SKA Observatory update

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Swiss SKA Days, 6 September 2023
SKAO Science Working Groups

Cosmology
Cradle of Life
Epoch of Reionization
Extragalactic Continuum

Extragalactic Spectral Line
Gravitational Waves
High Energy Cosmic Particles
HI Galaxy Science
Magnetism

Our Galaxy
Pulsars
Solar, Heliospheric & Ionospheric Physics
Transients
VLBI
The SKA Observatory - a global partnership

- **16 countries**, including
  - 9 full members
    - 11 of G20
    - 6 of the G7
    - 3 of the BRICS
  - plus 8 African partner countries
  - 5 continents
  - North-South and East-West collaborations
  - 17 time zones from Vancouver to Sydney
SKA-Mid telescope in South Africa

150 km extent

197 dishes (including 64 MeerKAT)
Frequency range: 0.35 – 15.4 GHz (goal of 25GHz)
SKA-Low telescope in Australia

74 km extent

512 stations, each of 256 antennas
Frequency range: 50 – 350MHz
Regional Centre Network - data processing stages

SKA-Low

- Large-area response data streams
- 2 Pb/s
- 8.9 Tb/s

SKA-Mid

- Beamformed data streams (focused on sky patch)
- 20 Tb/s

Correlated / conditioned signals

- 7.8 Tb/s

Data Products

- ~700 PB/yr

Perth

Cape Town

SKA Regional Centres
SKA Observatory timeline up to now

- 2013-2019: telescope design phase + institutional framework
- March 2019: SKAO treaty signed by 7 countries
- Jan 2021: SKAO born
- June 2021: SKAO Council approves start of construction activities
- July 2021: Construction activities began
- 5 Dec 2022: Site Construction Commencement Ceremonies
- August 2023: 69 contracts awarded to date, €562M committed
Construction timeline and strategy

- **Target**: build the SKA Baseline Design (197 Mid dishes; 512 Low stations: AA4)
- Not all funding yet secured, therefore following Staged Delivery Plan (AA*)
- Develop the earliest possible working demonstration of the architecture and supply chain (AA0.5).
- Then maintain a continuously working and expanding facility that demonstrates the full performance capabilities of the SKA Design.

### Milestone Event (earliest)

<table>
<thead>
<tr>
<th>Milestone Event</th>
<th>SKA-Mid (end date)</th>
<th>SKA-Low (end date)</th>
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<tbody>
<tr>
<td>AA0.5</td>
<td>4 dishes</td>
<td>2025 Jan</td>
</tr>
<tr>
<td></td>
<td>6 stations</td>
<td>2024 Nov</td>
</tr>
<tr>
<td>AA1</td>
<td>8 dishes</td>
<td>2026 Jan</td>
</tr>
<tr>
<td></td>
<td>18 stations</td>
<td>2025 Nov</td>
</tr>
<tr>
<td>AA2</td>
<td>64 dishes</td>
<td>2027 Jan</td>
</tr>
<tr>
<td></td>
<td>64 stations</td>
<td>2026 Oct</td>
</tr>
<tr>
<td>AA*</td>
<td>144 dishes</td>
<td>2027 Oct</td>
</tr>
<tr>
<td></td>
<td>307 stations</td>
<td>2028 Jan</td>
</tr>
<tr>
<td>Operations Readiness Review</td>
<td></td>
<td>2028 Jan</td>
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<tr>
<td></td>
<td></td>
<td>2028 Apr</td>
</tr>
<tr>
<td>End of Staged Delivery programme</td>
<td></td>
<td>2028 Jul</td>
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<tr>
<td></td>
<td></td>
<td>2028 Jul</td>
</tr>
<tr>
<td>AA4</td>
<td>197 dishes</td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td>512 stations</td>
<td>TBD</td>
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</tbody>
</table>

Dates from Integrated Project Schedule Version July 2023

**First data release to the community expected in 2026/27 (for science verification)**
The Evolution of Performance

With AA*, SKAO becomes the most powerful radio observatory on Earth


Credit: Mark Sargent
November 2022 - Indigenous land use agreement signed

- Indigenous Land Use Agreement (ILUA) signed between the Wajarri Yamaji, Australian federal and West Australian governments and CSIRO commits Australia and SKAO to a range of broad obligations including:
  - Assisting with education opportunities
  - Promoting Wajarri culture, heritage and art
  - Help develop small Wajarri businesses
  - Promoting employment and traineeship opportunities to Wajarri people
  - Actively providing contracting opportunities to Wajarri companies

- Wajarri community has gifted the site the name **Inyarrimanha Ilgari Bundara** - Sharing the Sky and Stars
December 2022 - Construction Commencement Ceremonies

- 5 quasi-simultaneous events organised to mark the official start of on-site construction
- Support from local communities key
- Opportunity to bring together & thank stakeholders - government, industry, local community, staff, partners, etc.
- Partners inc. Switzerland also marked the event
- Global media footprint
May 2023 - SKAO-NRAO Science meeting in Canada

- Joint meeting with US NRAO in Vancouver, Canada to discuss scientific & operational synergies between SKA and ngVLA telescopes
- Close to 300 participants from 21 countries
- 60+ talks
2023 - SKAO Science Data Challenge 3

- 234 participants
- 33 teams
- 16 countries
- 12 supercomputers supporting - inc. CSCS in Switzerland
SKAO member state updates

- January 2023 - The **Canadian** government announced its intention to join the SKAO
- March 2023 - The **German** government announced its intention to join the SKAO with a €21M commitment
- April 2023 - **Spain** joined the SKAO as its 9th full member with a €41M commitment
- Further progress expected in coming months
Influencing astronomical environment sustainability

- Interference from satellite constellations & use of the radio spectrum (WiFi, 5G, GPS, etc.) threatens ground-based astronomy

- SKAO participates in UN ITU (based in Geneva) and UN COPUOS in Vienna

- Active in development of policies and technical interventions around risks from satellite constellations

- Together with US partners, SKAO has established a joint centre of expertise under the IAU to coordinate technical and policy lobbying & develop mitigations
Establishing the SKA Observatory in Australia and South Africa

- In recent months, several SKAO facilities have been established in the two host countries:
  - Science Operations Centres (Cape Town, Perth)
  - Engineering Operations Centre (Geraldton, Klerefontein)
  - Construction camps being prepared in Australia and South Africa
SKAO teams in South Africa and Australia

- SKA-Mid staff in South Africa: currently ~40, eventually ~150.
- SKA-Low staff in Australia: currently ~43, eventually ~150.
- Staff in the UK: currently ~165, eventually ~175.
SKA-Mid on-site construction status
SKA-Mid – construction of first dishes
SKA-Low on site construction status
We recognise and acknowledge the Indigenous peoples and cultures that have traditionally lived on the lands on which our facilities are located.