broadband, public protection and disaster relief.
 - 400 to 470 MHz - – Two consolidated bands (BTX & MTX) with required capacity for electricity distribution and railway operations.
 - 470 to 694 MHz - Two TV channels of 8 MHz (co-channel transmissions) for low power digital terrestrial television transmissions (less than 60 dBm EIRP).
 - 890 to 960 MHz - Mobile cellular radio communications (with restrictions)
 - Specific requirements in the spectrum from 100 to 960 MHz or at higher frequencies may be identified and exempted.
 - Exempted frequency spectrum use and transmissions still require permits and compliance with protection criteria with RFI exemptions only for essential services.



Brief Update on SKA



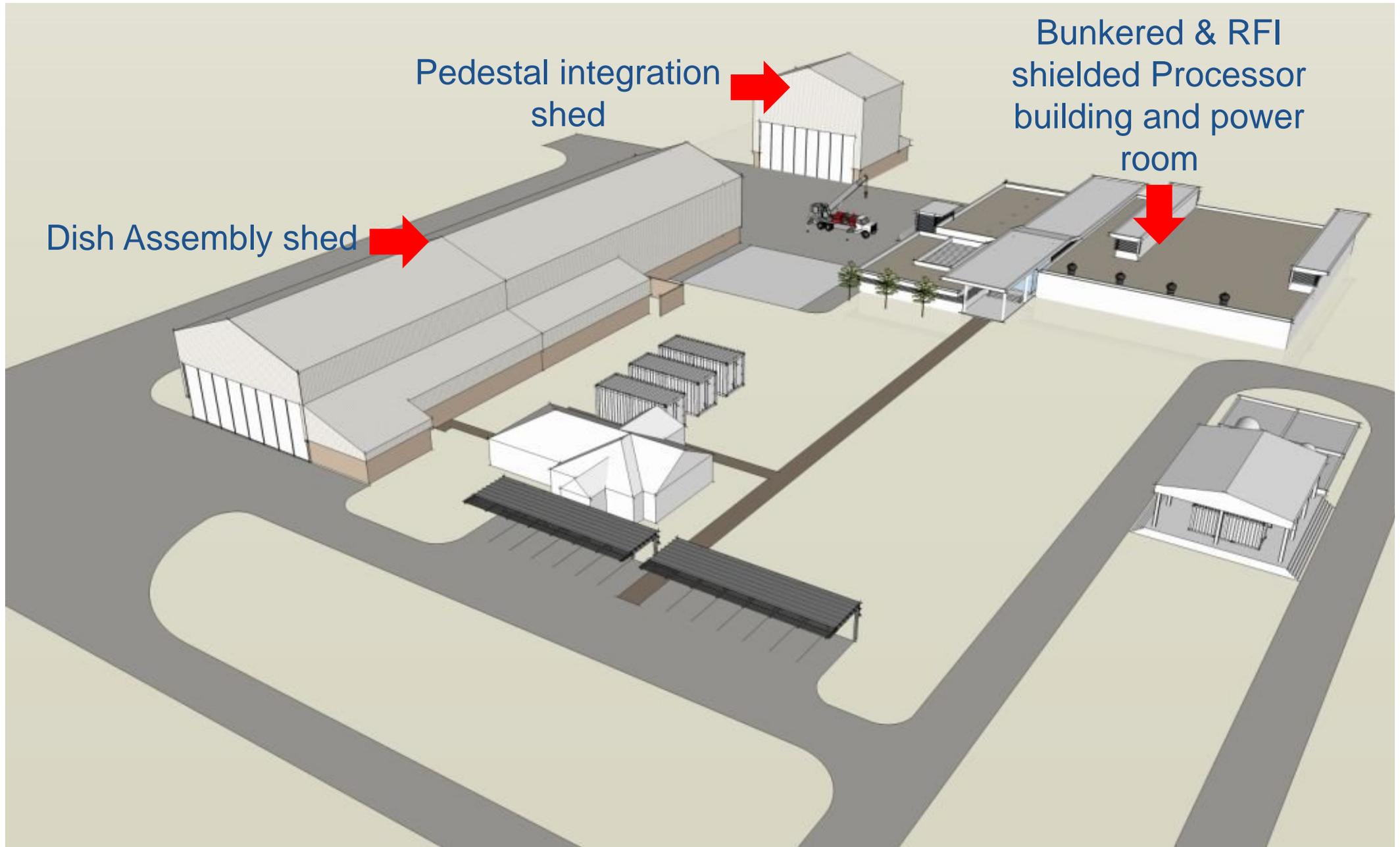
