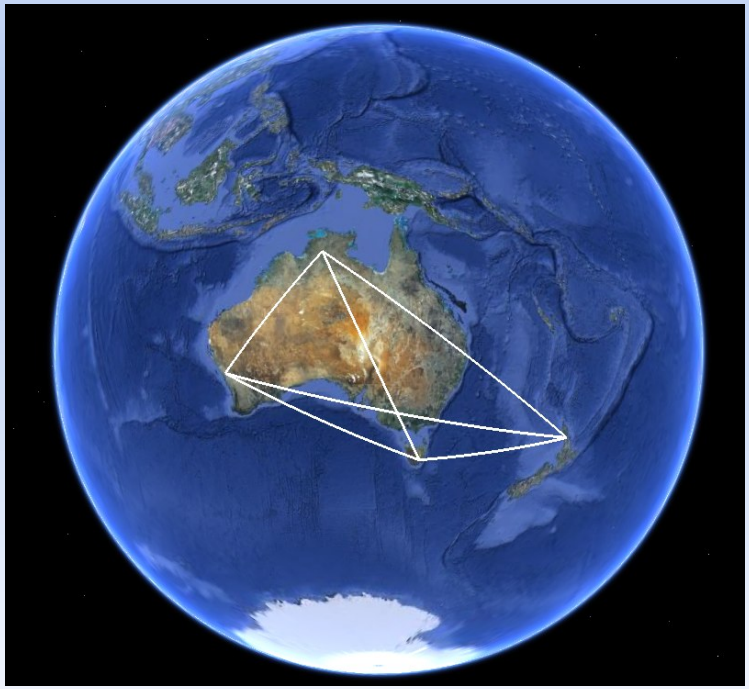
AuScope

AN ORGANISATION FOR A NATIONAL
EARTH SCIENCE INFRASTRUCTURE PROGRAM

The AuScope Project and Trans-Tasman VLBI



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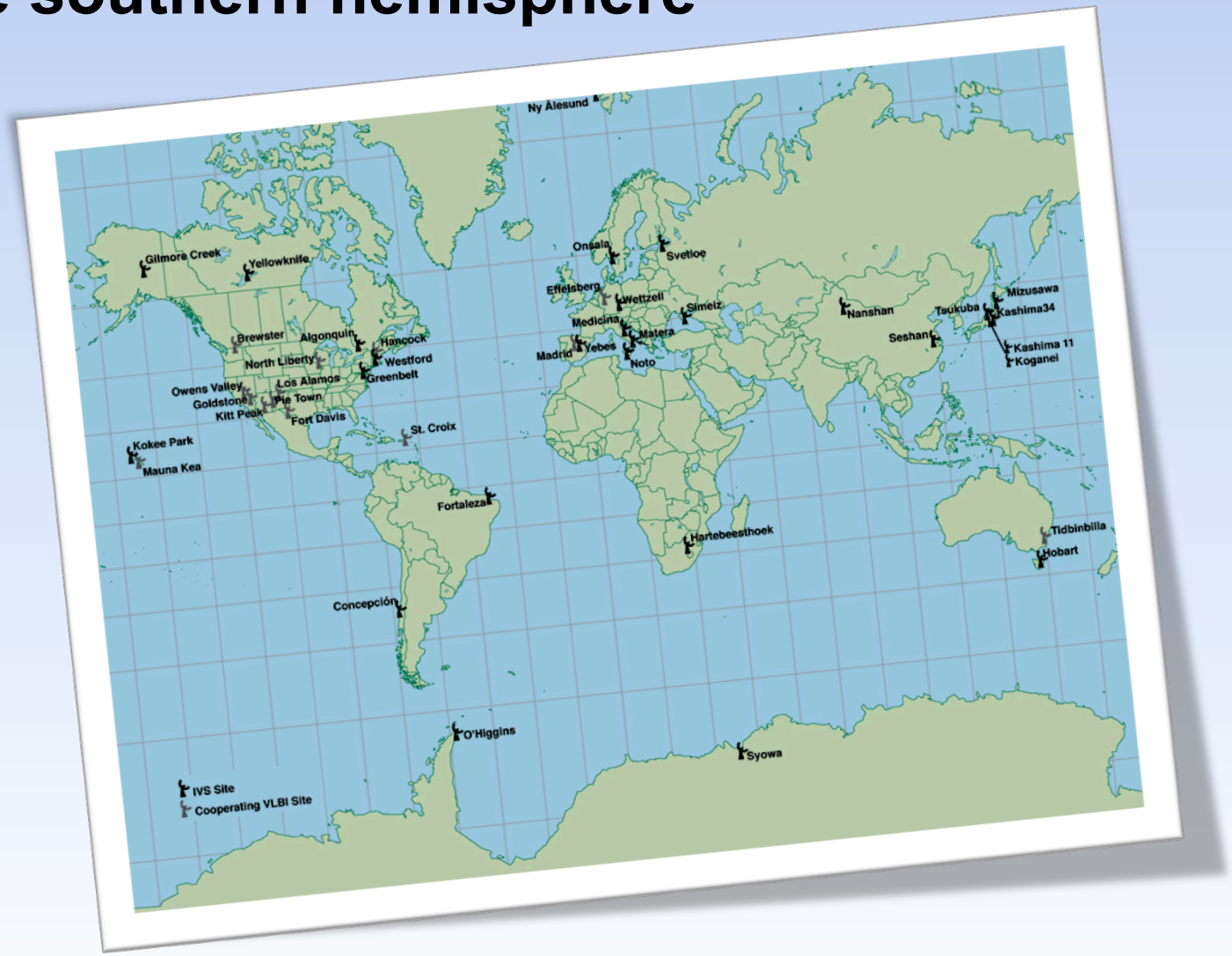
www-ra.phys.utas.edu.au/auscope

