

The SRAO Africa Programme



DARA Workshop 2026

RADIO ASTRONOMY

QUASAR
~10 BILLION
LIGHT-YEARS

STAR
~LIGHT-YEARS

NEBULA
~LIGHT-YEARS

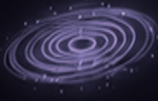
PLANETARY SYSTEM
~LIGHT-YEARS

GAMMA RAYS



Highest energy
from the most
extreme events

X-RAYS



Reveal hot gas
around black holes
and neutron stars

ULTRAVIOLET



Shows young
stars and hot
stellar regions

VISIBLE LIGHT



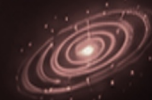
What our eyes
can see

INFRARED



Reveals cooler
objects and
hidden stars

MICROWAVES



Shows cold gas
and the cosmic
background

RADIO WAVES



Reveals the
Universe's
oldest signals

SHORTER WAVELENGTH
HIGHER ENERGY

LONGER WAVELENGTH
LOWER ENERGY

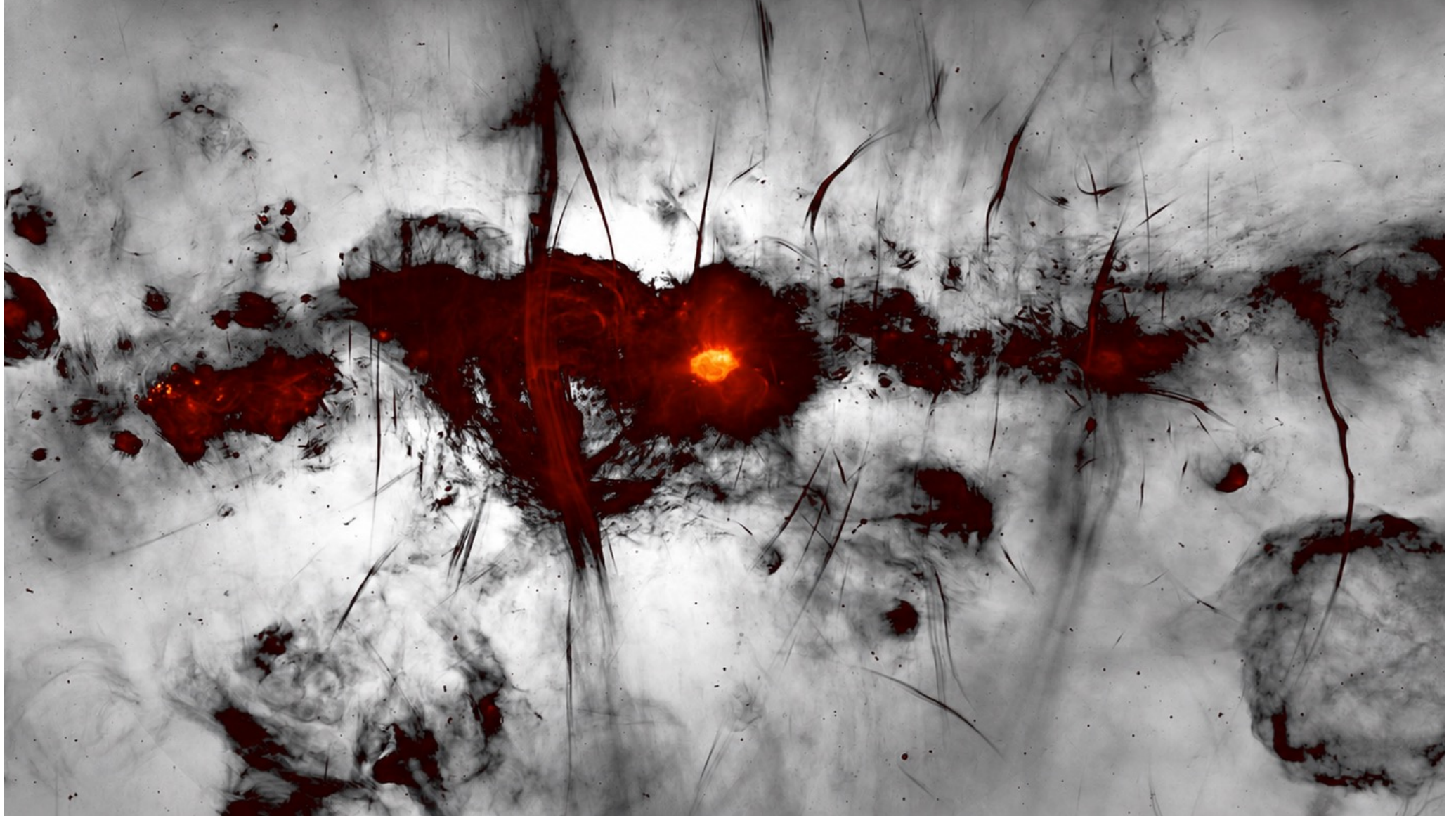
THE KAT7 TELESCOPE



THE MEERKAT TELESCOPE



THE GALACTIC CENTRE



The Africa Programme

The Africa Partner Countries

- The Africa Radio Astronomy Programme Strategy was accepted in 2023 by the eight SKA African Partner countries (APC's) namely; Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia

The Programme

- The Africa Programme is the portfolio managed by SARAO to implement, collaborate and coordinate the efforts in the SKA Africa Partner countries relating to radio astronomy activities



