MeerKAT

(Update & Commissioning) and Early Science

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SKA AFRICA
SQUARE KILOMETRE ARRAY

PHISCC Workshop

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SKA South Africa
Radio Astronomy Roadmap

- **Phase 1**: construction of the pathfinder KAT-7 (7 antennae) completed in December **2010** & in operation (published results: e.g. DL's talk)
- **Phase 2**: construction of the precursor MeerKat (64 antennae), fully funded (R3Bn), should be completed ~**2016** & merged with SKA_1- mid
- **Phase 3**: construction of the SKA-mid (phases 1&2) (~3000 ant.s) should be completed ~**2025**

The MeerKAT programme

- South Africa must have the legacy of a large radio telescope
  - Irrespective of the outcome of the SKA site competition
  - But not independent of the SKA
- MeerKAT is an SKA "precursor"
  - Engineering prototype
  - Early science (SKA "Phase 0")
  - Until the SKA is completed, MeerKAT should be one of the most sensitive radio interferometer in the L-band
  - Phased development: KAT-7, MeerKAT, SKA_1, SKA_2
  - MeerKAT will be the first 25% of SKA_1 (mid-frequency dish array)

MeerKat:
start of construction

July 25 2012

MeerKAT Overview

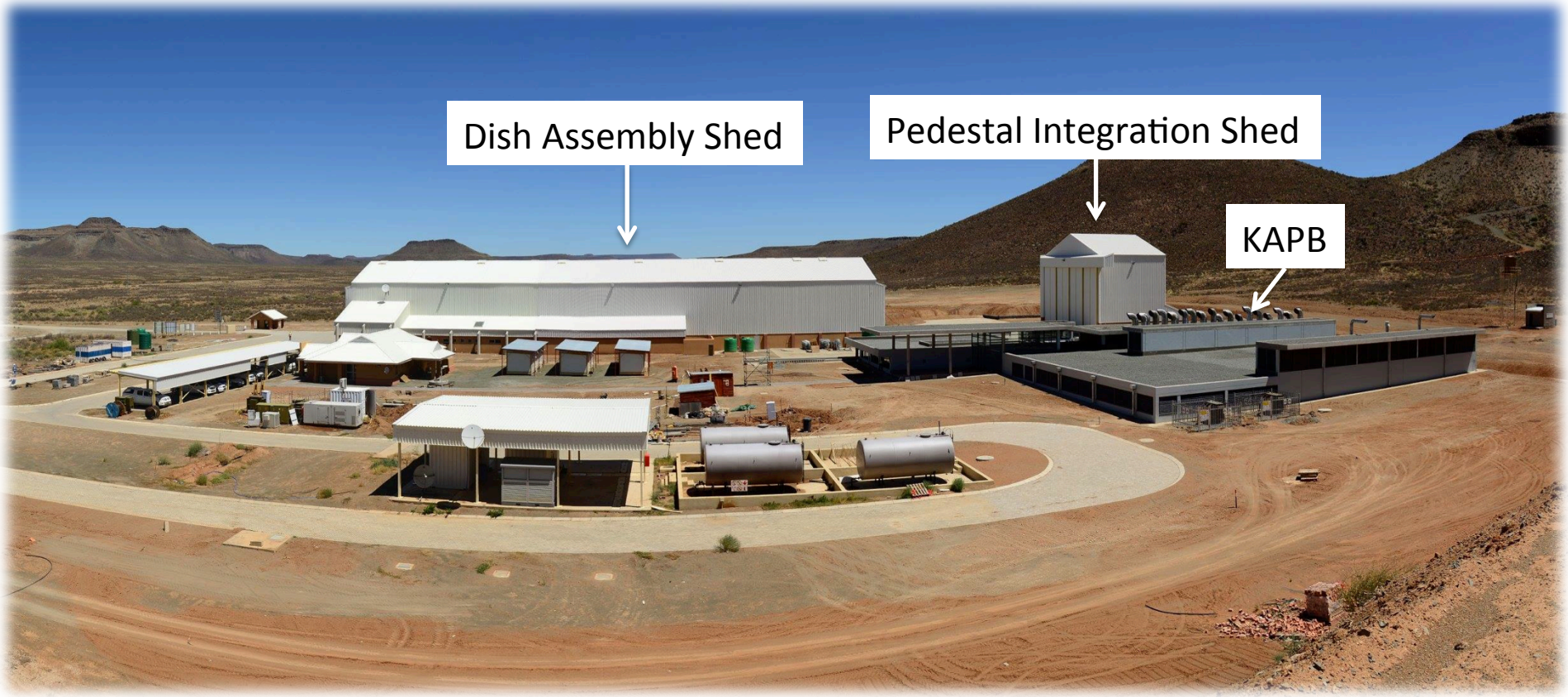
MeerKAT Overview

- Good progress is being made on all aspects of MeerKAT development
