



Australian Government
Geoscience Australia

Positioning
Australia

Geodetic Activities in Australia

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12th Plenary Meeting of UN-GGIM-AP WG1, 6-10 November 2023, Bali, Indonesia

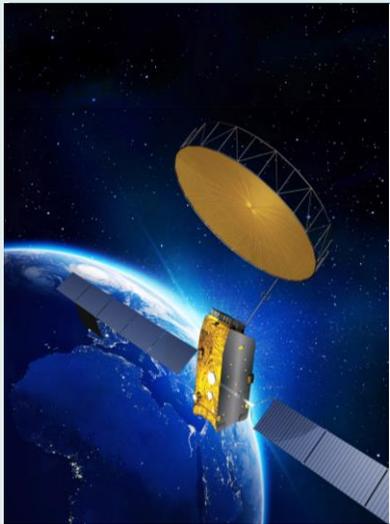


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Earth sciences for Australia's future | ga.gov.au

All in one program: Positioning Australia

- The national authority on geodesy and position verification
- Australian Government lead for position and navigation
- Operate world-class geodetic infrastructure and applied geoscience research
- Engagement with international positioning and geodesy communities on data and standards
- Provides analytic capability and trusted platforms
- Deliver precise positioning services that are reliable, accurate, nationally consistent, and openly accessible



Navigation Satellite System Constellations

- 4** Global
- 2** Regional

Geostationary payloads (coming)

- 2** Satellites



- 2** SBAS uplink stations (1 coming)
- 2** Satellite Laser Ranging + 3 VLBI stations
- 235** GNSS reference stations
- 15** Absolute gravity ground stations



3000 direct users
3-5cm Services across 96% of mobile coverage

SouthPAN Early Open Services to ~3.4BN devices

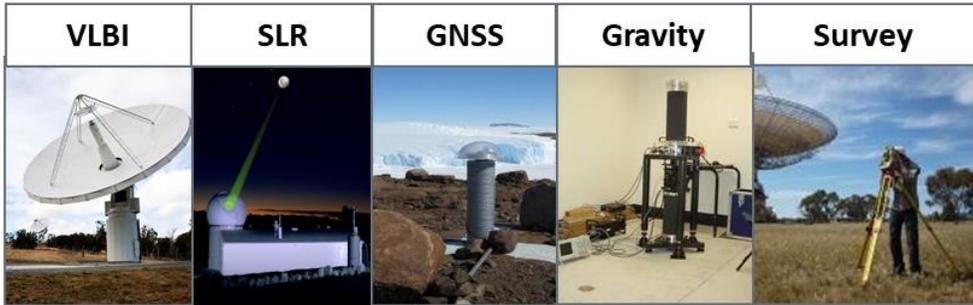


Ongoing goal: Enabling government, business and industry to use positioning and navigation services

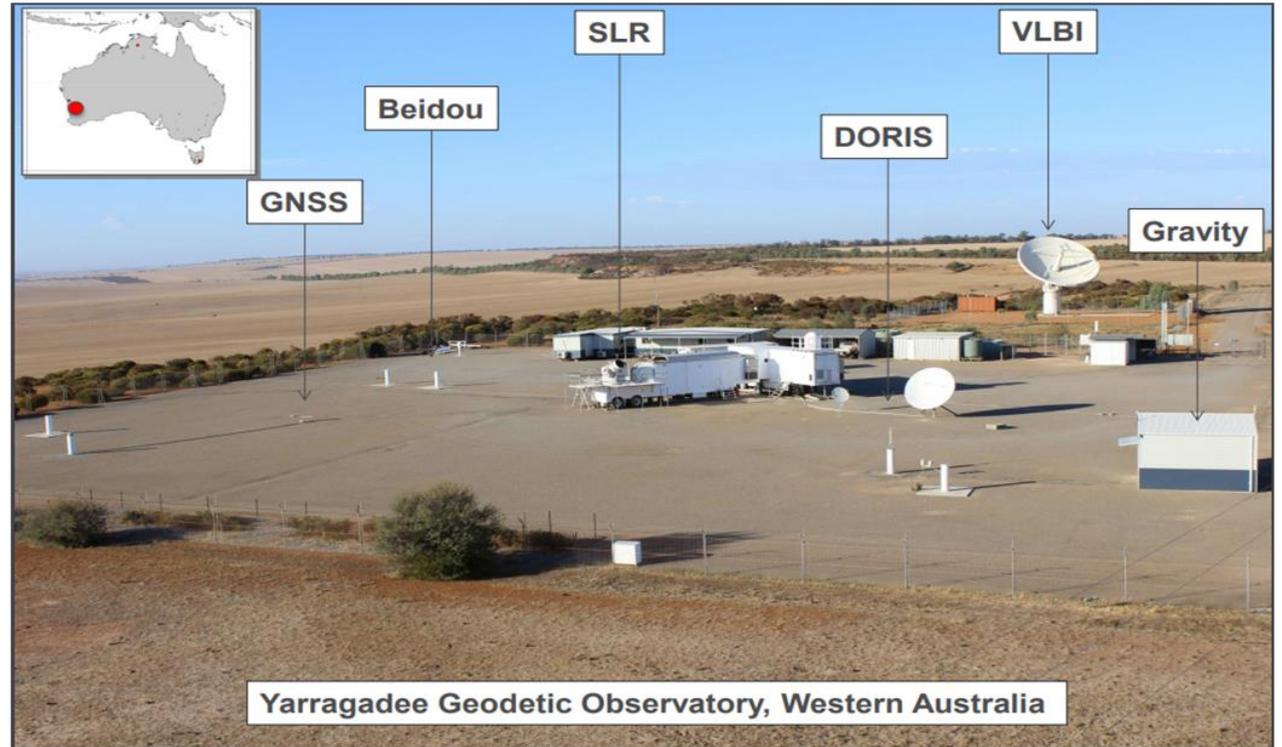
- Positioning Australia delivers world-class positioning services to accelerate the adoption and development of **positioning technology and applications** in Australia. By enhancing the **accuracy and reliability of positioning** in Australia, we will enable innovative technologies across a range of industries and accelerate economic growth.
- Positioning Australia delivers on Geoscience Australia's role as the Commonwealth lead agency on positioning in Australia. The Branch is accountable for leadership and governance of national positioning information and is responsible for the development of the Australian geospatial reference system, delivering services as the Verifying Authority for Position, delivering improved satellite positioning for Australia through SouthPAN and managing a regional network of ground infrastructure supporting geodetic and positioning technologies such as GNSS, satellite laser ranging and very long baseline interferometry.