Africa Radio Astronomy Programme (ARAP)

Interventions

Bursaries
Transient Array Training Telescope (TART)
Two Dish Interferometers
DARA Training Programmes
PC labs and HPC infrastructure and Training
Big Data Workshops
E-Learning Platform
GNSS Programme
Radio Astronomy Telescope Implementation (Ghana)



Botswana
Ghana
Kenya
Madagascar
Mauritius
Mozambique
Namibia
Zambia

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The Africa Programme Strategy

The Vision

- The sustainable establishment of African science and technology networks and skills, and growth of science and technology capacity in the SKA Africa Partner Countries



The Programme Pillars

- Human Capital Development
- Research and Technology Infrastructure
- Funding, Governance and Partnerships



High Performance Computing and Big Data

This programme was adopted in 2016 and various activities are under way, aimed at building High Performance Computing capabilities in the SKA African Partner countries.

Computer racks and relevant training workshops were rolled out by the Centre for High Performance Computing (CHPC) in South Africa

PC clusters were supplied by DARA to the Partner countries

- Linux and python training is provided
- Hybrid training is also delivered by the CHPC and local tutors

DARA has also implemented 5 Annual Big Data Challenge workshops with participants from all the SKA Africa Partner countries



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DARA Big Data Schools

	1 st Big Data Africa Summer School	2 nd Big Data Africa School	3 rd Big Data Africa School	4 th Big Data Africa School	5 th Big Data Africa School
Date	2 – 12 April 2017	10 – 17 Sep 2018	6 – 16 Oct 2019	5 – 12 March 2023	9 - 17 March 2025
Location	Cape Town	Noordhoek, Cape Town	Milnerton, Cape Town	Cape Town	Cape Town
Total Number of Students	40 participants	26 participants	26 participants	25 participants	25 participants
Students	Botswana - 3 Ghana - 3 Kenya - 4 Madagascar - 2 Mauritius - 3 Mozambique - no applications Namibia - 2 South Africa - 21 Zambia - 2	Botswana - 1 Ghana - 2 Kenya - 2 Madagascar - 3 Mauritius - 1 Mozambique - no applications Namibia - 1 South Africa - 14 Zambia - 2	Botswana - 2 Ghana - 2 Kenya - 2 Madagascar - 3 Mauritius - no applications Mozambique - 1 Namibia - 1 South Africa - 14 Zambia - 1	Lesotho - 1 Kenya - 4 South Africa - 4 Madagascar - 1 Zimbabwe - 1 Algeria - 2 Morocco - 1 Ethiopia - 1 Malawi - 1 Ghana - 2 Namibia - 1 Mozambique - 2 Uganda - 3 Zambia - 1	



HartRAO

The HartRAO Facility

- The site boasts a 26-metre radio astronomy antenna as well as many colocated space science and technology (SST) instruments.
- The accommodation was established at the HartRAO site, with a training facility, upgraded by DARA, to enable short and long-stay courses for African delegates.
- The unique value offering of HartRAO is as a premier African training facility in space sciences and technology as well as a centre of excellence that will become accredited to provide certifications.



The 2 Dish Interferometre Training Telescope



The Training Telescope project is intended to be implemented in partnership with the DARA program team, to enable training in single dish science and interferometry, maintenance and operations.

Two 3 metre dishes will be installed in each partner country.

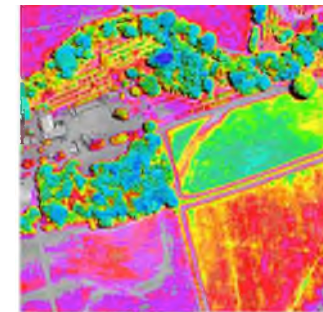
The dishes are being designed in-house at SARAO and will look to implement a skills transfer programme with the partner countries and are seeking collaboration towards the manufacture and installation.

Partnership Opportunities

The Colocation Programme

Colocation of space industry ground stations and space science infrastructure provides:

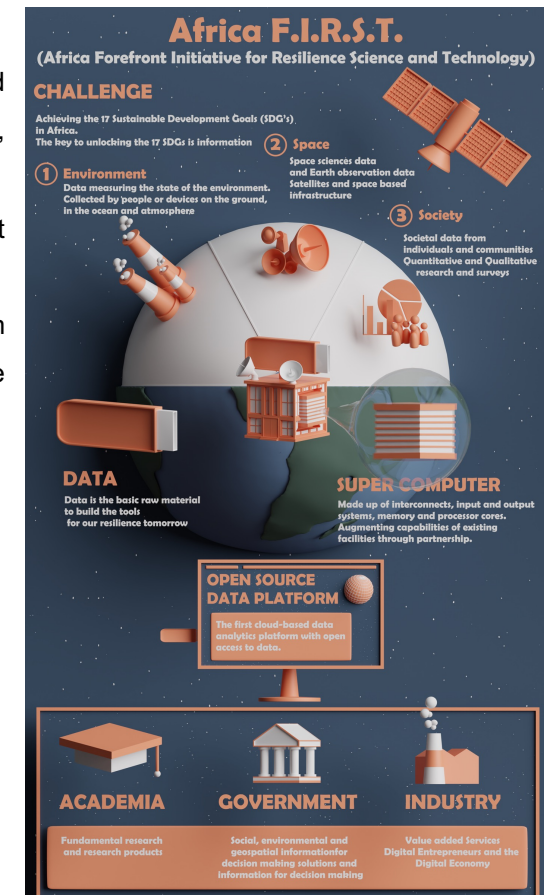
- Sustainable revenue for programmes and ongoing operations
- Employment and training opportunities in radio astronomy, technology areas, data administration and management skills
- Value added data solutions from data applications to earth observation data with many applications
- The Ghana Radio Astronomy Observatory (GRAO) colocation Pilot Programme was successfully implemented in 2021