- Site infrastructure complete including new Karoo Array Processor Building
- First couple of antennae will be constructed within the next few months
- L- and UHF-band feeds and receivers have been designed and prototyped
- L-band sensitivity expected to be ~320m^2/K rather than ~220 m^2/K (similar gains expected for UHF)
- Fibre networks being deployed at present
- Control system, monitoring system and digitizer system on track
- Correlator / beamformer development going well
- Time and frequency reference system development underway
- Science data processor development on track
- The integration of all those components into the Receptor Test System is underway and should meet the antennae schedule

Roll-out plan: March 2014

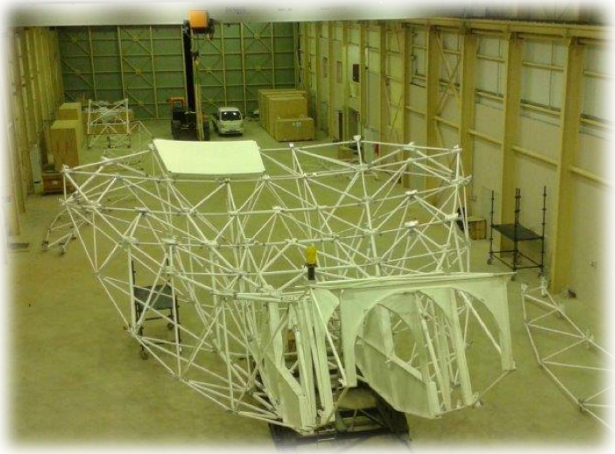
- **MeerKAT Infrastructure Complete and Commissioned**
  - Roads complete
  - MeerKAT foundations (64 piers) complete
  - Dish & pedestal assembly sheds are complete
  - New Karoo Array Processor Building (KAPB) complete with its Data Rack Area (130 racks capacity) and power facility (rotary diesel UPS systems) housed in the same building.

Roll-out plan: March 2014



Roll-out plan: July 2014

- **Receptor Test System (RTS)**
  - Two MeerKAT antennae installed on site
  - Populated with L-band receivers
  - Full signal and control chain deployed in the RFI shielded containers
  - Commissioning from July 2014