(<https://www.ga.gov.au/scientific-topics/positioning-navigation/positioning-Australia>)

World-class geodetic infrastructure



- **Very Long Baseline Interferometry (VLBI)** (IAG IVS)
 - 3 VLBI antennas
 - IVS Analysis Center
- **Satellite Laser Ranging (SLR)** (IAG ILRS)
 - 2 SLR systems
- **Global Navigation Satellite System (GNSS) operations and analysis** (IAG IGS)
- **Gravity observational capability** (IAG IHRF)
- **Terrestrial surveying and local tie capability** (IAG working group WG 1.2.1)



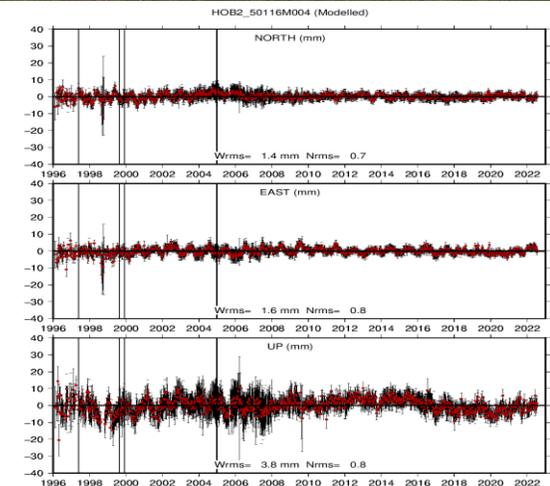
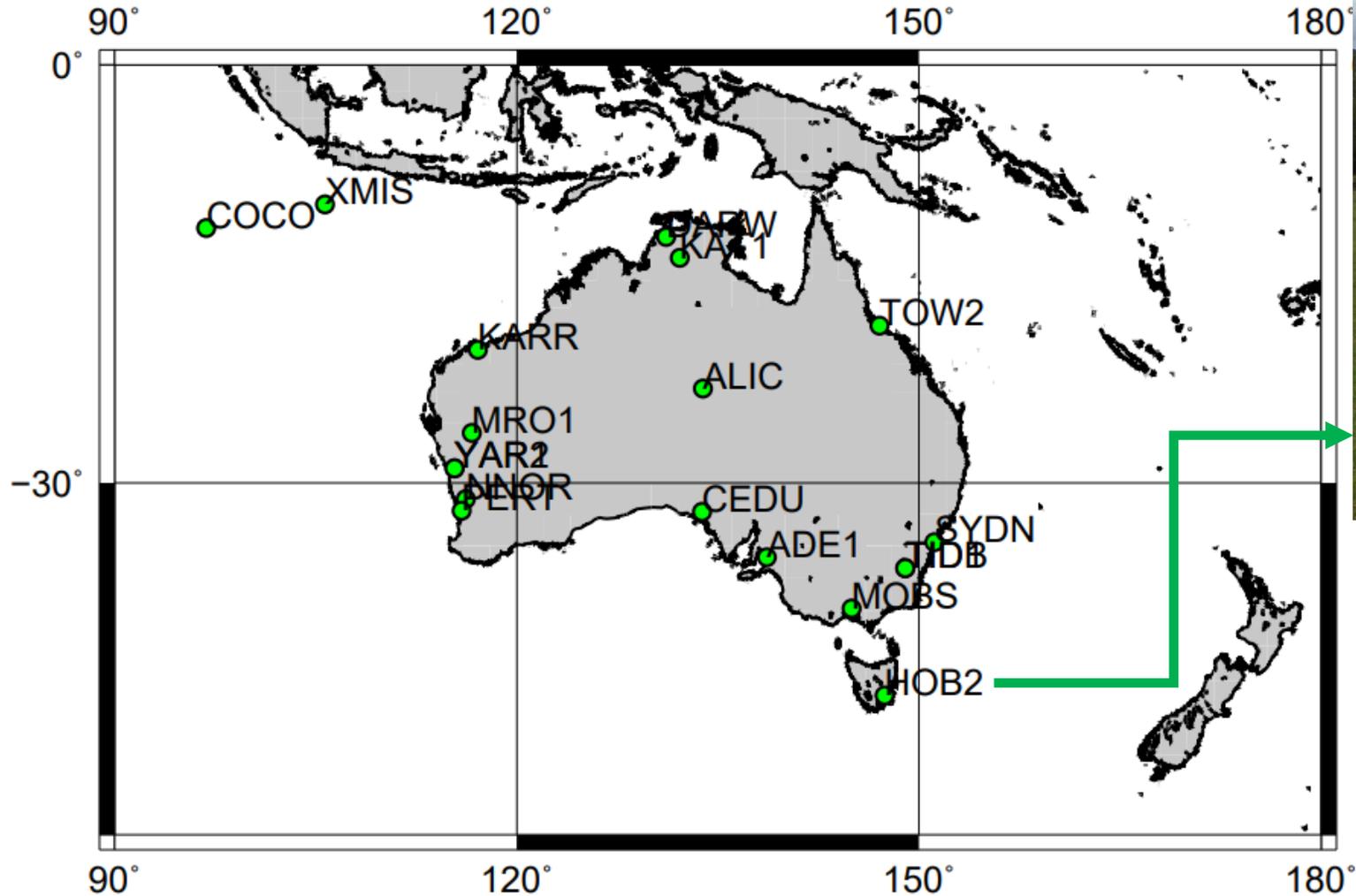
IAG Services our work contributes to:



GGOS
Global Geodetic
Observing System

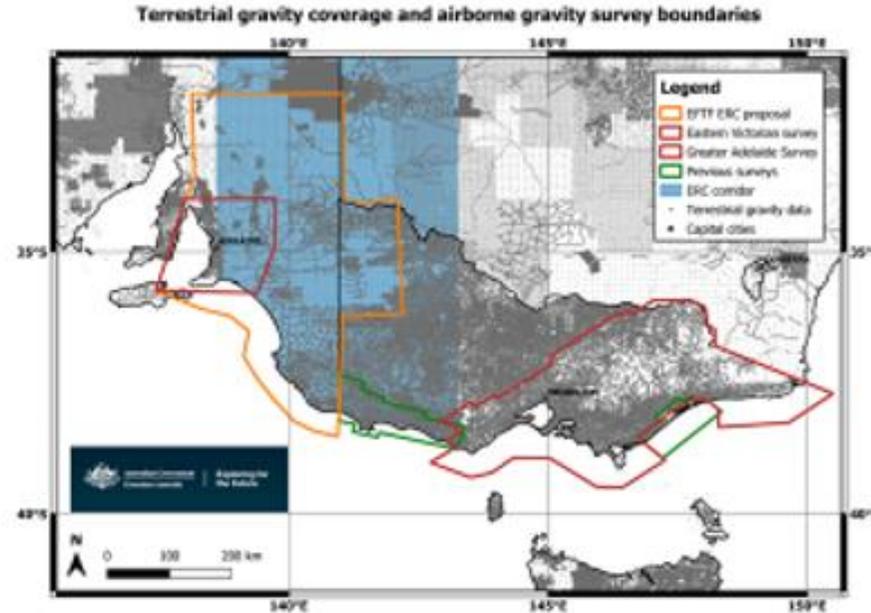
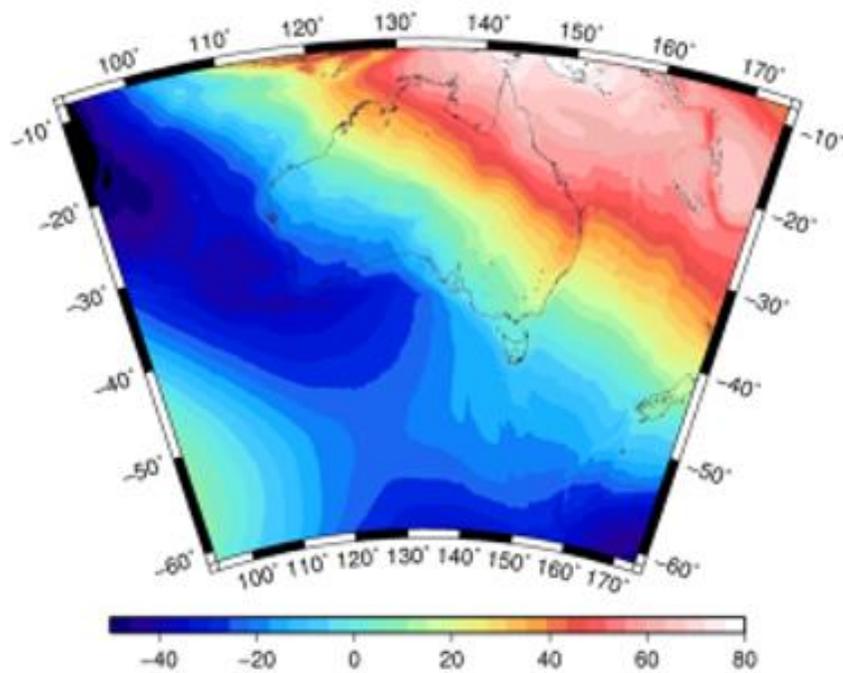