The Square Kilometre Array

Klerfontein Support Base : Workshops, Offices, Accommodation





Future MeerKAT On-Site Complex Expansion (Complete in 2013): SKA Phase 1 Ready

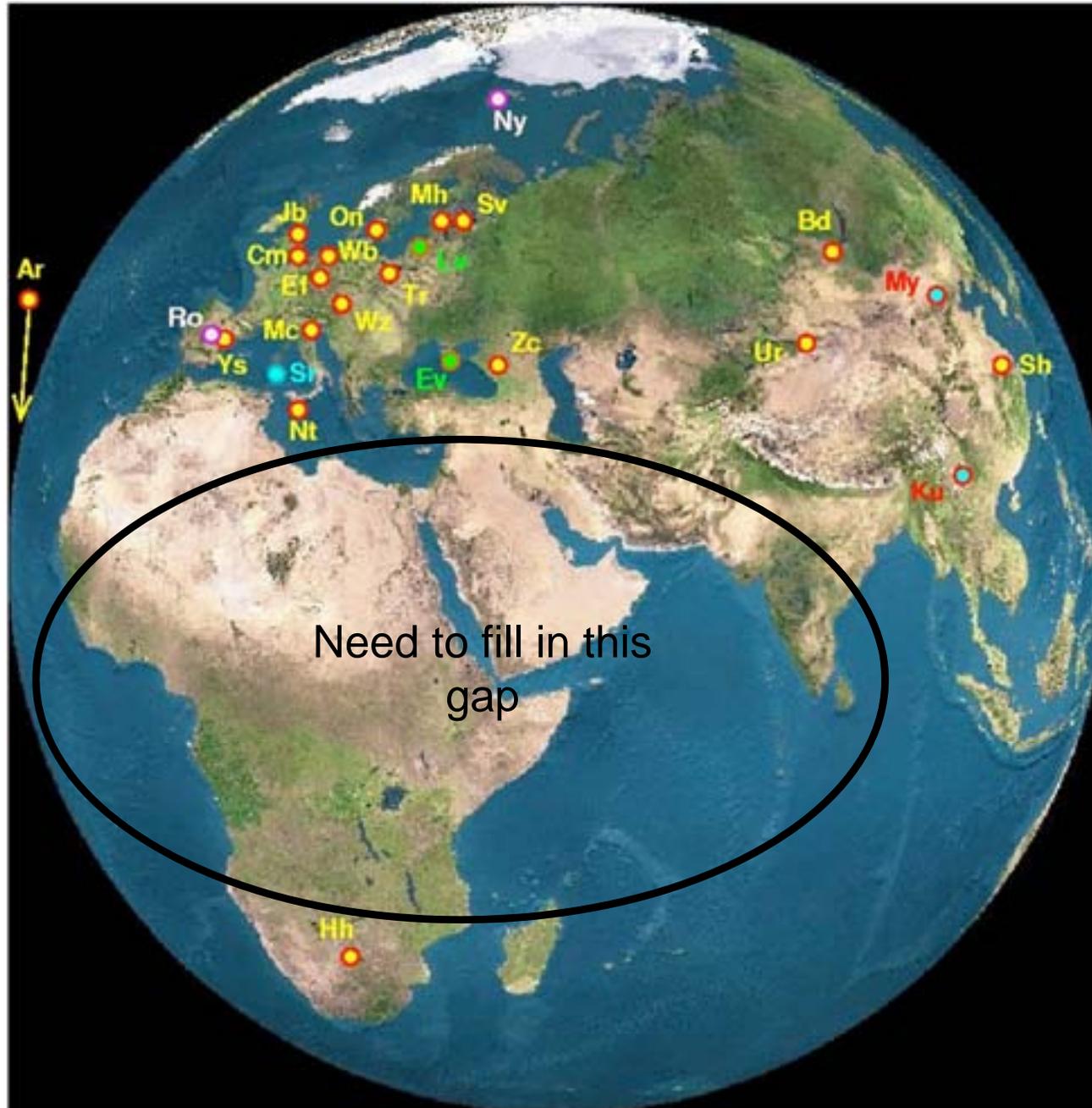


Dish Assembly shed

Pedestal integration shed

Bunkered & RFI shielded Processor building and power room

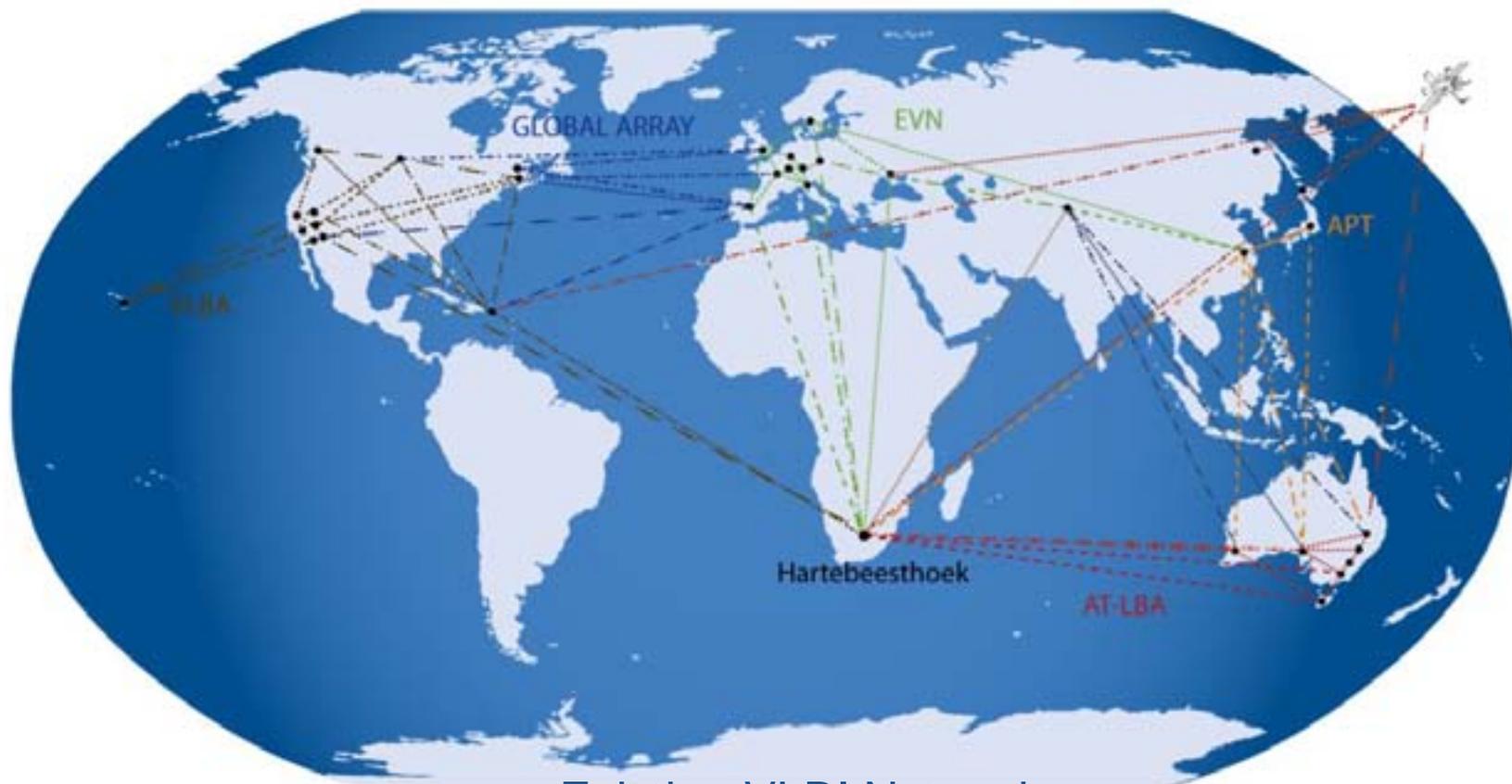
African VLBI Network (AVN)