Outline

- Why?
- AuScope VLBI
- New Zealand

Why we need more geodetic VLBI observatories in the southern hemisphere



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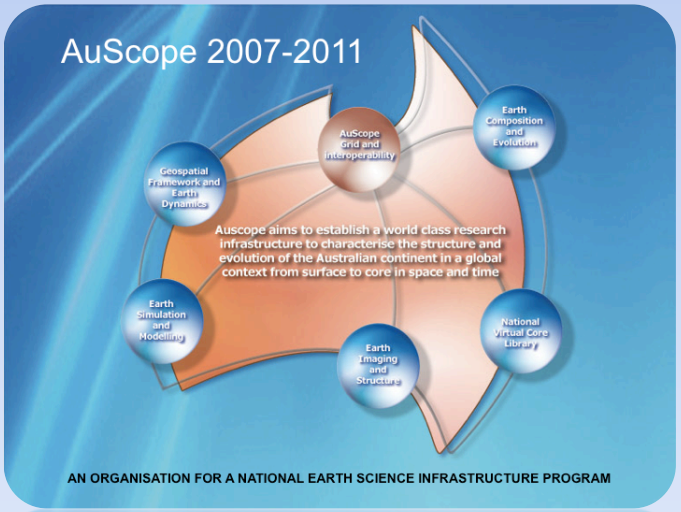
AuScope: Structure and Evolution of the Australian Continent



- AuScope is funded through the Federal Government's National Collaborative Research Infrastructure Strategy (NCRIS). *Infrastructure to provide an integrated spatial positioning system spanning the whole continent.* Divided into 5 components, including Geospatial
- The Geospatial component received $15.8M in NCRIS funding plus funds from Universities and State/Territory government. Infrastructure includes
  - 3 x 12m radio telescopes and a correlator
  - ~100 GNSS receivers
  - SLR upgrades
  - An absolute gravimeter and 3 tidal gravimeters
  - Improved computing facilities
- UTAS is constructing and will operate the VLBI array. New correlation facility at Curtin University of Technology.
- Main partners are UTAS, Curtin University of Technology and Geoscience Australia.