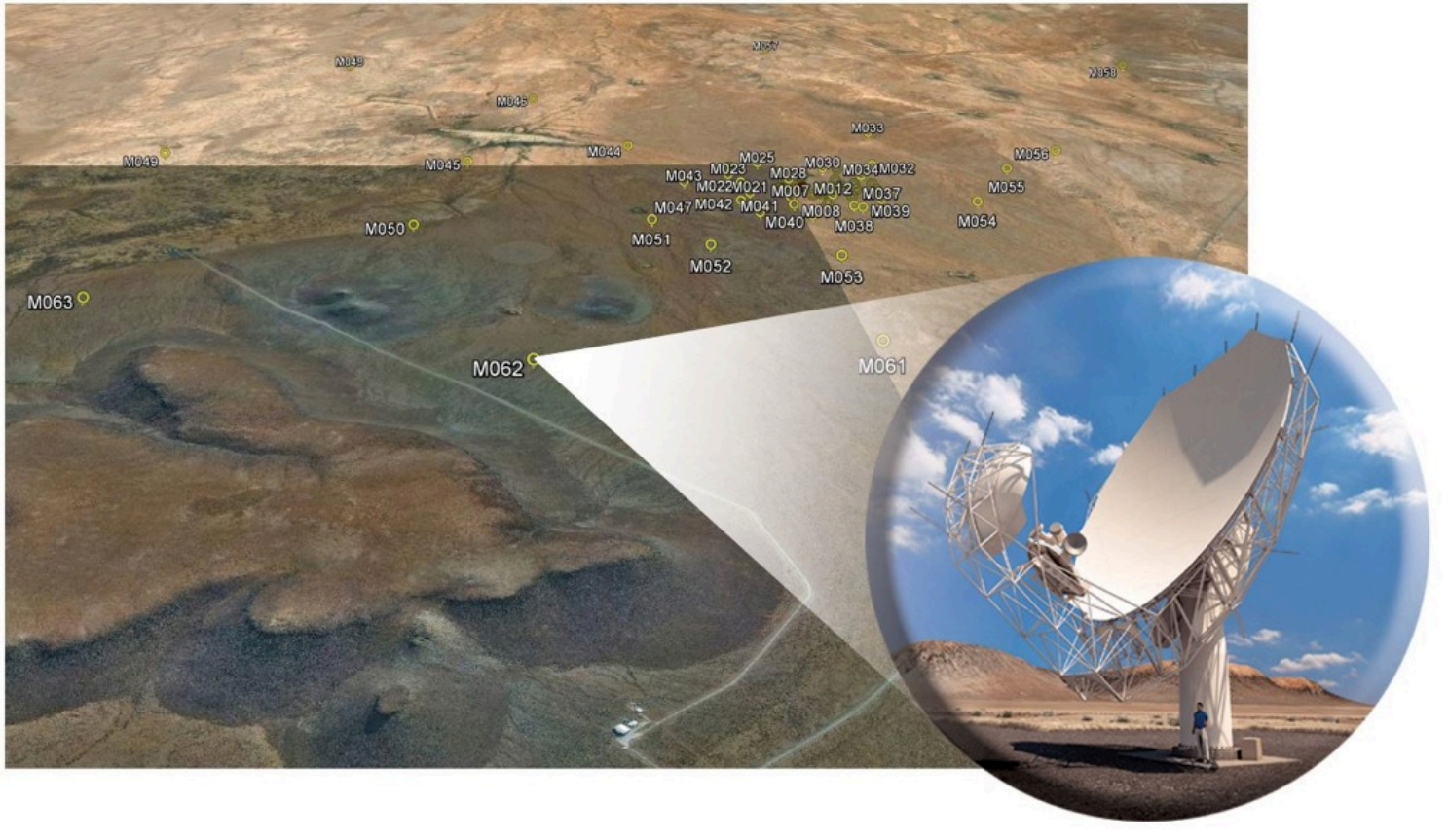
Roll-out plan: Jan-Dec 2014

- 2 MeerKAT antennae available to project team (July 2014)
- They will undergo intensive engineering tests in order to reduce risk prior to full MeerKAT roll-out
- Not expected to be available to the MLSP teams during 2014
- KAT-7 continues to be available (with priority to tests toward MeerKAT, when necessary)

Roll-out plan: Jan-Dec 2015

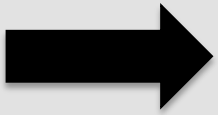
- **Array Release (AR1)**
  - 32 inputs (16 antennae) correlator & back-end
  - L-band continuum imaging
  - Modes
    - 856 MHz / 4096 = 209 kHz (corr. mode: wideband coarse: wbc)
    - 856 MHz / 32768 = 26 kHz (corr. mode: wideband fine: wbf)
    - Single beam coherent beamformer, channelisation likely to be any of the wideband modes (i.e. 32768 or 4096 or possibly 1024 channel modes covering the full 856 MHz bandwidth of which 770 MHz (0.9-1.67 GHz) is usable.