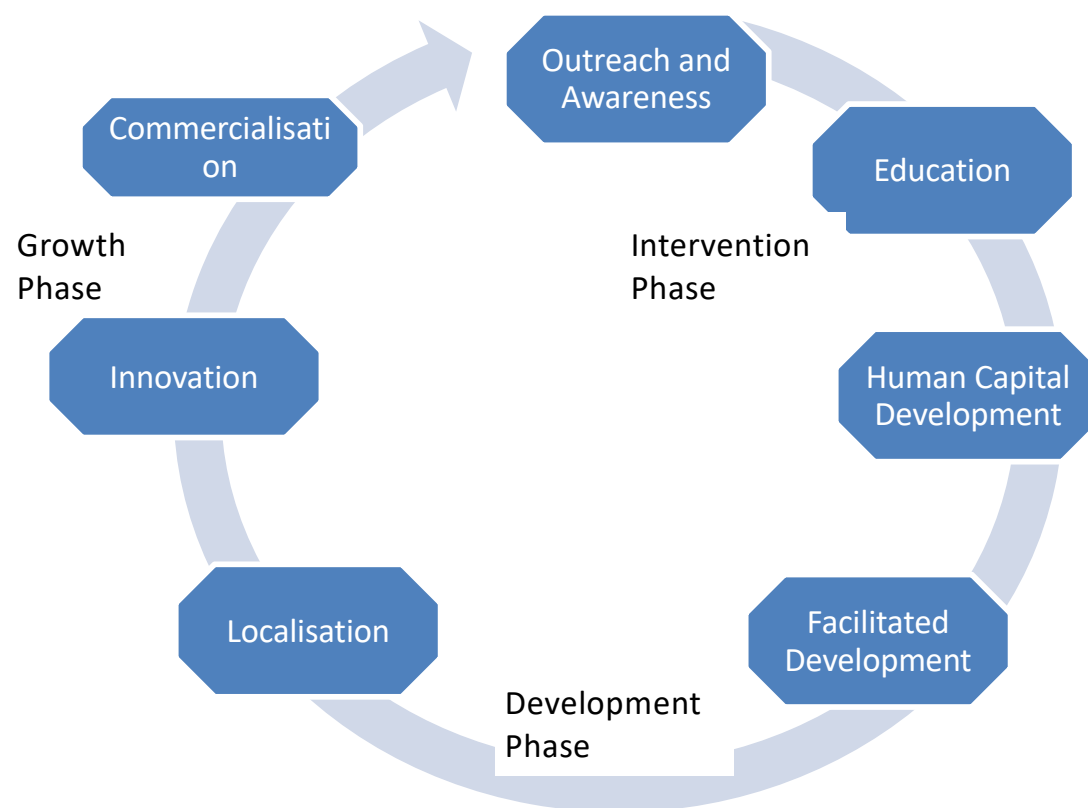
Partnership Opportunities

Africa First

- The Africa Forefront Initiative for Resilience Science and Technology (Africa FIRST) is a proposed continentwide data - sharing project, utilising green infrastructure for the generation, acquisition, storage, transfer and processing of data.
- The SARAO innovation, IronHive, is a mineral oil cooled, power efficient, high performance computer that eliminates the need for costly data centre infrastructure and can be implemented in rural/remote areas
- The key objective is to launch and host Africa's first Distributed Supercomputer and an Open Data Platform with a user - friendly interface for the sharing of data with academia, government and industry to achieve shared goals.
- The pilot demonstration will be implemented in Madagascar, Mozambique and Kenya
- Expected roll-out to South African HDIs



Science Driven Economy



The MeerKAT sustainability as a large-scale research infrastructure is rooted in following a science-driven economic benefit (SDEB) model whereby the cycle begins humbly with educational interventions and ultimately impacts communities, science, policy, spin-out technology solutions, industry development and this reinforces and strengthens the continuous cycle and its outputs

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The Transient Array Radio Telescope (TART)



TART instruments were installed in Mauritius and Kenya in 2024.

The Transient Array Radio Telescope (TART)



The TART instruments were also subsequently installed in Botswana, Zambia, Namibia, Ghana and Madagascar. We also displayed the TART proudly at the G20 visit to the SKA site.

