Dish Verification Program

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SPDO

The role of the SKA Program Development Office

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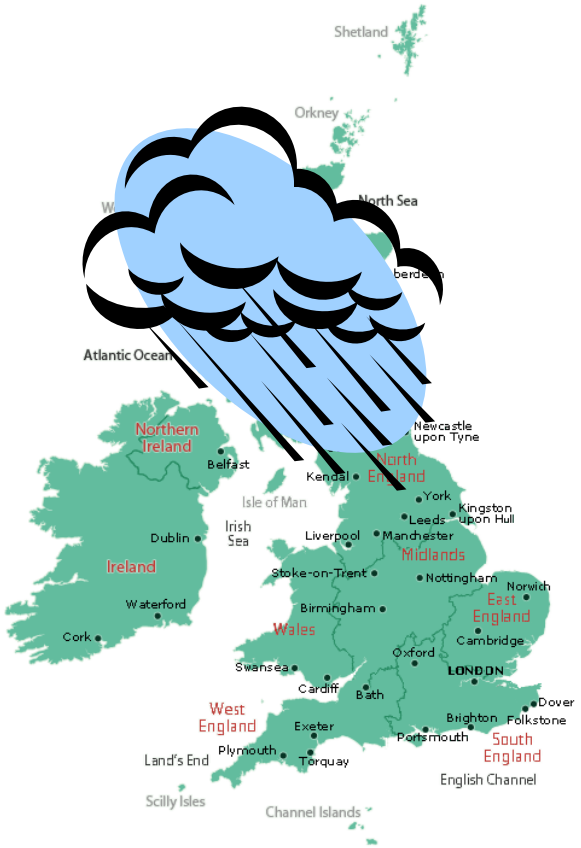
- Produce a costed system design for the Square Kilometre Array
- Develop a deployment plan



Aims of the Verification Programs

- *Costed system design*
- Engineering feedback to the Design Reference Mission
- Deliver the best science per €

Aperture Array Verification Program (AAVP)

Dish Verification Program (DVP)

System Engineering

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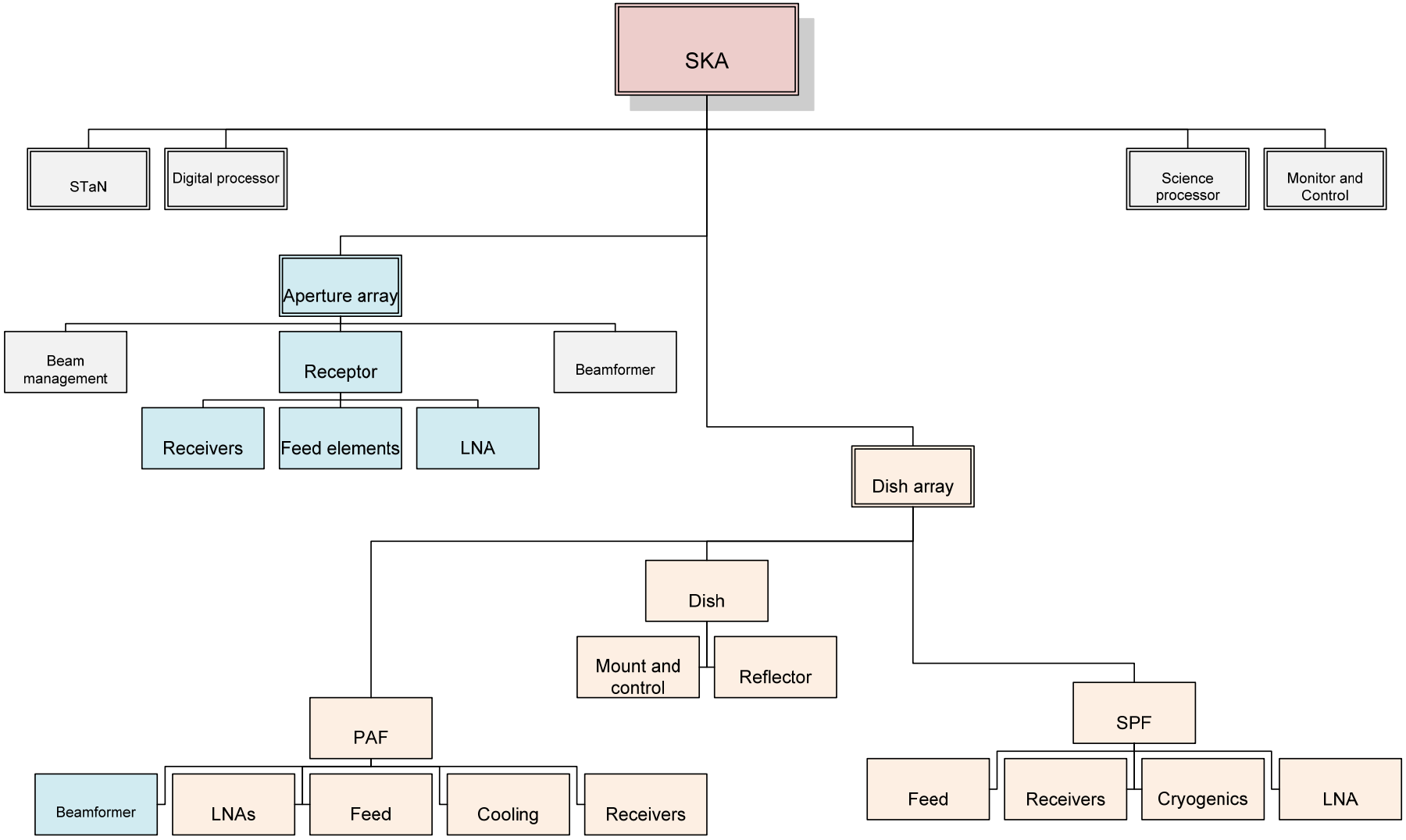