ITRF2020/IGS20 core sites in Australia: 20 of 332 IGS core sites

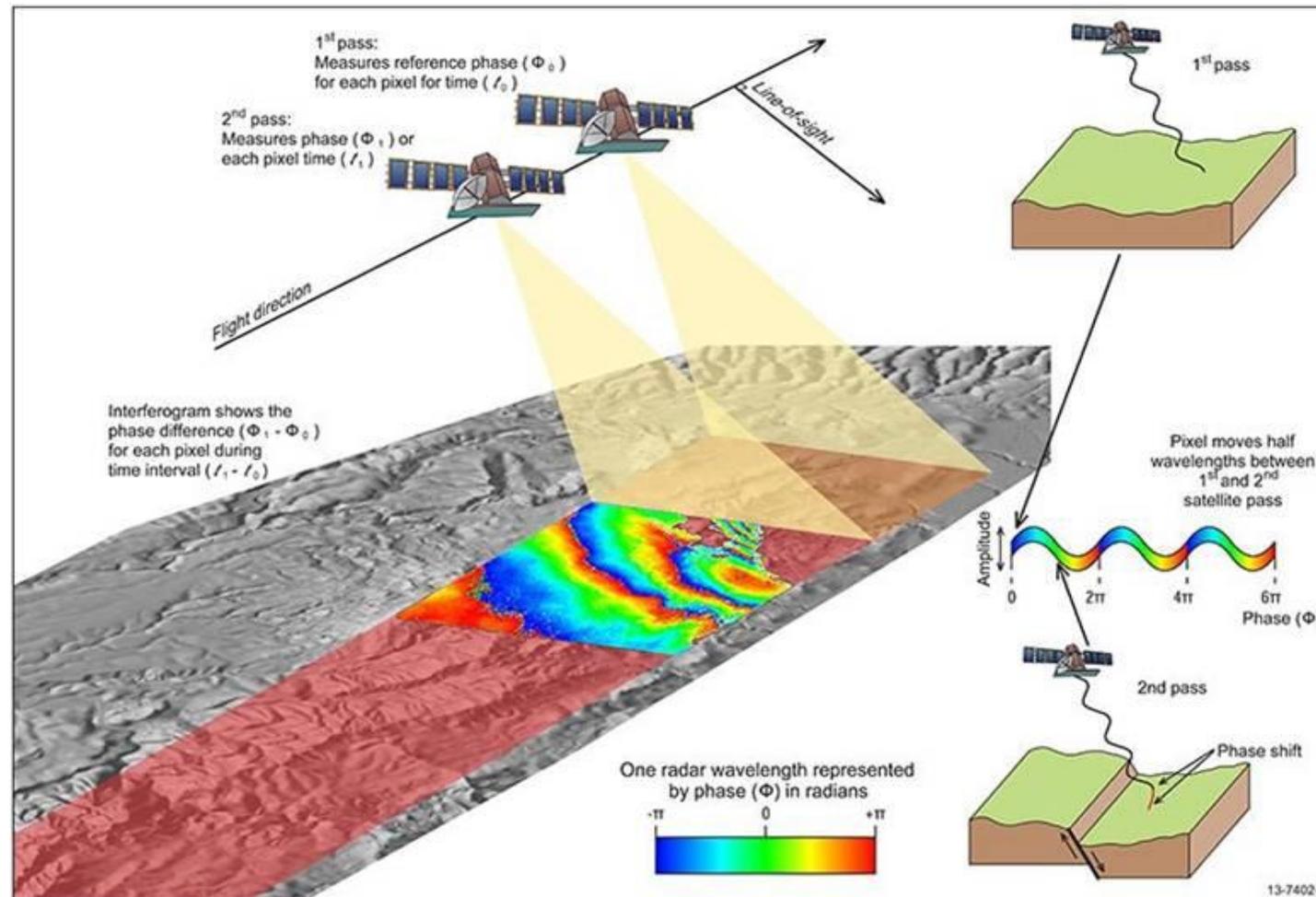


Airborne gravity: improving the AGRS

Airborne gravity surveys are underway to densify our gravity data coverage and improve the AGRS vertical reference surface.



InSAR: producing a national scale InSAR product of ground surface motion



Analytic Capability: Products and Services

Asia Pacific Reference Frame (APREF) Central Bureau

- The geospatial fabric that underpins positioning and geodesy
- Densification of ITRF in the Asia Pacific region
- Input for delivering the National Datum: GDA2020

Verification of Position under the National Measurement Act (1960)

- Regulation 13 certification

AUSPOS

- Online processing service for GPS data
- Uses data from both international and national GNSS stations

GNSS Antenna Calibration Facility

- Two robotic arms + access to anechoic chamber
- Used for calibrating GNSS antennas to achieve high accuracy GNSS positioning

Other products

- Pacific Sea Level and Geodetic Monitoring Project
- Tropospheric delay values for weather forecasting (delivered to BoM)

NPIC / Analysis Centre Software - Ginan



National Positioning Infrastructure Capability (NPIC)

VALUE PROPOSITION

A unified approach to the **management of the nation's positioning infrastructure** to ensure consistent, fit-for-purpose data.

- 1) Underpins Australia's geospatial fabric
- 2) Supports research and innovation
- 3) A platform for Australian business

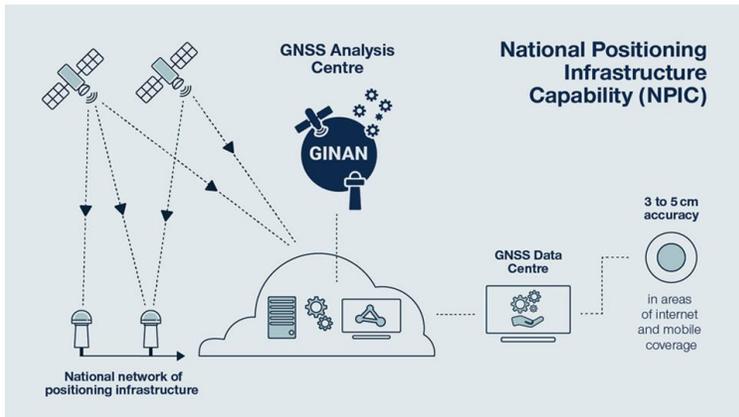
WHAT HAS NPIC DONE?

Established the **infrastructure and digital systems** to enable a centimetre level positioning capability.

- 1) Unified networks of **positioning infrastructure**
 - modernised Australian Regional GNSS Network
 - access to the data from other public and private networks
- 2) Modernised our **digital delivery platforms**
 - improved performance, availability and security of the AUSCORS platform
- 3) Analysis centre **software - Ginan**
 - open-source toolkit to process multi-GNSS data and deliver real-time corrections (SSR)

WHO BENEFITS?