Roll-out plan: Jan-Dec 2015



Order	Ant #	Year
1	M063	2014
2	M062	2014
3	M024	2014
4	M025	2014
5	M031	2015
6	M034	2015
7	M015	2015
8	M014	2015
9	M001	2015
10	M003	2015
11	M006	2015
12	M010	2015
13	M008	2015
14	M007	2015
15	M021	2015
16	M022	2015
17	M036	2015
18	M017	2015
19	M018	2015
20	M020	2015
21	M011	2015
22	M012	2015
23	M000	2015
24	M002	2015
25	M005	2015
26	M042	2015
27	M041	2015
28	M040	2015
29	M038	2015
30	M037	2015
31	M030	2015
32	M028	2015
33 - 64	Random	2015/16

Roll-out plan: Jan-Dec 2015

- **Array Release (AR1)**
  - 16 antennae will have a synthesized beam ~1 arcmin and reach a 5σ ~ 6.8 mJy/beam per channel in wbc
  - KAPS available with ample power, cooling and space for racks of MLSP supplied equipment
  - Integration and Verification start Jan 2015
  - Commissioning from July 2015
  - Number of antennae scales from 4 to 32 during 2015
- **Science Verification on AR1 (Oct to Dec 2015)**
  -  Beginning of Early Science (October 2015)

Early Science: from October 2015

- Still being discussed by the survey teams
- Discussions underway between the MeerKAT project (Jasper Horrell) and the PIs (e.g. TAC model)
- HI Science: LADUMA & MHONGOOSE
- LADUMA: examples given by Sarah yesterday
- MHONGOOSE: e.g. since the first antennae will be populating the core (except for ant.s 62 & 63), low column density HI projects appear the optimal targets (baselines 29m to x100m)

Roll-out plan: Jan-Dec 2016

- **Array Release 2 (AR2)** – as per AR1 with the following additions/extensions
  - 64 inputs (32 antennae) correlator
  - Modes (AR1 + the following additions)
    - 4 beam beamformer, channelisation as per AR1
    - Incoherent sum of antennae auto-correlations
    - 5 x 13.4 MHz zoom bands with 4096 channels giving 3.3 kHz resolution
    - 5 x 6.7 MHz zoom bands with 4096 channels giving 1.6 kHz resolution
    - 32 antennae will have a synthesized beam ~1 arcmin and reach a 5σ of 3.3 mJy/beam per channel after an hour in wbc

Roll-out plan: Jan 2017

- **Array Release 3 (AR3)** – as per AR2 with the following additions/extensions
  - 128 inputs (64 antennae) correlator
  - Modes (AR2 + the following additions)
    - Add spectral modes
    - Full system sensitivity, 64 antennae will have a synthesized beam ~ 5 arcsec and reach a rms ~ 1.1 mJy/beam per channel after an hour in wbc at 21 cm
    - Commissioning from Jan 2016
    - Scaling from 32 to 64 antennae during 2016