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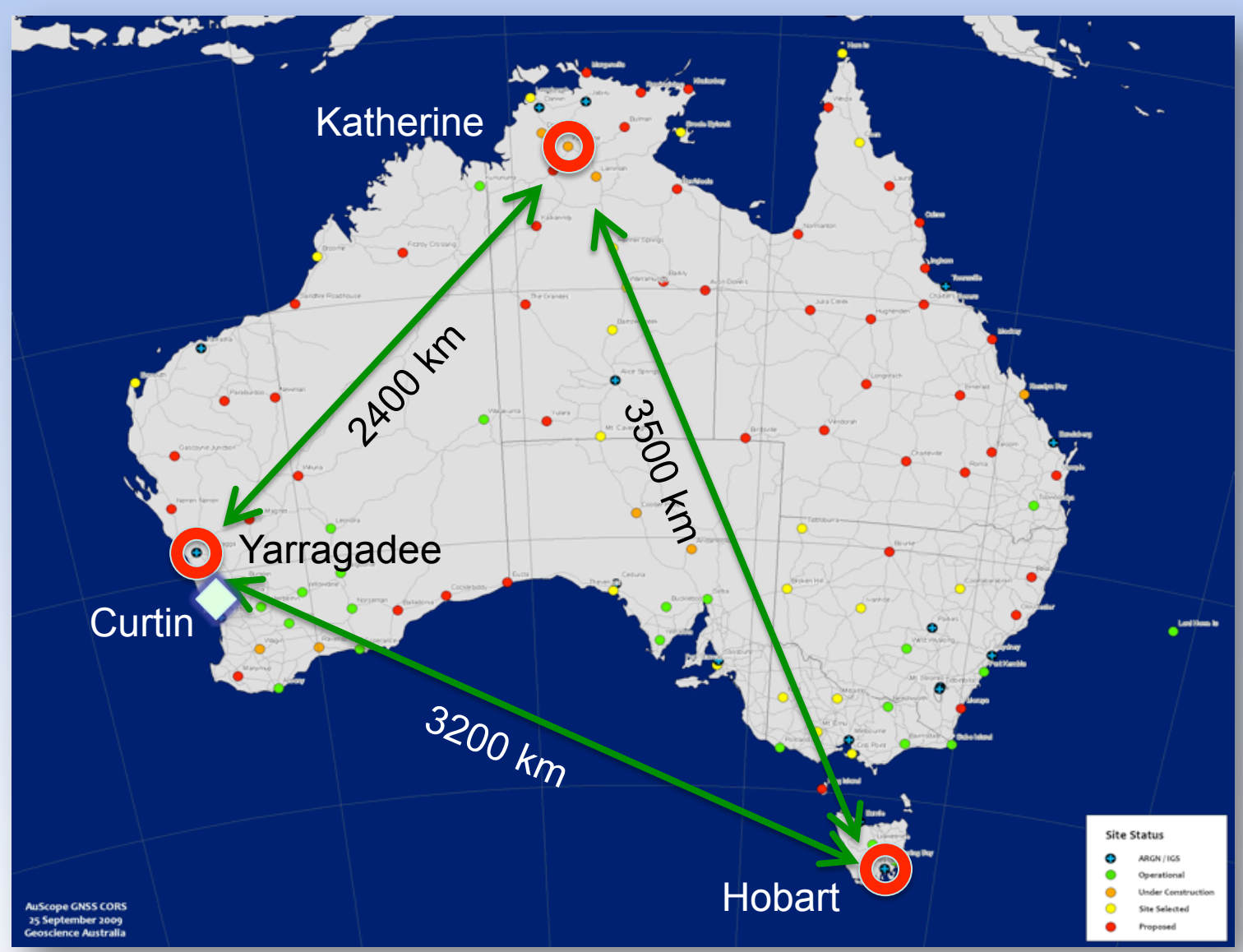
Katherine
2400 km
3500 km
Yarragadee
Curtin
3200 km
Hobart
Site Status
ARGN / IGS
Operational
Under Construction
Site Selected
Proposed
AuScope GNSS CORS
25 September 2009
Geoscience Australia

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AuScope VLBI project: Antenna infrastructure & hardware

- Aim to meet VLBI2010 requirements if possible, or ensure an upgrade path
- 12m Antennas from COBHAM Satcom, Patriot Products division
  - Surface RMS 0.3 mm
  - Slew rates 5 deg/s Az, 1.25 deg/s El (accel: 1.3 deg/s/s)
  - Coaxial S/X feed
- Room temperature, dual polarisation receiver (UTAS)
- DBBC (HAT Lab, INAF/IRA)
- Mark5B+ (Conduant)
- A Vremya H maser (VCH 1005A) at each site

- Strategy is to build and debug at Hobart before deploying to Katherine and Yarragadee

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AuScope VLBI correlation facility

- VLBI software correlator (DiFX: Deller et al. 2007, PASP, 119, 318);
- DiFX is an ongoing development for astronomical and geodetic VLBI, supported by a global development team;
- DiFX has provided the upgrade path for the Australian LBA (six antennas), the NRAO VLBA (10+ antennas) and the Bonn correlator. Also installed at Bologna, USNO, UTAS etc.
- At Curtin University of Technology, DiFX runs on:
  - 20 node Beowulf cluster;
  - 2 x quad-core processors per node;
  - 8 GB RAM per node;
  - 1 TB or greater disk per node;
  - 1 Gbps ethernet, with 10 Gbps to outside world;
  - 4 x Mark5B+ playback units;
  - 4 x Apple Xraid playback units;
  - Realtime e-VLBI capability.

