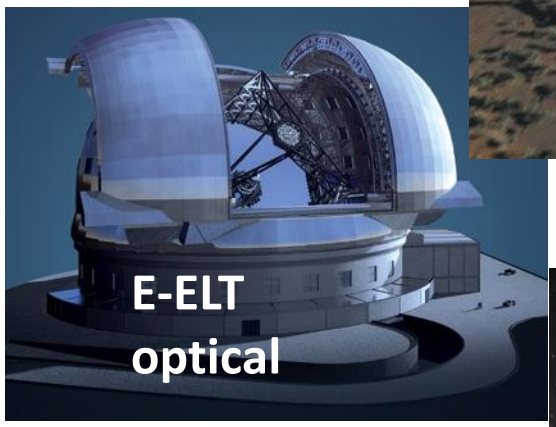
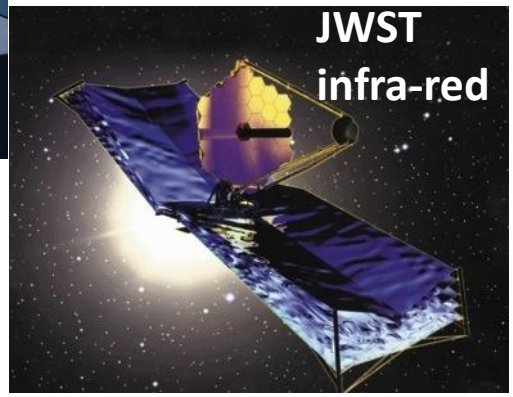
Square Kilometre Array

John Womersley
Chairman, SKA Board
5th July 2013

Great Observatories for the coming decades





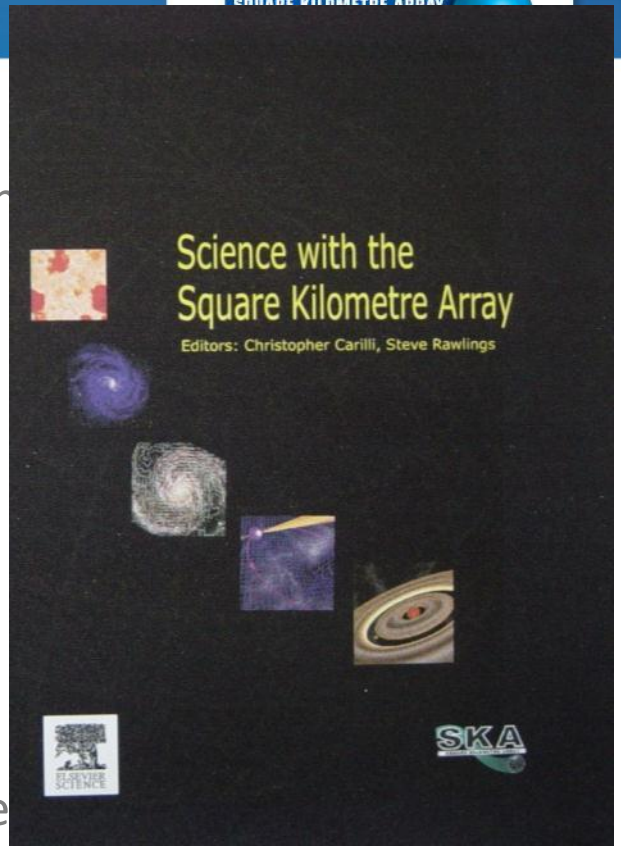
SKA Concept

- A large radio telescope for transformational science:
  - up to **1 million m²** antenna collecting area distributed over a distance of 3000⁺ km;
  - operating at frequencies from 70 MHz (wavelength = 3+m) to 10GHz (~3 cm) with two or more detector technologies;
  - connected to a **signal processor and high performance computing system** by a massive optical fibre network.
- Providing
  - **50 x sensitivity** of current world's best radio interferometers, and
  - up to **1 million x survey speed**
- Construction will proceed in two phases (SKA1 & SKA2)
  - SKA1 cost ~400 M€ (2013)
  - SKA1+2 cost ~1.7 B€ (2013)
  - Operations costs being studied.