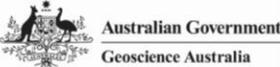
- **Positioning Service providers**
- Free and open access to high quality data
- Consistent national coverage
- **End users (everyone)**
- Flexible offerings from service providers
- Consistent coverage, high quality data



ROLE OF STATION OPERATORS

- Support on the establishment, operation of CORS
- Data validation and verification
- Alignment with nationally consistent guidelines
- Participation in NPIC Infrastructure Committee

National Positioning Infrastructure Capability (NPIC)



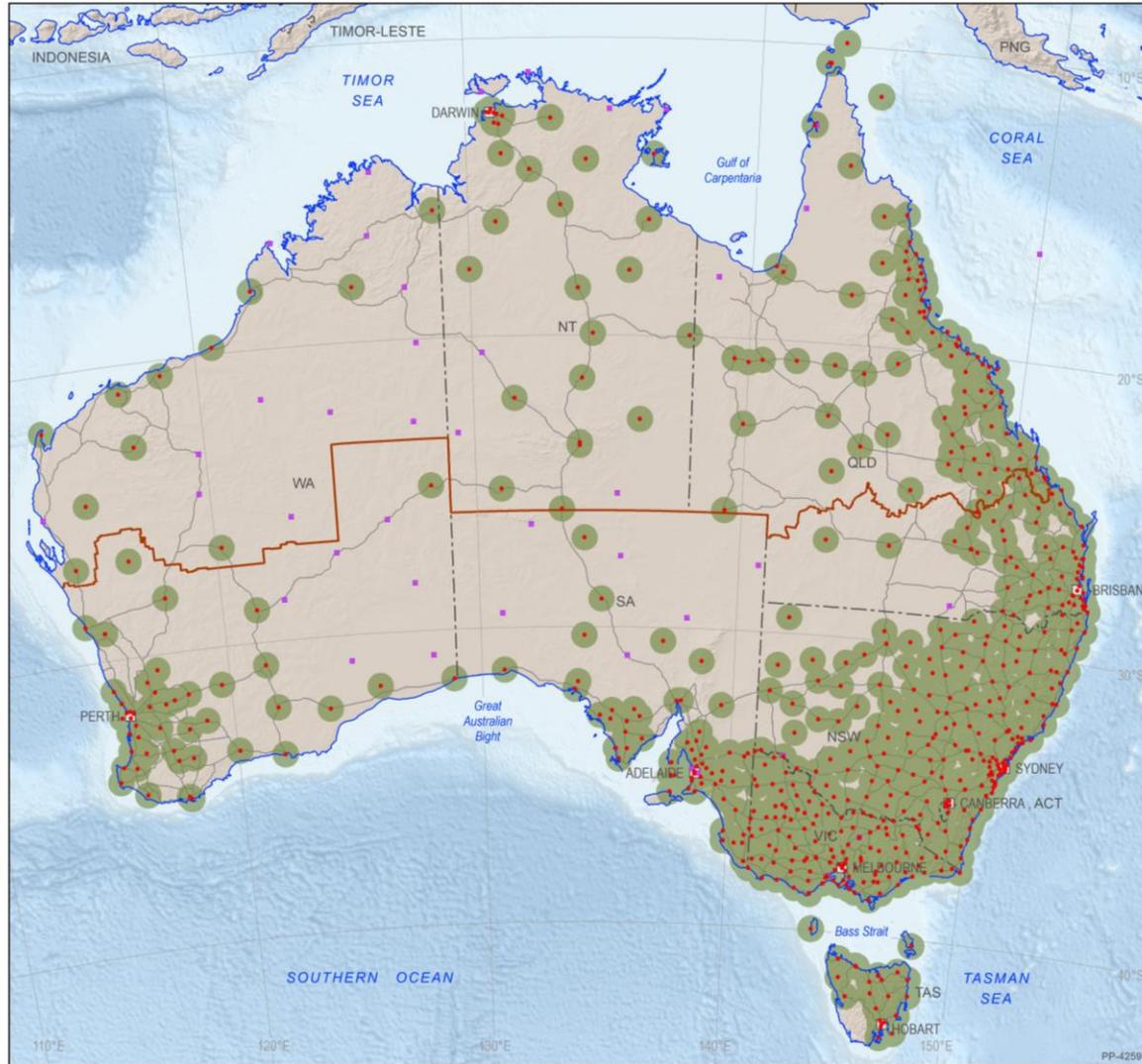
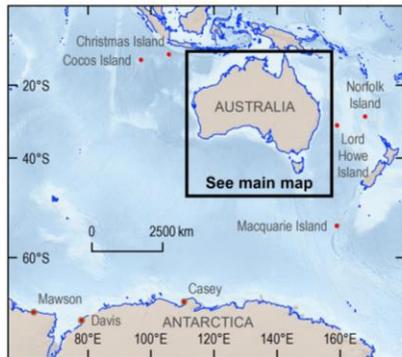
POSITIONING AUSTRALIA

NATIONAL POSITIONING INFRASTRUCTURE NETWORK,

0 750 km

LAMBERT CONFORMAL CONIC PROJECTION
 Central Meridian: 134°E Standard Parallels: 18°S, 36°S
 Geocentric Datum of Australia

- Maximum single base RTK coverage (50 km radius)
- Operational location
- Proposed location
- Northern Australia boundary
- Coastline
- State border
- Major road
- Capital city



