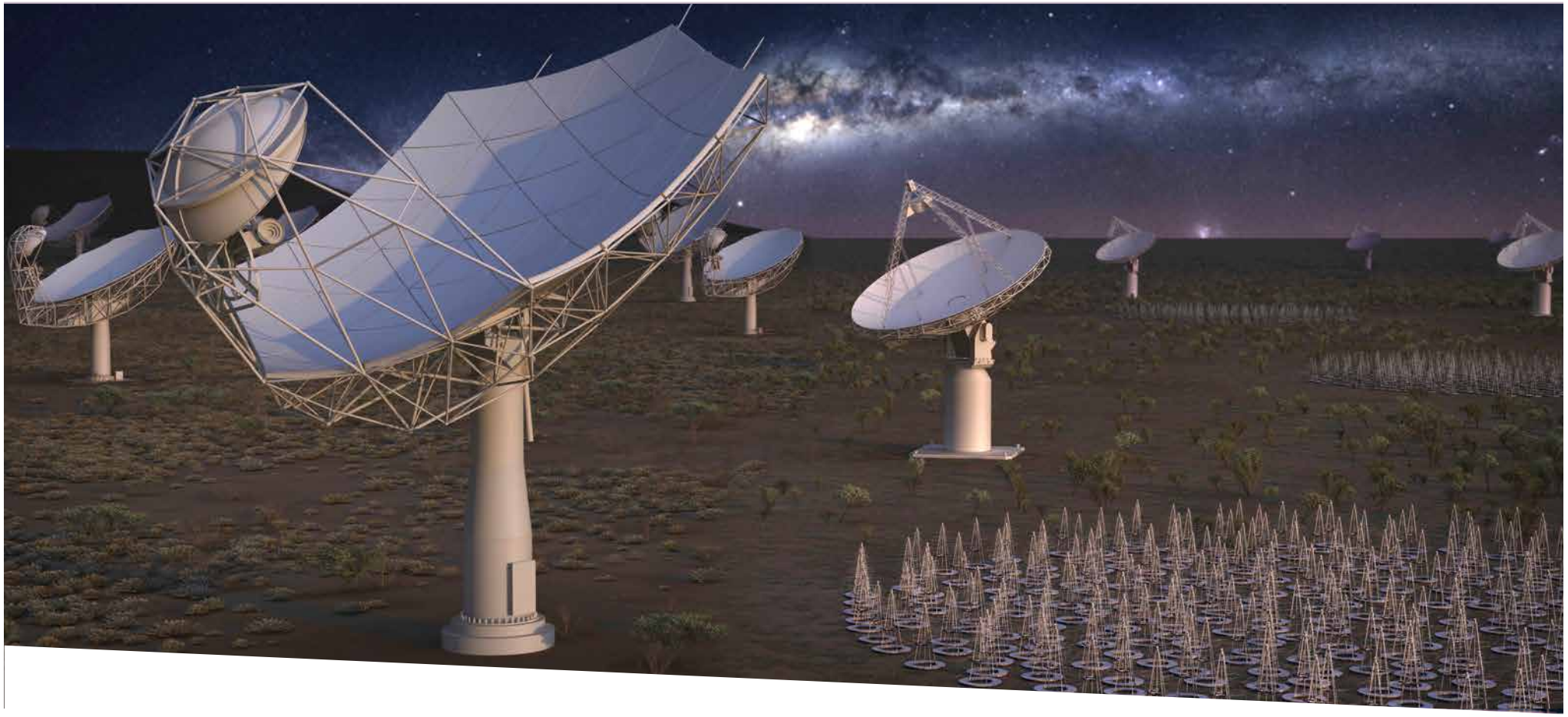
SKA SWG Update



SQUARE KILOMETRE ARRAY

Exploring the Universe with the world's largest radio telescope

Robert Braun, Science Director

14 February 2017

SKA1 Cost Control Action Plan

Ref	Work stream	Potential Outcome
1	**Review precursors and pathfinders**	Options that could be carried over
2	**Review alternative antenna designs** against SKA1 science requirements	Align on an effective design within budget
3	**Review Operating Model** for potential cost savings	Test assumptions against cost
4	**Review and critically evaluate Consortium cost estimates.**	Identify areas of highest potential impact for cost reduction.
5	**Review Identified Cost Reduction Options**.	Develop suggestions with most relevant savings
6	**Carry out review of requirements** to ensure there are no over-egged requirements that drive costs higher.	Reduce requirements on solution
7	**Carry out review of designs** to identify where over designed and relaxing design to specification can save budget	Remove any gold-plating
8	**Explore SDP Savings** taking into account roll-out of science cases	Resolution Team

