



# Mid Annual Status Update Meeting

Ben Lewis



**Welcome to MASUM!**



# MASUM

- MID
- Annual
- Status
- Update
- Meeting



# Introduction and purpose of meeting

- Welcome all to the Mid Annual Status Update Meeting
- This meeting aims to provide an update on the overall status of the SKA-Mid Telescope
- As our first MASUM, we will roughly be covering the period looking back to the start of the pandemic, and looking forward to AA0.5 and beyond
- We have invited speakers from across many of the key business areas to facilitate a broad based update
- Helps to drive alignment in the Mid Telescope teams and beyond!



# Meeting Logistics and safety

- Hybrid meeting with both in-person and remote attendance
- In-person attendees please ensure you're familiar with the layout of the building and SKA HSE policies
- Lunch will be served at 12pm (Tuesday only) for in-person attendees
- Conducted in accordance with the SKA Code of Conduct and the Equality, Diversity and Inclusion policy
- In-person presenters please present via zoom. Sit in the front row for the session with your presentation in it to ease the transitions.



# Presenters

- Meeting is hybrid, so we need to ensure equal participation for all
- We encourage in-person attendees to join the zoom room where possible
- Please raise hands in the zoom window or in the council chamber for questions related to the immediate presentation. The session facilitator will monitor these.
- Questions may be raised in chat: these will be captured and asked at the end of the session. Please avoid back and forth conversations in that chat during a presentation to give the presenter an opportunity to answer the question



# Presenters

- Reminder to presenters to please present from the Council Chamber where possible
- Please allow 5 minutes of your allocated time for questions at the end - if you have concerns with the length of your slot please speak with me in advance



# Mental Health Week

- Once again, as a regular annual event, SKA is taking part in Mental Health Awareness week.
- Loneliness is the theme for Mental Health Awareness Week 2022
- There is so much you can do during the week. Use MASUM as an excuse get in touch with a colleague, a friend, or a neighbour you haven't spoken with in a while.
- Look out for the relaunch of SKA and Friends Pub Hour or Two in Goostrey every Thursday
- Have fun! This is an opportunity to find out all the great progress your colleagues have made during the pandemic



# MID Status



# Purpose of talk

- Set platform for updates by teams
- High Level Schedule
- TDT and PDT Structure