MEERKAT EXTENSION



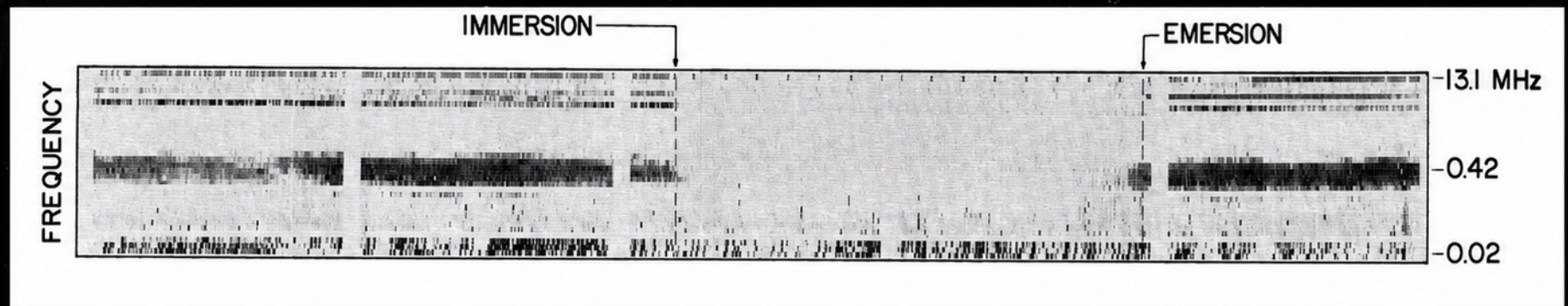
THE SKA TELESCOPE



HYDROGEN EPOCH OF REIONIZATION ARRAY (HERA)



