

The GNSS CORS Cluster for the Northern Territory Australia

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Key words: GPS, GNSS, CORS, Positioning, Networks / Clusters

SUMMARY

This Poster Presentation will describe the GNSS network / cluster in the Northern Territory of Australia. It will provide an overview of the GNSS infrastructure and the status of the development to date, the CORS management and control centre, the GNSS software that is used, the positioning services being provided and to whom, the current and emerging issues, and the future plans for the system.

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1. GENERAL DESCRIPTION

The Northern Territory (NT) is a Territory / State of northern Australia. It has a population of just 215,000 people who are spread across an area of 1,352,000 km².

The NT GNSS CORS clusters saw its tangible beginnings in late 2003 where several sites in the Darwin Central Business District were tested for their suitability as permanent GNSS basestations. This investigative viability study was facilitated by the NT Office of the Surveyor General (OSG) who are part of the Land Information Division of the Department of Planning and Infrastructure, NT Government.

As result of the investigation, the need for contemporary survey and positional infrastructure to meet the requirements for scientific and geospatial community was identified. The OSG then embarked on formalising policies, strategies and business cases to implement a broader network of GNSS CORS that spanned the NT and was promoted as essential infrastructure for the NT Geospatial Referencing System (GRS).

The NT GRS, which is also the responsibility of the OSG, is also known as the Geodetic framework of the NT. This integral component of NT Spatial Data Infrastructure is the reference system and fundamental layer for all NT survey, mapping, spatial datasets and activities that is, it ‘underpins’ most land related information through position, both horizontally and vertically. The NT GRS also supports and is aligned with the National Geospatial Referencing System (NGRS) which is maintained by the Federal Government agency - Geoscience Australia.

The present strategic plan for NT GNSS CORS network is to establish 25 ‘geodetic’ quality ‘fiducial’ or ‘primary’ permanent base stations that will be part of a national science and research network. It is envisaged this fiducial network of GNSS CORS will be the framework for more dense clusters of GNSS CORS infrastructure (non geodetic quality) in major NT cities or regions demanding positioning services.

From a National and Territory or State perspective, it is envisaged that the GNSS CORS network and clusters spanning the NT will:

- be part of a National network that measure and monitor the scale, motion and deformation of the Australian continent through the provision of three-dimensional coordinates of this network or framework of points as a function of time.
- assist with the determination of a sub-centimetre reference system and subsequent maintenance of the Geocentric Datum of Australia and the Australian Height Datum

- provide a 'core' or 'overarching' framework facilitating densification of positional infrastructure in user driven locations, and / or allow the exploration of downstream positioning applications.
- develop and evolve into 'strategic infrastructure supporting and underpinning many government and public activities and purposes'
- facilitate the provision of co-ordinated positions at various accuracies to surveyors and other spatial users via various methods, which also includes the examination of an internet based post processing positioning service
- provide users with the opportunity to explore using modern positioning technology efficiently and effectively to meet their business needs
- educate and build user base of GNSS base stations
- improve the OSG's skills, knowledge and experience with this technology
- look into the economic and business viability or opportunities of such infrastructure from a public and private perspective
- develop models to ensure spatial accuracy integrity and reliability
- permit the inspection of resourcing, management and maintenance models for such infrastructure
- accelerate the implementation of a NT Co-ordinated Cadastre.

2. MANAGERS / ORGANISATIONS

Presently the OSG owns and operates the NT GNSS CORS clusters in Darwin and Alice Springs and is therefore the primary custodian for the establishment and maintenance of the GNSS sites. The OSG also provides on site technical support for the National GNSS CORS facilities which are managed and operated by the Federal Government agency - Geoscience Australia.

To build the NT GNSS CORS 'primary and local cluster' infrastructure, the OSG has used Departmental capital and operational funds from annual budgetary allocations. To develop this network, the OSG acknowledge that such an incremental approach will take many years to achieve a GRS and CORS network that can facilitate science and quality positioning services. Subsequently, the OSG has been actively participating in Federal Government funding initiatives such as the National Collaborative Research Infrastructure Strategy, and have also been involved in joint ventures with other NT Government and Local authorities.

To further accelerate the GNSS CORS network development and its expansion the OSG will be exploring other partnerships with other Australian Government agencies, Academic Institutions and private sector entities as well.