Dish Verification Program: joint program of SPDO/TDP

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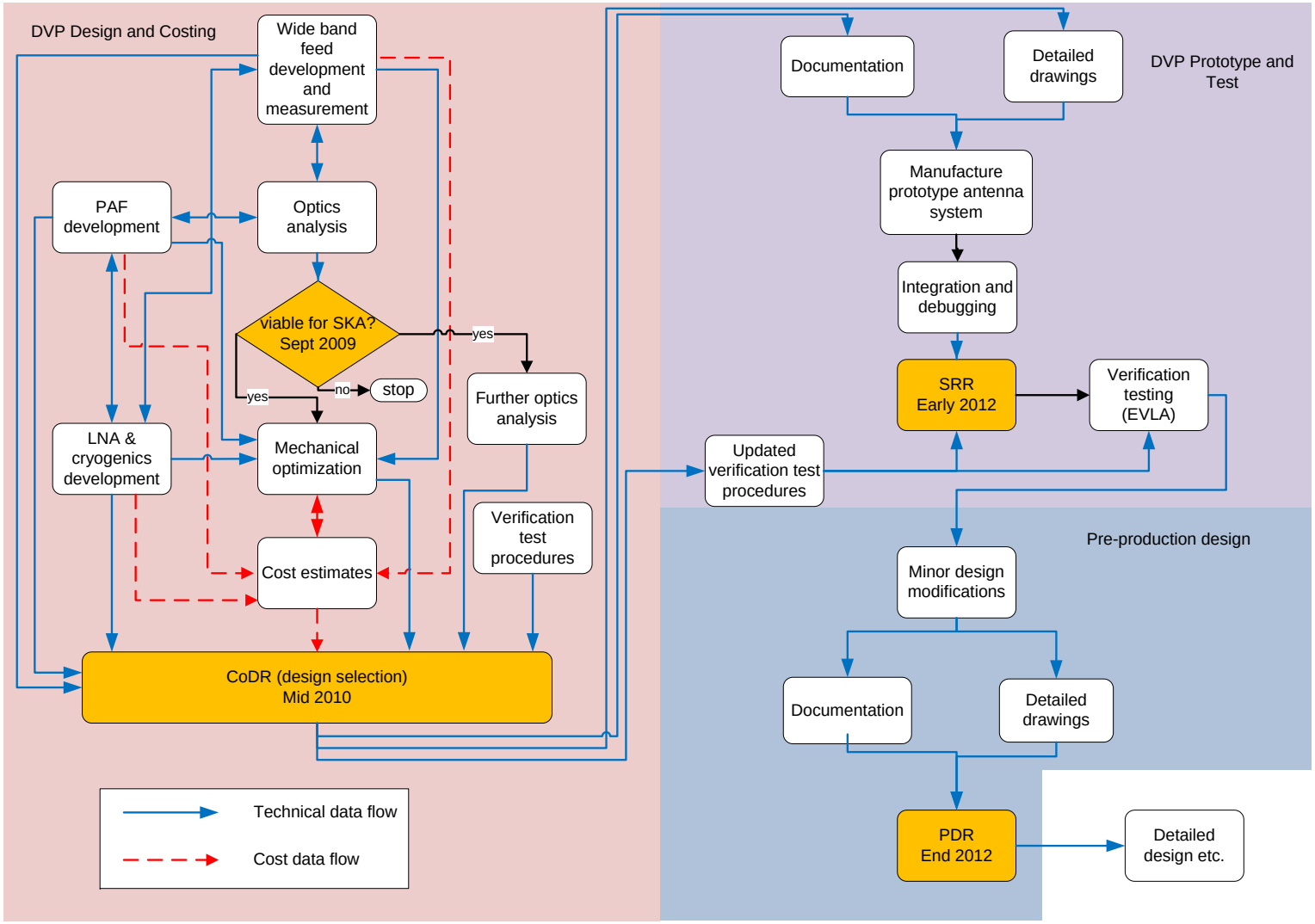

Dish Development

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Lessons from the Precursors: ASKAP and MeerKAT