under review

SKA2 Key Science Drivers

- ORIGINS
  - Neutral Hydrogen in the Universe from the Epoch of Re-ionisation to now
    - When did the first stars and galaxies form?
    - How did galaxies evolve?
    - Dark Energy, Dark Matter
  - Astro-biology
- FUNDAMENTAL FORCES
  - Pulsars, General Relativity and gravitational wave
  - Origin and evolution of cosmic magnetism
- TRANSIENTS (new phenomena)



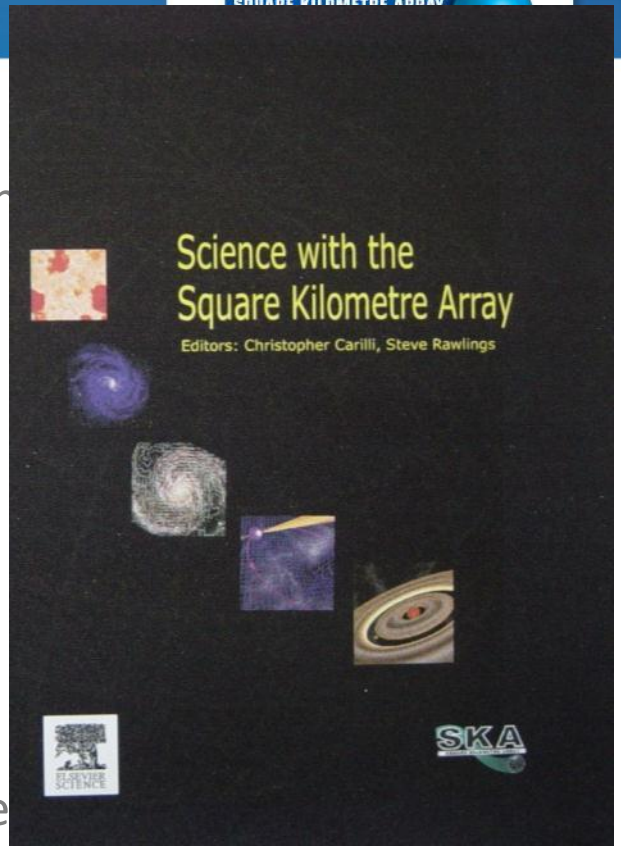
Science with the Square Kilometre Array

(2004, eds. C. Carilli & S. Rawlings, *New Astron. Rev.*, **48**)

SKA1 Key Science Drivers

- ORIGINS
  - Neutral Hydrogen in the Universe from the Epoch of Re-ionisation to now
    - When did the first stars and galaxies form?
    - How did galaxies evolve?
    - Dark Energy, Dark Matter

