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SKAO Regional Centre United Kingdom

SRC | Net

SKAO Regional Centre Network

UKRI Science and Technology Facilities Council

UK SKA Regional Centre - Overview and update

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(UKSRC Joint Directors)

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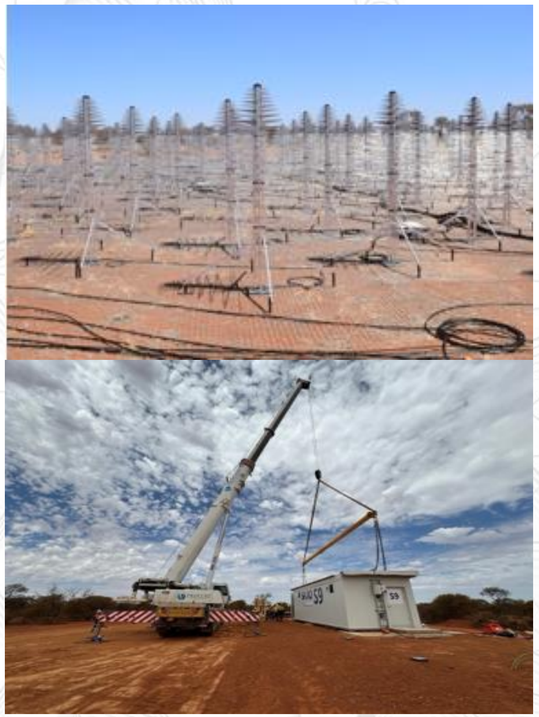
Jack Radcliffe (UKSRC Science & Community Director)

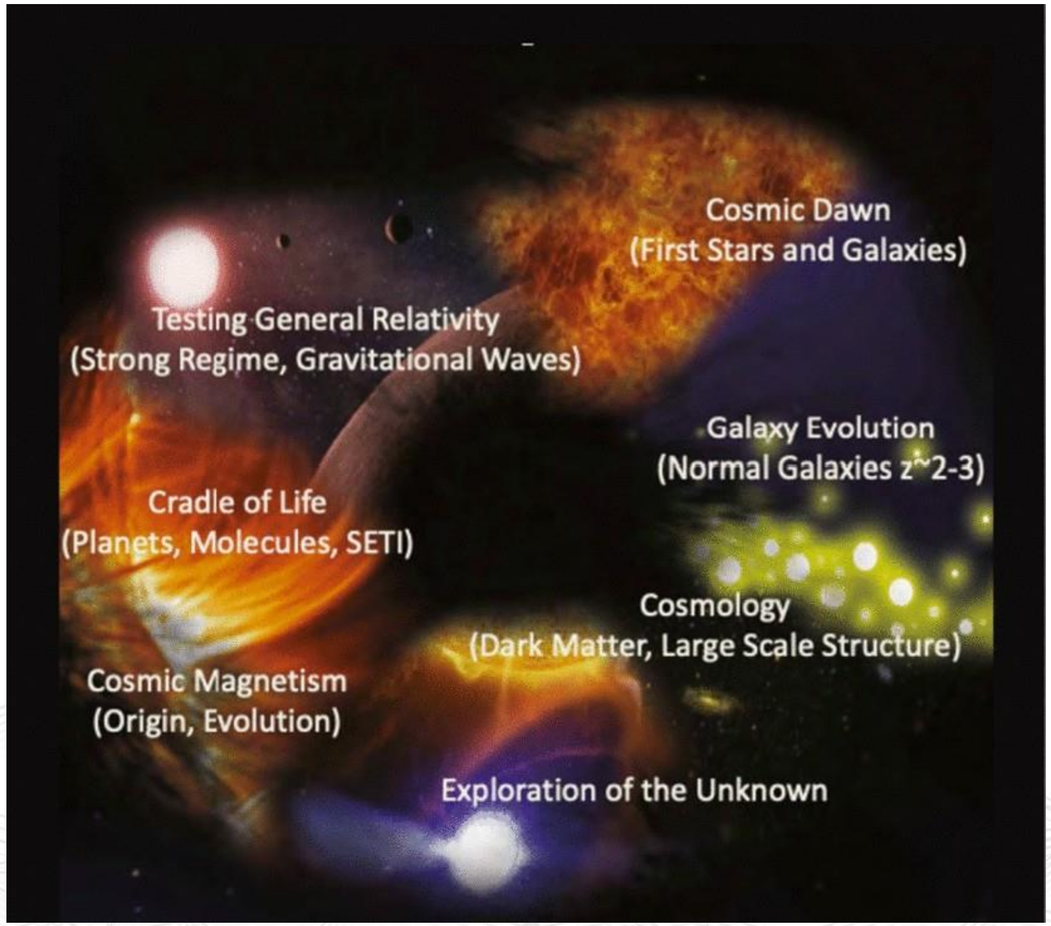
on behalf of the UKSRC team

Square Kilometre Array: Transforming Radio Astronomy

The Square Kilometre Array (SKA) Observatory (SKAO) is a next-generation radio astronomy facility covering the frequency range from 50 MHz to 15 GHz.



Construction steaming ahead!