- Infrastructure
- Installation
- Integration
- Industrialization
- Commissioning
- Environmental
- Operation and maintenance

SKA dish antenna: provisional characteristics

- Offset Gregorian optics (TDP design)
- Frequency range 1 (0.3) to 10 GHz
- Aperture efficiency > 60 % above 1 GHz
- Antenna noise temperature < 10 K
- Pointing stability < 1 % at half-power point (1.4 GHz)
- Lifetime 30 years minimum
- Maintenance interval 1 year minimum (target 5 years)
- Fast on-site assembly with minimal personnel and tools

Verification Dish(es)

- Design to be as close as possible to the final SKA dish design
  - Best possible assessment of real performance, especially dynamic range
  - Best possible estimate of cost
- But: this/these will be the first of a series of converging prototypes
- Allow for SPFs and PAF

Dish Verification Testing

- System under test comprises antenna, feed and LNAs
- We propose to carry out verification testing at the EVLA in New Mexico, USA.
- NRAO are increasingly involved in the project. Discussions are ongoing.

Test phases

- Single dish tests
  - Gain
  - Noise temperature
  - Pointing
- Array tests (interferometry)
  - Imaging dynamic range
  - Provide data for calibration and imaging studies

Dishes: possible implementations
3300 15m – 5150 12m antennas

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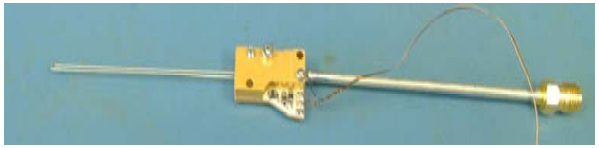
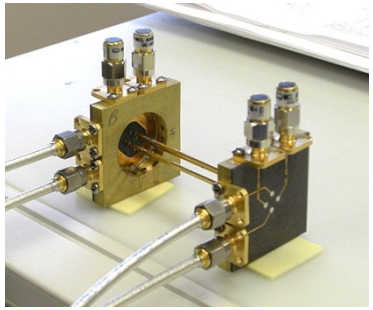
PAF options

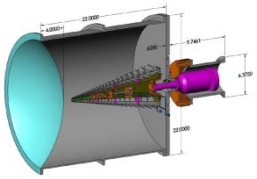


Cryogenic differential and single-ended LNAs



Cortes QSC

Lindgren



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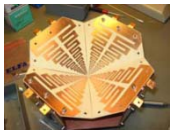

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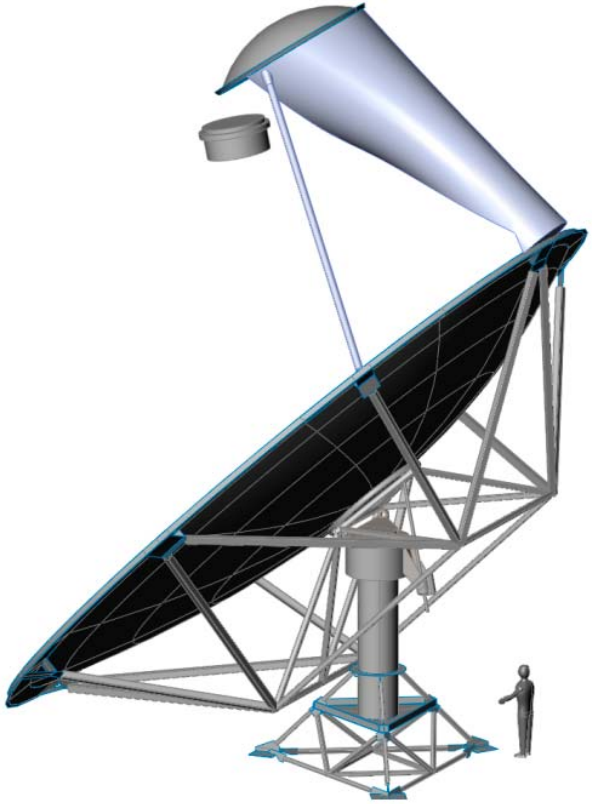
Wide band feed options

Multiple mount options under investigation

Reflector: cost estimates available for composite and hydroformed



Technical challenges

- Aperture efficiency and antenna noise (optics optimization)
- *Dish design: low cost, easy to ship, simple installation, fit for the environment.*
- LNA development: MMICs, room temp, differential, non 50 ohm.
- Noise measurements: LNAs (including differential and non 50 ohm), AAs, PAFs.
- Antenna/LNA interface.
- Cryogenics: low cost, low power, reliable.
- ***Imaging dynamic range.***
- Verification testing.

Key elements of work: Dishes

- Develop the test plan
- Optics analysis: informs mechanical design
- ***Antenna design and costing***
- Wide band feed: optimize performance and design for manufacture
- LNAs: to be tailored for wide band feeds
- Cryogenics: design for low maintenance, low cost of ownership, whilst minimizing Tsys (dewar also affects feed pattern)
- Receivers: design for high reliability (in the given environment)
- EMC
- Power minimization