African VLBI Network



- Project launched to convert >20 obsolete 32m class satellite telecommunication dishes in Africa into radio astronomy facilities
- Result in the creation of VLBI network to complement the EVN and SKA and improve existing VLBI network UV coverage and performance



Existing VLBI Networks

30-m class antennas in Africa

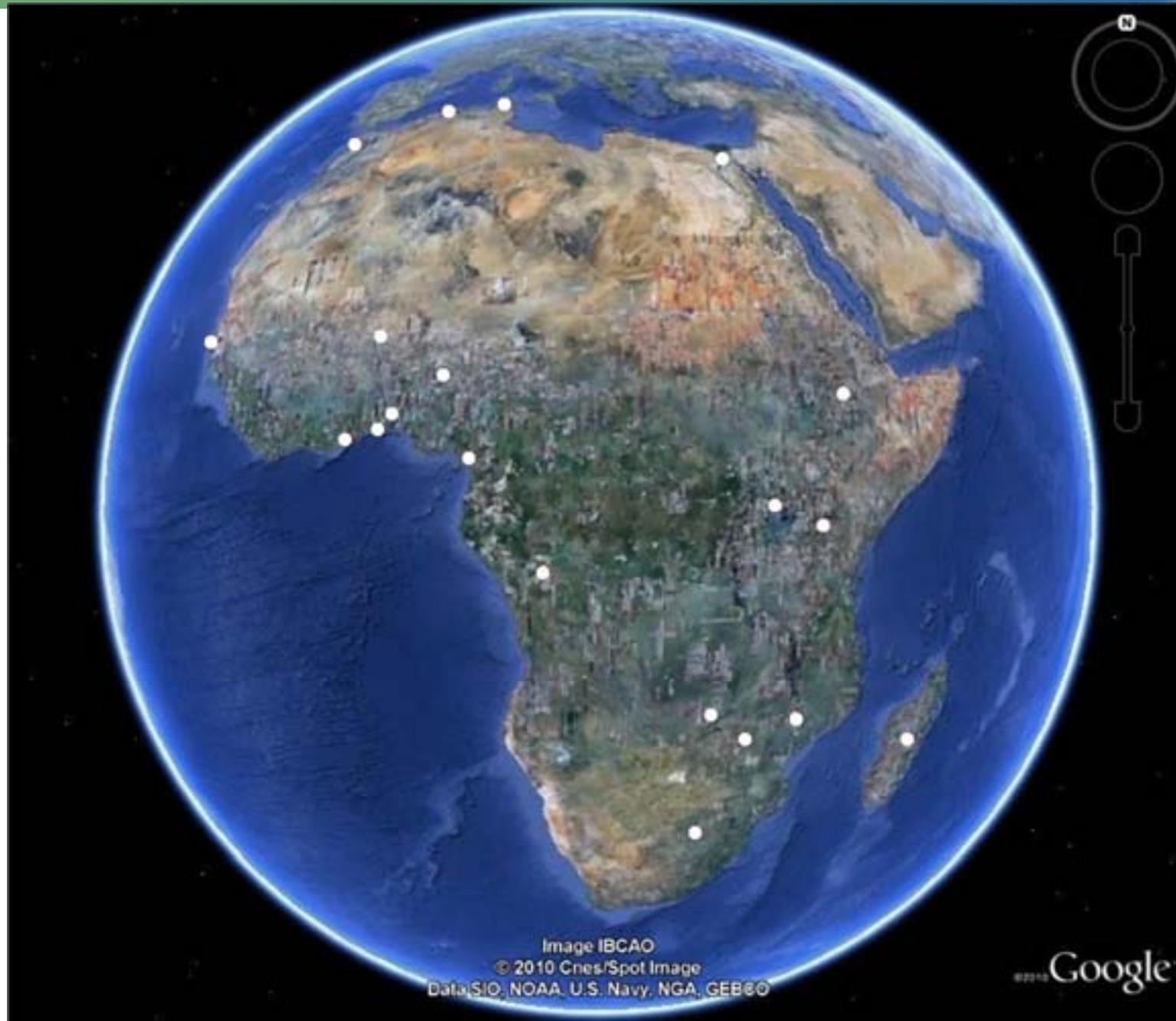


Image IBCAO
© 2010 Cnes/Spot Image
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google