CCP – Work Stream 1.7

Work Stream 1.7 Mid Paper from SKA SA

SKA SA propose for SKA1 Mid (January 2017 paper):

133 SKA1 dishes + 64 MeerKAT dishes
SKA1 SPF Bands 1,2,5 (Band 5 only available on SKA1 dishes)
MeerKAT digitizers Bands 1,2,5
CSP PSS and PST are SKA1, but 750 PSS beams (1500 specified)
MeerKAT timing solution **does not** appear to meet L1 requirements for precision pulsar timing and this is reflected in the assessment below.
MeerKAT frequency distribution system **must be redesigned** for use beyond 12km. Although it will be assumed to ultimately meet L1 requirements, this is unproven.
CSP CBF is a scaled up version of MeerKAT
Bandwidth Band 5 is 1 x 2 GHz (2 x 2.5 GHz specified)
Bandwidth Band 1 is 550 MHz (700 MHz specified)
Transient buffer may be limited (not fully specified TBD)
Channelisation is preserved (65k channels, zoom windows similar to L1 requirements)

CCP – Work Stream

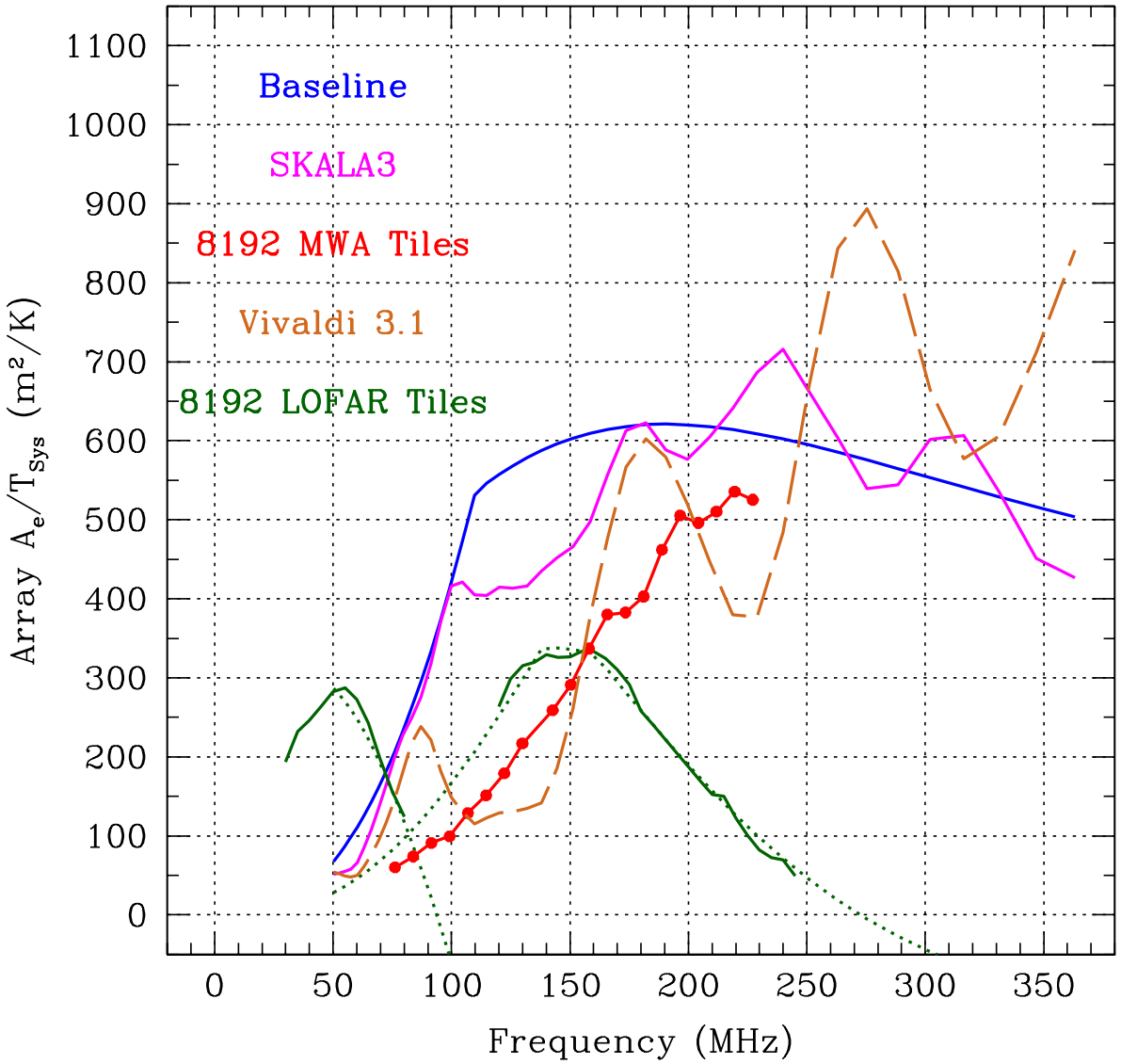
Science Impact Analysis – Overall assessment of complete proposal