Roll-out plan: 2017-2021

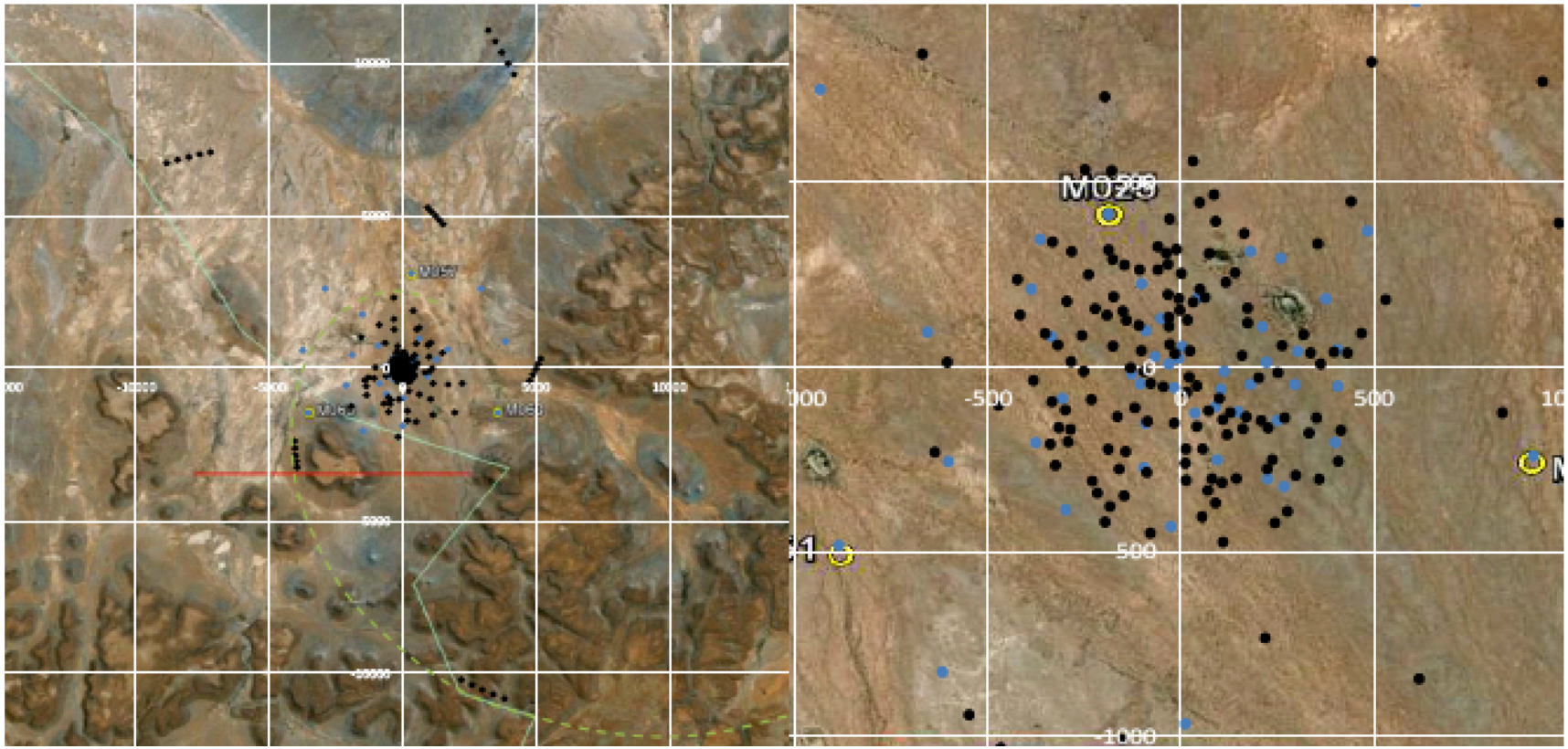
- **Commissioning & Science Verification on AR3 (Jan to June 2017)**
- **Array *"Survey Ready"* July 2017:** Start of Science Programme
- **Conduct currently approved UHF & L-band MeerKAT LSP Science Observations & TBD PI-lead experiments (July 2017 to Dec 2021)**
- Dates for fuller integration of MeerKAT with SKA1-Mid to be negotiated