Nkutunse - Ghana



Medicina - Italy



32m Vodafone dish at Nkutunse, Ghana

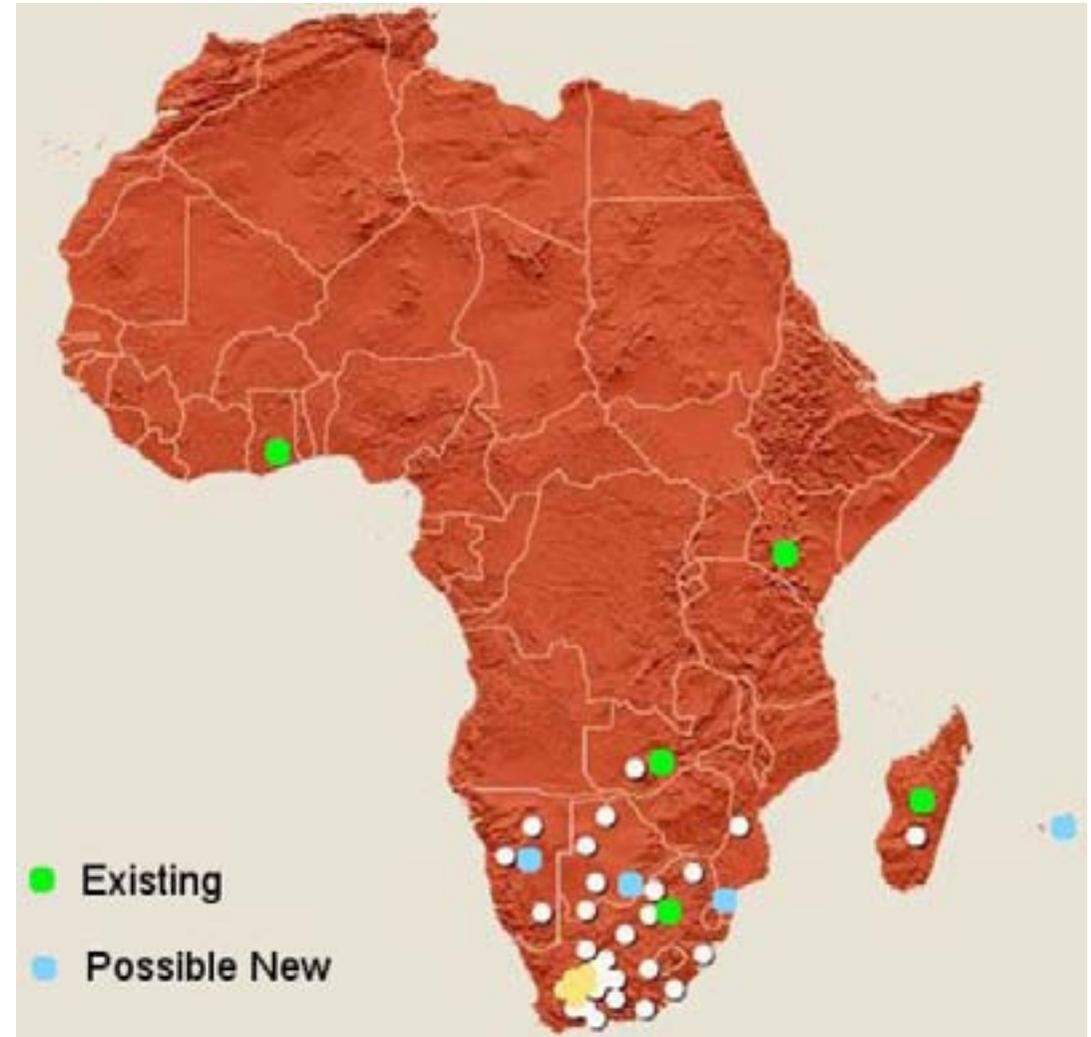


Ghanaian team inspecting dish. The team has already initiated work. First light by December 2012?