3. TYPE OF EQUIPMENT, DESCRIPTION OF A “TYPICAL” STATION

All of the existing NT GNSS CORS cluster sites have-

- Leica GRX Pro 1200 GNSS receiver
- Leica AX1202 Geodetic GPS and Glonass antenna.
- The antenna monument is a stainless steel bracket mounted to the concrete (reinforced) wall of a building.
- Power is ‘mains’ power protected by a ‘UPS’
- All cabling is surge protected
- Communication is via TCP/IP
- Back up of raw GNSS data is via data memory card in GNSS Receiver
- Pac Crest PDL Radio



The ‘primary’ geodetic GNSS CORS sites will be on stable ground (bedrock) and have equipment similar to the above however there will be differences such as-

- the choke ring antenna will be mounted onto a concrete pillar,
- communications could alternatively be via satellite or digital wireless technology.
- power source could alternatively be via solar panels
- a met station
- facilities for gravity measurements
- GNSS geodetic receivers are a mixture of brands

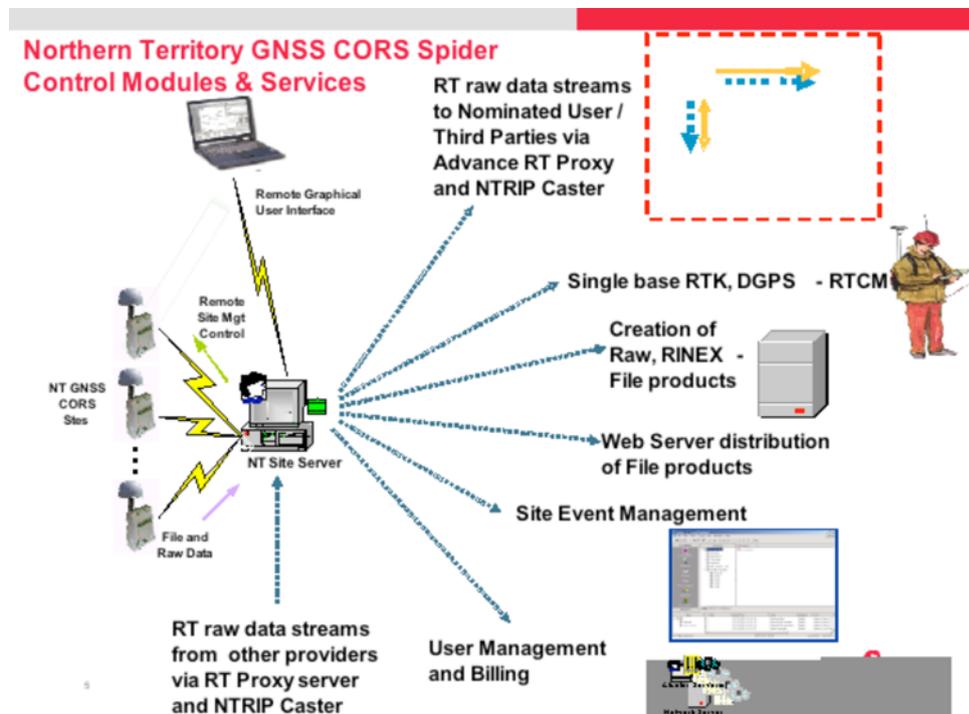
There is currently no existing official or published Australian specification for GNSS CORS. The Inter-Governmental Committee on Survey Mapping Geodesy Technical Sub-Committee are currently developing such standards and will be similar to the International GNSS Service

(IGS) Site Guidelines and / or the US National Geodetic Survey (NGS) CORS Site Specifications.

4. DESCRIPTION OF CONTROL CENTRE

The NT GNSS CORS cluster is managed by the OSG through Leica Geosystems Spider software. The OSG, via various Spider modules, can remotely manage -

- maintain, manage and control each GNSS CORS site
- produce a range of file products (such as RINEX files),
- offer single based RTK corrections via radio communications
- stream real time data (either RTCM or NTRIP via TCP/IP connections) to third parties who then ‘value add’ to the data stream
- manage data streams and the recipients (users)



5. STATIONS

Currently there are 4 national geodetic quality ‘primary’ GNSS CORS sites operational in the NT. These sites are part of the Australian Regional Geodetic Network and are spaced 100’s of kilometres apart.

There are also 2 clusters of GNSS CORS established in the main town centres of Darwin (4 CORS sites) and Alice Springs (2 CORS sites). The average distance between these sites is 25 kilometres as ‘radios’ are used to broadcast transmit single based RTK corrections. It is envisaged the distance between stations in these clusters will increase when real time

networked positioning services based on digital communications (mobile phone coverage) are introduced.