- FUNDAMENTAL FORCES
  - Pulsars, General Relativity and gravitational wave



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SKA across the world

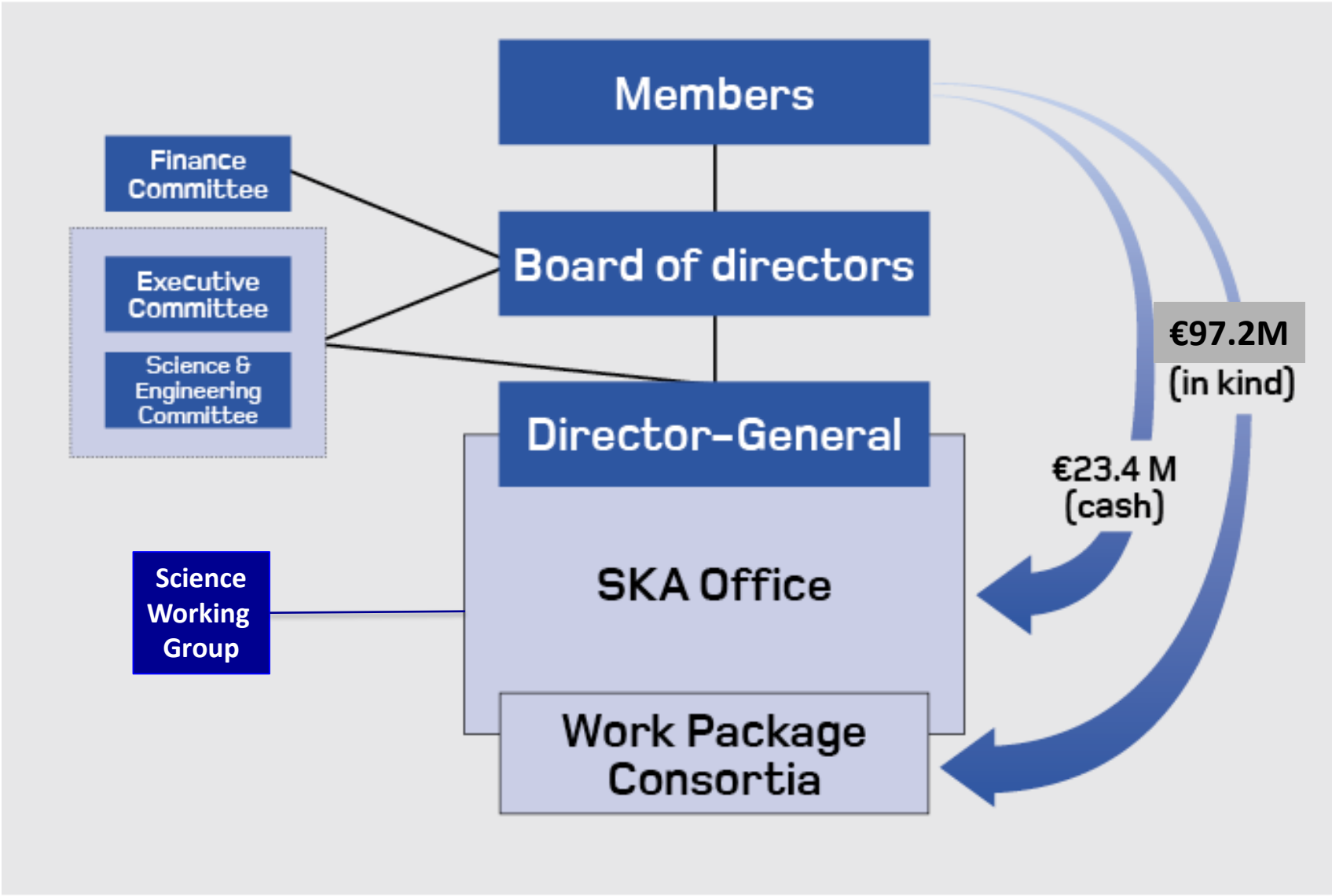
SKA Members and Governance

Australia (DIISRTE)
China (MOST)
Italy (INAF)
New Zealand (MED)
Sweden (Chalmers)
India (DAE)

Canada (NRC-Herzberg)
Germany (BMBF)
Netherlands (NWO)
South Africa (DST)
UK (STFC)

SKA is a UK Company Limited by Guarantee
(Expedient solution to enable SKA project to proceed; long-term governance structure under review)

