SKA: A global Research Infrastructure
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Potential Future Members

Members
Host Countries: Australia, South Africa, United Kingdom

African partner countries
SKA—Key Science Drivers: The history of the Universe

- Cosmic Dawn (First Stars and Galaxies)
- Galaxy Evolution (Normal Galaxies z~2-3)
- Cosmology (Dark Matter, Large Scale Structure)
- Cosmic Magnetism (Origin, Evolution)
- Cradle of Life (Planets, Molecules, SETI)
- Testing General Relativity (Strong Regime, Gravitational Waves)

Exploration of the Unknown

Broader science range of any facility on or off the Earth.
Square Kilometre Array

3 sites; 2 telescopes + HQ
1 Observatory

Design Phase: ~ €200M; 600 scientists+engineers,
Now in final year

Phase 1
Construction: 2020 – 2027
MeerKat (South Africa) integrated
Cost Cap: €691M (2017 Euros)

Phase 2
~2000 dishes across 3500km of Southern Africa
Major expansion of SKA1-Low across Western Australia
SKA: HQ in UK; telescopes in AUS & RSA

SKA1-LOW: 50 – 350 MHz
Phase 1: ~130,000 antennas across 65km

SKA1-Mid: 350 MHz – 24 GHz
Phase 1: 200 15-m dishes across 150 km
SKA1-Low: Array of Arrays

SKA1-Low Antenna/Receptor
- Antenna Beam

SKA1-Low “Station”
- Station Beam

SKA1-Low “Array”
- Correlation and Tied-array Beams

Exploring the Universe with the world’s largest radio telescope
SKA1 – Low: Layout

- 512 aperture array stations
- Maximum baseline 65 km
- 3 modified spiral arms
**SKA1 –Mid: Layout**

- 133 SKA 15m dishes
- 64 MeerKAT 13.5m dishes
- Maximum baseline 150 km
- 3 logarithmic spiral arms

Exploring the Universe with the world’s largest radio telescope
SKA1 –Mid: Layout

- 133 SKA 15m dishes
- 64 MeerKAT 13.5m dishes
- Maximum baseline 150 km
- 3 logarithmic spiral arms
- ~50% within ~2 km randomly distributed
SKA1 Anticipated Sensitivity

- Improved performance predictions now available at all frequencies
- Opportunity for seamless interface of SKA to ALMA capabilities
SKA HQ: Jodrell Bank, UK

- €20M project; UK contribution
- Building complete
- Occupancy: September
- A ‘nexus for radio astronomy’
- First meetings scheduled for October
Current status
SKA-P2: Karoo
MPG funded

Italy
Sweden
South Africa

Canada
Building SKA: AAVS1; SKA1-Low prototype
Launch of MeerKAT: July 13
To be integrated into SKA
MOST 843MHz image

Exploring the Universe with the world's largest radio telescope
MeerKAT 1.4GHz image

Exploring the Universe with the world's largest radio telescope
Development of Governance

Establishing treaty organization similar to ESO, CERN

Text of treaty and key protocols now finalized and agreed.


Expect treaty ratification ~12 months later.
Data flow challenges

- Uploads to Facebook: 180PB
- Uploads to Google: 100PB
- LOFAR: 23PB
- Phase 1 Science Archive: 600PB
- SKA-LOW: 2Pb/s
- SKA-MID: 9Tb/s
- SKA-LOW to Central Signal Processor: 7Tb/s
- SKA-LOW to Science Data Processor: 300 PB/yr, ~130 PFlops
- SKA-MID to Central Signal Processor: 5Tb/s
- SKA-MID to Science Data Processor: 130 PFlops, 300 PB/yr

Exploring the Universe with the world's largest radio telescope
• Data flow challenges
• Pipelines deliver science-quality data products to SKA Regional Centres
• Distributed data archive, centralized engineering data
• Metadata will follow VO standards
## CDR Activity – Updates

<table>
<thead>
<tr>
<th>Element</th>
<th>RRN Submission</th>
<th>CDR Submission</th>
<th>CDR Meeting</th>
<th>CDR Close</th>
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<tbody>
<tr>
<td>TM</td>
<td>29 January 2018</td>
<td>28 Feb 2018</td>
<td>17-20 Apr</td>
<td>27 Jul 2018</td>
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<tr>
<td>SaDT &amp; SAT</td>
<td>17 January 2018</td>
<td>28 Feb 2018</td>
<td>15-18 May 2018</td>
<td>Sep 2018</td>
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<td>INAU</td>
<td>19 March 2018</td>
<td>30 April 2018</td>
<td>27-29 June 2018</td>
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<td>30 April 2018</td>
<td>2-4 July 2018</td>
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<td>CSP</td>
<td>18 May 2018</td>
<td>30 Jun 2018 (includes LMC sub-element)</td>
<td>25-28 Sep 2018</td>
<td>31 Oct 2018</td>
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<td></td>
<td>- PSS Element CDR</td>
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<td>- PST Element CDR</td>
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<td>- CBF Low</td>
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<td>- CBF Mid</td>
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<tr>
<td>MeerKAT Integration</td>
<td></td>
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<td>22 Oct 2018</td>
<td>31 Dec 2018 (t)</td>
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<td>SDP Pre-CDR</td>
<td>09 Mar 2018</td>
<td>25 Apr 2018</td>
<td>20-22 Jun 2018</td>
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<td>SDP CDR</td>
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<td>31 Oct 2018</td>
<td>17-19 Dec 2018(t)</td>
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<td>03-05 Dec 2018</td>
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<td>AIV</td>
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<td>12 Nov 2018 (t)</td>
<td>08 Jan 2019 (t)</td>
<td>30 Mar 2019 (t)</td>
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<td>08 Nov 2018</td>
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<td>DSH CDR</td>
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<td>22 Apr 2019</td>
<td>05 Jun 2019 (t)</td>
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<td>- Dish Structure: Mar 2019</td>
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<td>- incl. B2;05 Jun 2019</td>
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<td>- B1,5: 24 Oct 2019 (t)</td>
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<td>System CDR</td>
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<td>Jun 2019 (t)</td>
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<td>Sep 2019 (t)</td>
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Timeline

Key dates:

• Nov/Dec 2018: Convention signing

• June 2019: System design final

• Dec 2019: SKA Observatory exists

• Dec 2019: Construction proposal submitted to SKAO Council

• Q1 2020: Construction begins

• 2026/7: SKA1 construction complete
Thank you

www.skatelescope.org