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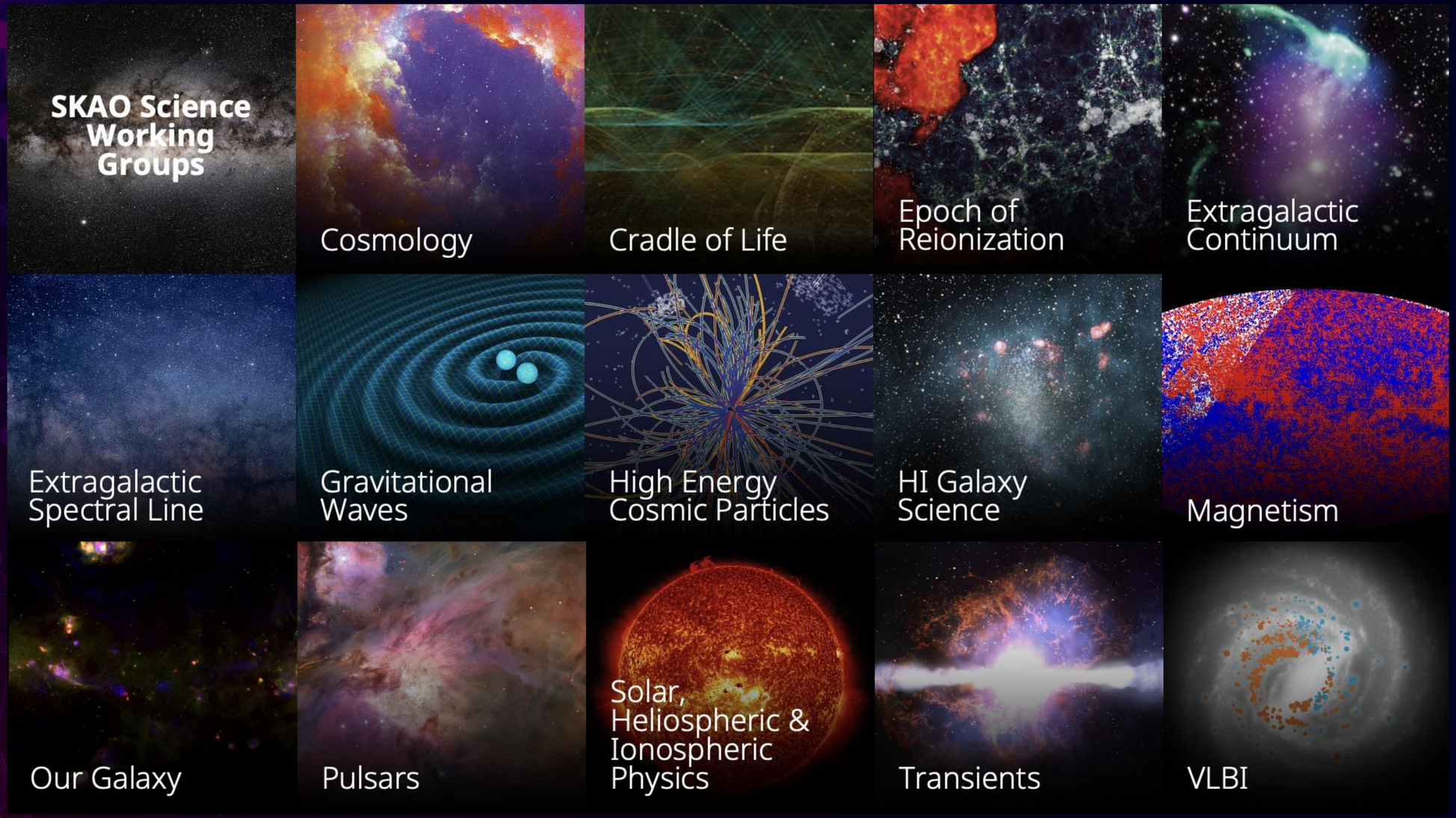
SKAO science drivers

Slide courtesy SKAO



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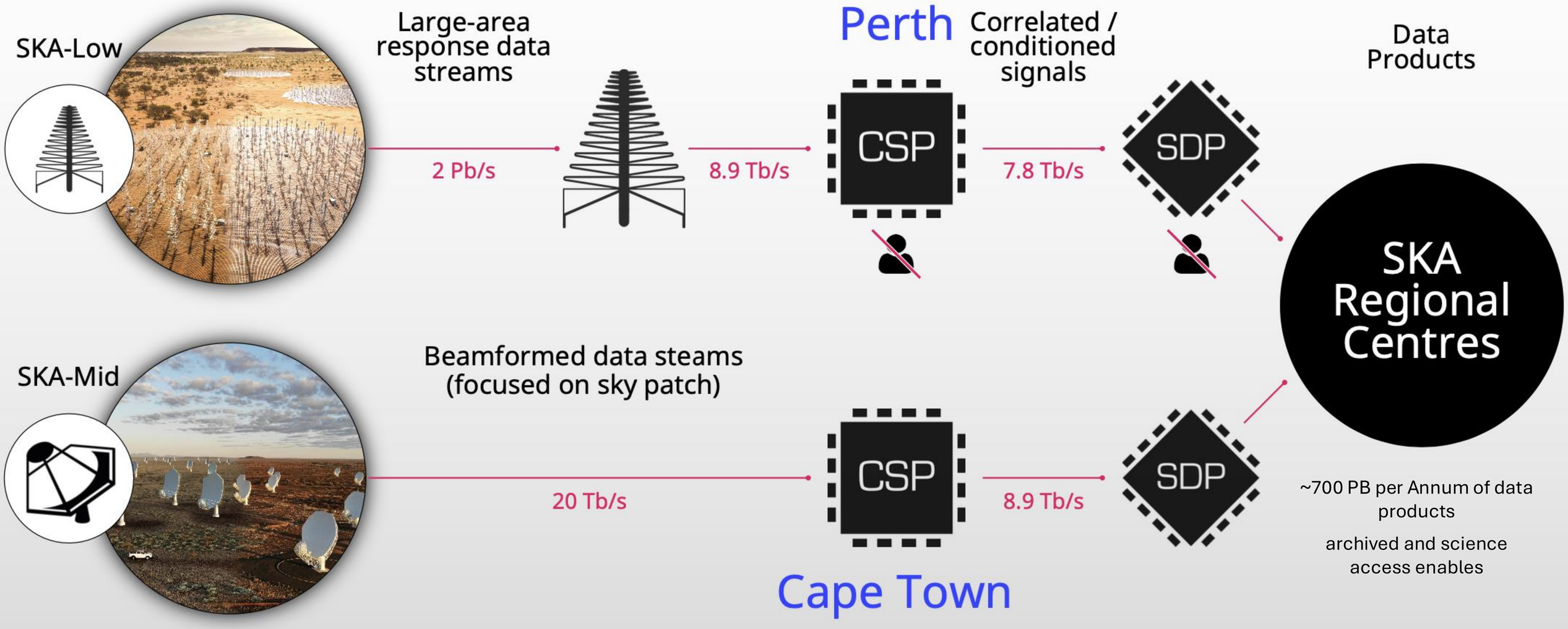
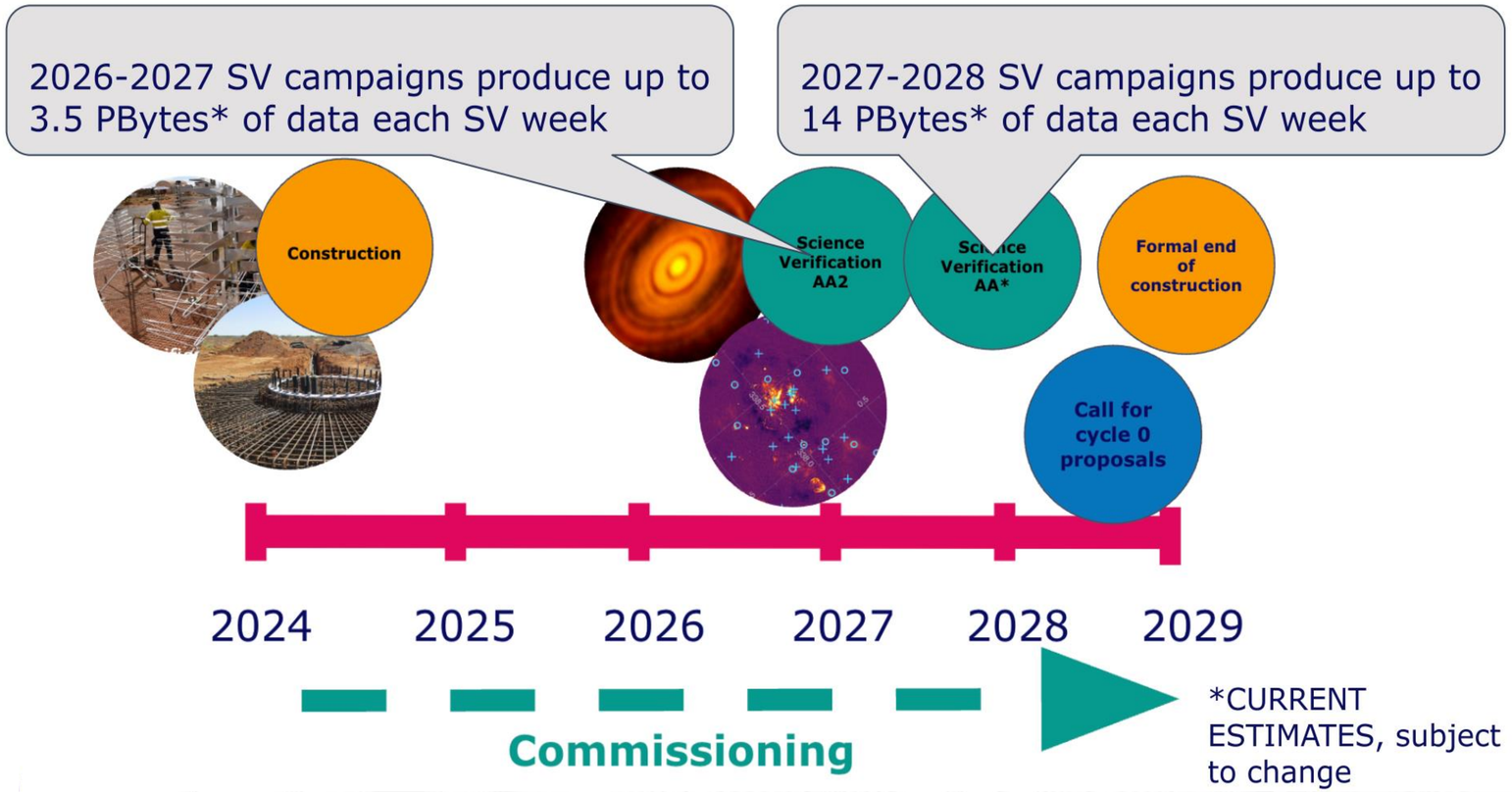
From telescope to user – Critical role of the SRCNet