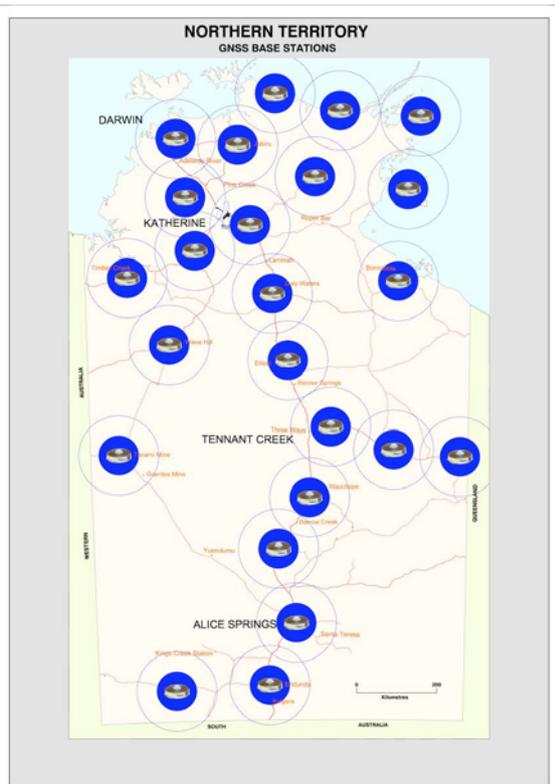


Darwin GNSS CORS Cluster



Alice Springs GNSS CORS Cluster

As previously mentioned it is proposed that there will be 25 national geodetic quality 'primary' GNSS CORS and these will be the overarching framework for GNSS clusters at user driven locations throughout the NT. That is, at major urban centres, mining regions, areas of scientific / research significance, agricultural sectors and locations demanding reliable / accurate positioning services.



Primary GNSS CORS of the Northern Territory

6. SERVICES

The existing GNSS CORS clusters has the capability of providing single based RTK corrections from each site via radio technology and static data (file products) for post processing.

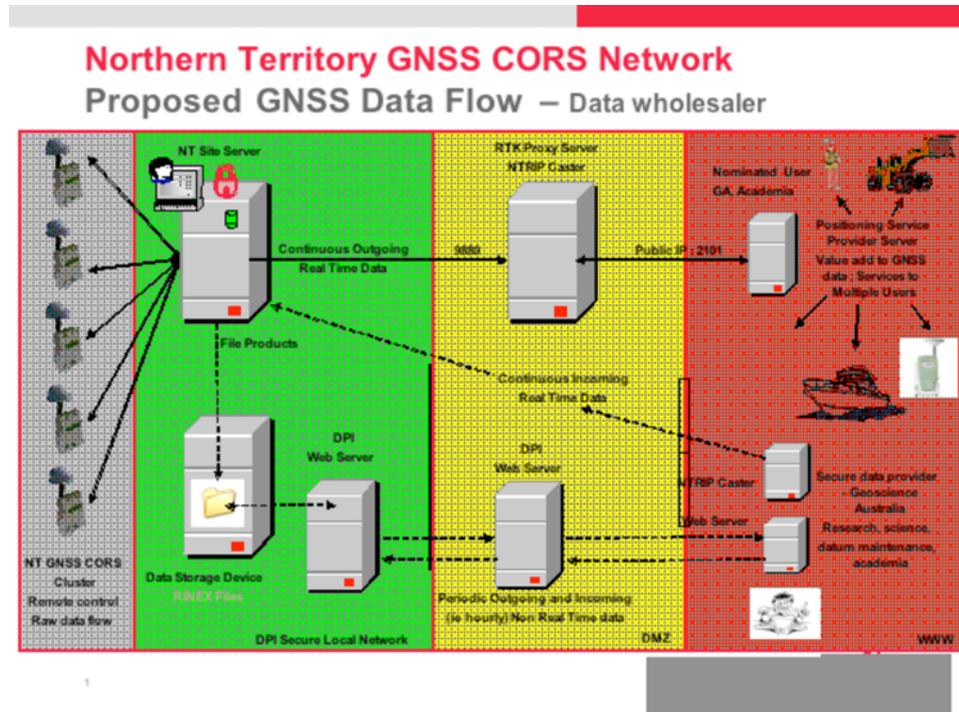
A pilot project with the regional Leica distributor - CR Kennedy and Company Pty Ltd is currently underway. This project examines the technical and managerial aspects of the OSG acting primarily as a real time data distributor, that is sending real time data (via NTRIP) to third parties who can then value add to the data stream. The proposed model in brief is - the third party pays a licensing fee for each GNSS CORS site that they receive data from. The third party then provides positioning services by value adding to the data and subsequently charging for these services. These services could range from networked real time positioning to provision of static data. Also, the primary role of the OSG will be to provide quality ITRF co-ordinates and maintain the associated infrastructure for each GNSS CORS data stream.