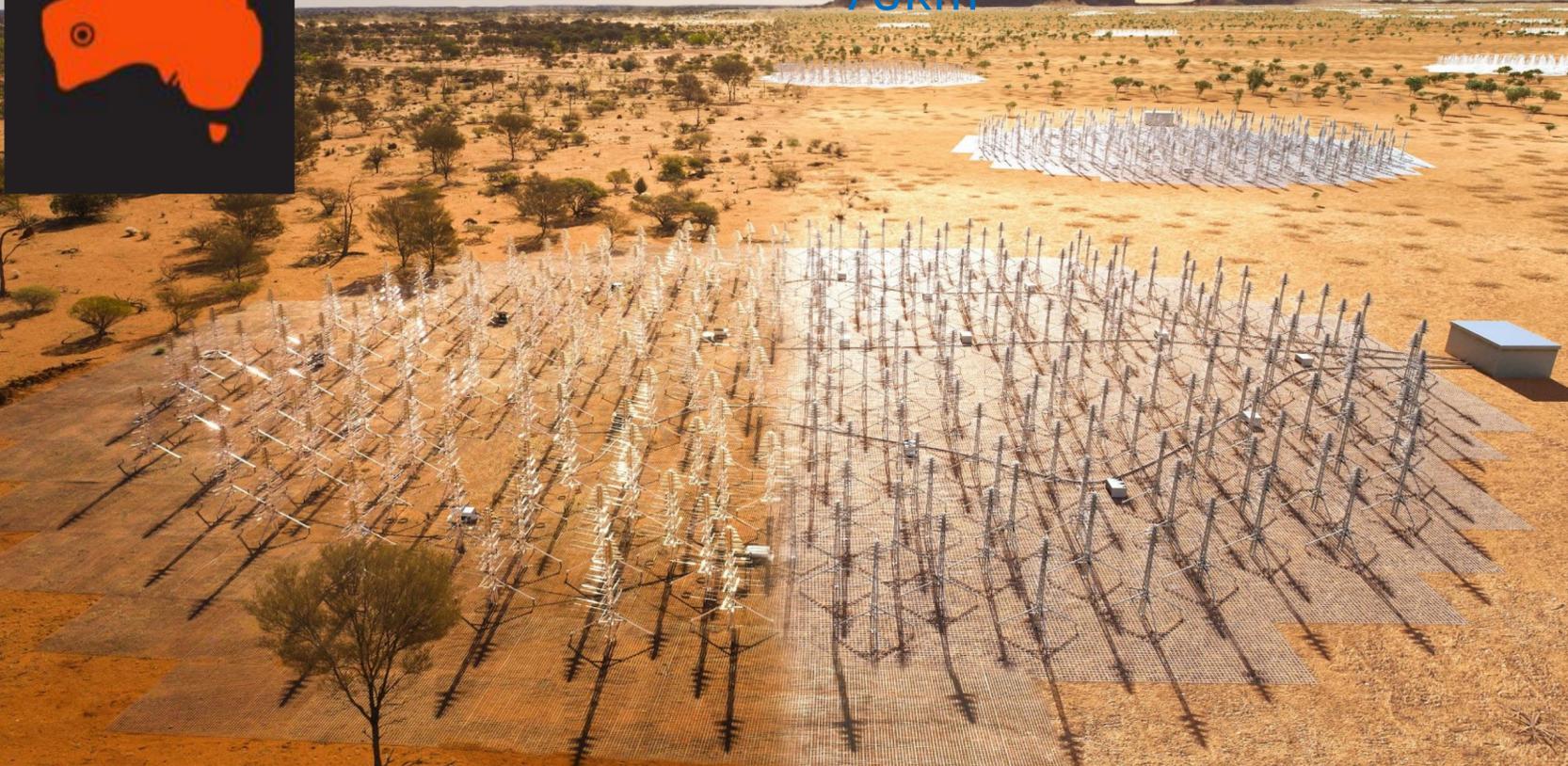


# SKAO

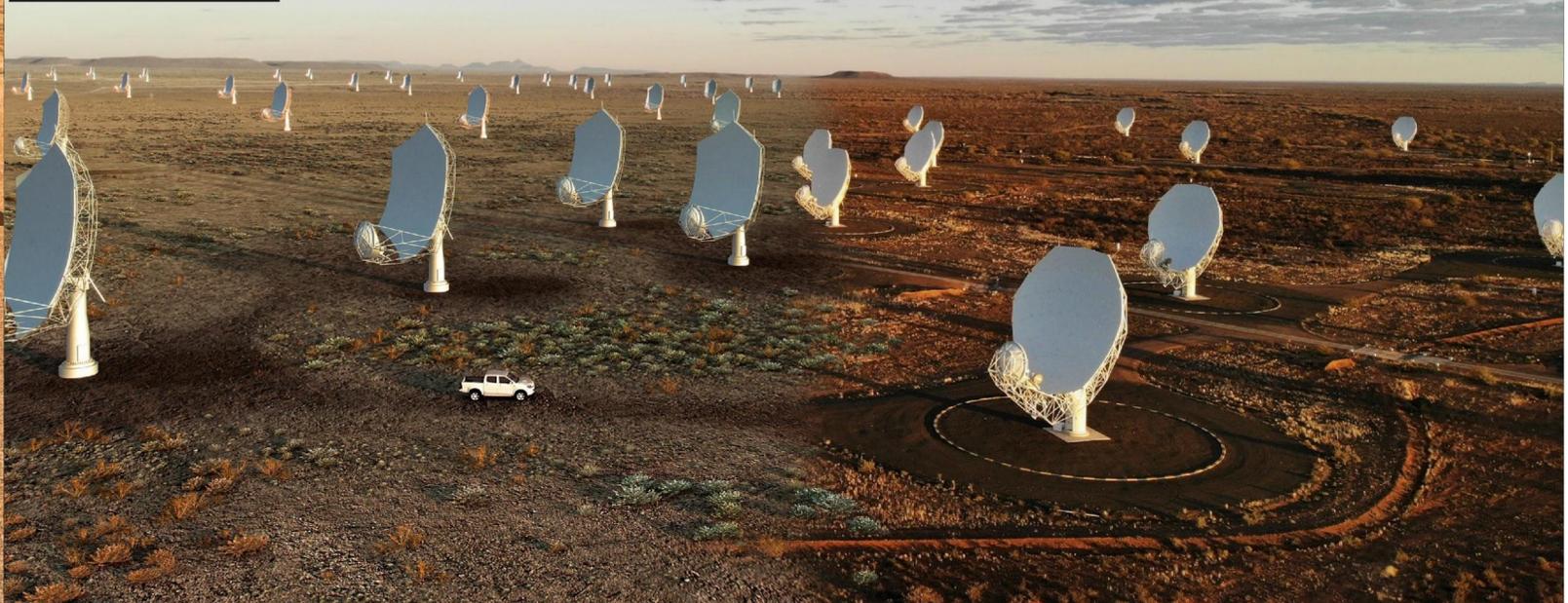
- A global collaboration of 16 countries which is building and will operate the next-generation radio astronomy observatory
- SKA Observatory (SKAO), a new Inter-Governmental Organisation governed by a treaty, born on 4 February 2021.
- Headquartered at Jodrell Bank (nr Manchester) in the United Kingdom
- Will be supported by a global network of SKA Regional Centres providing access to SKAO data
  
- 7-8 year construction schedule. Cost ~€2B (2021 euros) for first 10 years



**SKA-Low: 131,072 antennas spread across 70km**



**SKA-Mid: 197 15m dishes spread across 150km.  
Incorporates South Africa's MeerKAT**



**SKA Phase 2: 2500 dishes across Africa; 1,000,000 antennas across Australia**

# Timeline

- Q1 2019: Treaty signing
- Q1/Q2 2020: Major reviews
- Q3 2020: CP/OEDP endorsed by SKA Org Board
- Q4 2020: SKA Observatory exists, post ratification
  - 1<sup>st</sup> SKA Observatory Council Meeting (February 2021)
- 1<sup>st</sup> May, transition SKA Org  SKAO enacted
- 25<sup>th</sup> June: SKA Observatory Council to approve start of construction
- 1<sup>st</sup> July: Construction activity begins
- Q3 2024/5: Science Commissioning starts, community involved
- 2027/8: SKA1 construction complete