LOW FREQUENCY RADIO ASTRONOMY

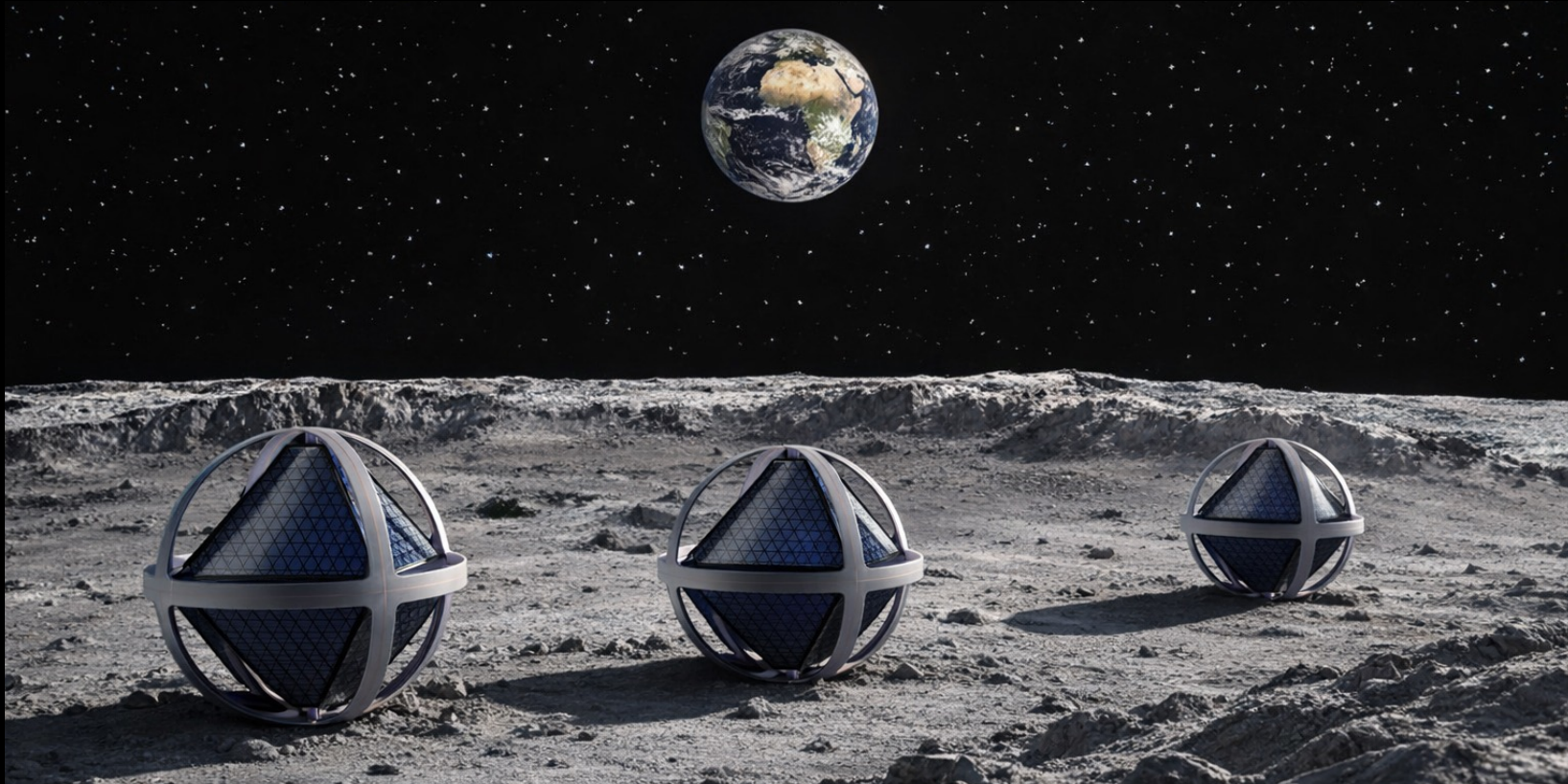


The lunar farside: a radio-quiet zone, 1973

Project	Frequency range (MHz)	Launch date	Location	Science data
RAE-1	0.4 - 6.5	1969	Earth orbit	Y
IMP-6	0.13 - 2.6	1971	Earth orbit	Y
RAE-2	0.025 - 13	1975	Lunar orbit	Y
PRA (Voyager 1&2)	0.02 – 40.5	1977	Flybys	Y
WAVES (Wind)	0.02 - 14	1994	Solar-Earth L1	Y
RPWS (Cassini)	0.001 - 16	1997	Saturn orbit	Y
NCLE (Chang'e 4)	0.08 - 80	2018	Earth-Moon L2	Y
LFS (Chang'e 4)	0.1 - 30	2019	Lunar farside	N
ROLSSES (Odysseus)	0.01 - 30	2020	Lunar nearside	?
LuSEE-lite (CLPS)			Lunar south pole	
LuSEE-night (CLPS)	0.1 - 50		Lunar farside	
Africa2Moon (TD)	0.1 – 50/L-Band	2029	Lunar south pole	
FARSIDE	0.2 - 40		Lunar farside	
European instrument	< 30		Lunar south pole	
Africa2Moon Farside	0.1 - 50		Lunar farside	

B.A.L.L.S.

Bounced African Low Lunar Spheres



AFRICA'S LUNAR MISSION

Africa2Moon is the first all-African space exploration mission, an African designed and built low-frequency radio telescope to be deployed on the lunar surface in 2029. This mission will demonstrate new technology, perform first-time science and inspire the next generation of African explorers and innovators.

Africa2Moon consists of two missions:

The first mission will deploy the technology demonstrator on the Moon, in 2029, 3 antennas are set to be the first radio astronomy array on the lunar surface, positioned in the Moon's south pole region.

The announcement of the Africa2Moon selection for the Chang'e-8 Mission was made on 24th April 2025.

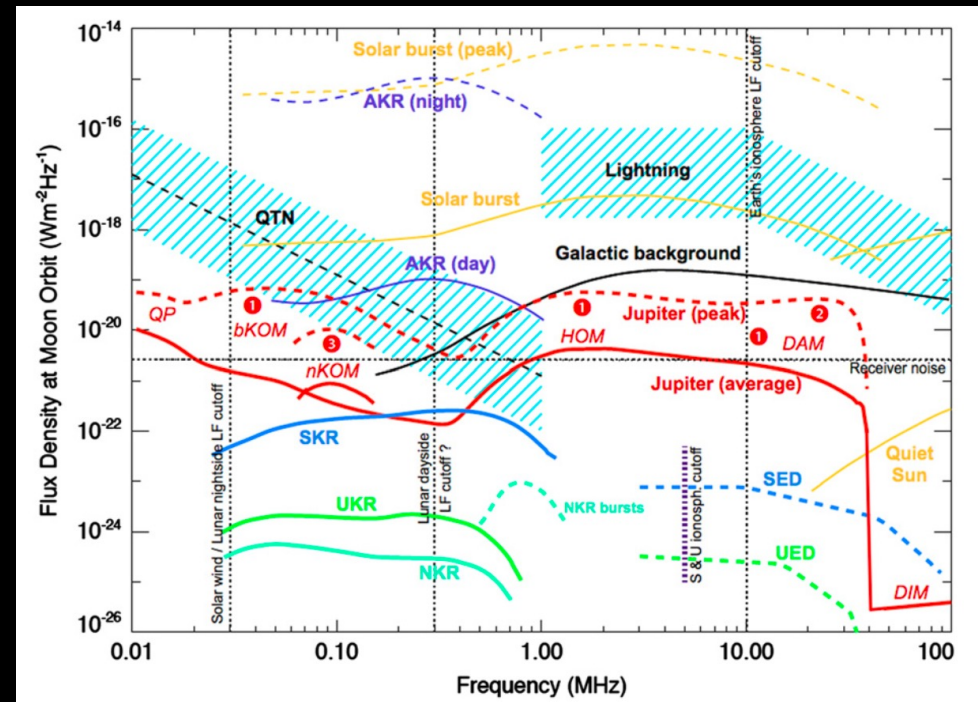
The second mission aims to deploy 55 antennas on the far side of the Moon, one for each nation in Africa.