Scoring Table (Baseline score is 100)

HPSO	Telescope	Band(s)	Bmax (km)	Viable?
1 EoR Imaging	Low	50-200 MHz	65	1
2 EoR Power Spectrum	Low	50-200 MHz	core/65	1
4 Pulsar search	Low/Mid	150-350 MHz + SPF1 + SPF2	core	0.5
5 Pulsar Timing	Low/Mid	150-350 MHz + SPF2	10	0
13 HI high Z	Mid	SPF1	45	1
14 HI low Z	Mid	SPF2	25	1
15 HI Galaxy	Mid	SPF2	25	1
18 Transients (FRBs)	Mid	SPF1	100	0.5
22 Planetary Disks	Mid	SPF5	150	0.5
27 RM grid	Mid	SPF2	50	1
32 Intensity Mapping	Mid	SPF1	AC	1
33 ISW	Mid	SPF2	50	1
37/38 SFHU	Mid	SPF2 + SPF5	150	0.75
				79

Table Notes:
Can do = 1
Cannot do = 0
Can partially do = 0.5

Alternate Antenna Technologies for SKA1-Low



CCP – Work Stream 1.8

Work stream 1.8.1: LOW proposal from Australia using MWA antenna
Analogue beam formation of groups of 16 antennas
Reduction of B_{Max} to 49km
Reduction of processed bandwidth to 200 MHz

Scoring Table (Baseline score is 100)

HPSO	Telescope	Band(s)	Bmax (km)	Viable?
1 EoR Imaging	Low	50-200 MHz	65	0
2 EoR Power Spectrum	Low	50-200 MHz	core/65	0
4 Pulsar search	Low/Mid	150-350 MHz + SPF1 + SPF2	core	0.5
5 Pulsar Timing	Low/Mid	150-350 MHz + SPF2	10	0.5
13 HI high Z	Mid	SPF1	45	1
14 HI low Z	Mid	SPF2	25	1
15 HI Galaxy	Mid	SPF2	25	1
18 Transients (FRBs)	Mid	SPF1	100	1
22 Planetary Disks	Mid	SPF5	150	1
27 RM grid	Mid	SPF2	50	1
32 Intensity Mapping	Mid	SPF1	AC	1
33 ISW	Mid	SPF2	50	1
37/38 SFHU	Mid	SPF2 + SPF5	150	1
				77

Table Notes:

Can do = 1
Cannot do = 0
Can partially do = 0.5

CCP – Science Scoring

	A	B	O	P	Q
1	Please Read Definitions Sheet for Guidance to Complet				
2	Ref	Name of Cost Reduction Option	Science Score	Science Impact Notes	Ability to Recoup current baseline science capability
3			100 = Baseline delivery of HPSO package in constrained time frame.	Color coding: Green - no impact Amber - partial HPSO loss Red - complete HPSO loss _ HPSOs impacted, and how	
12	5.5	Options for delaying feeds in SKA-MID			
13		5.51 Delay Band 1	71	Lose 13,18,32. Partially lose 4	Possible recovery if Band 1 deployed within 2 years
14		5.52 Delay Band 5	88	Lose 22. Partially lose 37/38	Possible recovery if Band 5 deployed within 2 years
15		5.53 Delay Band 2	56	Lose 14,15,27,33. Partially lose 4,5,37/38	Impossible in the 5 year science impact window
16		5.54 Delay Bands 1 & 5	63	Lose 13,18,22,32. Partially lose 4,5,37/38	Maybe if Band 1 & 5 deployed within 2 years (TBD)
17	5.6	Stage Band 5 bandwidth deployment for Mid.CBF	94	Partially lose 22, 37/38	Possible recovery if full processed bandwidth available within 2 years
18	5.7	Eliminate or reduce sub arraying		Partial loss of 4,5.	Possible recovery with restricted sub-array definition.
19	5.8	Fewer stations with larger diameter for Low	77	Loss of 1,2. Partial loss of 4,5.	
10	5.9	Early Integration of MeerKAT	100	No science impact	
11	5.10	3 by 3 systolic array in Mid.CBF	100	Low impact (relies on all SKA dishes)	
12	5.11	Use one FPGA family across the board			
13	5.12	Reduce F-Part complexity for Mid.CBF	100		
14	5.13	Reduce processed bandwidth	88 - 94	Partial loss of 1,2,22,38.	Recovery possible with increase of processed bandwidth.
15	5.14	Reduce spares delivered for SaDT			
16	5.15	Standardise software tools for TM			
17	5.16	Merge work packages for TM			
18	5.17	Correlators			
19	5.18	Relocating Pulsar Search	100		
10	5.19	SA Timing Options	92	Loss of 5	Timing must meet specification.
11	5.2	LFAA deployment			

CCP Process w.r.t Capability Reductions

5 Capability Reductions

The SKA Board have mandated that the current Cost Control Project is intended to preserve, to the largest extent possible, the transformational science capabilities of SKA1. The science impact analysis described above will be presented to the SEAC for their review during the Pisa face-to-face meeting in March. In the event that one or more of the HPSOs are deemed by the SEAC to be significantly negatively impacted by a package of measures being considered for recommendation, then the following additional steps would be undertaken. The process described is similar to that undertaken for Re-Baselining.

5.1 Science Assessment Workshops – Community Consultation

A workshop would be scheduled in April/May 2017 to bring together a group of independent representative experts within each science area that is deemed to be negatively impacted, to critically consider the proposed change of capability and provide a detailed assessment of continued scientific viability within the context of such a change. A written report to the SKAO would summarise the findings of each assessment workshop.

5.2 Science Review Panel Consultation

In the event that multiple science areas are negatively impacted by the package of changes being considered, then the "ad hoc" Science Review Panel would be reconvened in early June 2017 and asked to consider the overall trade-off of priorities between the science areas in question. They would make use of the reports provided by the Science Assessment Workshops and provide a written report that recommends the relative priority that should be considered for each area.

5.3 SEAC Consultation

The complete set of assessment workshop reports and potential SRP report would be provided to and discussed in detail with the SEAC, to allow a suitable recommendation to be formulated for the July 2017 Board meeting.

EWASS17, URSI-GA17, IAU-GA18

- EWASS-2017, Prague, 26 & 27 June
  - "Scientific Synergies enabled by the SKA, CTA and Athena" (Organisers: Andrea Possenti & Evan Keane, Xavier Barcons, Emma de Ona)
  - Six sessions of 1.5h
    - Athena – Other
    - CTA – Other
    - SKA – Radio
    - SKA – mm/sub-mm,IR
    - SKA – Optical, X-ray
    - SKA – Other (GW, particles,…)

EWASS17, URSI-GA17, IAU-GA18

- URSI-GA-2017, Montreal, 19 – 26 August
  - "The SKA and its pre-cursors" (Organisers: Bock, Jonas & Braun)
  - Seven "technical" talks in two sessions

EWASS17, URSI-GA17, IAU-GA18

- IAU-GA-2018, Vienna Symposium Proposal
  - "Science with the SKA Precursors and Prospects for the SKA" (Organisers: Bock, Camilo, Wayth, Parsons, Braun)
  - Eight science (rather than facility)-based sessions
    - Session 1: Probing the origins of life
    - Session 2: Understanding the Sun and the heliosphere
    - Session 3: Testing general relativity
    - Session 4: The cycle of matter in our Galaxy
    - Session 5: Elucidating galaxy evolution
    - Session 6: Constraining theories of dark energy and structure formation
    - Session 7: Witnessing cosmic dawn and the epoch of re-ionisation
    - Session 8: New insights into transient events

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