At this stage the services are free of charge.

7. USERS

Clients or users of the current clusters include traditional spatial users from both the private and public arena. This includes - surveyors, scientists / researchers, GIS data collectors,

service authorities (power, water), asset managers, road and transport infrastructure owners, civil works operators, imagery and mapping organisations. The OSG use this infrastructure to primarily maintain the geodetic and cadastral survey infrastructure for the NT.



8. ISSUES TO RESOLVE

Densification of the NT GNSS Primary CORS Network and Clusters –

The OSG need to establish partnerships or joint ventures with other Australian Government agencies, Academic Institutions and private sector entities so as to secure sufficient investment to enable the expansion and development of the GNSS CORS network in the NT.

Sustaining the resources to maintain the NT GNSS CORS

This issue involves developing appropriate business models to justify and secure resources (especially from the NT Government) for maintenance, replacement, upgrading of GNSS infrastructure. The OSG believes this can be accomplished if the –

- NT Government accept GNSS CORS as critical or essential and ‘whole of government’ spatial data infrastructure
- OSG can establish ‘partnerships’ with the ‘public and private’ sectors
- the concept that the OSG establishes it self as a GNSS data distributor and the private sector provides positioning services by ‘value adding’ to the data stream is endorsed

Reliable Mobile Phone Communications

In order for GNSS positioning services to be delivered effectively the NT requires better mobile phone coverage and a reliable service. The OSG has been advised by the telecommunications companies that improved mobile phone infrastructure at various NT locations will be market driven. This is seen by the OSG as an opportunity as there could be scope for major telecommunications companies or similar to invest in GNSS CORS infrastructure in regional areas if the down stream positioning business is economically viable or attractive.

9. FUTURE PLANS

The future plans for the NT GNSS CORS network are interconnected to resolution of the 'issues' previously mentioned, however another future plan is to -

Utilise AUSPos Service

The OSG would like the Geoscience Australia 'on-line process system' known as 'AUSPos' to consider expanding its service by incorporating the NT GNSS Primary CORS and CORS clusters located within the major cities of the NT into their internet processing system.

BIOGRAPHICAL NOTES

Robert Sarib, Manager, Survey Services in the Land Information Division of the Northern Territory Government's Department of Planning and Infrastructure, Licensed Surveyor, Foundation member of the Australian Spatial Sciences Institute, Member of the Institution of Surveyors, Australia, and Vice Chair of Administration for FIG Commission 5 – Position and Measurement.

Robert Sarib obtained his degree in Bachelor Applied Science – Survey and Mapping from Curtin University of Technology Western Australia in 1989. He was registered to practice as a Licensed Surveyor in the Northern Territory, Australia in 1991 and achieved this during his employment with the Northern Territory Government. Since then he has work in the private sector as a cadastral surveyor, and more recently re-employed by the Northern Territory Government to manage the Northern Territory Geospatial Reference System and administer the Survey Services work unit of the Office of the Surveyor General. He also holds a Graduate Certificate in Public Sector Management received from the Flinders University of South Australia.

Mr Sarib is currently a member of the FIG Commission 5.2 Working Group – Reference Frame in Practice, and the Northern Territory delegate on the Australian Inter-governmental Committee on Survey and Mapping - Geodesy Technical Sub Committee. He is the Northern Territory Federal Councillor of the Institution of Surveyors Australia, and the Northern Territory Vice-President, representative for the Land Survey Commission and Board Member

of the Spatial Sciences Institute of Australia. He is also a board member of the Surveyors Board of Northern Territory for Licensed or Registered surveyors.

Philip Verrall, Geodetic Manager, Survey Services in the Land Information Division of the Northern Territory Government's Department of Planning and Infrastructure, Licensed Surveyor, Foundation member of the Australian Spatial Sciences Institute, Member of the Institution of Surveyors, Australia.

Phil Verrall obtained his Degree in surveying from the University of Queensland in 1975 and was registered as a Licensed Surveyor in the state of Queensland in 1978. He worked in private practice in North Queensland before gaining employment with the Northern Territory Survey and Mapping Division in 1980, where he spent the next seven years undertaking cadastral and photo control surveys over the top end of the Northern Territory. Since 1987, he has worked in private practice and the Commonwealth Australian Survey and Land Information Group before returning to Northern Territory Government as the Manager of the Geodetic Section of the Office of the Surveyor General.

He is a board member of the Surveyors Board of Northern Territory for Licensed or Registered surveyors.

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