

# International Member

## Regional Update

# Australia

**Matt Higgins**

*President of the IGNSS Society of Australia*

*Manager Geodesy and Positioning, Queensland Department of Natural Resources and Mines*

*Member Australian National Positioning Infrastructure Advisory Board*

*Adjunct Professor Queensland University of Technology*



# Presentation Outline

- Global Geodetic Reference Frame;
- National Positioning Infrastructure;
- Space Based Augmentation Discussions;
- Spectrum Issues;
- Multi-GNSS;
- Applications and Benefits.



# Global Geodetic Reference Frame



# UN Recognition...

How geodesy contributes to  
strengthen the study of  
our changing planet



UN-GGIM

United Nations Initiative on  
Global Geospatial Information Management

*Positioning geospatial information to address global challenges*

[ggim.un.org](http://ggim.un.org)

US PNT Advisory Board - June 2015 - Higgins



# UN Recognition...

## Global collaboration

- Global geodesy is dependent on contributions from nations all around the globe
- No single country can maintain the global geodetic reference frame alone
- We aim to change from the current system where contributions to the development of the global geodetic reference frame are undertaken on a "best efforts" basis to one where they are made through a multilateral collaboration under a UN mandate



UN-GGIM

United Nations Initiative on  
Global Geospatial Information Management

*Positioning geospatial information to address global challenges*

[ggim.un.org](http://ggim.un.org)

US PNT Advisory Board - June 2015 - Higgins



# UN Recognition...

United Nations

A/69/L.53



**General Assembly**

Distr.: Limited  
18 February 2015

Original: English

---

**Sixty-ninth session**

Agenda item 9

**Report of the Economic and Social Council**

**Argentina, Australia, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Ethiopia, Fiji, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Jamaica, Japan, Lithuania, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Papua New Guinea, Philippines, Poland, Portugal, Republic of Korea, Samoa, Slovenia, Solomon Islands, Spain, Sweden, Tunisia, Tuvalu, United Kingdom and Great Britain and Northern Ireland, United States of America and Vanuatu: draft resolution**

**A global geodetic reference frame for sustainable development**

*The General Assembly,*

*Reaffirming the purposes and principles of the Charter of the United Nations...*

# UN Recognition...

*Acknowledging* that the global geodetic reference frame depends upon the participation of countries all around the globe, and the need to take action to strengthen international cooperation,

1. *Notes with appreciation* the establishment of a working group by the Committee of Experts on Global Geospatial Information Management to develop a global geodetic road map that addresses key elements relating to the development and sustainability of the global geodetic reference frame;

2. *Encourages* Member States and relevant international organizations to enhance global cooperation in providing technical assistance, especially for capacity development in geodesy for developing countries, with the aim of ensuring the development, sustainability and advancement of a global geodetic reference frame;

3. *Urges* Member States to implement open sharing of geodetic data, standards and conventions, on a voluntary basis, to contribute to the global reference frame and regional densifications through relevant national mechanisms and intergovernmental cooperation, and in coordination with the International Association of Geodesy;

4. *Also invites* Member States to commit to improving and maintaining appropriate national geodetic infrastructure as an essential means to enhance the global geodetic reference frame;

5. *Further invites* Member States to engage in multilateral cooperation that addresses infrastructure gaps and duplications towards the development of a more sustainable global geodetic reference frame;

6. *Invites* Member States to develop outreach programmes that make the global geodetic reference frame more visible and understandable to society.



# UN Recognition...



GEODESY - A GLOBAL SCIENCE ON A RESTLESS PLANET

Video link at [http://ggim.un.org/UN\\_GGIM\\_wg1.html](http://ggim.un.org/UN_GGIM_wg1.html)  
or directly available at: <https://vimeo.com/89695290>

# National Positioning Infrastructure



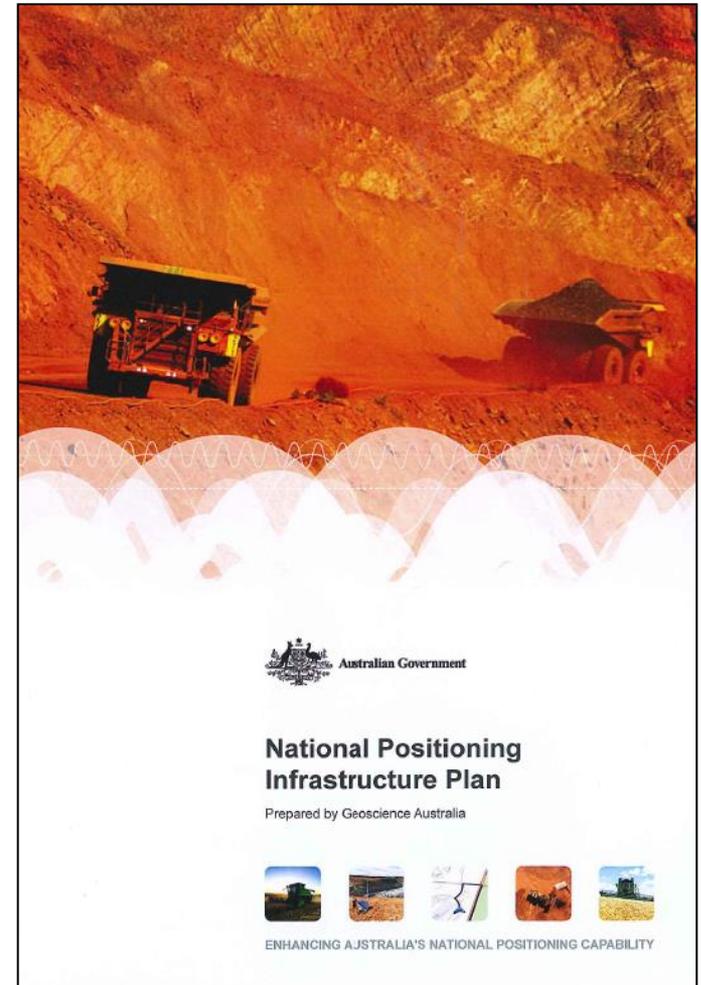
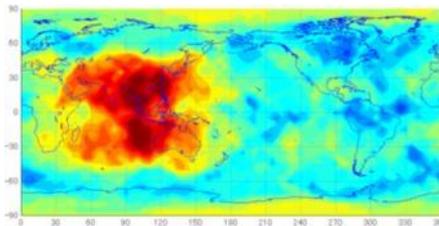
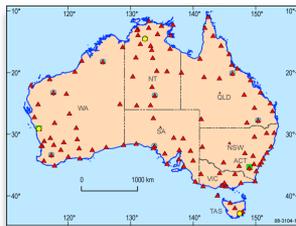
# National Positioning Infrastructure Plan

A coordinated whole-of-government approach to building a NPI that supports Positioning, Navigation & Timing (PNT) in Australia.