AVN Status



- Conversions envisaged (fully funded):
 - Ghana, Kenya, Madagascar, Zambia
- New build:
 - Botswana, Namibia, Mauritius, Mozambique (fully funded, including training facility)
- AVN teams in place, detailed designs and project plans completed
- First light (Ghana) aim early 2013



Site Selection Process



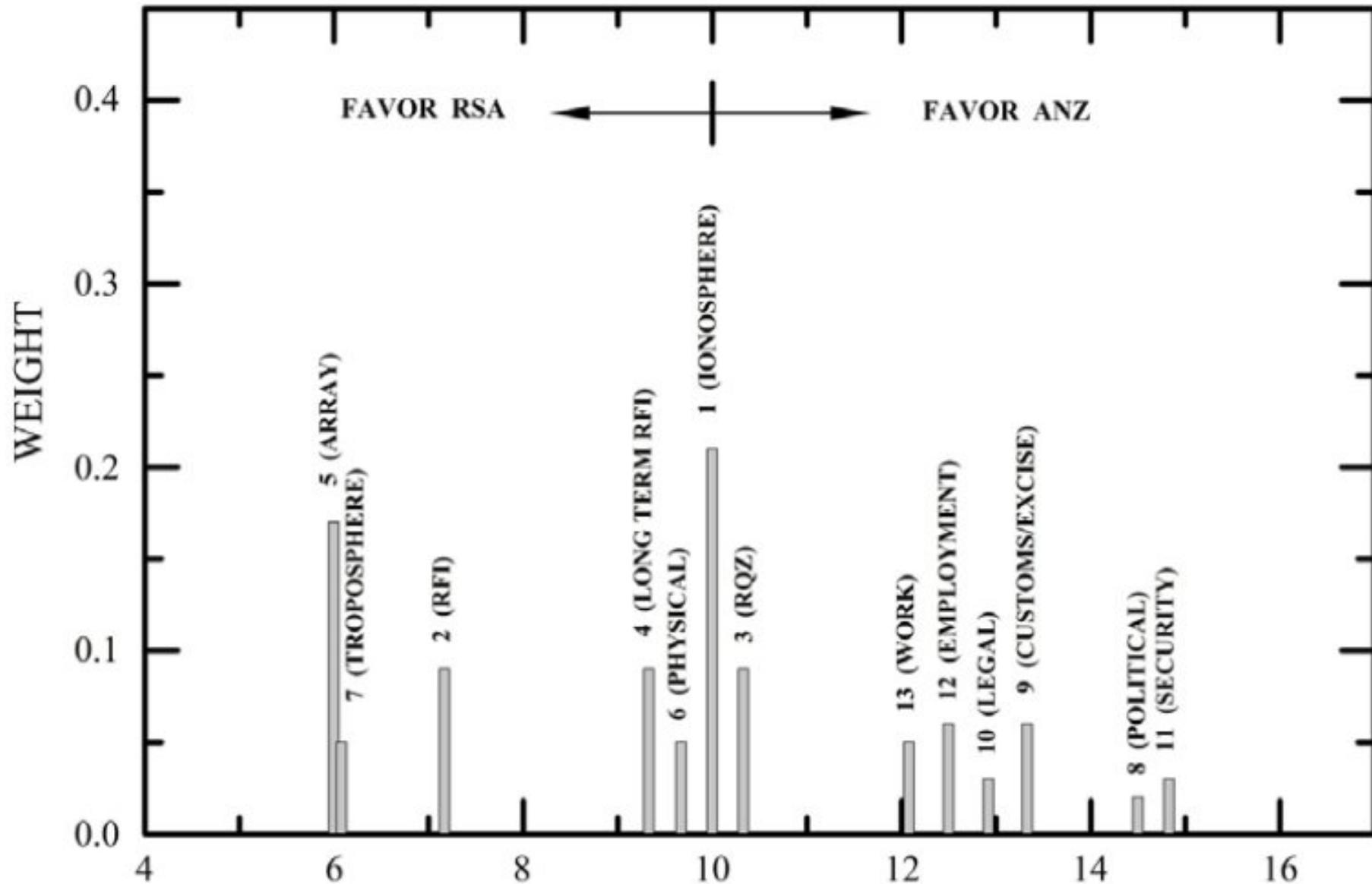
- 1991 – SKA is Born
- 2005
 - Submitted original Proposal to Host the SKA, on behalf of the African Partner Countries (South Africa, Namibia, Botswana, Mozambique, Madagascar, Mauritius, Kenya Ghana) to the International SKA Project Office
 - Other bidders: China, Argentina and Brazil, Australia
 - African proposal shortlisted, along with an Australia, in 2006
- 25th June 2011
 - SKA Siting Group (SSG) released a Request for Information to each of the site proponents
 - Site proponent to submit reports to the SSG on a variety of factors
 - Factors
 - Scientific – factors that would affect the scientific observations of the SKA (numerical comparison)
 - Technical – factors pertaining to the implementation plans and costs of the infrastructure (qualitative comparison)
 - Other – factors that would affect the local and international operational workforce (numerical comparison)