Covid-19

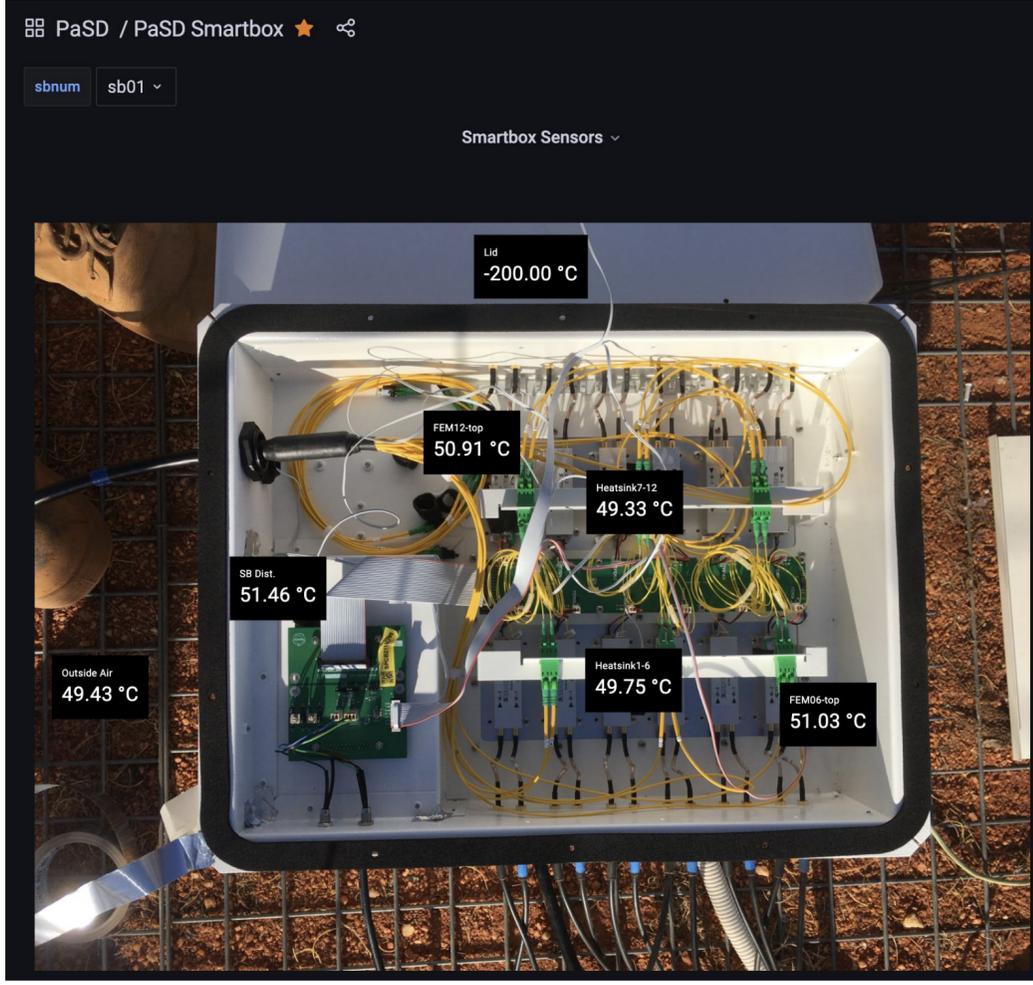


# SKA-Mid prototypes





# Construction Photos



# SKA-Mid - Members/Aspiring Members Represented

- Portugal
- South Africa
- Canada
- China
- France
- Germany (MK+)
- India
- Italy
- Spain
- Sweden