A recognised need to identify and address government, industry and research positioning requirements for:

- Accuracy
- Open Data
- Integrity
- Standardisation
- Certification
- Interoperability
- Risk mitigation
- Privacy

A vision to assure instantaneous, reliable and fit-for-purpose PNT services anywhere and anytime across the Australian landscape and beyond.



# Australian Government Position, Navigation & Timing Working Group (PNT-WG)

Chaired by Geoscience Australia.

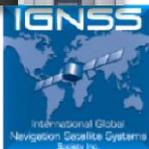
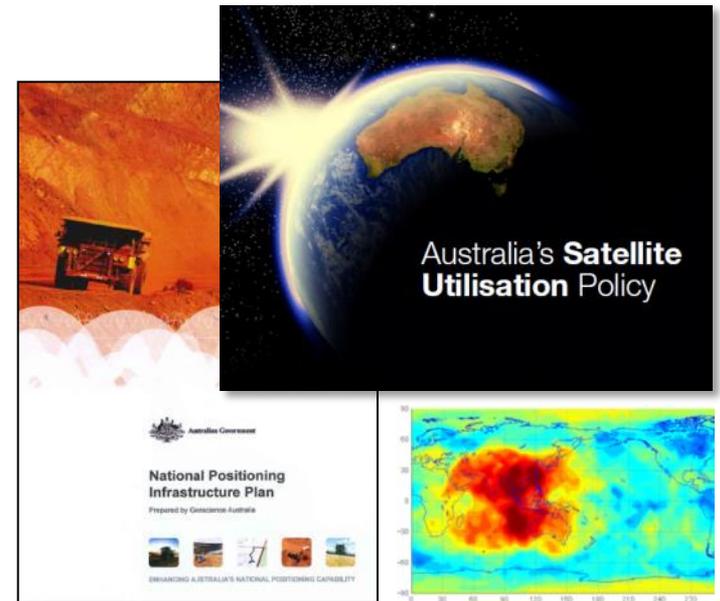
Reports to the Space Coordination Committee (SCC).

Draws together key Australian Government agencies involved in PNT to advise the SCC on the status and future of positioning in Australia.

Quarterly meetings with presentations invited from industry.

Key discussion points for 2014 include:

- Spectrum management
- Status and capabilities of new GNSS
- International engagement
- Hosting of GNSS ground infrastructure
- Planning for the NPI



# NPI Advisory Board (NPI-AB)

- Established in December 2014 to advise GA on developing and implementing the NPI
- Ten permanent members (outside of GA) nominated from government, industry and research for their individual expertise
- Inaugural meeting held in March 2015
- Technical Working Groups (TWG) will be commissioned to address key issues and priorities for the NPI, including infrastructure management and minimum performance standards.



*'Instantaneous, reliable and fit-for-purpose access to position and timing information anytime and anywhere across the Australian landscape and its maritime jurisdictions.'*



# NPI-AB Membership:

- **Gary Johnston, John Dawson & Grant Hausler** (GA – Chair & Secretariat)
- **Stuart Ballingall** (Austroads)
- **Graeme Blick** (NZ Government)
- **Dr Suelynn Choy** (RMIT University and CRCSI)
- **Paul Harcombe** (NSW Government, ICSM)
- **Matt Higgins** (QLD Government, IGNSS Society, US PNT Advisory Board)
- **Nick Lemon** (Australian Maritime Safety Authority)
- **Rod MacLeod** (NovAtel)
- **Ian Mallet** (Civil Aviation Safety Authority)
- **Tim Neale** (Precision Agriculture)
- **Martin Nix** (Position Partners)



# NPI Progress/Planning



- PNT Working Group & NPI Advisory Board
- Engage key Government, industry and research stakeholders
- Facilitate standards adoption and data sharing
- Upgrade national GNSS ground infrastructure
- Facilitate international engagement and collaboration
- Develop and validate GNSS products and services (Analysis Capability)
- Investigate ground and space-based delivery systems
- Mitigate vulnerabilities



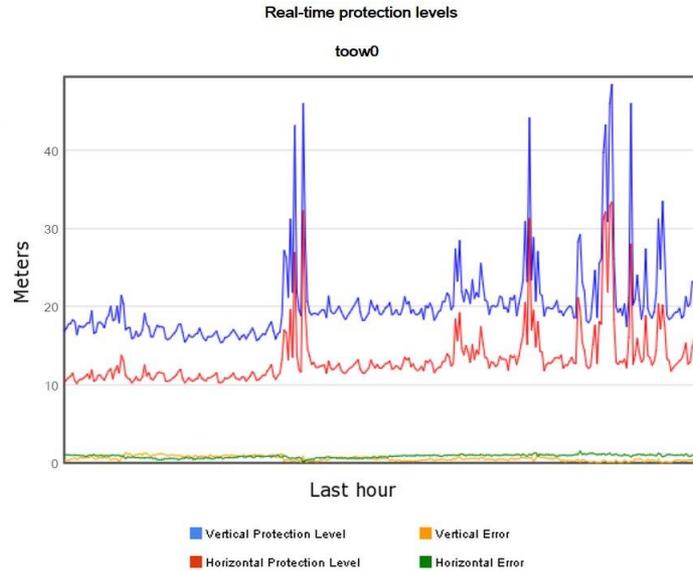
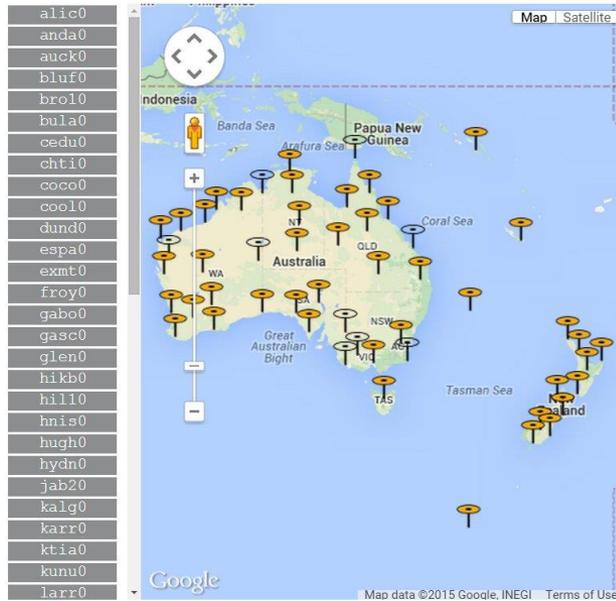
# Space Based Augmentation Systems



