AUT

IRSR

Developments in NZ Radio Astronomy

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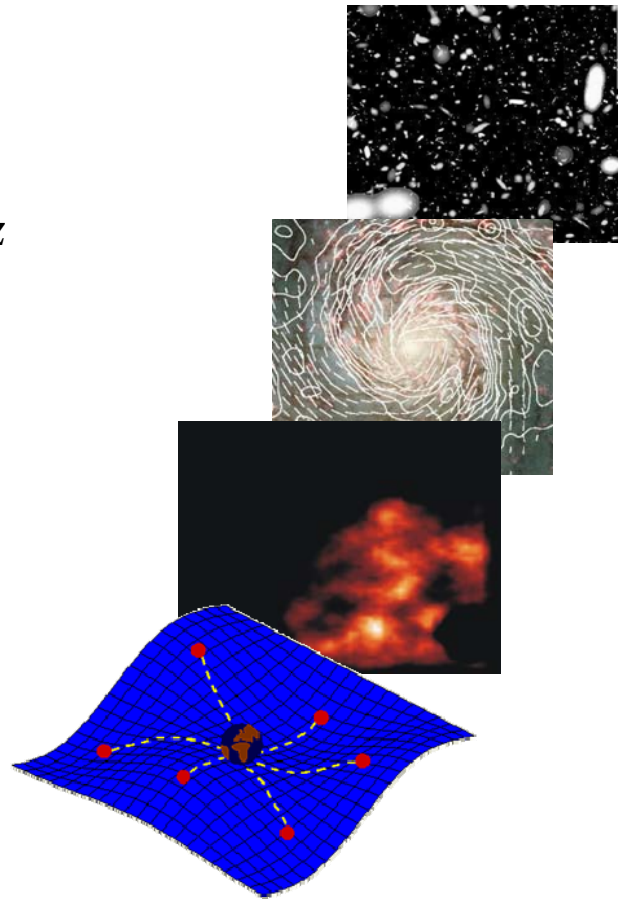
Overview of talk

- SKA
- ASKAP
- New 12m AUT Radio Telescope

SKA

- Square Kilometre Array
- Aperture Synthesis Radio Telescope with combined collecting area of 1 Square Kilometre (1 x 10^6 m^2)
- Originally envisaged as a “Hydrogen telescope”operating in range $0.1GHz \leq f \leq 1.4GHz$
- Current specification calls for $0.1GHz \leq f \leq 25GHz$
- to meet enhanced science goals that include;
  - Probing Dark Ages / Epoch of Re-Ionisation
  - Galaxy evolution
  - Origin / evolution of Cosmic Magnetism
  - Strong Field tests of Gravity (Pulsars + Black Holes)
  - “Cradle of Life”