- Switzerland
- United Kingdom
- Australia
- Japan (MID AIV)
- ~~Netherlands~~

South Korea

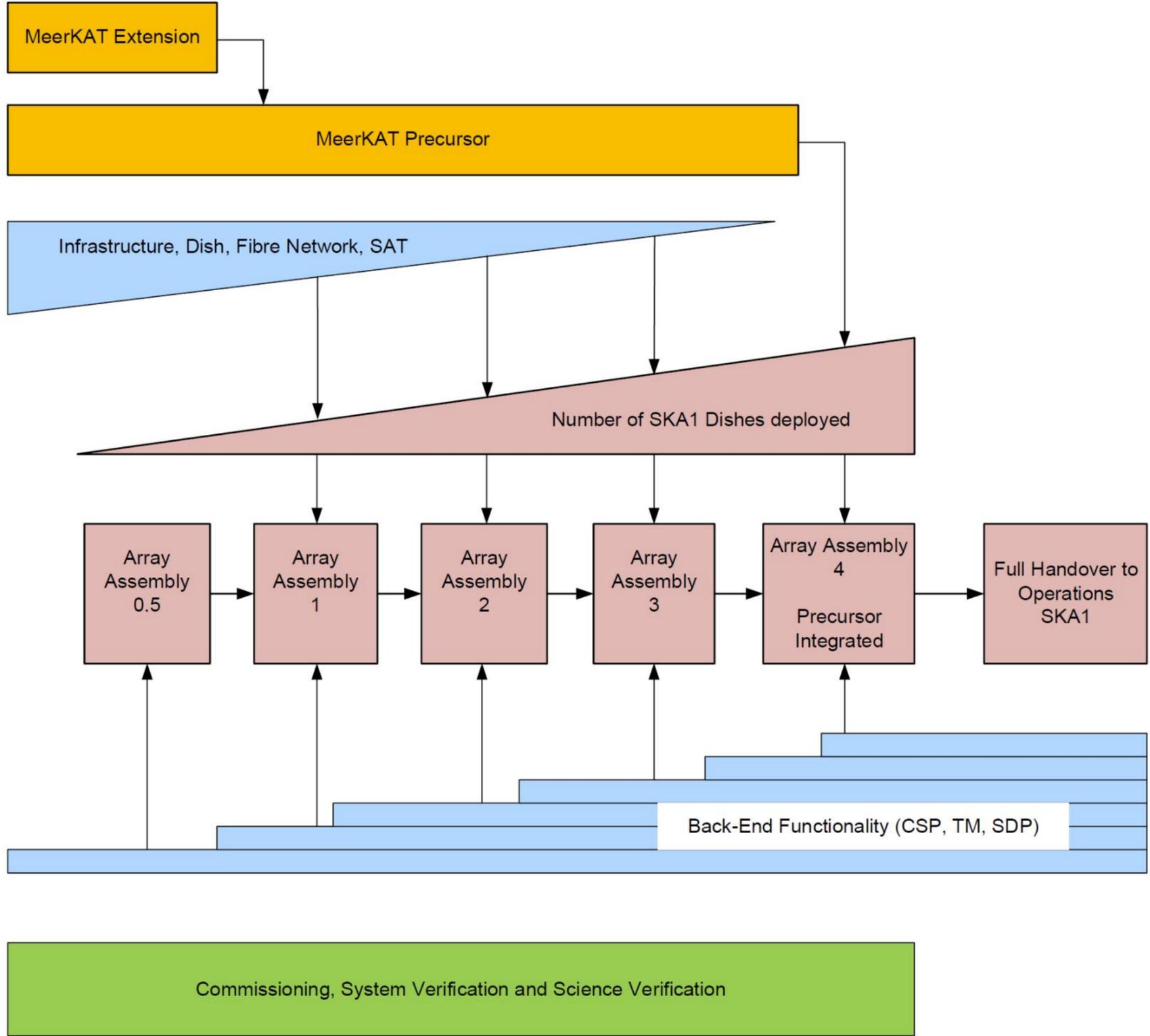


# Level 1 Milestone Update

Milestone Name		P6 Activity ID	Dates in Construction Proposal	Current Snapshot Date
Start of SKA1 construction (T0)		PM1000	01-July-2021	1-July-2021
MID AA0.5	Start	VM3290	Aug-2023	
	Finish	MS1510	Mar-2024	Jun-2024
MID AA1 Finish		MS1520	Feb-2025	Sep-2025
MID AA2 Finish		MS1530	Dec-2025	Jul-2026
MID AA3* Finish		MS1540	Sep-2026	Jun-2027
MID Telescope Operations Readiness Review (MORR of AA3*)		MS1560	Dec-2026	Aug-2027
MID Formal end of construction (incl. contingency)		MS1620	Jul-2028	Jul-2028



# Roll Out Plan



# Staged Delivery

- The purpose of the Staged Delivery ECP is NOT to change the telescope design, but only to constrain the initial contracting of HW and SW to fit the committed funds.
- This aligns roughly with our Array Assembly roll out and so this has been designated as AA\*.



# Staged Delivery

- AA\*: SKA1-Mid in South Africa: 84 (16 by MKwith band 2 feeds, 60+4+4 by SKA1\_Mid) new dishes plus integration of MeerKAT (64 dishes)
- maximum infrastructure baseline lengths 150 km
- receiver bands 1 (x 84), 2 (x 68) and 5 (x 84); 375 pulsar search nodes.



# Staged Delivery

- Compared to the full Design Baseline this represents the initial 60% dishes with the new dish number including 16 MK+ and it represents 75% PSS and PST.
- Baseline lengths for infrastructure and the number of bands are unchanged.
- Full (100%) infrastructure, networks and correlation capabilities are delivered.
- The rollout plan is not expected to change, but will end earlier, without contractual penalty, if there is no additional funding.



# Hot Off the Press - Dish Structure Early Procurement!

- Long lead item review 28th, 29th April
- High residual risk remains on the elevation drive and control system
- Sufficient confidence to proceed with early procurement of four dishes for AA0.5
- Accelerated procurement schedule, aiming to have cash contract awarded to CETC54 in May for a target delivery to site Q2 2023
- Aligned with strategy to deploy dishes to site as early as possible



# Where are we at

- Infrastructure work on site taking place through MK Extension
- PSC's in place, more to come
- Many, many procurements in progress



# Establishing SKAO South Africa

- Staff in South Africa: currently 13, eventually ~140
- [Staff in UK: currently ~140, eventually ~170]
- Facilities in South Africa:
  - Science Operations Centres (Cape Town)
  - Engineering Operations Centre (Klerfontein)



# Challenges



# Staff Challenges

- Pandemic and difficulty of travel
- Cost of living
- IGO Transition
- Staff turnover



# Ongoing improvements

- IPS
- Communication with SAFe/software teams
- Logistics
- Dish Construction
- Monthly report



# Technical Challenge Areas

- Dish Structure
- Band 5 (RXS45 and B5 SPF)
- Software requirements definition
- Dish Construction
- Contract structure and ICD's



# Budget Challenge Areas

- Materials
- Labour
- Dish Construction
- Shipping
- Cash flow



# Schedule Challenge Areas

- Procurement schedule under pressure
- Danger of overloading procurement teams
- Dish Structure delivery
- Band 5 product delivery
- CBF delivery
- AA0.5 software functionality
- Shipping and logistics
- Lead times
- Membership timelines



# Top 5 PO risks

- Uncertainty in Cost Estimate
- Contractor Delay Due to Insufficient Coordination with Other Contractors
- Procurement Phase Duration and Complexity Under-Estimated in Project Schedule
- In-Kind Contributions Are Not Compliant With Technical, Quality Or Programme Requirements
- Low Stations Cannot be Calibrated to Meet Requirements



# Top 5 MID risks

- Qualification of the Dish Prototype and/or Finalization of the Design (CDR) Delayed (Non IP reasons)
- Pre-cursor MK/MK+ Operations and SKA Construction Activities Clash
- Refit of Dish's in AA0.5
- MID: Restart of economy after C19 will increase price of electronic components
- MK+ Dish Structure deviates from SKA design



# TDT and PDT



# What's a TDT?

- The telescope delivery teams are the highest facility-level authority and are responsible for the LOW and MID telescope deliveries.
- The telescope delivery **teams are responsible for the overall delivery of the LOW or MID facilities to the Observatory:**
- leading the product delivery teams to assemble and demonstrate the components and subsystems
- managing the overall system integration
- manage the schedule, budget and risks throughout the construction phase.