# SBAS Issues for Australia

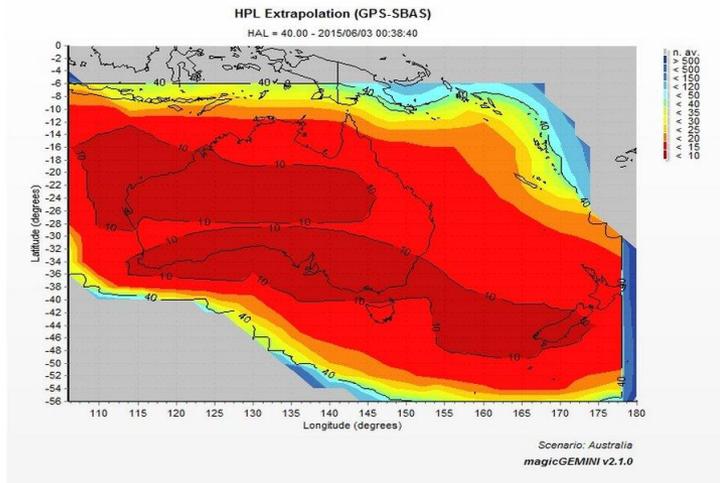
- Huge areas of Australia not serviced by terrestrial mobile communications so satellite delivered service must be part of the NPI solution;
- Discussion of “Aviation Style SBAS” vs other forms of Satellite Delivered Augmentations ~ e.g. QZSS LEX, Commercial DGNSS and PPP solutions via satellite;
- Safety of Life applications lead Government to tend toward free-to-air, sovereign capability;
- Business Case for Aviation Style SBAS is not strong in general aviation alone so C-ITS and other high integrity apps bolster the business case;
- Tension between standardised approach of aviation SBAS vs innovation and improved services from other solutions.



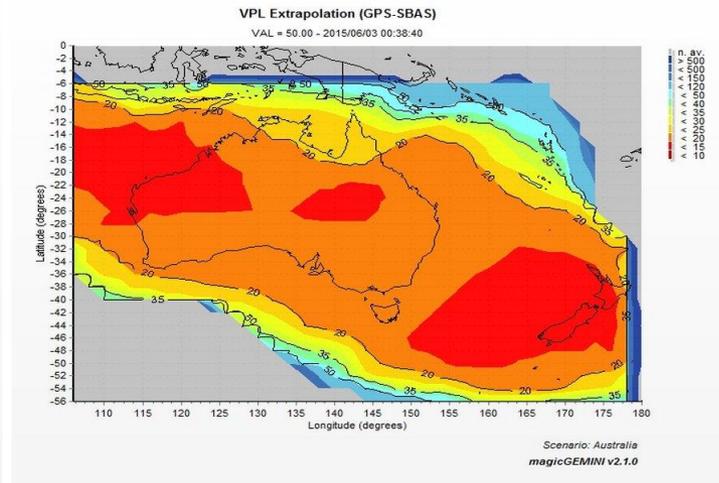


*magicGEMINI* User Level Performance

Last update: Wed Jun 03 10:39:24 GMT+1000 2015 (Refresh time: 30 secs)



Horizontal Protection Levels (in meters).



Vertical Protection Levels (in meters).



# Spectrum Issues





# Remaking the Space Object Class Licence

Australia is in the unique position that all regional and global RNSS systems provide some coverage to the Australian mainland and the density of systems offering RNSS radiocommunications is increasing.

The ACMA proposes to make the RNSS class licence to better facilitate the use of the RNSS in Australia as well as to make additional frequencies that are being brought into use by RNSS operators internationally available. The proposal also recommends that an alternative licensing regime apply to the operation of RNSS receivers in Australia given the density of deployment and the benefits it provides, not only economically, but to everyday life.

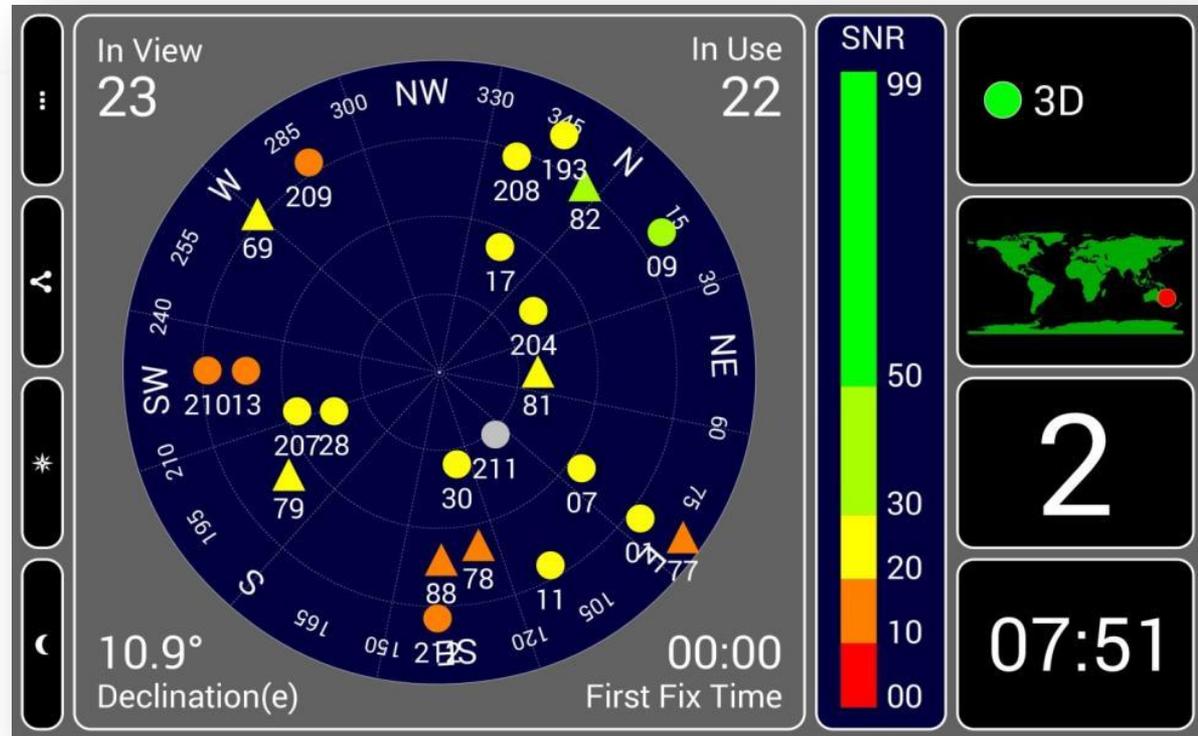
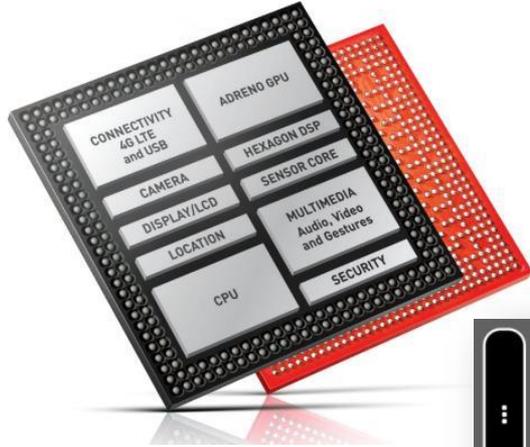
proposing to remake the CSO class licence with a number of amendments, including a proposal to excise the frequency bands of the radionavigation-satellite service into a new class licence.