Commissioning Activities

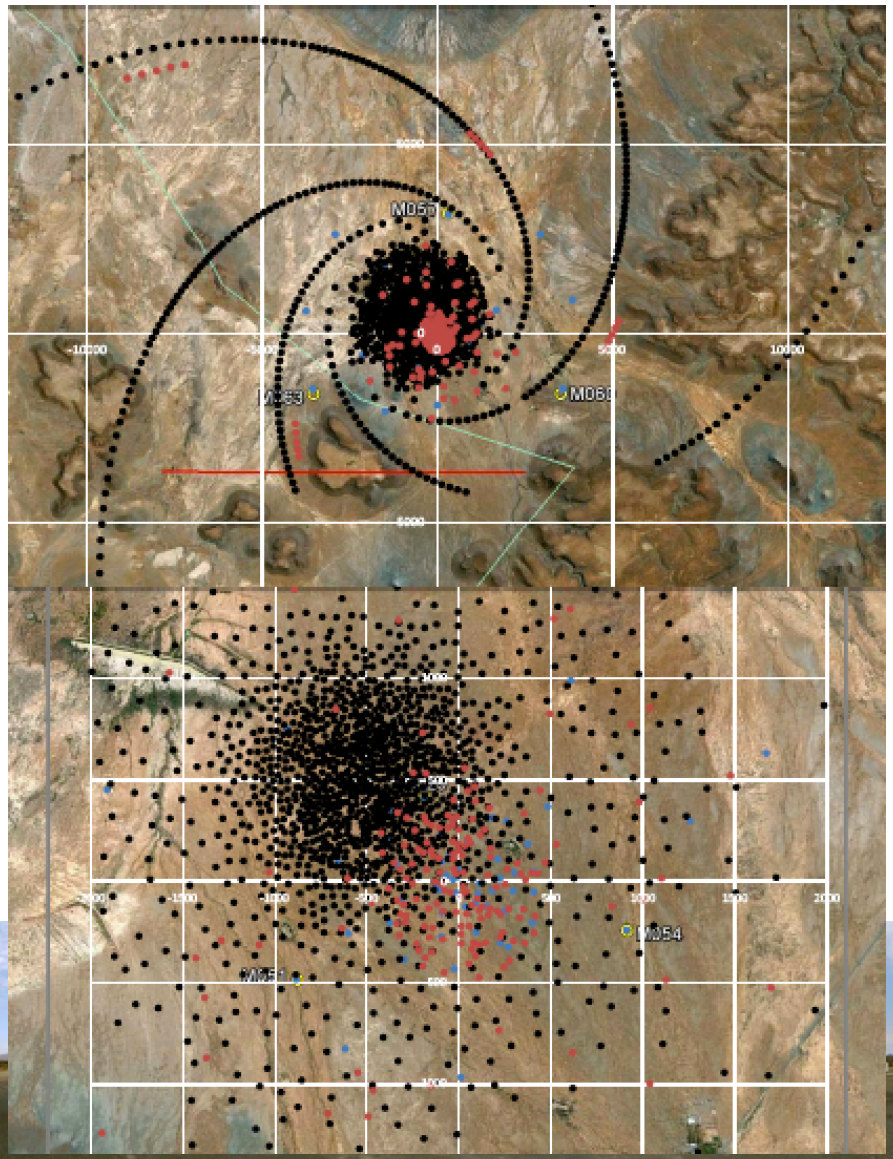
- Commissioning will start in conjunction with the MeerKAT AVI (Assembly, Integration and Verification) team in July 2014 and will continue throughout the roll-out until the array is “survey ready” when it will be handed over to operations during 2017.
- At each stage, once functional operation has been confirmed, science verification will start until the next array release.
- If science verification is met before the next array release, early science on a TAC basis can be performed OR if the array is “survey ready”, the MLSP and any allocated smaller project PI time can start.

NOTE: This reflects current planning. Realities of construction and commissioning may force some changes in the planning.

MeerKAT & SKA$_1$



MeerKAT & SKA$_2$



Summary

- **Important milestones for MeerKAT:**

1. First 2 antennae: April 2014
2. First Receptor Test System: July 2014
3. Science Verification & Early Science: Oct 2015
4. Antennas construction completed: end of 2016
5. MeerKAT Science Verification: Jan to Jun 2017
6. MeerKAT Array “Survey Ready”: Jul 2017
7. MLSP & PIs-lead: Jul 2017 to Dec 2021 + merging with SKA1-Mid

Thank's to Jasper Horrell

Science processing sub-system manager on the MeerKAT project

for the current MeerKAT status as of 6 March 2014

The MeerKAT programme

SKA Science Director (MeerKAT) - JRID46060

Submitted by Square Kilometr... on Wed, 2013-09-25 09:14

Submission Dates

Post Date: October 1, 2013
Archive Date: November 30, 2013
Deadline to Apply for Job: November 19, 2013

Job Details

Job Category: Science Management
Institution/Company Name: Square Kilometre Array South Africa
Institution Classification/Type: Government Agency

Submission Address for Resumes/CVs

Attention To: http://nrfinter.careerjunction.co.za/job

Contact Information For Inquiries About Job

Email Address for Inquiries: natasha@tlabs.ac.za

Related URLs

Related URLs:
Career Junction

Announcement

Job Announcement Text:

SKA Science Director (MeerKAT)

SKA SA seeks to employ a Science Director to manage the scientific programme of the MeerKAT telescope and related projects and the interface and merger with the international SKA science programme. The MeerKAT scientific programme includes a large component of time already allocated to international teams for large surveys, but it is foreseen that there will be calls for further proposals from the community for shorter observing programmes.