# What does that mean though?

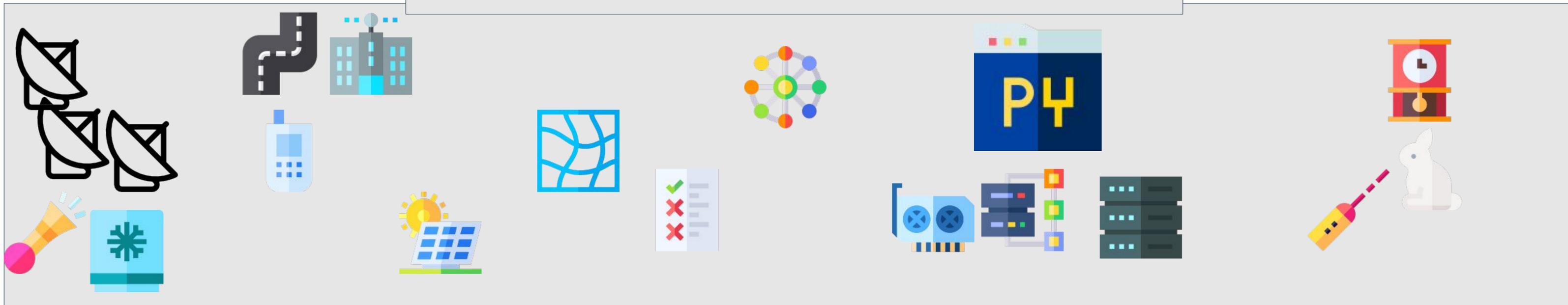
Scientific Community

System Scientists

Operations

SKA MID Telescope

TDT MID





# Who is the MID TDT?

- MID Senior project manager - Ben Lewis
- MID Telescope Engineer - Gerhard Swart
- MID Domain specialist - Songlin Chen
- MID Systems Engineer - Andrea Cremonini
- MID AIV lead Engineer - Peter Hekman
- MID Site construction director - Tracy Cheetham
- Lead product manager (sits on both MID and LOW TDT) - ???
- Lead software architect (sits on both MID and LOW TDT) - Marco Bartolini



# What is a Product Delivery Teams (PDT)?

- A product delivery team is composed of a project manager/domain specialist pair who together have responsibility for managing one or more Tier 1 contracts and/or self-delivery work and are the only individuals authorised to communicate directly with the contractor.
- Each PDT is responsible for the delivery of a number of sub-systems (in relation to the number of contracts the PDT is managing).
- The PDT itself will follow the delivery in accordance with the quality assurance plan as described in the Quality Assurance Process.



# Product Delivery Teams

PDT1	PDT3	PDT4	PDT6	PDT7		
Mid Infrastructure	Dish	Mid Digital	Networks & Computing	Computing and Software		Mid AIV/MKI
MID INFRA	DISH	CSP, SAT	SaDT	SDH&P	OMC	MKI, AIV, ITF
Du Bruyn Jonker	Mark Harman Chang Xia (deputy)	Nontobeko Mnyandu	Jill Hammond	Maurizio Miccolis (PM) Solution Members: Ray Brederode, Ferdl Graser		Peter Hekman
Du Bruyn Jonker Craig Smith (electrical)	Alice Pellegrini Ockert Strydom (mechanical)	B. Alachkar A. Hendre J. Roy Gottlieb van de Merwe (Contract)	Miles Deegan Pete Lewis	Marco Bartolini	Marco Bartolini	A. Cremonini Richard Lord
				Peter Wortmann Ben Mort Aristeidis Noutsos FerdL Graser	Alan Bridger Sonja Vrcic Daniel Espada Snehal Valame	
Mid Infra PSC	Mid Dish PSC	Mid SPFRx (digitiser)	Low Networks	Science Data Handling & Processing	Obs Management & Control	Mid AIV PSC
Mid Infra 1: Foundations, access, power, fibre, security, temp. accomm.	Mid Dish: Dish Structure	Mid CSP	Mid Networks			Mid System ITF
Mid Infra 2: Buildings, power facility, BMS	Mid Band 1	Mid CBF				MeerKAT Integration PSC
Mid Infra 3: RFI, weather, visual, STI monitoring	Mid Band 2	Synchronisation and Timing (joint with PDT5)	Mid CPF Comp.			Mid AIV Software Support
Mid Infra 4: Comms.	Mid Band 5					
Mid Infra 5: PV power and shielding	Mid SPF Services		Mid SPC Comp.			
Mid Infra 6: Eskom sub-station	Mid Cryo		Mid Ops. Comp.			
Mid Infra: surveys, vehicles						



# What have we been doing?

- **Preparing the construction proposal**
- Integrating the designs provided by the pre-construction consortia
- Aligning budgets and schedules to ensure we can deliver the right products at the right time, for the right cost
- Gaining an understanding of the risks facing the deployment of the telescope
- Developing our people for the long term



# And what's next?

- **Build the thing!**
- We need to finalize our designs (primarily dish)
- We need to test our designs
- We need to prepare contracts for companies to detail and then build our designs
- Then award and manage those contracts
- Assemble, integrate, verify everything
- Eventually, one day, hand over to the community for them to do some scientific research