Site Selection Process



- 15th September 2011 (12 weeks later)
 - South Africa, on behalf of Africa, submitted its response to the SSG Request for Information
 - 11 Reports
 - 150 page summary
 - 27,000+ pages in detailed annexures
- 15th September 2011 – 19th February 2012
 - Comparative analysis by SKA Site Advisory Committee performed, consisting of independent scientists, engineers, policy makers
 - SSAC assisted by Expert Panels, Committees and independently contracted consultants
 - SSAC conducted site interviews (6th December 2011)
 - Recommendation is robust and significant

Site Selection Process



Site Selection Process



Evaluation for Factors C

14	Provision and cost of infrastructure components based on the Model SKA	RSA has a low advantage
15	Provision and cost of internal and external data transport based on the Model SKA	RSA has a medium advantage
16	Provision and cost of electrical power based on the Model SKA	RSA has a high advantage
17	Consolidated costs of capital and operations expenditures*	

*combination of Factors 14–16

25th May 2012



- An historic event in the history of South Africa's development in the global community of science and technology
- SKA Board announced that:
 - Africa was the recommended site, based on scientific and technical criteria, according to the independent SKA Site Advisory Committee
 - To maximise the investments made by both sides, Africa would receive two of the three receiver components (dishes, mid frequency aperture arrays), whilst Australia would receive one of the three (low frequency aperture arrays)



CONGRATULATIONS!
WORKING TOGETHER,
WE CAN REACH FOR
THE STARS!

What does it mean?



- Africa

- SKA Phase 1

- MeerKAT (64) + 190 dishes (SPFs)
 - 100km baseline to core

- SKA Phase 2

- Full dish requirement
 - 3,000 dishes
 - 3,000km baseline to core
 - Full dense aperture array requirement
 - 250 stations
 - 180km baseline to core

- Australia

- SKA Phase 1

- ASKAP (36) + 90 dishes (FPAs)
 - <100km baseline to core

- SKA Phase 2

- Full sparse aperture array requirement
 - 250 stations
 - 180km baseline to core



Thank you for listening

Proposed inserts into ICASA's Draft Radio Frequency Migration Regulation



- Item 3 – Principles

Add sub item (7) – *Frequency migration may be required in core and central astronomy advantage areas in terms of section 22(2)(c) of the Astronomy Geographic Advantage Act (Act No. 21 of 2007).*

- Item 4 – Process

Add sub item (f) – *Where a South Africa specific requirement must be accommodated, such as that arising from protecting radio frequency spectrum for radio astronomy purposes in core and central astronomy advantage areas in terms of the Astronomy Geographic Advantage Act (Act No.21 of 2007).*

Proposed inserts into ICASA's Draft Radio Frequency Migration Plan (1 of 6)



Section 1 – Introduction

Add sub section 1.3 – *Spectrum use in the Karoo Central Astronomy Advantage Areas*

The radio frequency spectrum use in the Karoo Central Astronomy Advantage Areas to be declared in the Northern Cape Province must be protected for radio astronomy purposes in terms of the Astronomy Geographic Advantage Act (Act No.21 of 2007). Section 22 of the AGA Act provides specifically for Restrictions on use of radio frequency spectrum in core and central astronomy advantage areas. The protection measures will be prescribed in Regulations to prohibit and restrict the use of certain radio frequency spectrum and certain activities in the Karoo Central Astronomy Advantage Areas and in Regulations on procedural and related matters for central astronomy advantage areas. A South Africa specific frequency allocation plan is required for these areas.