HxGN SmartNet



SouthPAN - Southern Positioning Augmentation Network

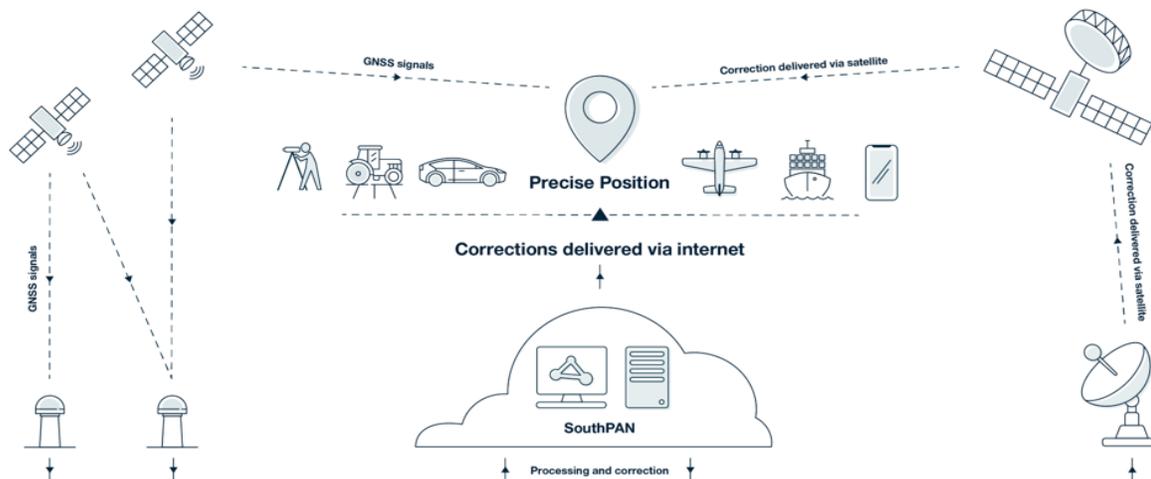
VALUE PROPOSITION

- 1) Improve and augment the **accuracy, integrity and availability** of GNSS in Australia and New Zealand.
- 2) Benefit all users of satellite positioning, particularly in **remote areas without mobile phone coverage**.
- 3) Designed as **safety-of-life service** to provide best **interoperability with other SBAS** (frequency, PRN etc.)

WHO BENEFITS?

- **Positioning Service providers**
 - Free and open access, national coverage
 - Safety-of-life certified (99.5% reliability)
- **End users (everyone)**
 - Free and open access, national coverage
 - Improved offering from service providers

SouthPAN



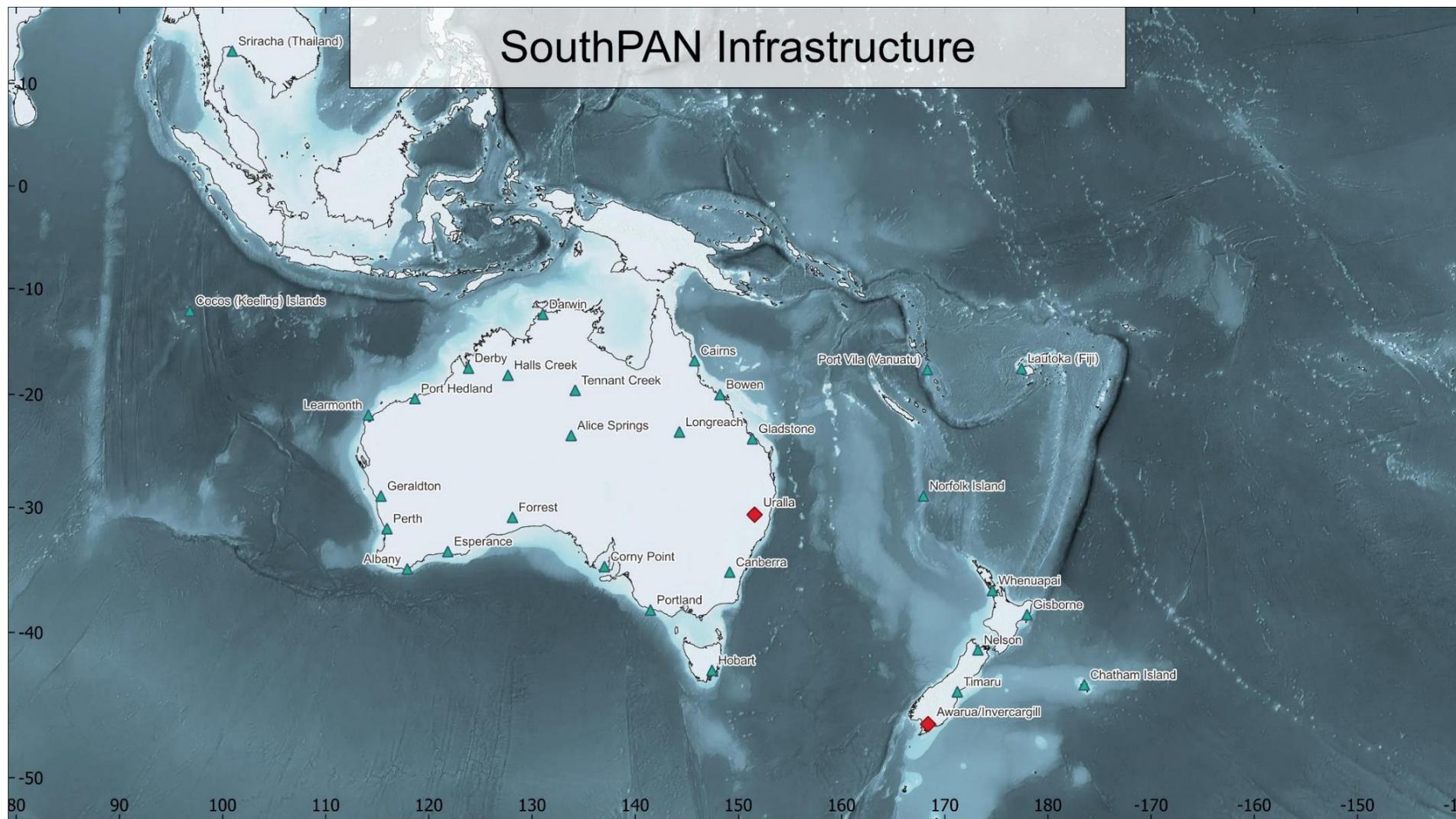
WHAT IS COMING?