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AuScope VLBI project: Operations model

- 180 days per year observing
- ~100 of these will be participation in existing IVS programs
- Remainder will be aimed at measuring the strain-field of the Australian continent and trans-tasman plate motions, strengthening the southern reference frame

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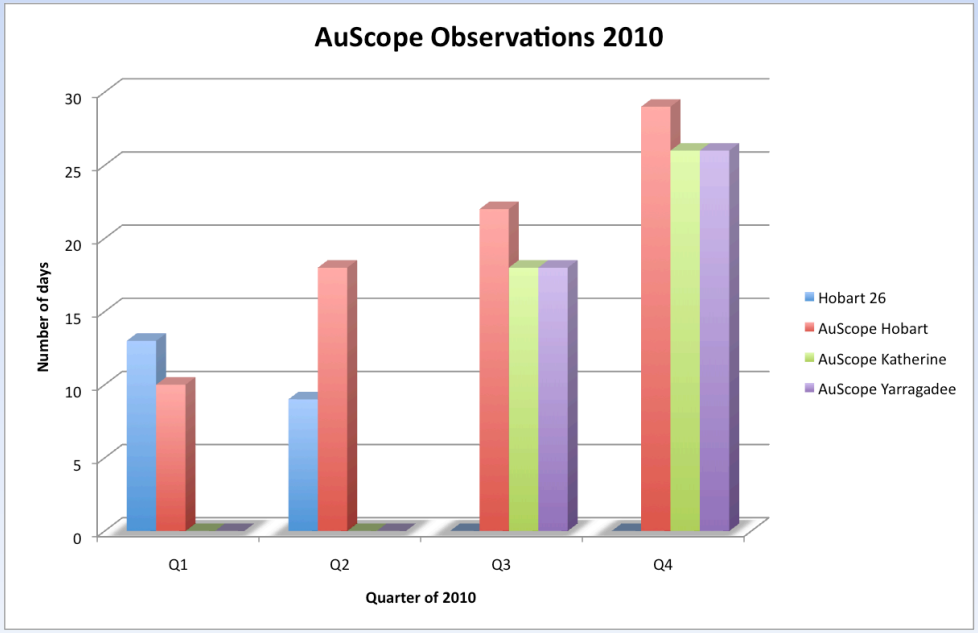
AuScope VLBI project: Operations model

- Overlap period between Hobart 12m and 26m before the 26m ceases IVS observations at the end of May
- Ramp-up of Hobart 12m observations through 2010
- Yarragadee and Katherine start around mid-year and ramp up.
- All three 12m antennas to a rate of 100 obs/year by end of year
- We will also schedule AuScope-only geodetic observations with correlation at Curtin for end-to-end testing of AuScope facilities.



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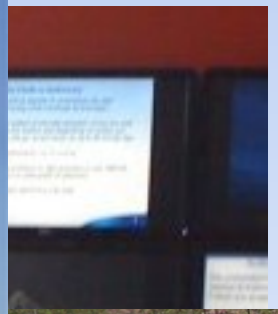
AuScope VLBI project: Current status



this week

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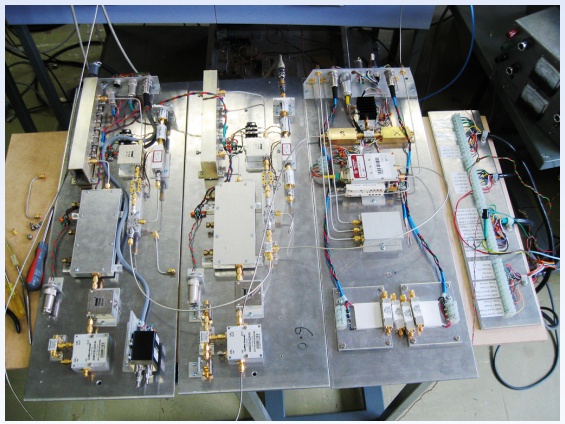
AuScope VLBI project: Status

- All three masers in Hobart
- One receiver installed and under testing on 12m. Traditional phase-cal (for now).
- One DBBC, two due soon
- 3 x Mark5B+ in Hobart
- Ordered 40 x 6 TB disk packs with 50 to come
- 12m now under PCFS control
- e-control (Neidhardt et al : S05-T04)