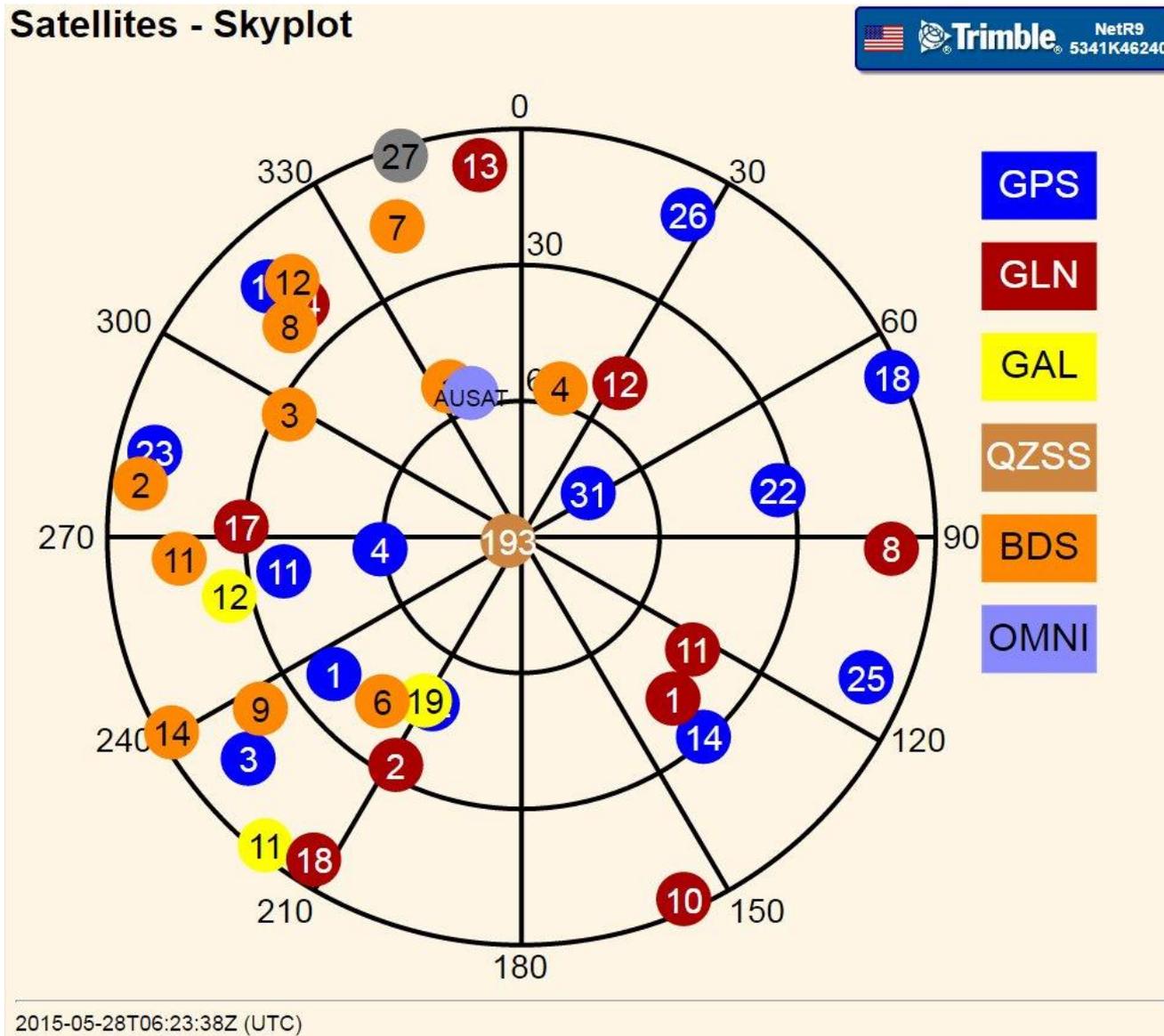
# Multi-GNSS



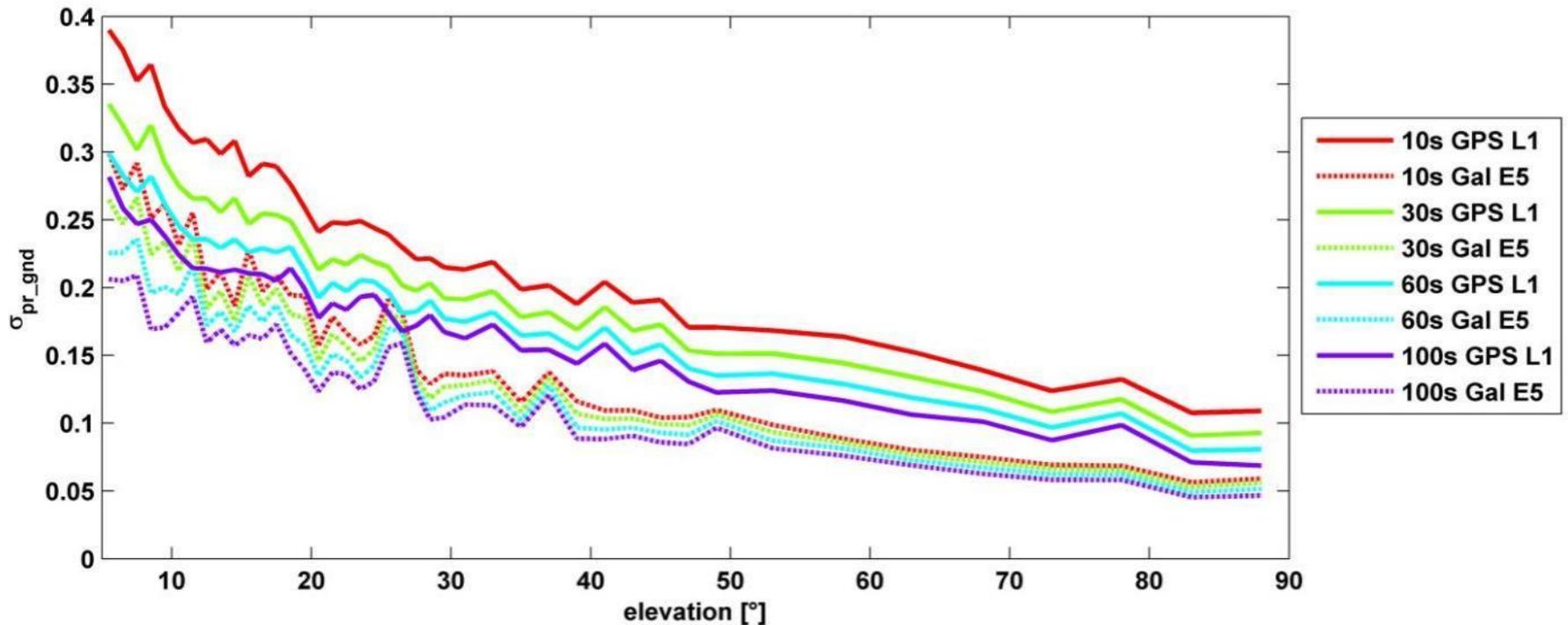
# Satellites over Brisbane



# Satellites over Brisbane



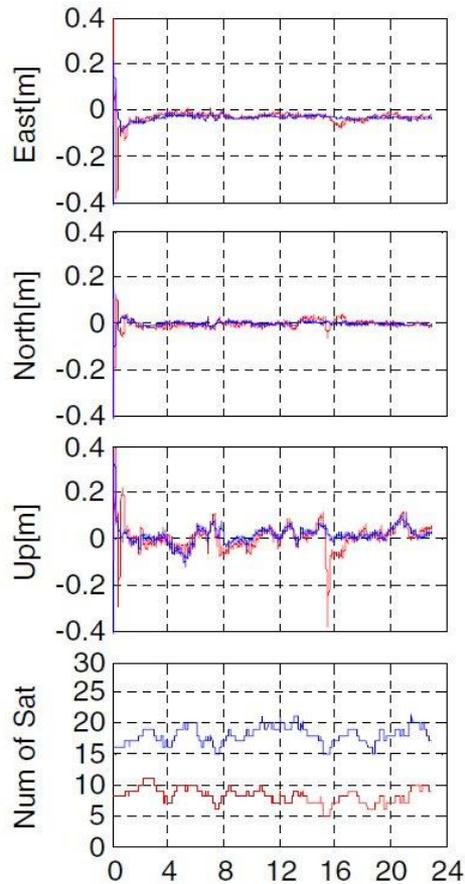
# Galileo Signal Design



“Analysis of new Galileo signals at an experimental ground-based augmentation system (GBAS) compares noise and multipath in their performance to GPS L1 and L5. Raw noise and multipath level of the Galileo signals is shown to be smaller than those of