SKA Members and Governance

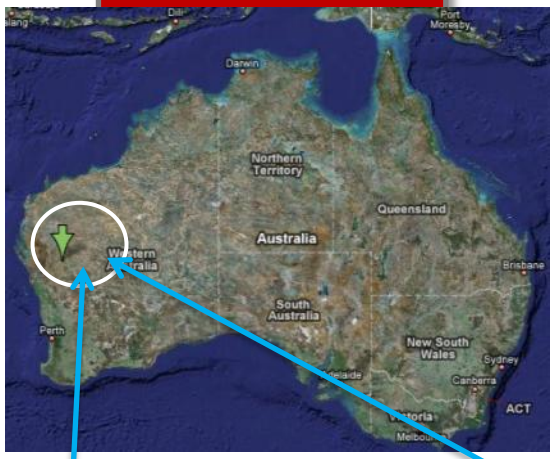


SKA Phase 1 (SKA1)
Cost > €400M, construction start 2017

Southern Africa

SKA1_MID
254 Dishes including:
64 x MeerKAT dishes
190 x SKA dishes

Australia



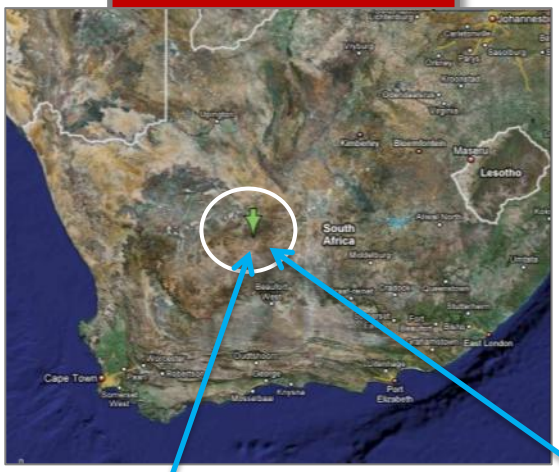
SKA1_LOW
Low Frequency Aperture Array Stations

SKA1_SURVEY
96 Dishes including:
36 x ASKAP
60 x SKA dishes

Exploring the Universe with the world's largest radio telescope

SKA Phase 2 (SKA2)
Cost > €1.5B; construction start 2022

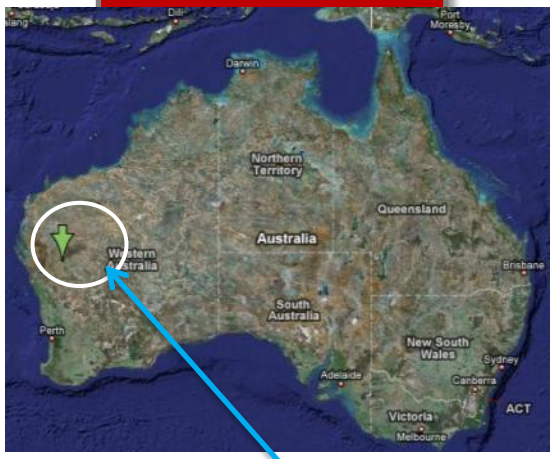
Southern Africa



SKA2_MID
2500 Dishes

SKA2_AA
Mid Frequency Aperture Array Stations

Australia



SKA2_LOW
Low Frequency Aperture Array Stations

Exploring the Universe with the world's largest radio telescope

Milestones and momentum

- Formation of SKA Organisation
- Selection of Jodrell Bank as SKA HQ
- Site Selection (May 2012)
- Appointment of Director-General
- Confirmation of pre-construction funding (>120M€)
- Release of Request for Proposals for participation in design process. Proposals now under evaluation.
- Review of costs
- Approval of principles for funding framework.
- Recruitment underway: 24 positions advertised.

Facilities on Boolardy Site (AUS)

Facilities on Karoo Site (SA)

SKA is driving development of new science & technical solutions

- Dishes, feeds, receivers (N=2500)
- Low and mid aperture arrays (N=250)
- Signal transport (10 petabit/s)
- Signal processing (exa-MACs)
- Software engineering and algorithm development
- High performance computing (exa-flop capability)
- Data storage (exa-byte capacity)
- (Distributed) power requirements (50 -100 MW)

INDUSTRY ENGAGEMENT IS CENTRAL TO THE SKA

Timeline (under review)

- 2013 – 2016: pre-construction, detailed design
- 2014 – 2015/16: partners seek SKA1 funding
- 2017: tender for and procure construction
- 2018 – 2021: construction of SKA1
- 2019/20: early science begins
- 2022 – 2025: construction of SKA2

- SKA operational for 50 years.

Thank-you for your attention

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www.skatelescope.org