SKA Reference design

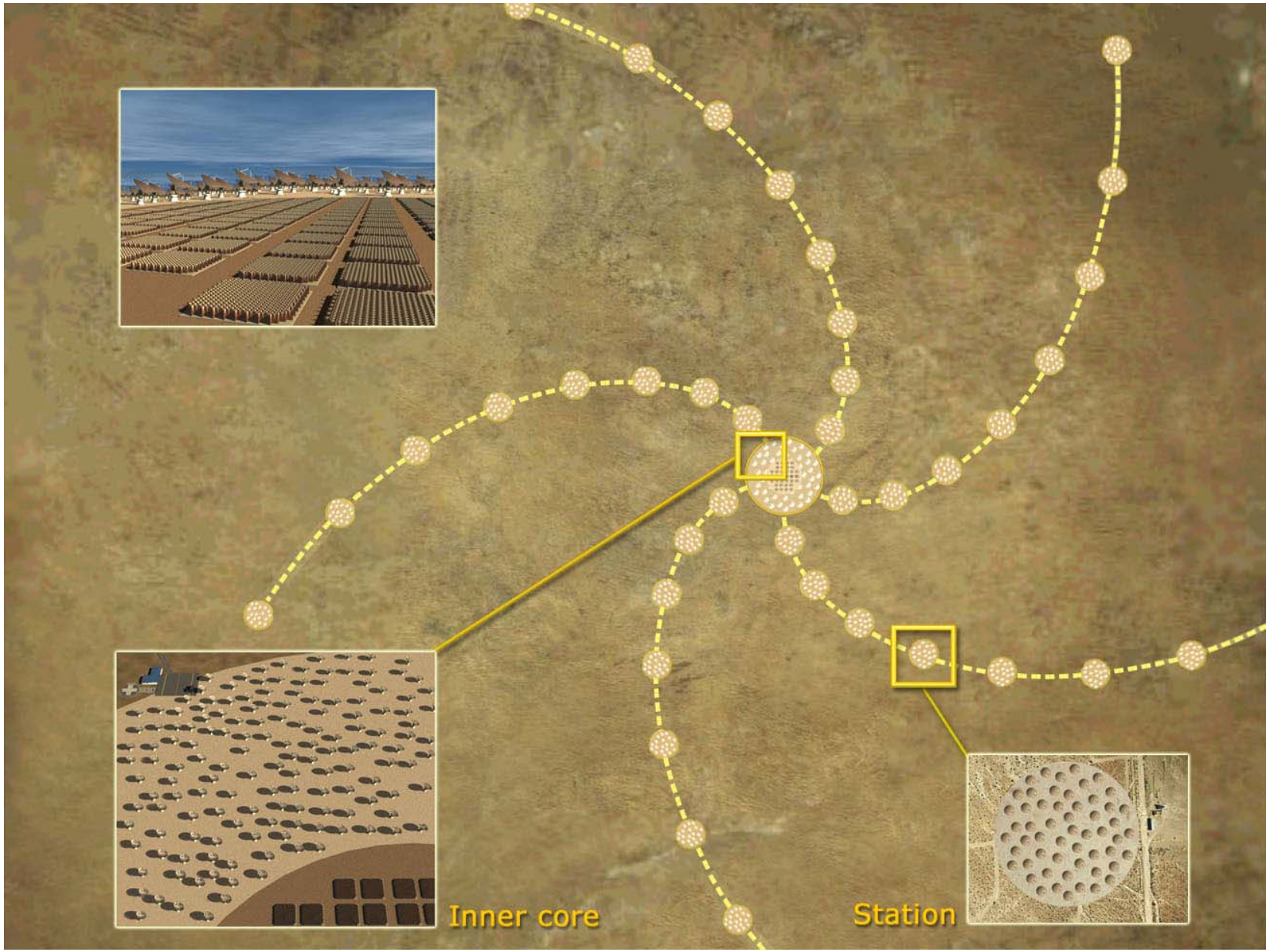
- 1 x 10^6 m^2 effective collecting area
- Sensitivity ~ 10,000 m^2 K^{-1} $\left(A_e/T_{sys}\right)$
- FOV ~ tens of deg^2 @ 1.4 GHz
- Survey speed metric ~ 4.57 x 10^4 sr m^4 K^{-2} Hz

$$(FoV \times \left(A_e/T_{sys}\right)^2 \times BW)$$

- 50% of collecting area at r ≤ 2.5 km
  Further 25% at r ≤ 180 km
  Remaining 25 % at r ≤ maximum extent of array

- Costs
  - single telescope α $d^{2.7}$
  - array computation α n^2
- Small d large n
  - 8000 x 12 m dishes

