



# CORsnet-NSW: Towards State-wide CORs Infrastructure for NSW, Australia

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FIG Congress 2010  
Sydney, Australia  
11-16 April 2010

## Outline

- Introduction to **CORsnet-NSW**.
- Elements necessary to provide **world-class CORs infrastructure** for NSW:
  - RTK vs. NRTK
  - Seamless positioning
  - System integration
- Issues that need to be addressed to enable **consistent high-accuracy service** across NSW.
- Conclusions.



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# CORS in NSW

- **CORS** operating since 1992 (Bathurst).
- Initially 7 ref stns in greater Sydney area (**SydNET** from 2004).
- Expansion underway to provide state-wide coverage for NSW (**CORSnet-NSW**).



SydNET



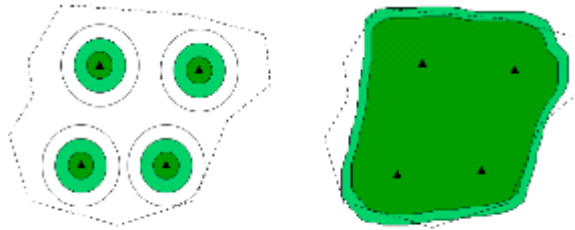
# CORSnet-NSW (April 2010)



35 stations in operation  
40 stations by mid-2010  
70 stations by 2013

## RTK vs. NRTK

- **Single-base RTK** generally limited to ranges of 10-20 km.
- **Network RTK**: several ref stns (max. spacing 70-100 km).
- NRTK provides homogeneous & high accuracy, reliability and availability.



▲ = GNSS Reference Station  
 ■ = Coverage Area for Highest Accuracy

- **Initial tests:**
  - NRTK as good or better than single-base RTK.
  - Initialisation times reduced significantly.



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## Seamless Positioning for NSW

- **VRS<sup>3</sup>Net** CORS management software:
  - VRS & MAC corrections in RTCM 3.1 via internet
  - Data for post-processing (single base & virtual)
- **Advanced features** in VRS<sup>3</sup>Net:
  - Comprehensive user management & billing system
  - Customisable reporting functions, alert services, RSS feeds
  - Virtual RINEX
  - Real time network integrity monitoring
- **System redundancy:**
  - Dual network control centres (Sydney & Bathurst)
  - System architecture
  - Communication links



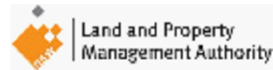
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# System Integration

Real-time



Archived Data



SIX: Spatial Information Exchange



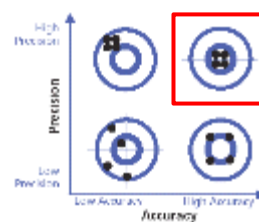
# Homogeneous GNSS Positioning

**Aim:**

- Reliable positioning of homogeneous & high accuracy state-wide.

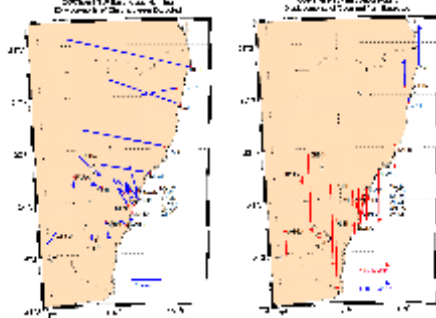
**Requirements:**

- Direct connection to national datum.
- Legal traceability of CORS coordinates.
- Compatibility with AUSPOS online processing service.
- Site calibration or localisation surveys.
- Interoperability between states & commercial providers.
- Adoption of absolute APCV models.



## Direct Connection to National Datum

- **Distortions** in GDA94 (0.3m) & AHD71 (0.5m) in NSW:



Distortions between  
"global" & "local"  
realisation of GDA94  
across eastern NSW

- **NRTK** requires consistent accuracy of 15 mm for CORS  
→ **CORSnet-NSW** uses "global" GDA94.
- Planned update of GDA (20xx) will be truly 3D.



## Legal Traceability of CORS Coords

- **GA** is NATA accredited.
- **Reg 13** valid for 5 yrs, giving "global" GDA94 based on Bernese processing (1 week data).
- **Recognised value standard** assists with legal traceability, e.g. police, aquaculture farmers, aboriginal/heritage GIS.
- **Reg 13** certificates for all **CORSnet-NSW** sites are currently being obtained.



NATA: National Association of Testing Authorities Australia



## Compatibility with AUSPOS

- **AUSPOS:**
  - GA's online geodetic-quality GPS processing service.
  - Accuracy: 10 mm (hz) & 10-20 mm (vt) for 24h data.
- AUSPOS does **not** fully propagate uncertainties of ARGN  
→ no legal traceability.
- “Global” **CORSnet-NSW** coords compatible with AUSPOS but **not** with “local” ground control.



<http://www.ga.gov.au/geodesy/sgc/wwwgps/>



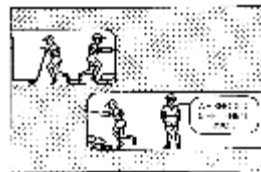
## Site Calibrations / Localisations

- Future 3D GNSS accuracy represented by size of cork.
- High-accuracy users will demand that RT positioning accuracy (2cm hz) is **compatible** with ground control → **homogeneous, state-wide GDA94 infrastructure needed.**
- Re-adjustment of state network in NSW (802,000 km<sup>2</sup>) to “global” GDA94 **not** planned in intermediate future.
- **Site calibration** required to relate “global” **CORSnet-NSW** coords to existing “local” ground control.
  - Already good practice but **essential** to account for larger diff. betw. “global” & “local” GDA94.
  - NSW: “local” = GDA94(1997)  
“global” = GDA94(2010)



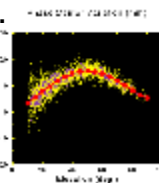
## Interoperability between Providers

- **Interoperability** of CORS networks highly desired, especially at state borders.
- Facilitate **future integration** of state networks to provide consistent, nationwide CORS infrastructure.
- **Issues:**
  - Sharing of base stations in border regions.
  - Ensuring user gets GNSS positioning results independent of CORS network used.
- LPI actively seeks arrangements with neighbouring states and commercial CORS providers.



## Adoption of Absolute APCV Models

- **Absolute** APCV models replace **relative** models.
- Significant **errors** if absolute & relative APCV models are mixed during processing (especially in vertical).
- **Consistency** through use of parameters approved by IGS → avoids confusion.
- **CORSnet-NSW** uses absolute APCV models:
  - **RT operation:** CORS antenna transmitted as **null antenna** → user to ensure absolute APCV model is used at rover.
  - **Post-proc:** Data files specify antenna used → user to ensure absolute APCV models used at both ends.



# Conclusions

- **CORSnet-NSW:**
  - Currently consists of 35 sites.
  - Expansion to provide **state-wide coverage** by 2013 (70 stations).
- **World-class CORS infrastructure** for NSW through seamless positioning & system integration.
- Requirements for **homogeneous high-accuracy GNSS positioning** across NSW:
  - Direct datum connection & compatibility with AUSPOS via “global” GDA94, legal traceability via Reg 13, interoperability, site calibrations, absolute APCV models.



Questions...?