- Early Open Service performance will improve as SouthPAN is deployed
- Safety-of-Life Services are in development, expected 2028

ROLES

- Joint service delivered by Geoscience Australia and Toitū Te Whenua Land Information New Zealand.
- Lockheed Martin Australia, with GMV and Zeta Associates establishing & operating SouthPAN
- SouthPAN Geostationary Payload (SGP) 01, supplied by Inmarsat Australia and operational in 2027
- Until 2026: 55 CORS through NPIC, + 7 in NZ

SouthPAN Infrastructure



Legend

- ◆ Uplink / Processing Centres
- ▲ GNSS Reference Stations (Customer and Contractor)

Bathymetric data from
© GEBCO Compilation Group (2020) GEBCO 2020 Grid
(doi:10.5285/a29c5465-b138-234d-e053-6c86abc040b9)



Ginan – Analysis Centre Software

VALUE PROPOSITION

- **Validation and verification** on the quality and performance of the regions GNSS networks
- The creation of an open GNSS **correction service** to support science and innovation
- Support for reference frame development, crustal deformation studies, atmospheric studies, and environmental monitoring

WHO BENEFITS?

Geoscience Australia

- Building in-house expertise and capability

Academia and innovators

- Open-source and highly configurable
- Modern implementation and standards

End users (everyone)