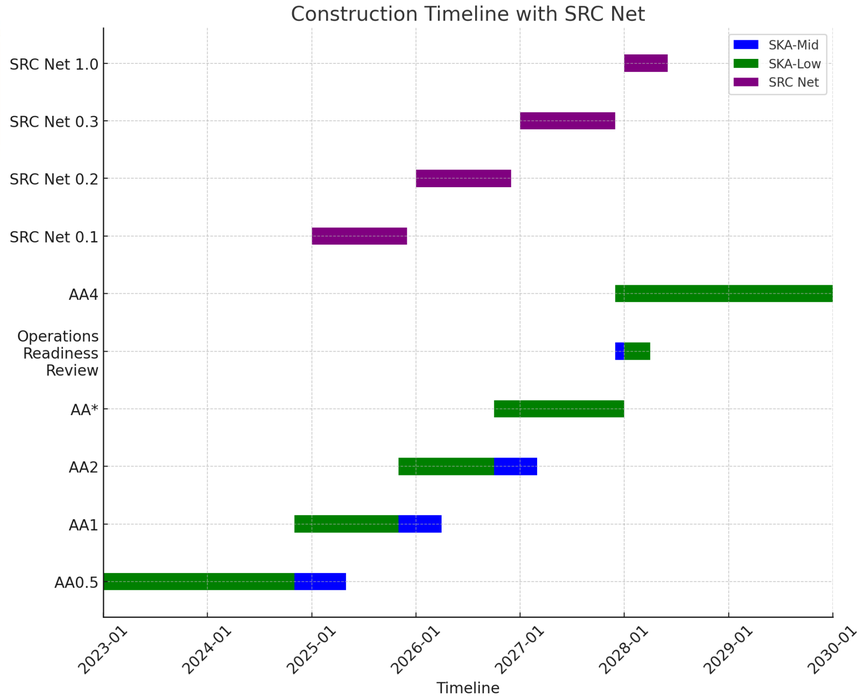


Slide courtesy SKAO

SRCNet Timeline

- Build up capabilities within SRCNet before needing to scale out in capacity
- Delivery timelines are aligned with SKAO telescope array construction
- SRCNet is needed for Science Verification (SV) which provides an end-to-end test of the science performance of SKA with the astronomical community.





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What will be SRCNet

The SRC Network functionality will be operationally crucial to SKA science outcomes.

It will provide the

- distribution of observatory data products (ODPs) to the SKA science users,
- the processing of SKA data products to create **advanced data products** (ADPs),
- the operation of a science archive facility,
- and the user support needed for these activities.

It will be an interoperable **unified** SRCNet and not a set of loosely collaborating national SRCs that each support 'their' national users.

The total storage and compute requirement for SKA science drives the need for a SRCNet to provide the total resources that are much more than any one country can do alone.

… Users will not be downloading their SKA data. The SRCs will provide the resources and access for you to run your analysis and workflows.