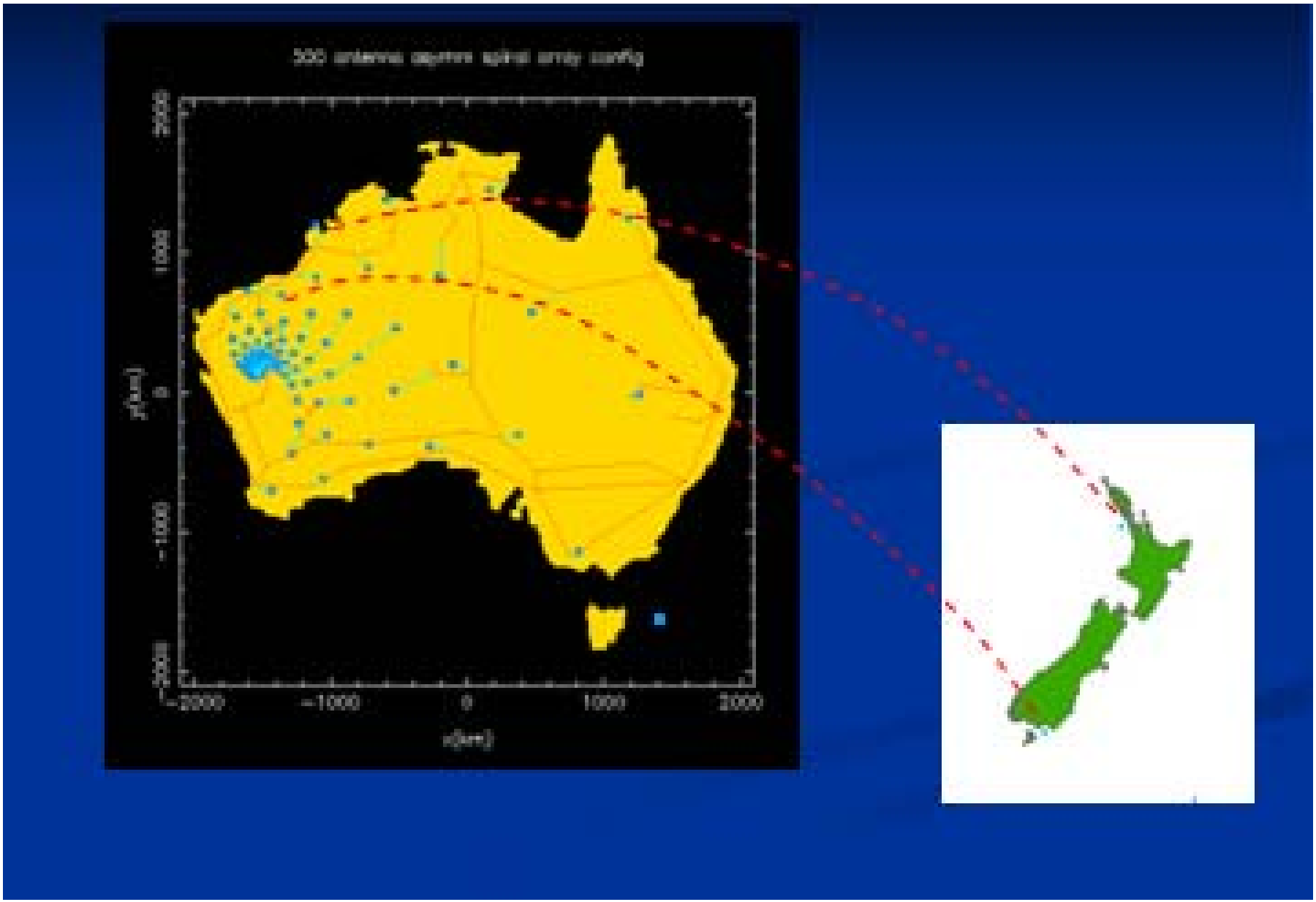
SKA Reference design



- 2 billion € project
- 17 nation consortium
- Currently two countries in line to host the instrument;
  - Australia (with NZ support)
  - South Africa