GPS. Even after smoothing, Galileo signals perform somewhat better than GPS and are less sensitive to the smoothing time constant.”

(Source: GPS World, 4 March 2015)

# Benefits of Multi-GNSS

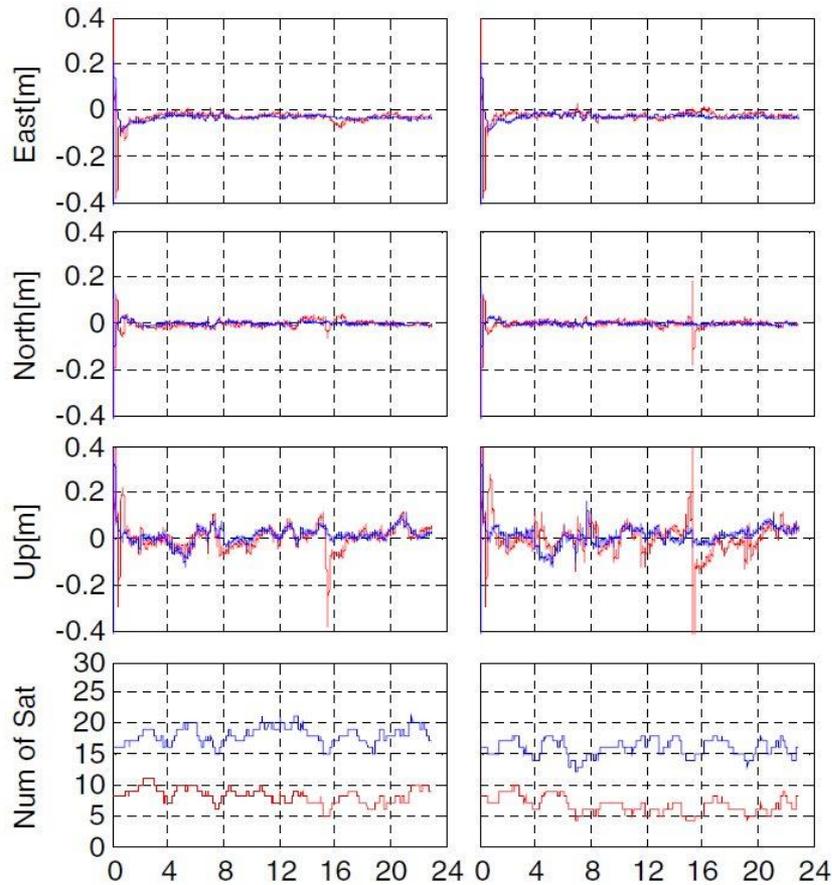
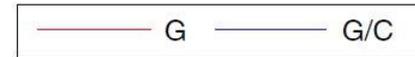


Comparisons of PPP results in single- and dual-system modes under different elevation cutoffs (from 10° to 40°) at station CENT. The corresponding satellite numbers and PDOP values are also shown