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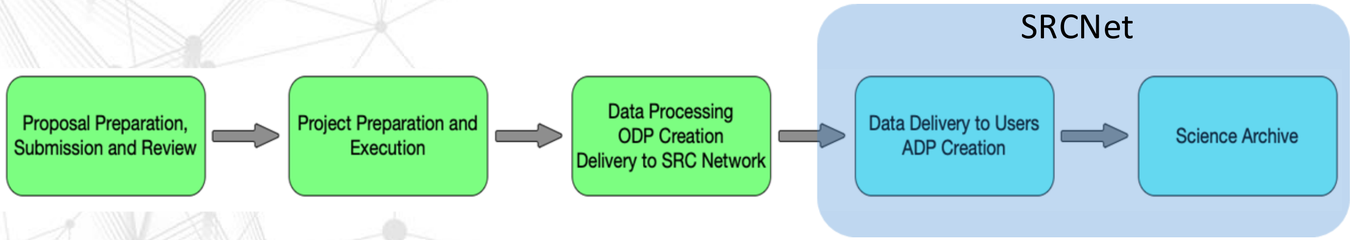
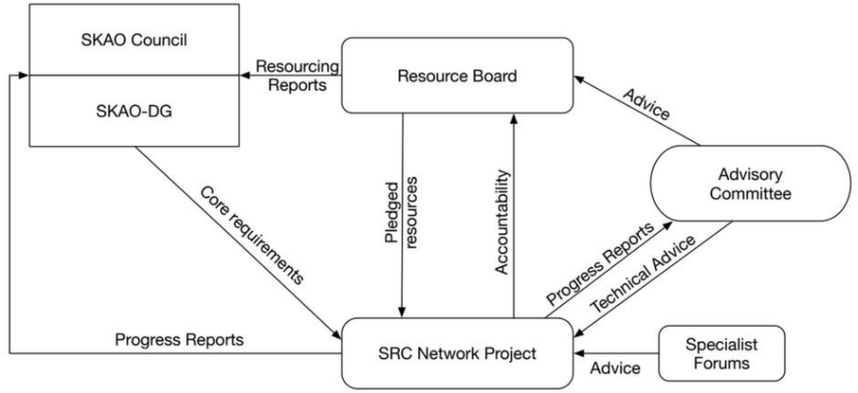
Global SKA Regional Centre Network





SKAO Council endorsed governance structure

- **Global SRC Network is essential to deliver science from the SKA**
  - SRCNet is the sole access point for Scientists to SKA data & science
- **UK is the largest single partner**
- UK's SRCNet contributions align with SKAO construction:

  ~20% effort and e-infrastructure facilities & services

SRC Network – a collaboration of 16 partner countries.

- All SRCs are outside of SKAO cost book
- Formal pledging of effort and e-infrastructure facilities & services
- Expecting c300-700PB/year from SKA-LOW and SKA-MID combined (growing). UK 20%)
  - There is too much data for one country

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SRC capabilities

Slide courtesy SRCNet/Jesus Salgado/Rosie Bolton

Science enabling applications

Analysis tools, notebooks, workflow execution, machine learning, etc

Distributed data processing

Computing capabilities provided by the SRCNet to allow data processing

Data discovery

Discovery of SKA data from the SRCNet, local or remote, transparently to the user

Visualisation

Advanced visualisers for SKA data and data from other observatories

Support to the science community

Support community on SKA data use, SRC services use, Training, Project Impact Dissemination

Interoperability

Heterogeneous SKA data from different SRCs and other observatories

TAP
DataLink
SODA

Data management

Dissemination of data to SRCs and Distributed Data Storage

Icons correspond to software in SRCNet v0.1

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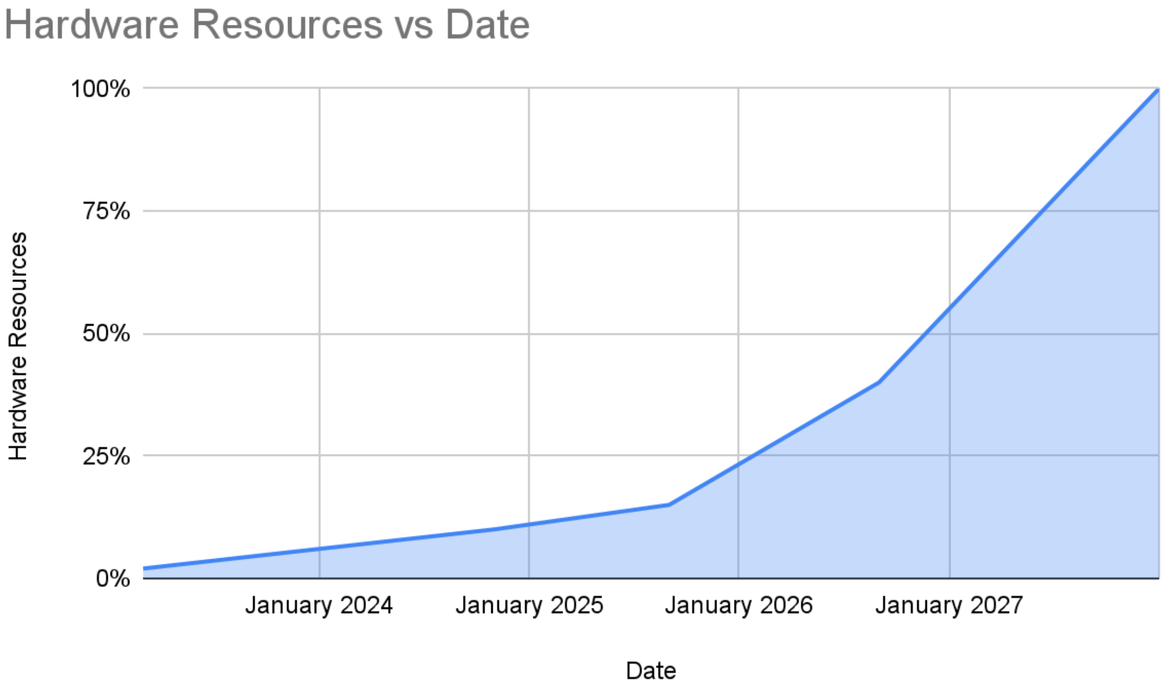
SRCNet Developing resource and infrastructure

SRCNet:

- Pledged services & resources from all SRCNet partner (commensurate level with SKAO country contributions)
- Compute, storage and services
- Science data archive and science community access point to SKAO
- **… UK is the largest SRCnet Node ~15-19% of Global SRCNet…**



- ~1exabyte storage – growing year on year thereafter – -Science archive
- Associated Compute for data processing of ADPs and analysis
- Science and operational support services
- Full stack of services
- Program of Continuous development

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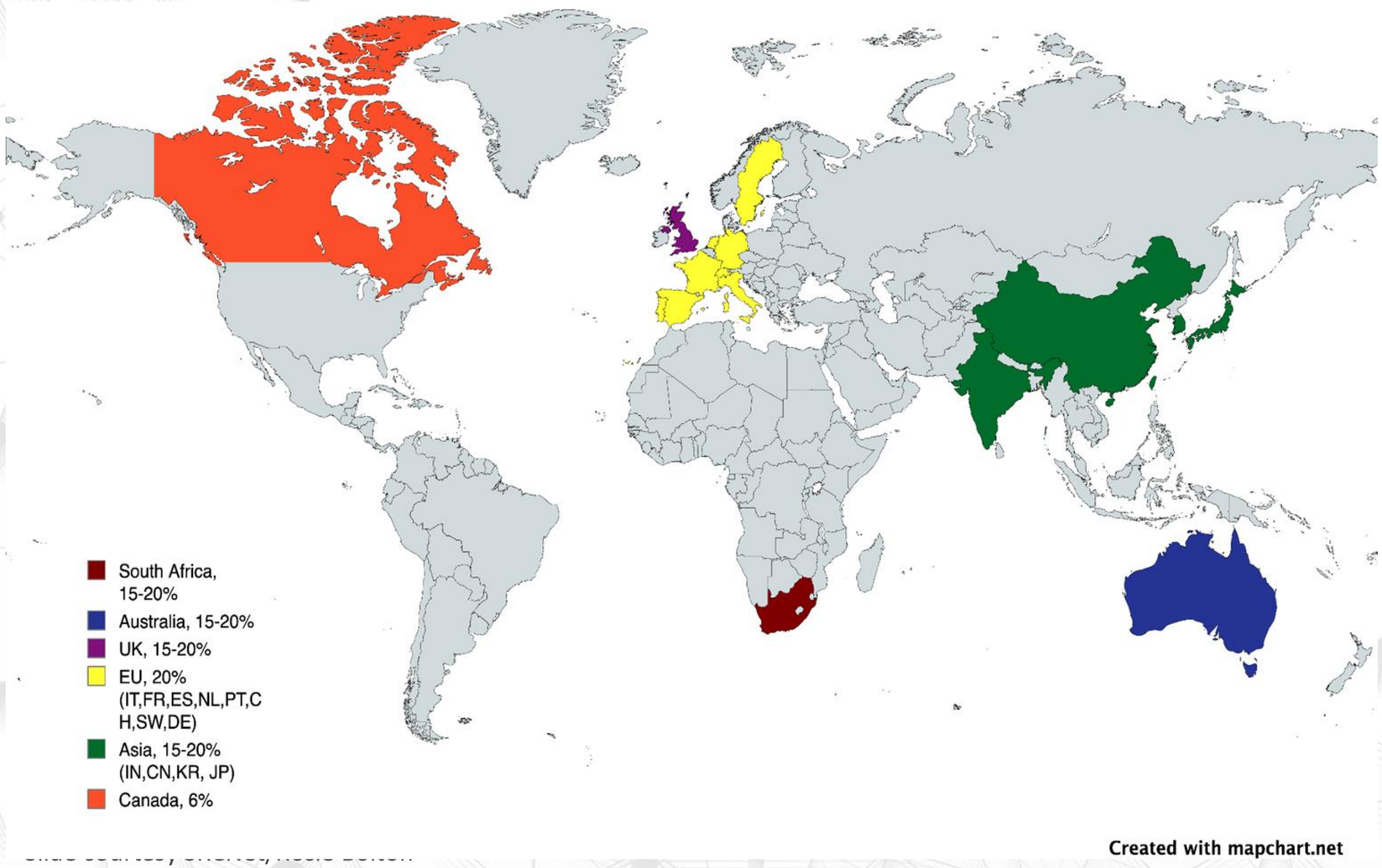
Developing the SKA Regional Centre Network



Roughly, 6 global zones of equivalent size (Canada smaller)

- **Distribute two base copies** of each data product to different countries, and perhaps insist to different regions
- Average incoming rate per (20%) region not more than 2x40 Gbit/s = 80Gbit/s (~2x12 Gbit/s for Canada)
- **Up to 100 Gbit/s out of SA and AUS**

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The UK’s Science Regional Centre (UKSRC)

UKSRC infrastructure and services:
Supporting and facilitating UK science

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SKAO Regional Centre United Kingdom

Global SRC Network:
Developing and delivering the global SRCNet.

UNIVERSITY OF CAMBRIDGE
THE UNIVERSITY of EDINBURGH
Durham University
University of Hertfordshire UH
MANCHESTER 1824 The University of Manchester
UCL
UKRI Science and Technology Facilities Council | Scientific Computing

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Timing & science milestones: matching SKAO construction

Milestone event (earliest)		SKA-Mid (end date)	SKA-Low (end date)
AA0.5	4 dishes 6 stations	2025 Oct	2024 Dec
AA1	8 dishes 18 stations	2026 Jun	2025 Nov
AA2	64 dishes 64 stations	2027 Sept	2026 Oct
AA*	144 dishes 307 stations	2028 Jun	2028 Jan
Operations Readiness Review		2028 Jun	2028 Apr
AA4	197 dishes 512 stations	TBD	TBD

Before science Verification

- SRCs not needed to support commissioning
- Development, ramp-up and Opportunity for testing (data, transfer, access, pipelines)!