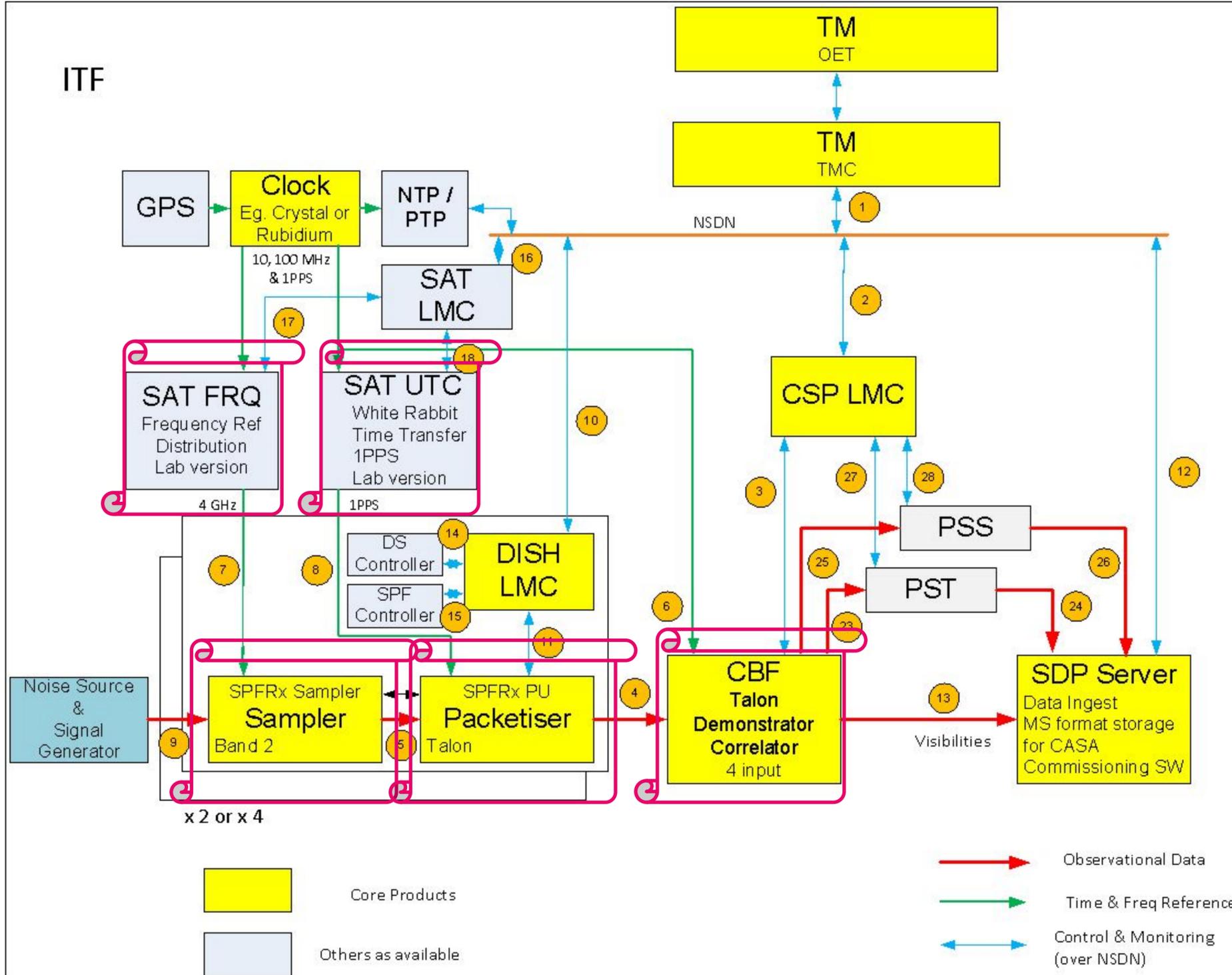


# What do we need to do that?

- **Execute** clear plans for how to contract, build, integrate, commission and operate our observatory
- The right people: SKA employees, people in our SAFe trains, and the right contractors
- A stable, accurate dish design that can be deployed efficiently and at a reasonable cost
- The right Software development processes to build the software to control the telescope systems, and to analyze the data we get out