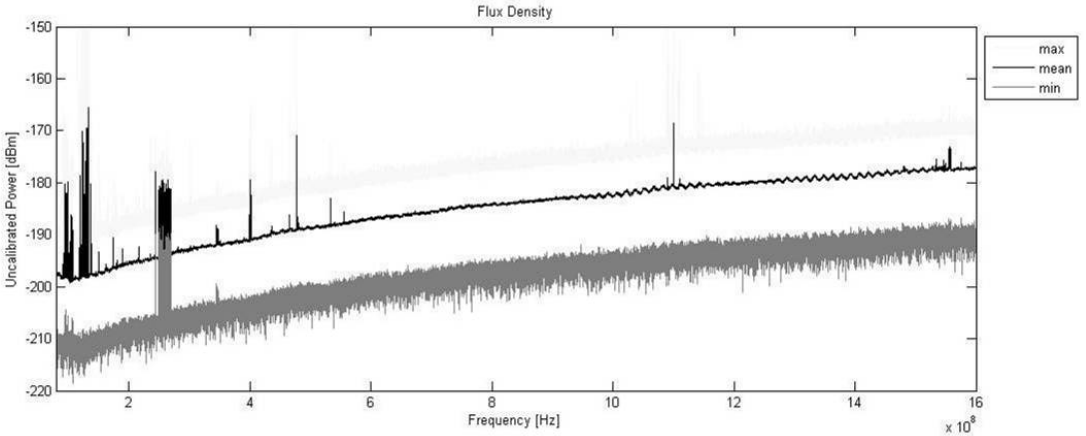
International SKA Timeline

- Sep 2006: Site Selection (Australia/ NZ and South Africa only 2 remaining sites in running as hosts)
- 2007/08 Technology Selection
- 2009-11 International SKA Pathfinder (US$100M)
- 2012 SKA Production Readiness Review
- 2013 SKA Construction Beings (simultaneously in WA and NZ?)
- 2015/16 SKA begins operations
- 2020 SKA construction complete


500 antenna approx spiral array config
2000
1000
0
−1000
−2000
y [km]
−2000
−1000
0
1000
2000
x [km]

ASKAP

- Australian SKA Pathfinder
- Fully funded $110m AU
- 30 – 45 x 12m dish Synthesis Array
- Sited in Western Australia desert
  - $\rho_{flies} >> \rho_{humans}$



ASKAP prototype

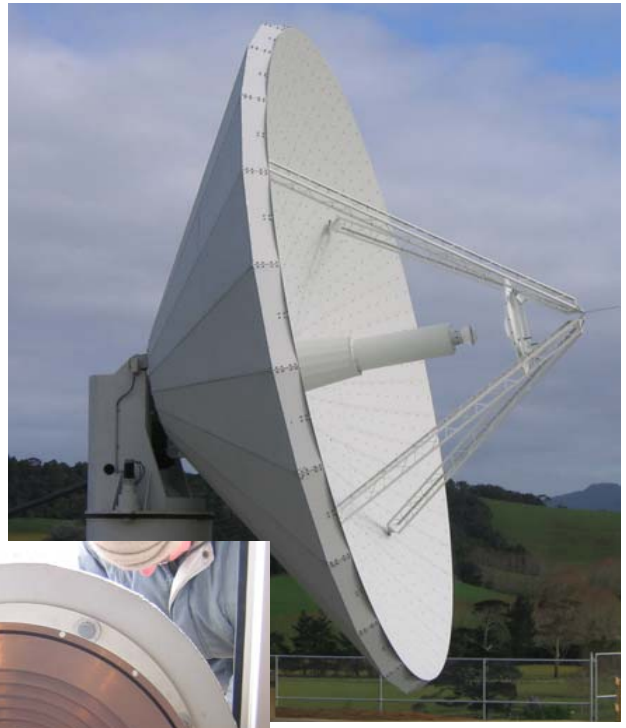
- Parkes Radio Observatory NSW
- 12m Patriot Antenna
- FPA (Focal Plane Array)
  - 10 x 10 grid of receivers = 100 “pixel” image