SCIENCE AND DISCOVERY

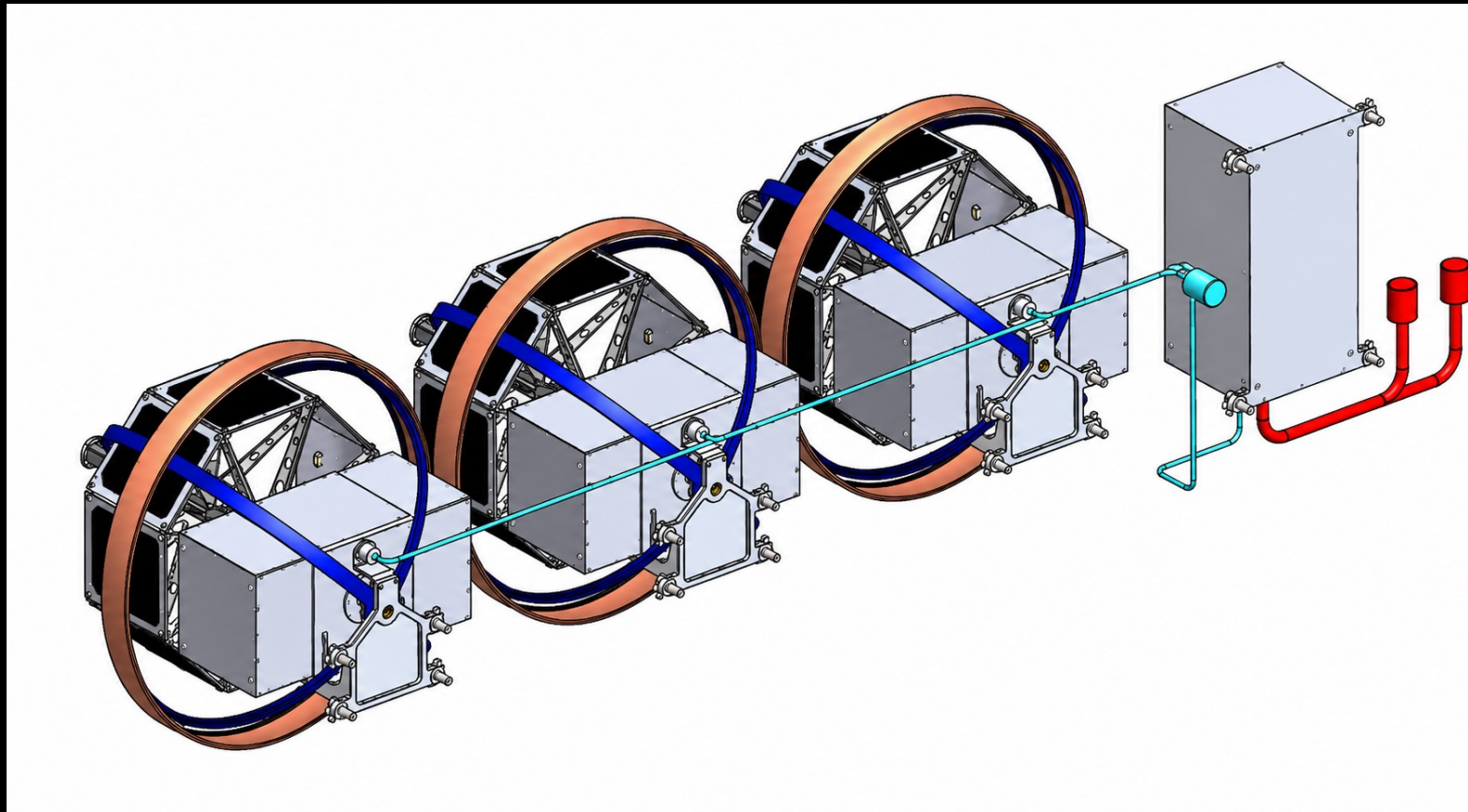
The Africa2Moon radio telescope array is designed to be the first array on the Moon and to perform first time science in radio astronomy in the sub 20 MHz frequency range.

This frequency range is largely opaque from Earth and thus has to be observed in space.



Credit: Philippe Zarka

LANDER ATTACHMENT



POSTIONING AND OPERATIONS

BALLS PLACEMENT



BALLS (1, 2, 3)

Three identical BALLS antennas deployed on the lunar surface in an equilateral triangle formation.



BASELINE SEPARATION

18 m between each pair of BALLS.



FORMATION ANGLE

60° internal angle (equilateral triangle configuration).



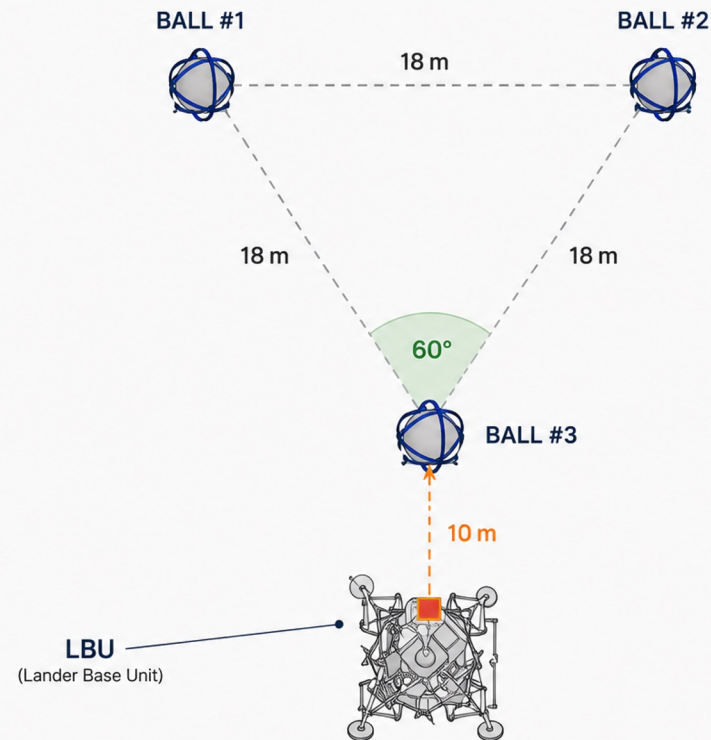
BALL #3 TO LANDER

10 m separation between BALL #3 and the Lander (LBU location).