Source: Li et al, Journal of Geodesy, Vol. 89 No. 6, March 2015



# Benefits of Multi-GNSS

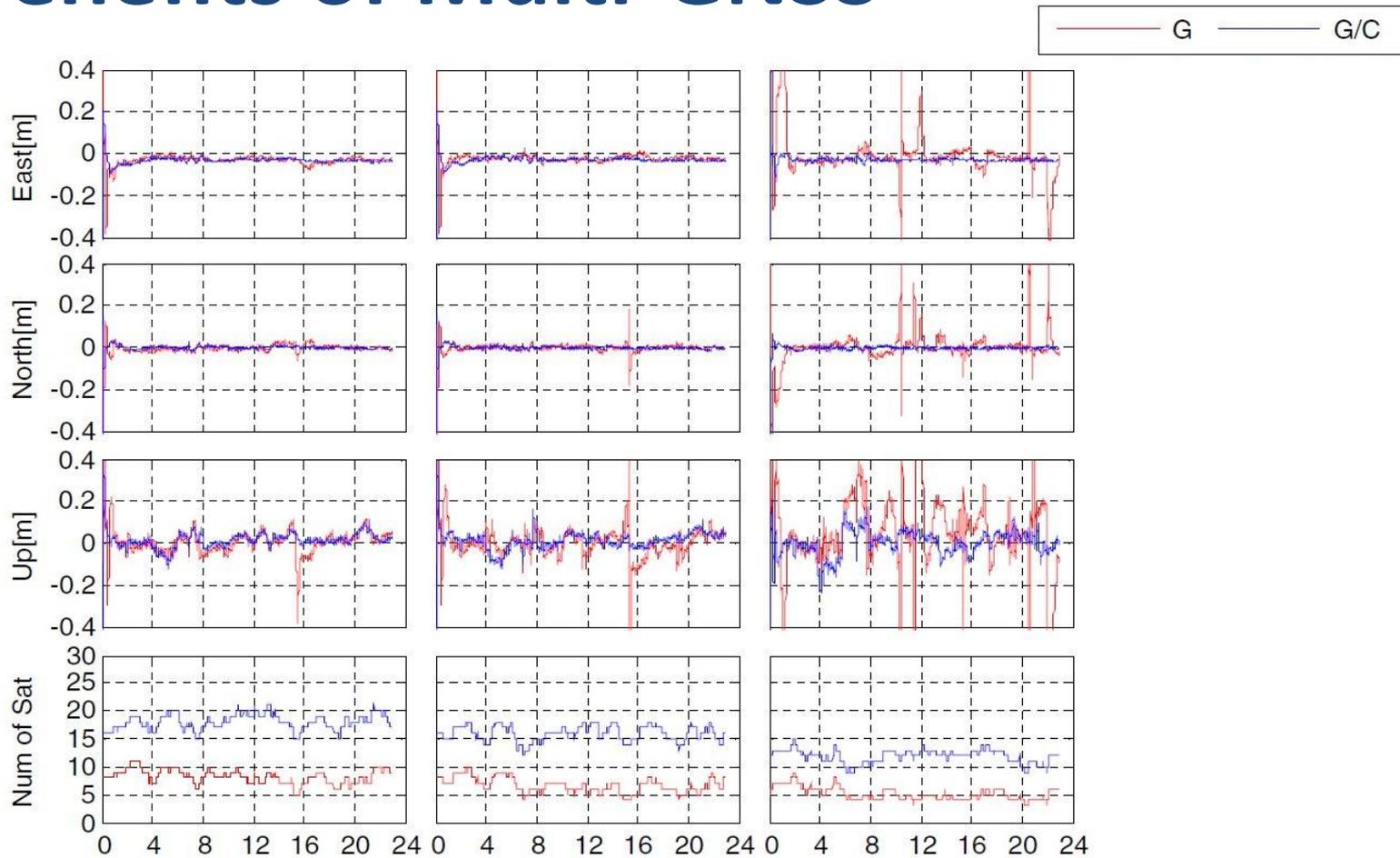


Comparisons of PPP results in single- and dual-system modes under different elevation cutoffs (from 10° to 40°) at station CENT. The corresponding satellite numbers and PDOP values are also shown

Source: Li et al, Journal of Geodesy, Vol. 89 No. 6, March 2015



# Benefits of Multi-GNSS

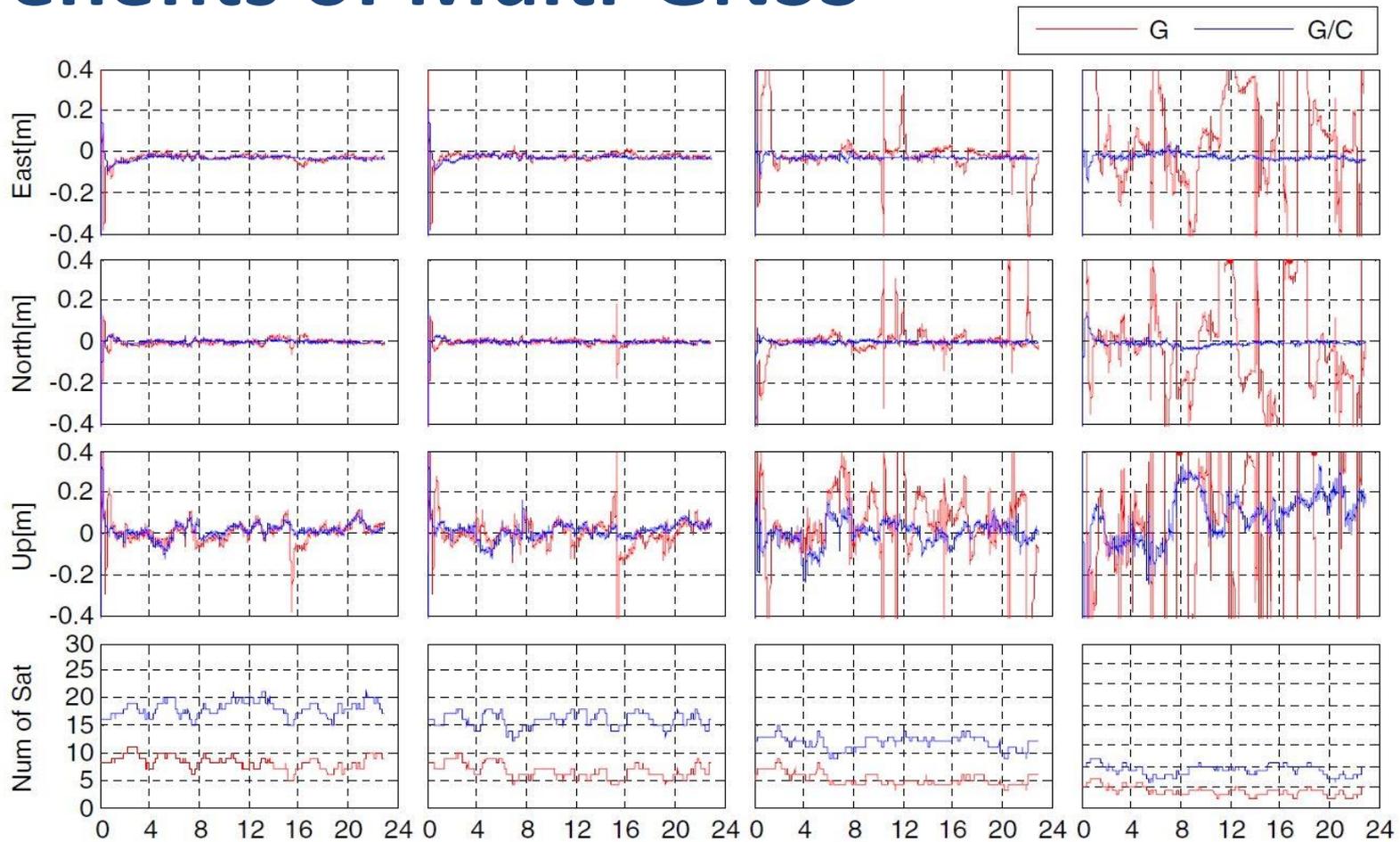


Comparisons of PPP results in single- and dual-system modes under different elevation cutoffs (from 10° to 40°) at station CENT. The corresponding satellite numbers and PDOP values are also shown