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AuScope VLBI project: 12m antenna performance

- Meeting or exceeding all specifications except…
  - SEFD:
    - X-band: 4500 Jy
    - S-band: 5000 Jy
  - Tsys ~95 K in both bands.
  - S-band squint w.r.t. X-band of up to 0.1 deg

- Problem iswith the feed. Patriot are working on changes to feed that will provide SEFD of 3800 Jy

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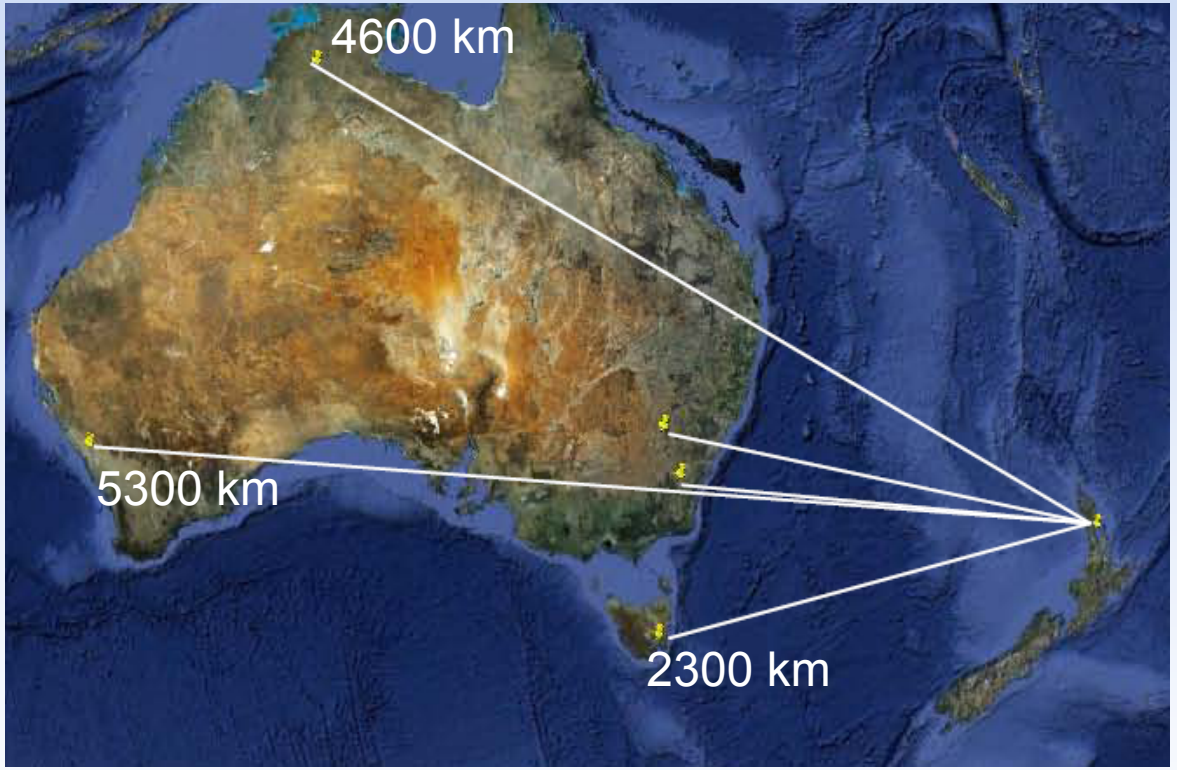
AUT Project: Introduction and aims

- Develop VLBI capability in NZ
- Contribute to both IVS and Astrophysical VLBI communities



AUT Project: Infrastructure

- Cobham/Patriot antenna
- 12m Cassegrain
- Maximum Slew rates:
  - Azimuth = 5 deg s^{-1}
  - Elevation = 1 deg s^{-1}
- Currently equipped with dual polarisation dual frequency S/X feed for Geodesy

AUT VLBI project: Operations model + project status

- IVS observations planned to begin May/June 2010
- 20 days observing scheduled for 2010

- Receivers+ Maser + Recorder in place
- Waiting on delivery of DBBC (expected March)

Conclusions

- We're nearly there!

- Four new geodetic antennas in southern hemisphere
- Identical antennas, equipment

- Future work
  - 12m antenna deformation studies
  - Source structure & reference sources
  - Broad-band upgrade?
  - VLBI of GPS

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