Science Verification

- Data immediately public
- Full dress rehearsal!
- Some SRCNet resources for analysis would be an advantage
- Observed as trickle but also in dedicated blocks

Cycle 0

- “Proper” shared risk projects
- Teams, proprietary periods, visualisation, ADP creation etc

- **UKSRC phase 1 Development (2023-2025)**
  - Team development
  - Dev of UKSRC capabilities
  - Co-development with UK community
  - Early services to Pathfinder/precursor communities via demonstrator cases
  - SRCNet v0.1 - 0.2
- **UKSRC phase 2 (2026+) Dev-ops**
  - Ramp of SRC capabilities
  - Science verification support and services
  - Continuous Co-development with science community needs
  - Services to Pathfinder/ precursor communities

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Driving global SRCnet development

Contributing to developing SRCnet architecture document

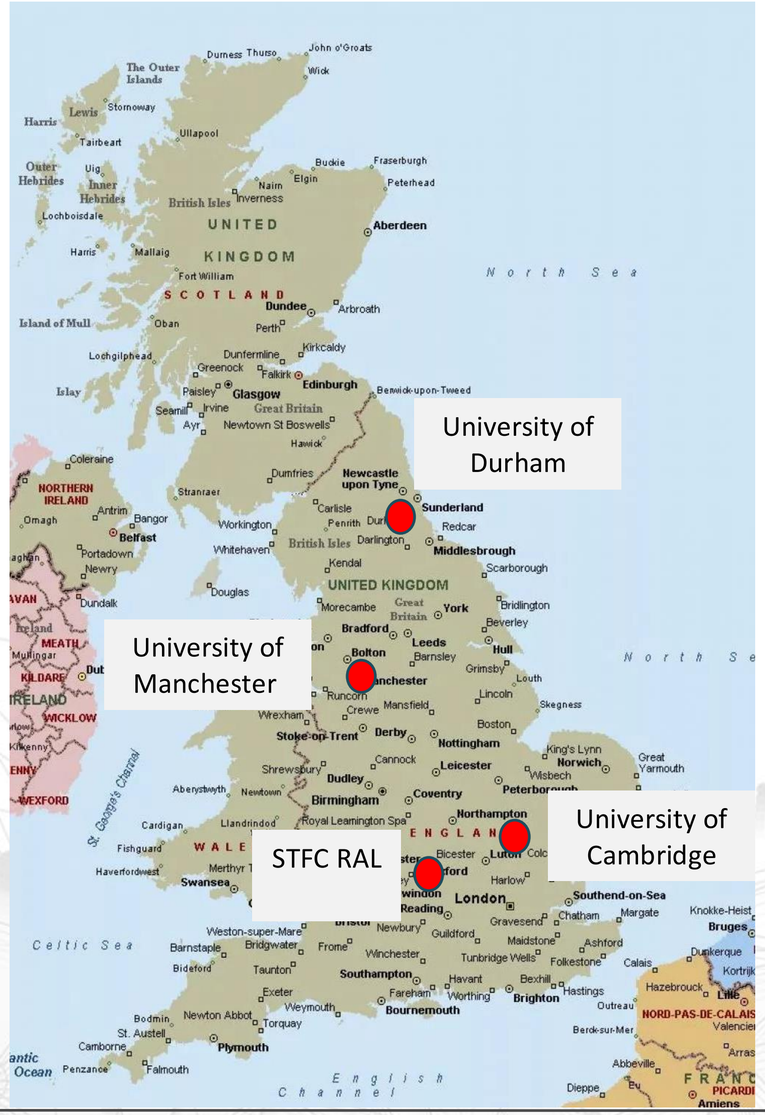
Facilitating SRCnet Prototyping activities

Developing workflows

Developing AAI

Federated data management

Develop UKSRC Digital Research Infrastructure



Enable UK astronomers

UK astronomy community workshops determined demonstrator case topics.

Developing workflows for larger data analysis using pathfinder & Precursor SKA data (e.g. LOFAR, e-MERLIN, Meerkat, EVN, ASKAP, etc)

Demonstrator Case Working Groups

- Understanding future workflow requirements
- Research projects proposed by the working groups to test & evaluate new tools, resources and services
- Generating new research insights

Early adopter schemes

Community engagement and support

SRCNet v0.1 ... on track...

SRCNet0.1 Node Completion
UKSRC

Congratulations to the UK team on completing deployment and integration of all the required services needed to become an SRCNet0.1 node!
Kudos to all involved!

tested by:

J. Salgado

Jesús Salgado

SRCNet Architect

confirmed by:

R.Bolton

Rosie Bolton

SRCNet Project Lead

Date: 24/03/2025

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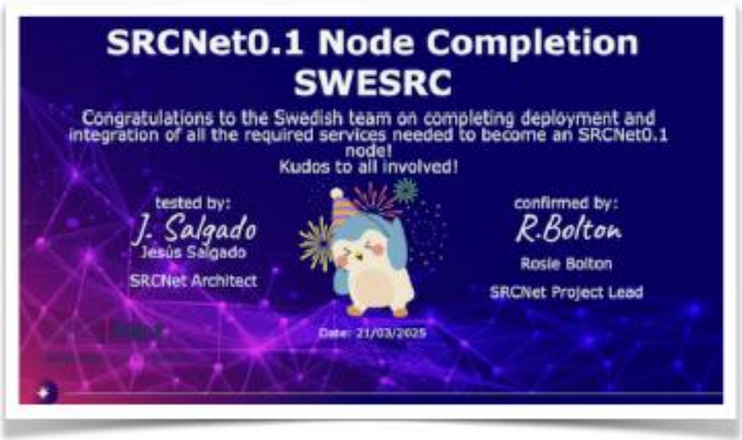
SRCNet international node verification

SRCNet Node accreditation process ongoing:

- Verification by SRCNet Architect: Jesús Salgado
- 5 nodes so far: SRCNet v0.1 operational!
- Validation process starting with SRCNet v0.1 Test Campaigns

  Being led by James Walder (UKSRC)