Source: Li et al, Journal of Geodesy, Vol. 89 No. 6, March 2015



# Benefits of Multi-GNSS

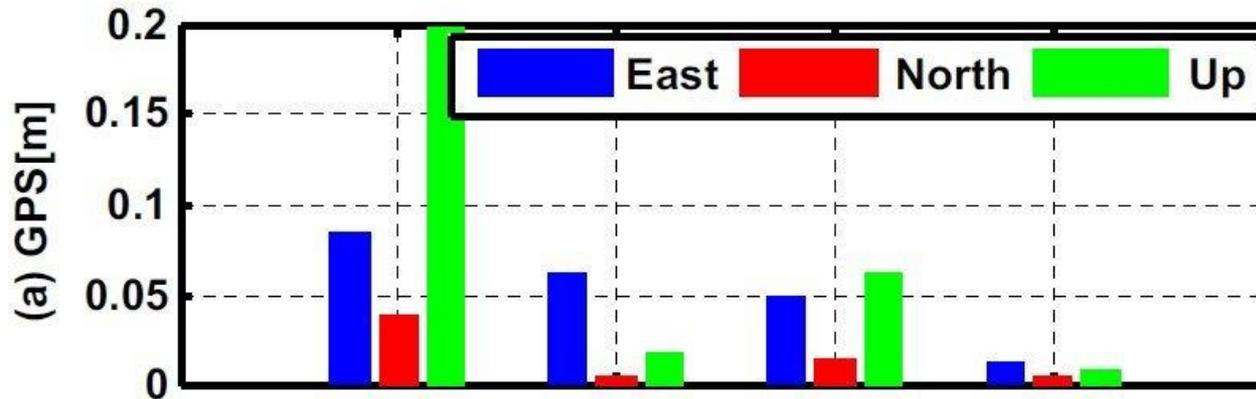


Comparisons of PPP results in single- and dual-system modes under different elevation cutoffs (from 10° to 40°) at station CENT. The corresponding satellite numbers and PDOP values are also shown

Source: Li et al, Journal of Geodesy, Vol. 89 No. 6, March 2015



# Benefits of Multi-GNSS

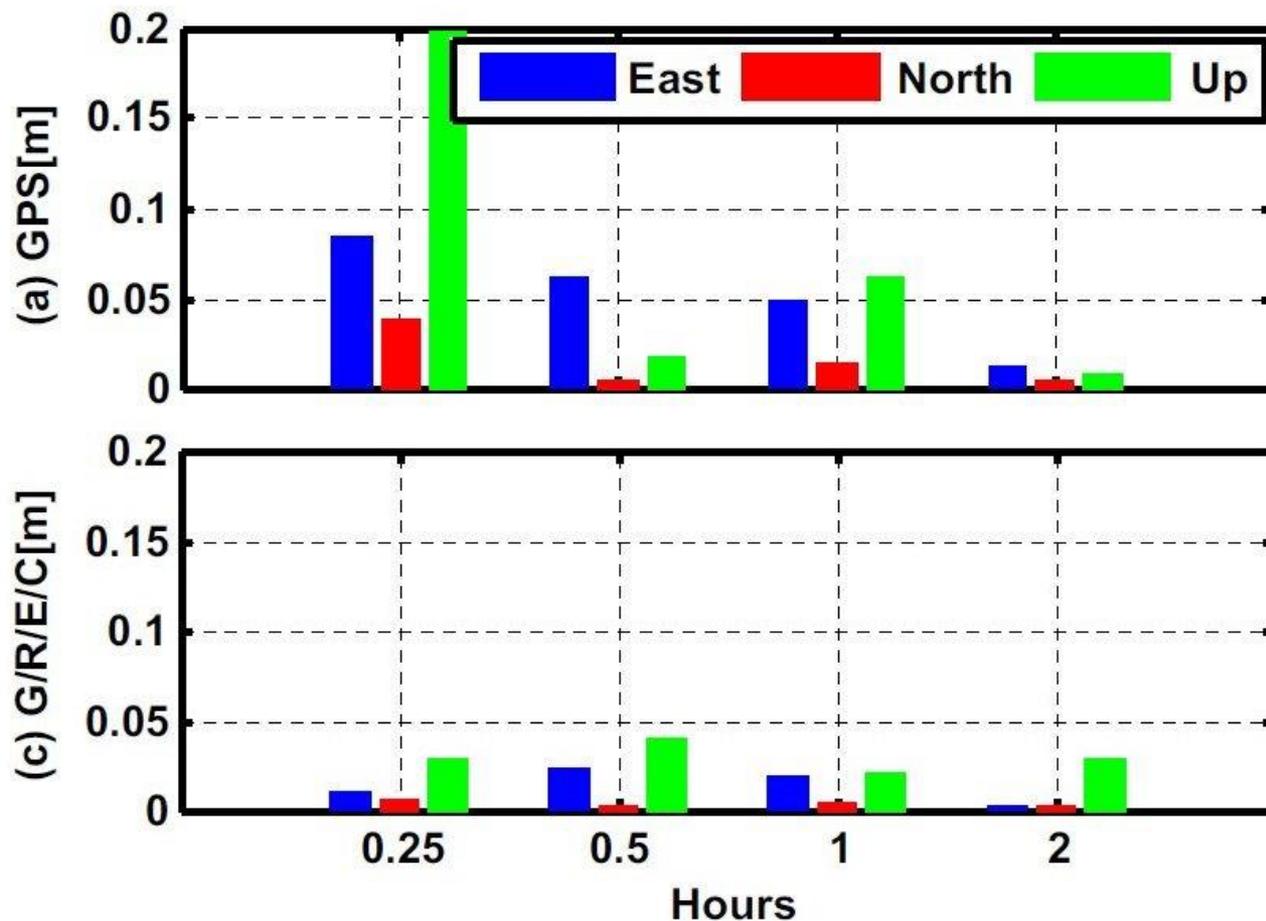


Position errors of kinematic PPP solutions at station LMMF with different observational lengths of 0.25, 0.5, 1, and 2 h in single-system and multi-GNSS modes