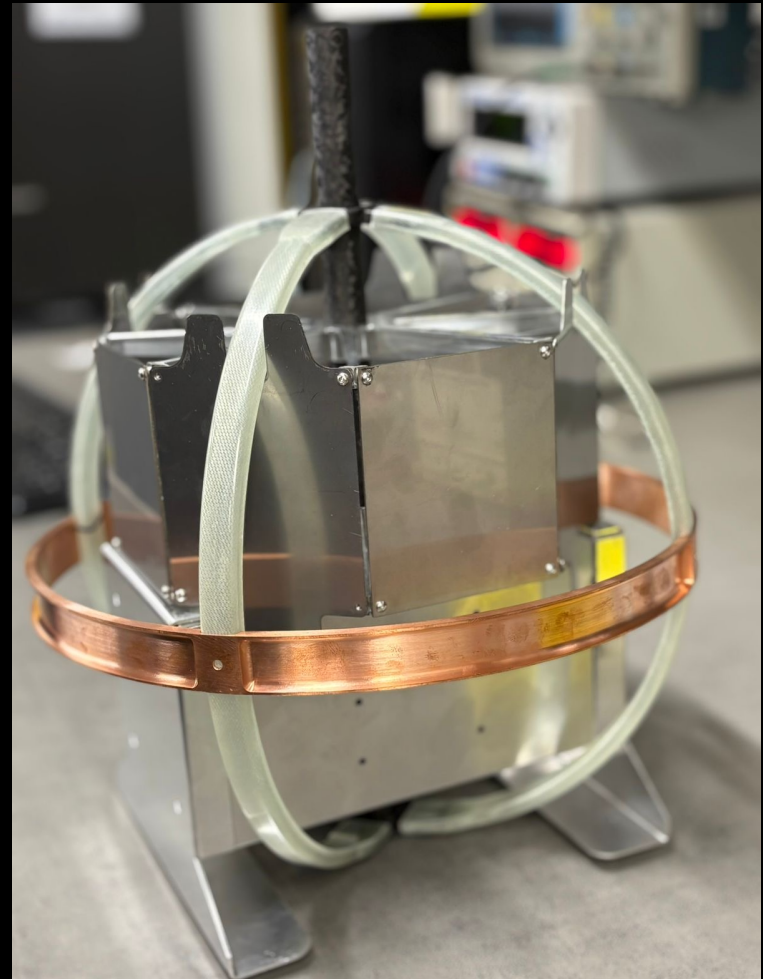
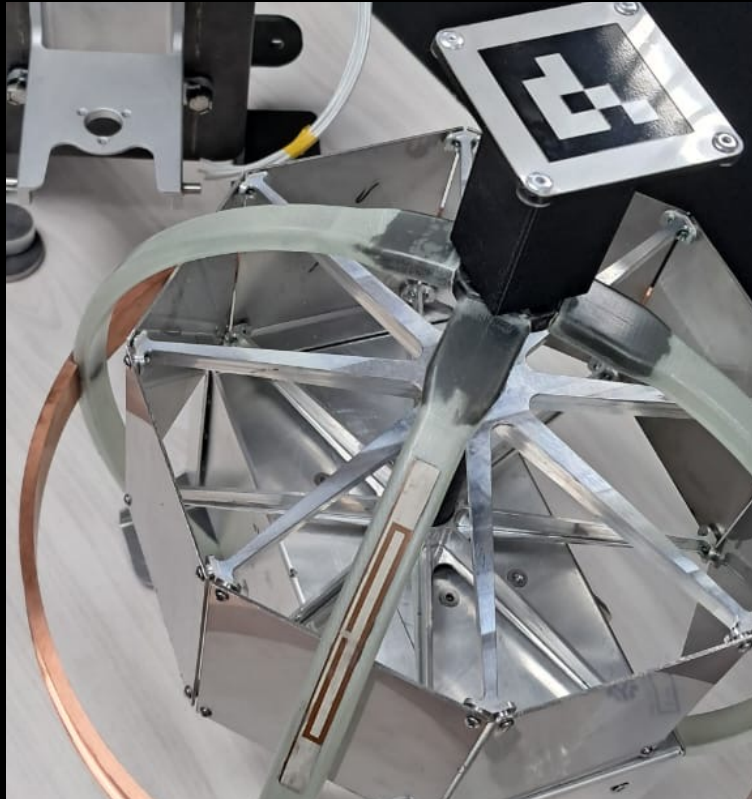


LBU (LANDER BASE UNIT)

Central lander unit positioned 10 m from BALL #3.