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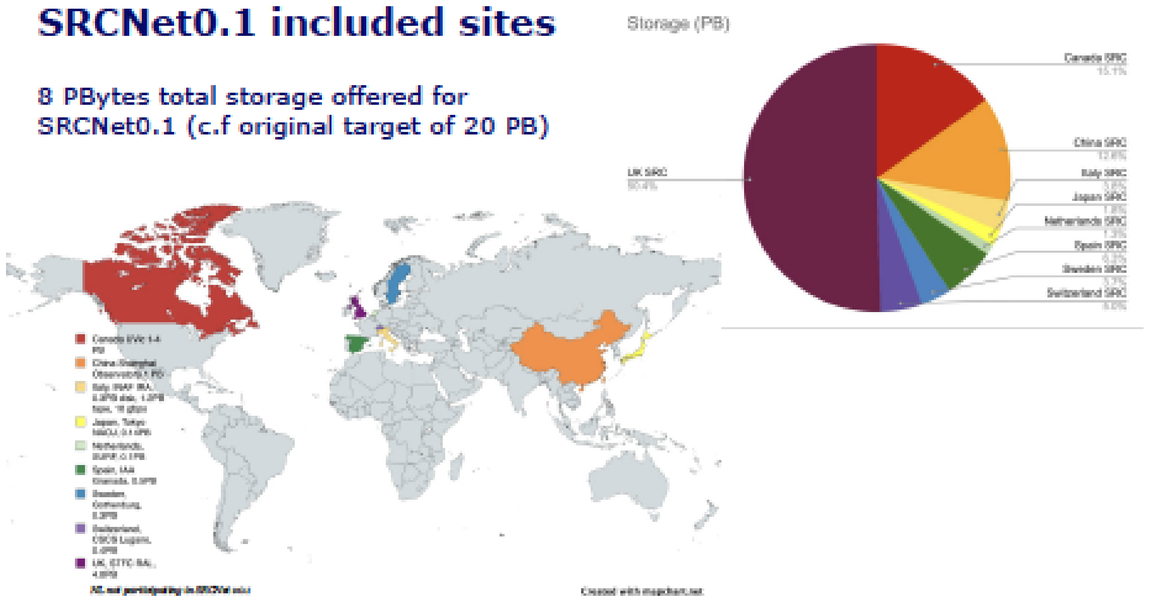
Toward SRCNet v0.1

- SRCNet v0.1 represents the initial functional prototype release
- Eight countries are expected to participate in v0.1.
- ‘Engineering Prototype’: Internal users only; providing:
- Common authentication and authorisation
- Use of Test (i.e random/simulated) – or open–data
- Data ingestion
- Data discovery
- Data distribution and replication
- Data access
- Basic data analysis (e.g. visualisation/notebooks)
- Also, to continue to develop pipelines, workflows, benchmarking and profiling.



Milestone	Description	SRC Net Functionality	Scope (users)
SRCNet v0.1 First quarter of 2025	First version of SRCNet sites deploying common services and connecting via SRCNet APIs. **Enable technical tests of the architectural implementation.** [Added c.f. document] (Potentialy Opportunity to engage SRCNet with AA0.5 data transfer and access.)	• Test data (and some precursors data) disseminated into a prototype SRC Net • Data can be discovered through queries to the SRC Net • Data dissemination to SRC nodes • Data can be accessed through a prototype data lake • Data replication. Data can be moved to a local SRC area where non-connected local interactive analysis portals (notebooks) could allow basic analysis • Unified Authentication System for all the SRCs • Visualisation of imaging data	**SRC ART members** Members of SKA Commissioning team **(potentially, but not required)**

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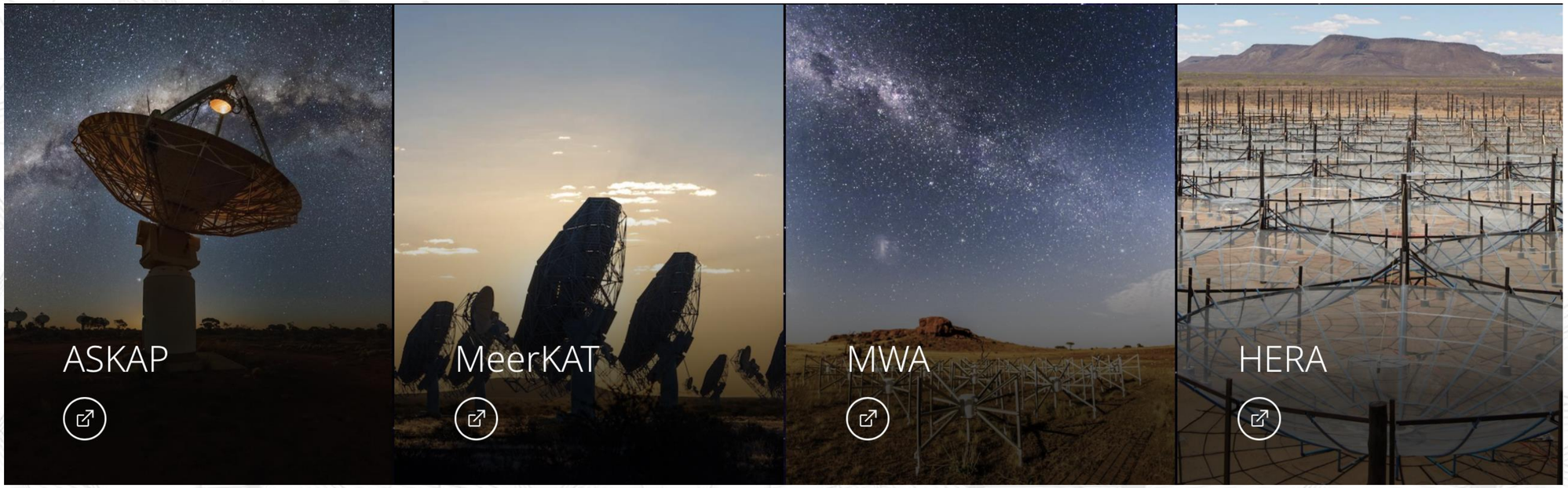
UKSRC supporting the UK community

- If the SKAO is under construction, and SRCNet has no data to deliver - **what are we doing now for the community?**
- The UKSRC will support **UK astronomy** so we can co-develop together and **maximise community from the SKA**.
- **Support** SKAO precursors,