- Proposal for 4 – 5 dish cluster in NZ
  – ASKAP extension
  - currently subject of AUS / NZ inter-governmental discussions
  - $12m NZ proposal

Current developments at AUT

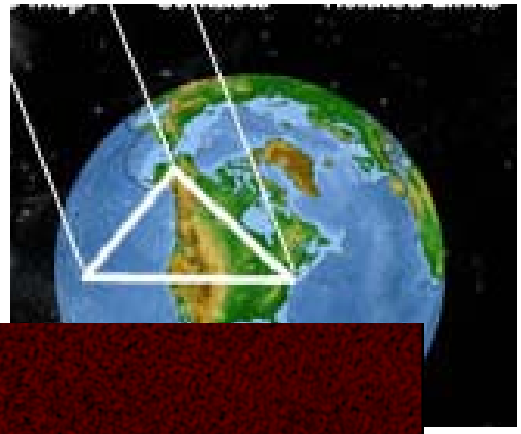
- 12m Cassegrain
- Patriot Antennas (Albion Michigan)
- $f_{effective} \approx 0.6$
- 5 deg s^{-1} Azimuth
- 1.25 deg s^{-1} Elevation
- “Shaped” surface
  - optimised for G/T
  - Surface rms < 0.3 mm
  - 1.6 GHz ≤ f ≤ 35 GHz

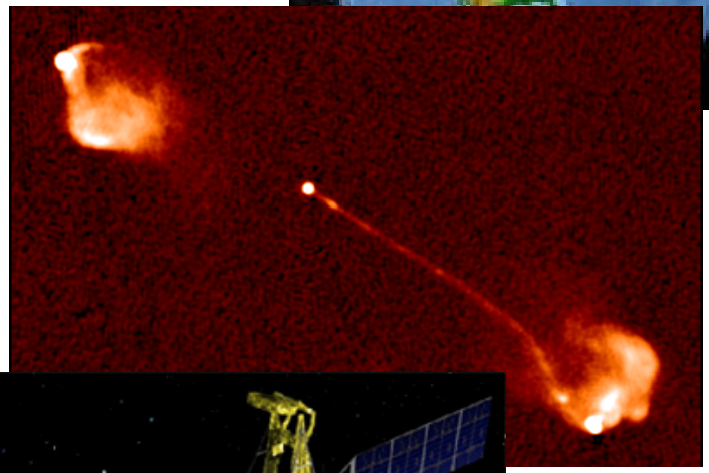
- Coaxial Dual band Dual Circular Polarisation feed
- S band: 2.3 GHz
- X band 8.5 GHz

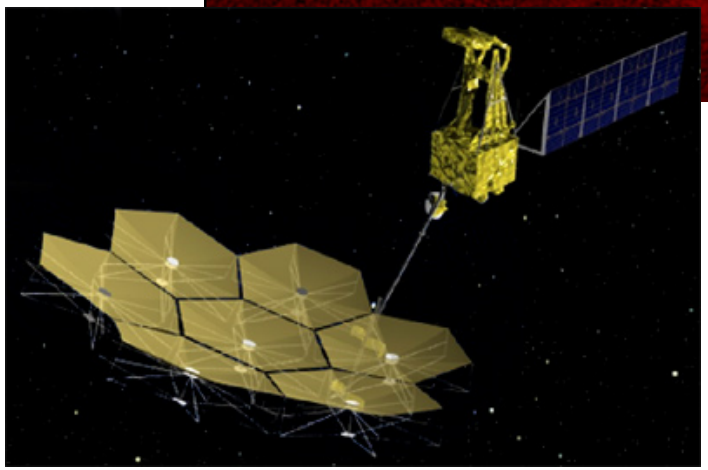


Science programs

- Geodetic VLBI
- VLBI studies of AGN
- VSOP 2 – JAXA
  Space VLBI program







The end?