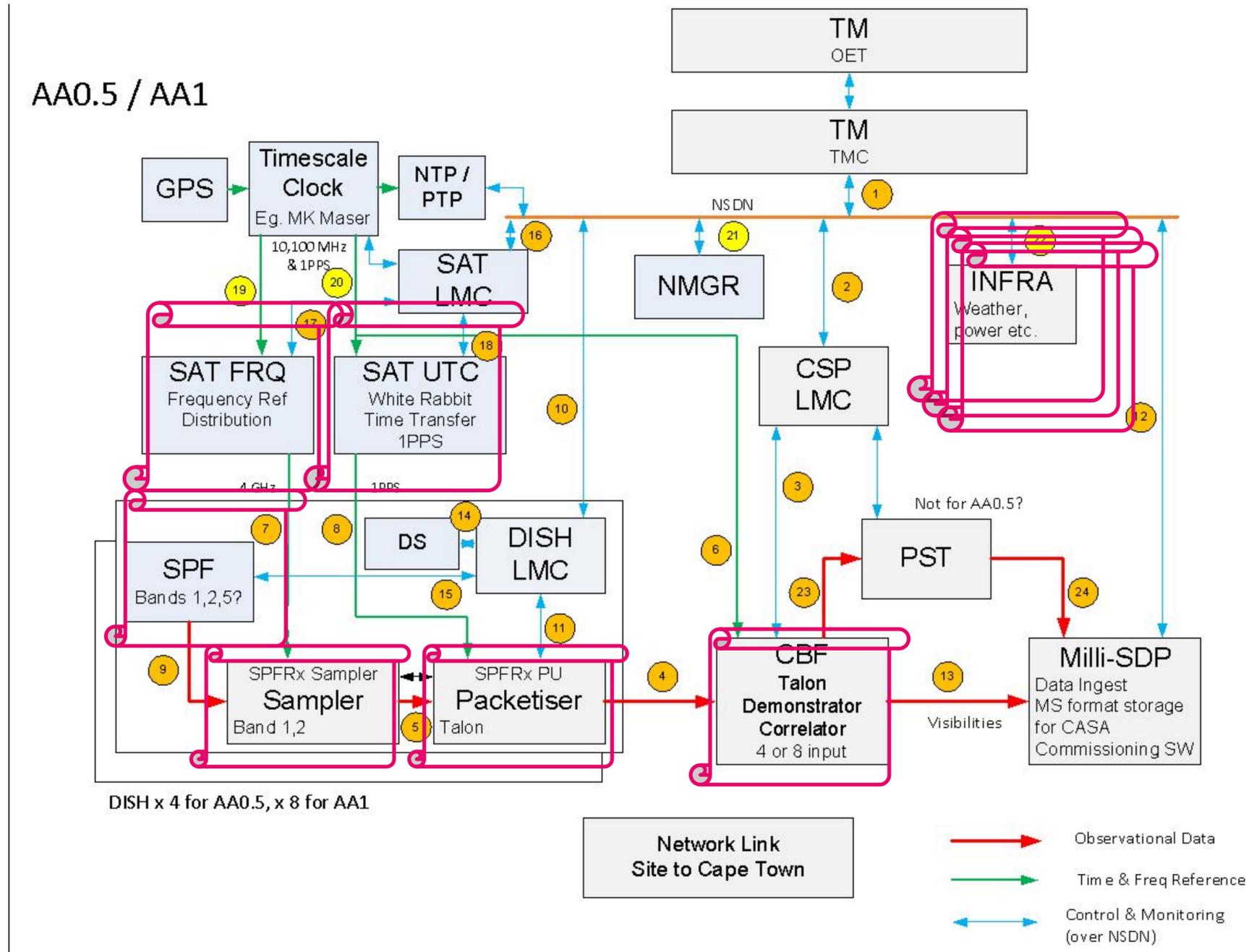
# TDT-Mid Vision - Mid Telescope - ITF



- ITF Qualification Event Start - Q1 2023
- Needs:
- 5 Products from ECC contracts
- Three LMC MVP's
- TM, SDP functionality
- Plus test equipment, simulators, emulators
- All in less than a year from now!



# TDT-Mid Vision - Mid Telescope - AA0.5



- AA0.5 - Q4 2023
- Needs:
- All of the same products as ITF, PLUS:
- Infrastructure (trenches, roads, foundations, fibre, power - many ECC's!)
- Dish structure, Band 1 feed, SPF Services, Cryo, indexer, sub-reflector etc etc



# SKA1\_Mid Roadmap - Top Goals - Finalizing the design

- **Dish Structure CDR and AA0.5**
- Dish Element CDR
- SPFRx (digitiser) CDR, including integration with the frequency distribution system (SAT.FRQ)
- System performance analysis
- Software and Computing



# SKA1\_Mid Roadmap - Top Goals

- Dish Structure is the KEY RISK for the Mid telescope deployment at this time. We need to focus efforts and capacity on testing and finalisation of the design
- AA0.5 is a key risk reduction activity for all systems, but particularly the dish structure and surface
- We want to conduct interferometric holography, at high frequency, as soon as possible
- Where products for AA0.5 are lagging, we need to take actions to ensure they arrive on time



# SKA1\_Mid Roadmap - Contracting - Why the rush?

- MID ITF Starts in Q1 2023 - needs products
- First SKA dish arrives on site - Q2 2023 - needs roads, foundations, fibres, power
- A full contract pack takes a Product Delivery Team (as well as ops, system engineering etc) ~3 months to prepare
- Technical document preparation - requirements, reference design
- Contract awarded up to 6 months from when contract is ready for tender: internal review, pre-qualification and tender periods, tender evaluation, negotiation, approval from SKAO Finance Committee