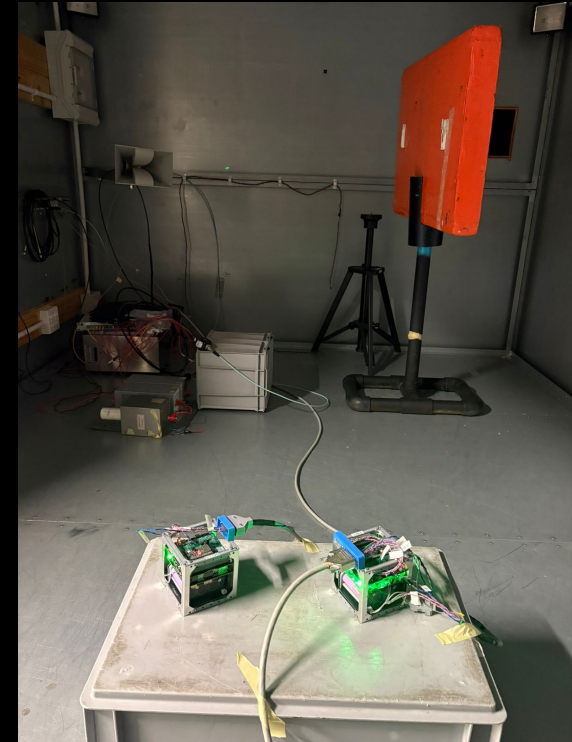
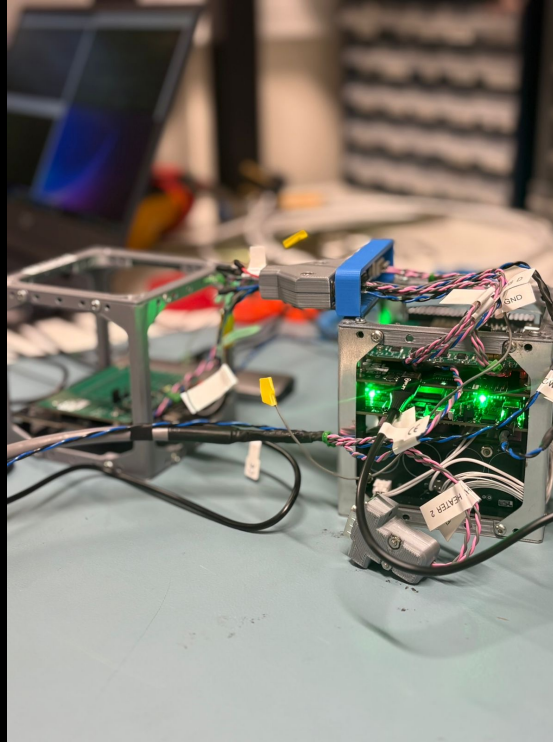
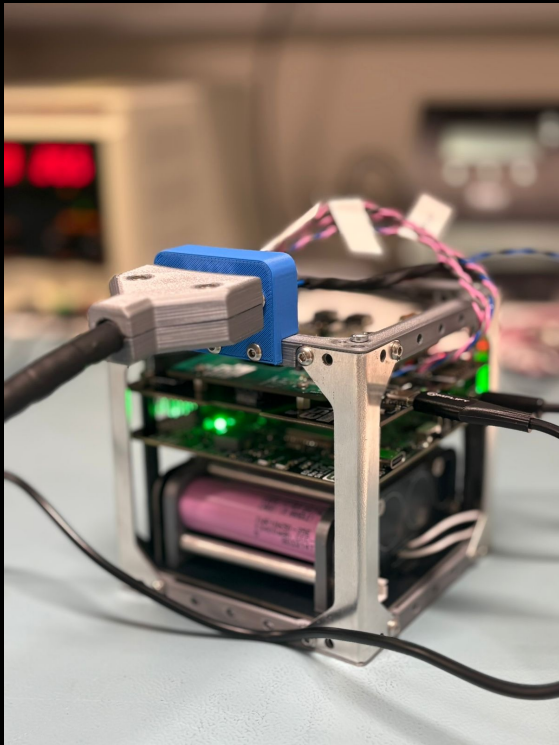
OUR B.A.L.L.S.



B.A.L.L.S. ASSEMBLY



ELECTRONICS



MILESTONES



Engineering Model Phase – 2026



Qualification Phase – 2027



Flight Model Phase – 2028



Launch – 2029



ENGINEERING

- The telescope is to be deployed in the south pole region of the Moon
- One of the harshest environments in the Solar System
Temperatures plummet to **below negative 200 degrees Celsius**
- While humanity has not yet landed technology at this location, the lunar south pole is an important place to collect data because this is where the **first permanent off-world research bases** are to be established.

The many challenges to solve for lunar missions include

- Launch Forces
- Survival of the lunar night
- Radiation Protection
- Power



COLLABORATION

This mission showcases the power of multinational and multidisciplinary collaboration to solve complex scientific and engineering challenges, demonstrating that collaboration can overcome any challenge.

It also positions Africa as a contributor to global space, science and technology.

Several spin out innovations have been developed out of the Africa2Moon work to date.



THE POWER OF TOGETHER

AFRICA2MOON

OUR MISSION. OUR FUTURE.

A SIMILAR
MISSION

**\$120
MILLION**

TRADITIONAL
MISSION COST

ONE VISION.
MANY PEOPLE.
LIMITLESS
POSSIBILITIES.

LESS THAN

**\$1
MILLION**

MADE POSSIBLE THROUGH
DONATED TIME, SKILLS,
KNOWLEDGE AND
MANUFACTURING

WHEN PEOPLE WORK WITH PURPOSE,
IMPOSSIBLE THINGS BECOME POSSIBLE.



EXPLORATION



TOGETHER



HOPE

EDUCATION

The programme aims to inspire future developing nation generations to push the boundaries of space, science and technology. The mission is a platform to promote space awareness and STEM education curricula across Africa.

The Foundation for Space Development programmes are education-driven, and key milestones are the first space science and technology school curriculum and the Africa wide roll-out of this curriculum and platform. Interactive project based learning will incorporate a classroom version of the Moon BALLS that can be built from recycled materials at a very low cost.



AD ASTRA PER FIDEM

Thank you for your time

Presenter

Dr. Carla Mitchell

Africa Programme Manager

Email: carla@sarao.ac.za

