Summary of costs

Cost estimates for the SKA

- A costing strategy has been developed by the SPDO in consultation with participating institutions:
  - R. McCool, MGT-040.070.000-MP-001RevC
- *The costing strategy described in this document is based on two simple principles:*
  - That cost estimation will be an ongoing and iterative process throughout the design, development and build stages of the SKA.
  - That the confidence levels attributed to cost estimates are predicated on both the maturity of the SKA design and the substantiating evidence in support of the cost estimate.
- The costing strategy also states that cost estimates '…will include hardware costs, associated software costs and operational costs'.

Cost estimates for the CoDRs and beyond

- The SKA System Engineering Management Plan calls for the CoDR documentation to include first draft cost estimates for the options being reviewed.
- It is expected that cost estimates will be revised over time and that accuracy and confidence levels will increase as technology matures.
- Ultimately the SKA will need the best possible cost estimates to enable the process of technology selection and the optimization of the system design.

Dish cost estimates in the CoDR documentation

- Cost estimates for dishes have been provided by DRAO/TDP and NAOC/JLRAT (2 options).
- ASTRON provided cost estimates for an integrated reflector structure and a feed support structure.
- NRF were unable to provide costs for their option owing to commercial restrictions.

Dish cost estimates

Cost estimates for 15 m offset Gregorian dishes for the SKA						
quantity basis	600	3000	1 - 250	1 - 250	251 - 3000	251 - 3000
concept	DVA1	DVA1	DVAC1 aluminium	DVAC1 carbon fibre	DVAC1 aluminium	DVAC1 carbon fibre
estimator	DRAO/TDP	DRAO/TDP	NAOC/JLRAT	NAOC/JLRAT	NAOC/JLRAT	NAOC/JLRAT
total cost €	€ 201,557	€ 185,432	€ 198,000	€ 207,000	€ 191,000	€ 199,000
reflector cost €	€ 69,775	€ 64,193	€ 75,000	€ 85,000	€ 73,000	€ 82,000

Cost estimates for 15 m axi-symmetric dishes for the SKA						
quantity basis	1 - 250	1 - 250	251 - 3000	251 - 3000	?	?
concept	DVAC2 aluminium	DVAC2 carbon fibre	DVAC2 aluminium	DVAC2 carbon fibre	Thermoplastic axi-symmetric	Thermoplastic axi-symmetric (future)
estimator	NAOC/JLRAT	NAOC/JLRAT	NAOC/JLRAT	NAOC/JLRAT	ASTRON	ASTRON
total cost €	€ 211,000	€ 220,000	€ 202,000	€ 210,000		
reflector cost €	€ 65,000	€ 75,000	€ 63,000	€ 72,000	€ 106,000	€ 84,800

Dish cost estimates: cost of ownership

- Cost estimates on the previous slide are capital costs, and do not include maintenance/operating costs. It will be essential to estimate the total cost of ownership for dish options that are further developed in the PEP phase of the SKA.
- Accurate estimates of dish cost of ownership will be needed in order to optimise the overall SKA system design.

Single pixel feed payload cost estimates

- No cost estimates were provided in advance of the review.
- As noted previously the capital cost of SPF feed payloads is expected to be small compared to dish costs. However, the cost of ownership of SPF feeds that include cryogenics will be a significant part of the SKA system costs.
- SPF feed cost of ownership estimates must be given high priority in the PEP phase, as they are an important input to the SKA system design process.

Phase Array Feed cost estimates

- Cost estimates have been produced for a 2014 build of PAFs using RF over fibre for SKA1.
- These are based on an exchange rate of 1 AUD = 0.75 €
- Total 2014 PAF cost excluding contingency = €176,550
- Projected 2014 costs for ASTRON APERTIF type PAFs = €225,300
- Current ASKAP RFoF PAF costs are estimated at €292,350
- The cost breakdown for the 2014 SKA1 PAF is on the next slide

PAF cost breakdown

mechanical, structure	€ 21,000
Feed element, LNA, filters and amplifiers	€ 49,500
RFoF links	€ 22,500
ADC & signal condition	€ 28,500
Coarse filterbank	€ 3,000
ADC/filterbank boards	€ 3,750
Cross connect	€ 4,800
Beamformer (boards and FPGAs)	€ 36,000
Other infrastructure	€ 7,500
Total	€ 176,550
Contingency	€ 26,400
Total including contingency	€ 202,950

Other PAF cost estimates

- Cost estimates on the previous two slides are based on 200 antenna elements per PAF. If this were reduced to 100 elements the cost is expected to reduce to €106,000 - €124,000
- Further cost reductions are envisaged beyond 2014. Best current estimates for 2016/7 costs are €100,00 - €135,000 for 200 elements and €78,000 - €93,000 for 100 elements.

PAF operation and maintenance costs

- Capital cost estimates have been produced for the PAF hardware.
- It will be vital in to obtain good estimates of operating and maintenance cost for PAFs during the PEP phase of the SKA. They will be important inputs to the SKA design process.

Impact of Dish Array costs on system costs

- In order to optimise the SKA system design it will be necessary not only to know the cost of ownership of individual sub systems, but also the cost implications of deploying those subsystems in the SKA.
- Examples include the need for physical infrastructure (roads, buildings, foundations etc.), signal transport, signal processing, computing and power.
- Extensive cost modelling will be required, as described in the SKA costing strategy.

End