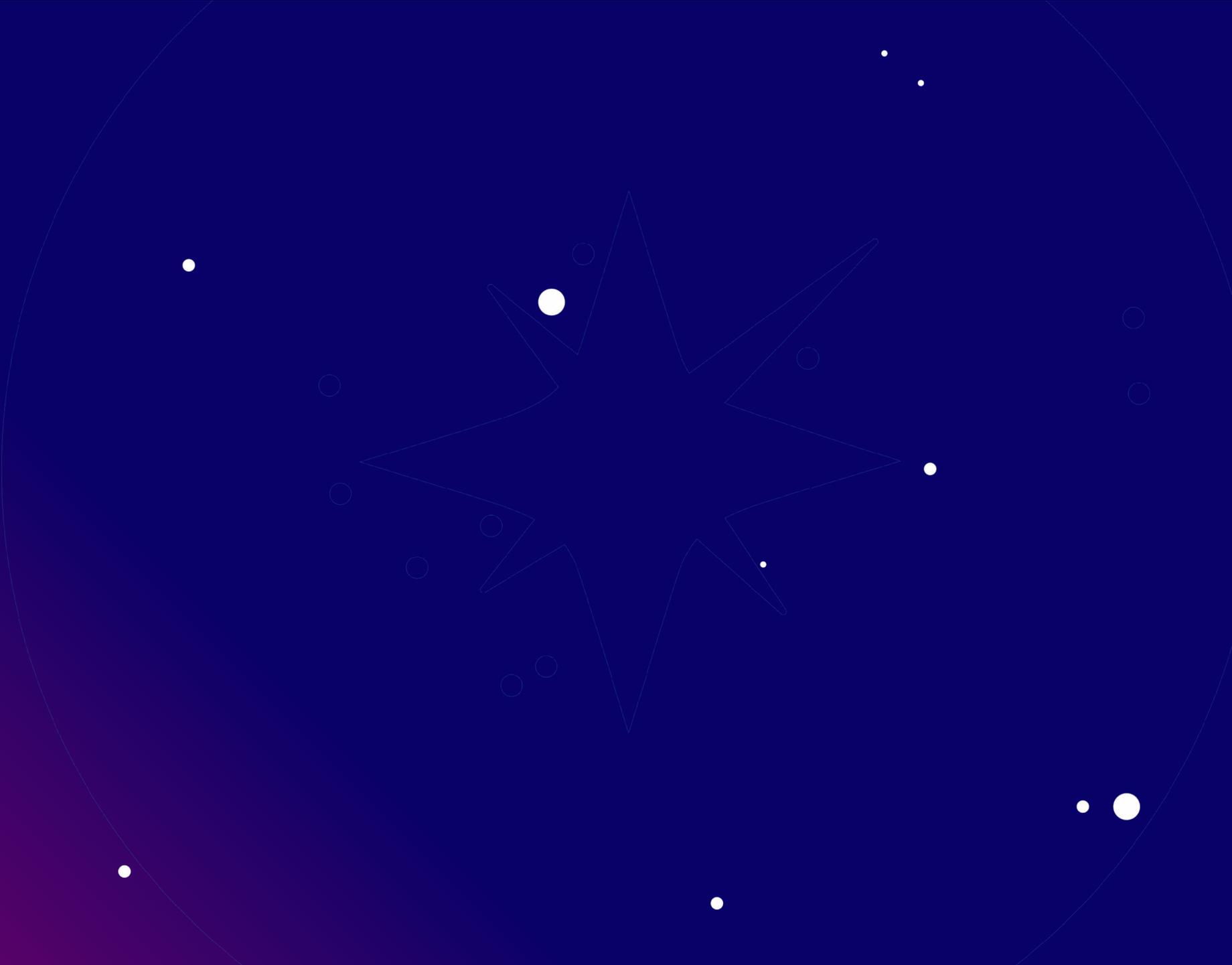


# Summary

- Big year coming up
- Building on a foundation set by Consortia, System CDR and CP approval



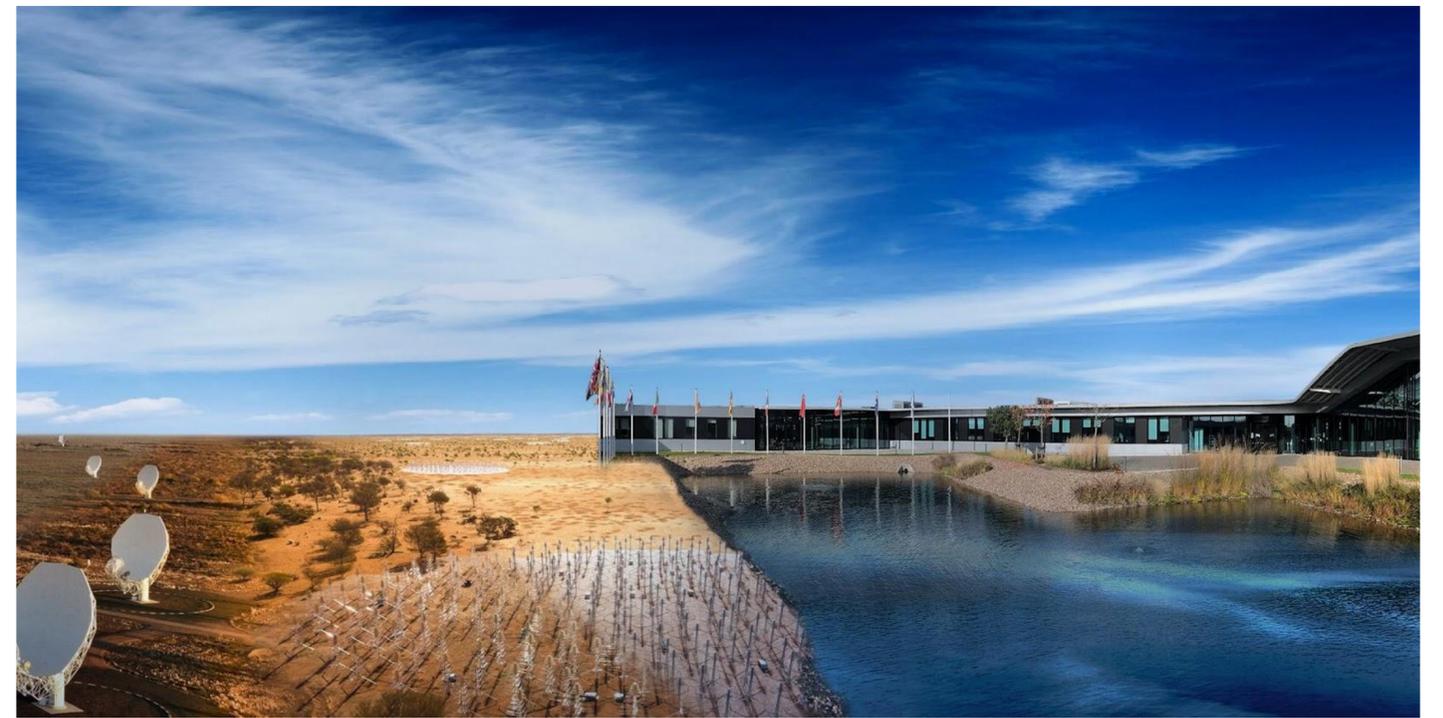
**SKAO**





# Slide title

- Body Level One
- Body Level Two
- Body Level Three
  - Body Level Four
    - Body Level Five





- Body Level One
- Body Level Two
- Body Level Three
  - Body Level Four
    - Body Level Five



*We recognise and acknowledge the  
Indigenous peoples and cultures that have  
traditionally lived on the lands on which  
our facilities are located.*

**SKAO**

[www.skao.int](http://www.skao.int)