- File based products and real-time streams
- Modularised toolkit

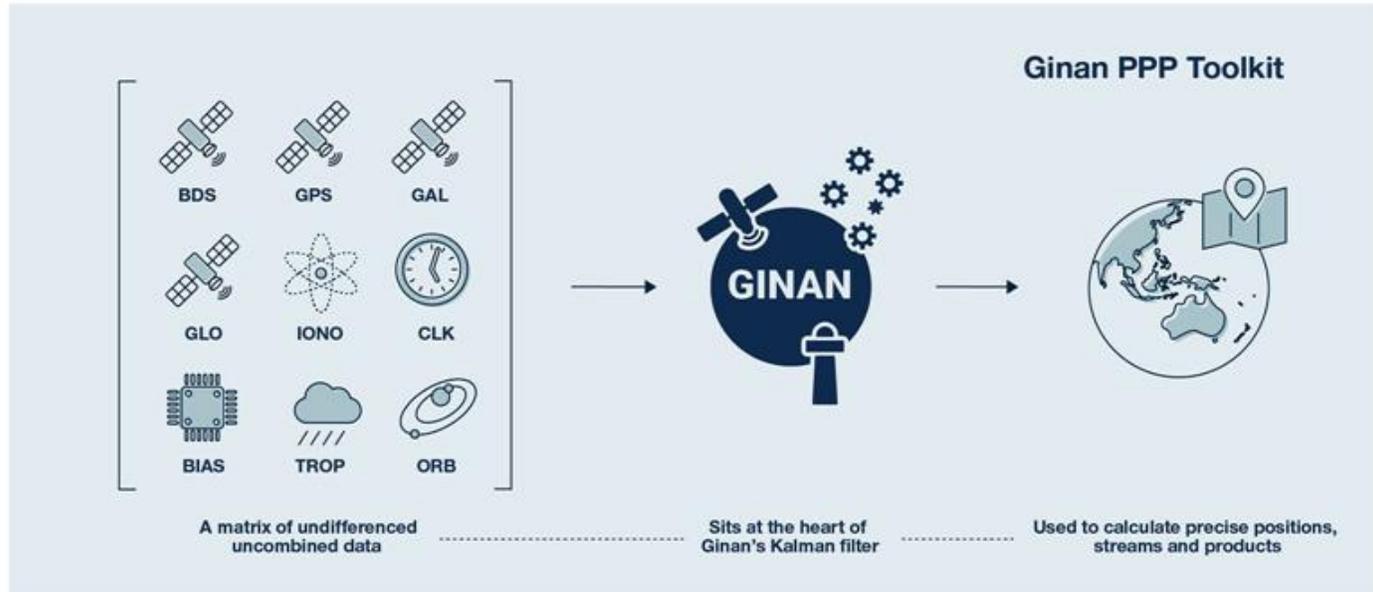
ACHIEVEMENTS SO FAR

Open-source toolkit MVP (version 1) in July 2022

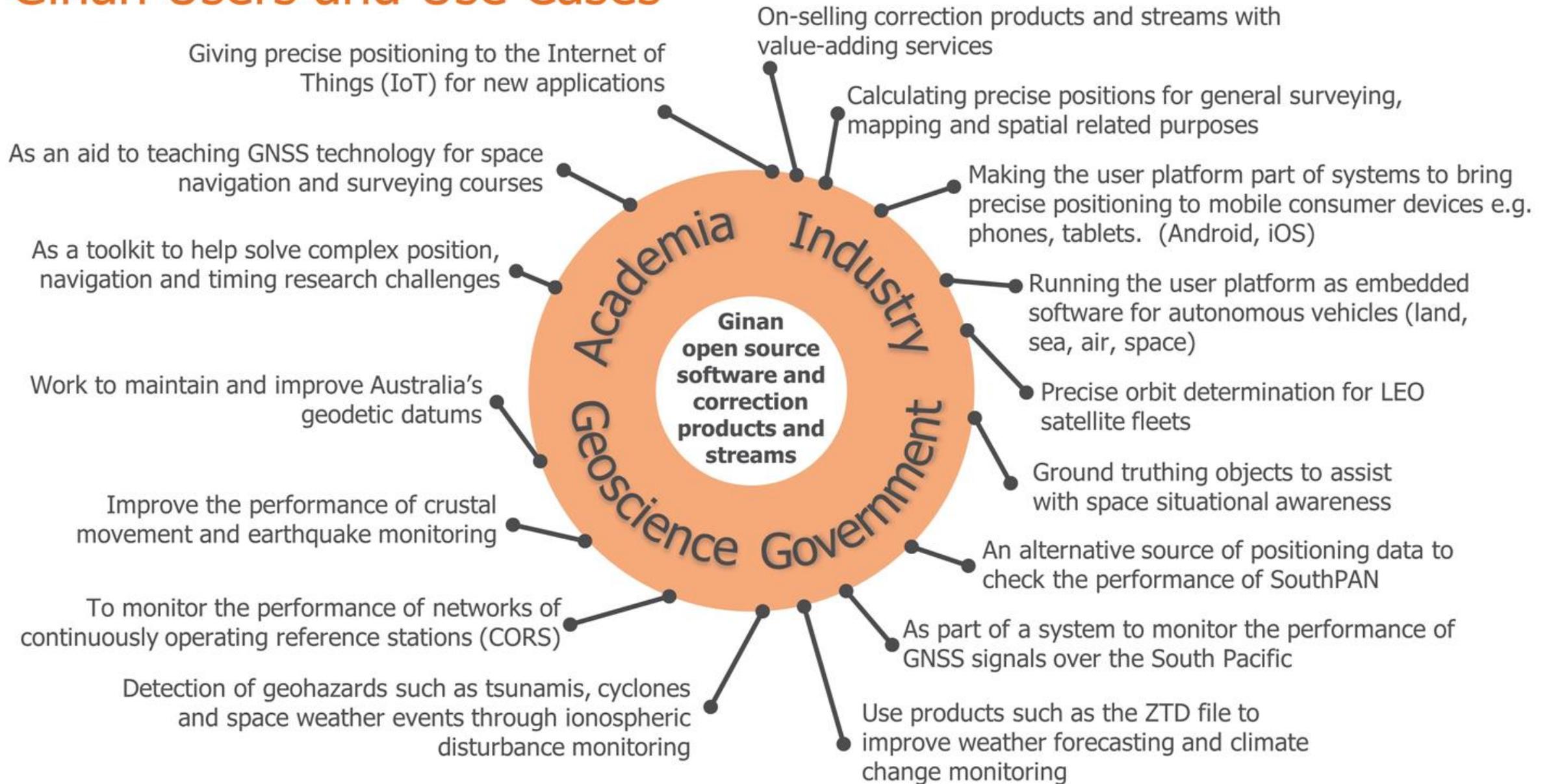
- Undifferenced/combined, Ionosphere-free

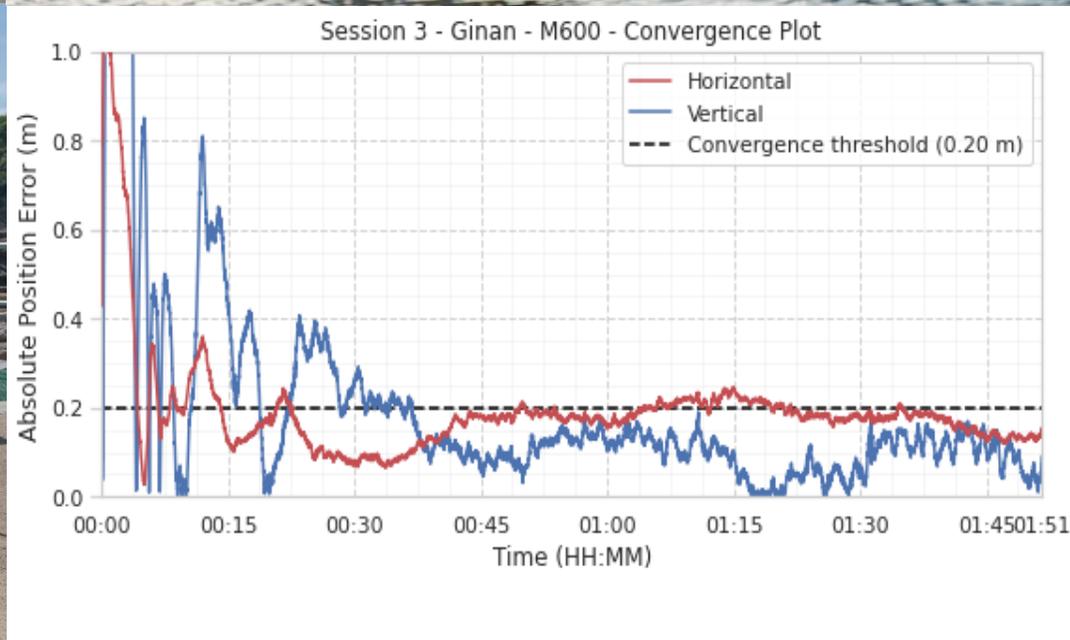
Version 2 in July 2023

- Unified User and Network operation modes (One Observation Model & Filter)
 - Undifferenced/uncombined
 - Multi-GNSS, multi-frequency
 - Integrated and coupled Precise Orbit Determination (POD)
 - Complete RTCM3 phase 1 and Phase 2 message decoding and encoding
 - Satellite Laser Ranging data handling
 - Performance improvements
 - Better accuracy and operational stability
- Ginan deployed operationally
- RTCM SSR Correction Stream - NTRIP (1059, 1060)
 - File based products (satellite orbits, clocks, earth rotation parameters, and position coordinates)



Ginan Users and Use Cases







Geoscience Australia acknowledges the traditional owners and custodians of Country throughout Australia and acknowledges their continuing connection to land, waters and community. We pay our respects to the people, the cultures and the elders past and present.

Further information

Email positioningaustralia@ga.gov.au