Proposed inserts into ICASA's Draft Radio Frequency Migration Plan (2 of 6)



Section 2 – Review of Legislation and Regulations

Add sub section 1.3 – *Spectrum use in the Karoo Central Astronomy Advantage Areas*

The proceedings of ICASA are also subject to the Astronomy Geographic Advantage Act. This act contains the following provisions that affect the Draft Radio Frequency Migration Plan. Certain subsections in section 22 (Restrictions on use of radio frequency spectrum in astronomy advantage areas) and section 23 (Declared activities in core or central astronomy advantage area,) that are relevant, state the following:

- *2.4.1 Section 22(1) - the Minister has the authority subject to subsection (2) within a core or central astronomy advantage area to protect the use of the radio frequency spectrum for astronomy observations.*
- *2.4.2 Section 22(2) - Pursuant to the authority granted in subsection (1) and with the concurrence of ICASA, in so far as the Minister's action is likely to affect broadcasting service license or broadcasting service, the Minister may, by notice in the Gazette –*

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Proposed inserts into ICASA's Draft Radio Frequency Migration Plan (3 of 6)



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- (a) prohibit completely or restrict in any way the use of specific frequencies within the radio frequency spectrum or the radio frequency spectrum in general within a core or central astronomy advantage area;*
- (b) require the conversion, within a reasonable time period, of analogue transmissions in the radio frequency spectrum within a core or central astronomy advantage area, to digital transmissions;*
- (c) require any user of the radio frequency spectrum which transmits or broadcasts into a core or central astronomy advantage area to migrate onto a radio frequency or utilise alternative technology that more effectively protects radio astronomy observations; or*
- (d) exempt from the provisions of such notice any person or organ of state who has entered into an agreement with the management authority of the core or central astronomy advantage area to mitigate their impact on the radio frequency spectrum within the relevant astronomy advantage area.*

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Proposed inserts into ICASA's Draft Radio Frequency Migration Plan (4 of 6)



- 2.4.3 Section 22(6) - Notwithstanding anything contained in any other law, ICASA must not issue a broadcasting service license or a radio frequency spectrum license after the coming into force of this Act where the service to be licensed would cause radio frequency interference in a core or central astronomy advantage area, unless the conditions set out in the license make provision for the protection of such areas.
- 2.4.4 Section 23(1) - the Minister may, with the concurrence of ICASA where his or her action is likely to affect broadcasting service license or broadcasting service, declare that no person may, in a core or central astronomy advantage area, conduct any activity in any of the following categories (only the items relating to radio frequency spectrum are listed below):
 - (b) the construction, expansion or operation of any fixed radio frequency interference source;
 - (i) activities capable of causing radio frequency interference, including bringing into the area or operating any interference source, mobile radio frequency interference source or short range device;
 - (k) any other activity which may detrimentally impact on astronomy and related scientific endeavours, or the astronomy advantage of any core or central astronomy advantage area or may direct that such activities may only be conducted in a core or central astronomy advantage area in accordance with standards or conditions prescribed by the Minister.

Proposed inserts into ICASA's Draft Radio Frequency Migration Plan (5 of 6)



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- 2.4.5 Section 23(2) - Following publication of a declaration under subsection (1), the Minister must review all declared activities which were lawfully conducted in any affected core or central astronomy advantage area immediately before a declaration in terms of subsection (1) was published.

- Add subsection 3.4 – Frequency Migration in the Karoo Central Astronomy Advantage Areas
 - The need for frequency migration in the Karoo Central Astronomy Advantage Areas will be determined by the South Africa specific requirements for protecting the use of the radio frequency spectrum for astronomy observations. The following principles will be applied:
 - 3.4.1 The protected spectrum within a core or central astronomy advantage area will be determined in the declaration of the area in terms of the Astronomy Geographic Advantage Act.

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Proposed inserts into ICASA's Draft Radio Frequency Migration Plan (6 of 6)



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- 3.4.2 The frequency bands in the protected spectrum to be exempted from the restriction of its use will constitute a frequency allocation plan for the Karoo Central Astronomy Advantage Areas
- 3.4.3 The frequency band exemptions will be determined by the relevant management authority designated for the declared areas in terms of the Astronomy Geographic Advantage Act and will be subject to a public consultation process after advance consultation with ICASA.
- 3.4.3 The frequency band exemptions will be published in the Gazette after the public consultation had been concluded.
- 3.4.5 Frequency use outside the exempted frequency bands must migrate to frequencies inside the exempted frequency bands.