Source: Li et al, Journal of Geodesy, Vol. 89 No. 6, March 2015



# Benefits of Multi-GNSS

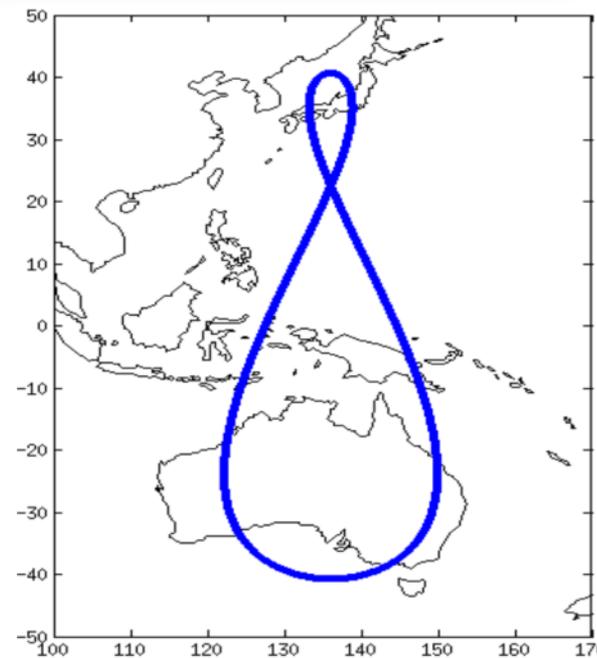
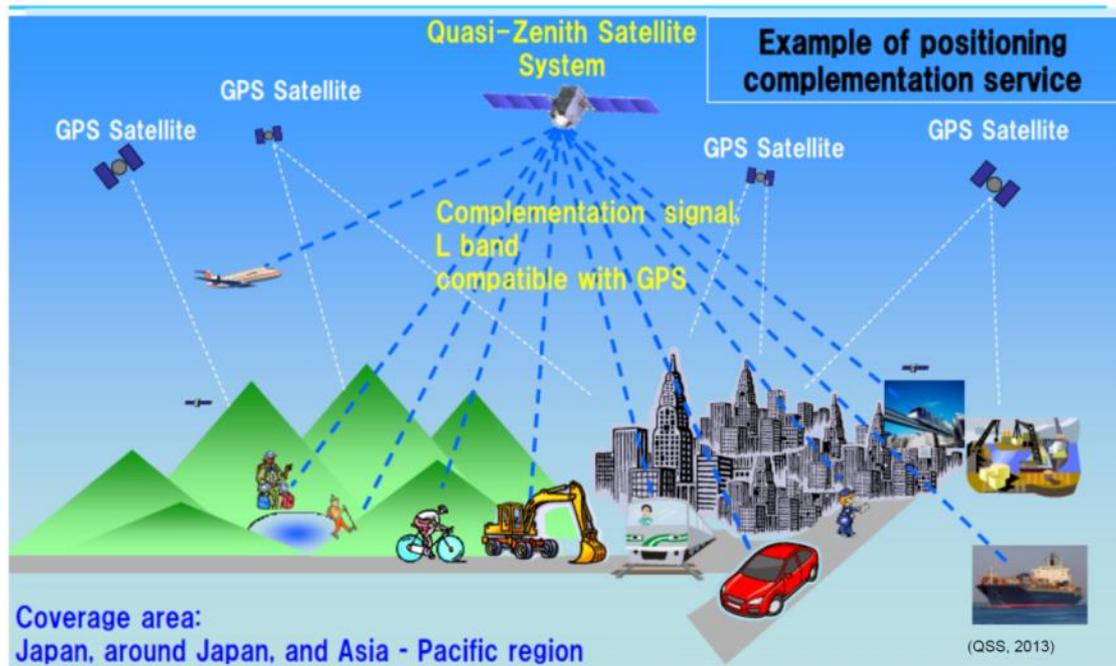


Position errors of kinematic PPP solutions at station LMMF with different observational lengths of 0.25, 0.5, 1, and 2 h in single-system and multi-GNSS modes

Source: Li et al, Journal of Geodesy, Vol. 89 No. 6, March 2015



# Continued interest in QZSS Augmentation Capabilities



- Two R&D projects with JAXA:
  - One on Real Time Precise Point Positioning (RT-PPP) to test QZSS LEX signal, facilitated by the Cooperative Research Centre for Spatial Information (CRCSI);
  - Another through RMIT on QZSS L1-SAIF for disaster alert messaging.

# Applications and Benefits



# QZSS Research and Testing

 Rural

 ABC

## Japan tests new satellite on robotic tractors in Riverina



**PHOTO:** A drone hovers over the Japanese robotic tractor trialled at Rice Research Australia in south-west NSW. (Laurissa Smith)

Source: <http://www.abc.net.au/news/2015-01-28/robotic-tractor-on-rice-crop-2801/6052366>

US PNT Advisory Board - June 2015 - Higgins



# Automated Mining

MINING... IRON ORE

Remote Control for  
Remote Locations



# Next is Automated Trains



After the automated drills and AHS come the automated trains – AutoHaul<sup>®</sup>, which Rio Tinto hopes will be operating in the Pilbara in 2015. Rio has invested over US\$518 million on their automated trains and as with the autonomous drills and trucks, Rio Tinto sees AutoHaul<sup>®</sup> having significant long-term productivity and safety benefits. It will also be a major contribution to the cost efficient expansion of Rio Tinto’s Pilbara production from 290 to 360 million tonnes a year.

“When complete, it will be the world’s first automated, long distance, heavy haul rail network,” said Mr Harding. “We’ll no longer have to drive more than 70,000 kilometres each week just to get our drivers in the right place to start or finish their shifts. It will also provide safer road crossings over railway lines.”



# Societal Benefits of Precision Ag

 Search for people, places and things 

 **Payne's Prairie MN** shared Peterson Farm Bros's photo.   
5 May at 01:04 · Edited · 

One of the biggest benefits of auto steer, family time. With how many hours farmers spend in the tractor, seeing those that are important to you, reminds you why you put in so many hours.



**Peterson Farm Bros**  
Benefits of autosteer! #Plant15 #Farm365  
-From Michael Cline (@precisionnerd) on Twitter

Like · Comment · Share

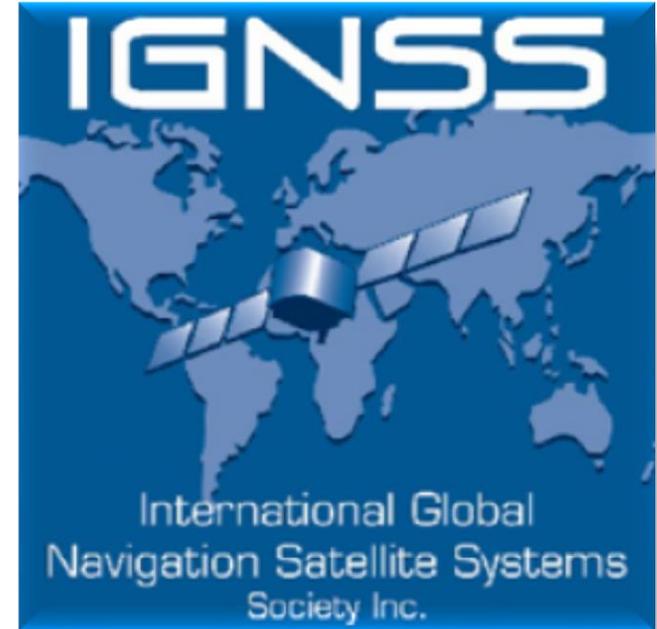


# IGNSS 2015

Gold Coast, Queensland, Australia

14th to 16th July 2015

[www.ignss.org](http://www.ignss.org)



***Thanks for your attention - [matt.higgins@qld.gov.au](mailto:matt.higgins@qld.gov.au)***



US PNT Advisory Board - June 2015 - Higgins