SKA precursor telescopes



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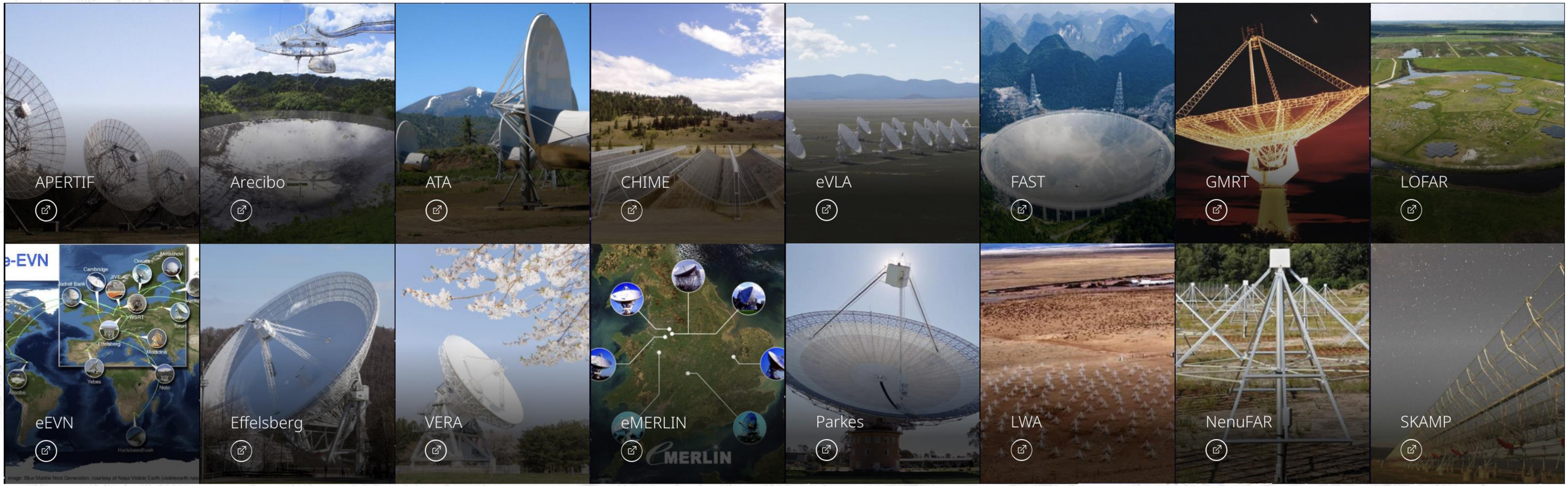
UKSRC supporting the UK community

- And **pathfinder** science:



...Early access...

Early adopter/Demonstrator cases are:

- User-driven, co-developed projects.
- Designed to test and refine UKSRC functionality.
- Drive scientific and technical innovation.
- Engage with researchers using SKA pathfinder/ precursor data.

Goals of the demonstrator case scheme:

- Advance UK leadership in SKAO science.
- Refresh topics to reflect evolving research.
- Build skills and readiness in the community.
- Enable co-creation between UKSRC and users.
- Support UK community

Open Call for Demonstrator Cases - Cycle 1

Introduction

The UK SKA Regional Centre (UKSRC) is pleased to announce an open call for new demonstrator cases. The demonstrator cases aim to represent a diverse subset of the UK SKA community with leading researchers working on SKA-related projects while also covering a wide range of use cases. These cases are meant to help the UKSRC test its capabilities, including computing, software and user support. This initiative represents a key effort by the UKSRC to co-develop the facility with the community. These cases will inform the development of the UKSRC facility and develop the UK SKA community as we prepare for the coming decades of SKA science.

Successful applicants will **benefit** from the following:

- UKSRC compute resources
- Usable scientific workflows within the UKSRC architecture
- Science, development, and technical support from UKSRC staff
- Opportunities to shape the future direction of the UKSRC and the international SKA Regional Centre Network
- Potential new science using UKSRC resources.

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Summary

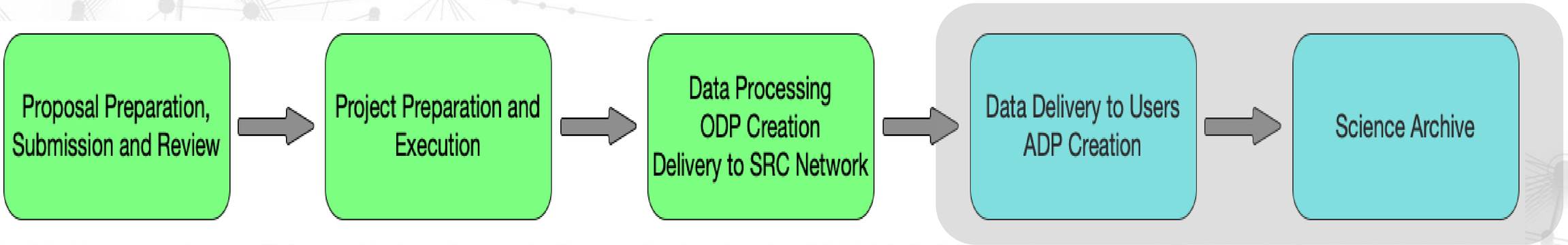
SRCNetwork:

- SRCNet is an integral part of the SKAO project workflow
- SRCs will be the route that the science community will access SKAO data

… a global partnership of SRCNet countries…

UKSRC:

- Ensure delivery of UK SRC services (& SRCNet)
- Develop a full-stack/suite of services of SRCs
- Support SKA science now – Pathfinders/precursors / future SKA projects
- Supporting UK SKA community now and into operations



…the SRC Network operationally crucial to enabling and deliver SKA science…

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UCL
- Louise Chisholm
- Marcus Keil
- Lucy Caselton
- Owain Kenway
- Jeremy Yates (up to 2024, past Director)

University of Durham
- Leah Morabito
- Alistair Basden
- Matthijs van der Wild

University of Hertfordshire
- Martin Hardcastle
- Bonnie Barkus
- Lara Alegre

UKRI-STFC
- George Madden
- Cassandra Mercury
- Cinzia Porcedda

University of Edinburgh
- George Beckett
- Phil Best

STFC Scientific Computing
- Ian Collier
- Tom Dack
- Rose Cooper
- Jonathan Churchill
- Jens Jensen
- Matt Mayer
- Chris Green
- James Walder

StackHPC
- John Taylor
- Matt Pryor
- John Garbutt

University of Cambridge
- Eloy de Lera Acedo
- Paul Calleja
- Jeremy Coles
- Mark Ashdown
- Charlie Walker
- Haoyang Ye
- Tunde Oyewo
- Duncan Watson
- Wojciech Tuerk
- Paul Browne
- Sean McConkey
- Richard McMahon
- Nicolas Walton
- Cassie Bradley

University of Manchester/JBCA
- Rob Beswick
- Keith Grainge
- Ben Stappers
- Paul Harrison
- Ant Holloway
- Bob Watson
- Chris Skipper
- Iulia Cimpan
- Jacob Burba
- Jack Radcliffe
- Julia Healy
- Tianyue Chen
- Michael Johnson
- Erin Brassfield Bourke
- Elliot Goodwin
- Steve Lloyd
- Dave Morris
- Ian Leigh
- Anthony Moraghan
- Ben Green
- Andrew Gordon

And thanks to all SRCNet team members from around the world

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