OVERVIEW

- Where is Australia?
- Recent activities
- CNS Transition
- SBAS
- Issues
- Discussion
ACTIVITIES

- US PNT Advisory Board
- APEC GNSS Implementation Team - Korea
- NPI
- PBN Working Group
- Defence Workshop on GNSS Vulnerabilities
- IGNSS – [WWW.IGNSS.org](http://WWW.IGNSS.org)
- ICAO – Navigation Panel, PBNSG, CNS
- Papua New Guinea
- ASTRA – [www.astra.aero](http://www.astra.aero) ATM Advisory
- MH370 search
NPI

- National Positioning Infrastructure
  - Advisory Board
  - Multi-agency
    - Advice to Government
- Improved International Engagement
- Building Australia’s NPI
  - Ground Infrastructure
  - NPI Plan
Australian Government Positioning, Navigation & Timing Working Group (PNT-WG)

Established by Australia’s Satellite Utilisation Policy

Chaired by Geoscience Australia.

Reports to the Space Coordination Committee (SCC)

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

Quarterly meetings with industry presentations.

Key discussion points from 2014/2015:
• Australian Government coordination
• Spectrum management
• International engagement
• GNSS site-hosting (e.g. Japan, China)
• Critical infrastructure resilience
National Positioning Infrastructure Advisory Board

- Established December 2014 to advise Geoscience Australia on developing and implementing the NPI.
- Comprises 10 members representing key user groups across Australia and New Zealand:
  - Land/Maritime Transport
  - Aviation
  - Engineering/Construction
  - Agriculture
  - Surveying/Mapping
  - Device Manufacturers
- Technical Working Groups (TWG) will address priority issues, including infrastructure management and performance standards.
Spectrum Management

- The Attorney General’s Space Community of Interest (CoI) identifies spectrum as a potential vulnerability.

- The Australian Communications and Media Authority (ACMA) is the regulatory authority for spectrum management in Australia.

- The PNT Working Group and NPI Advisory Board consult with government and industry on spectrum and related PNT issues.

- The ACMA is proposing to make the *Radionavigation Satellite Service (RNSS) Class License 2015* to better facilitate the use of GNSS frequencies in Australia.
Australian Collaboration on GNSS Infrastructure

Australia

Australia-Pacific

Australia-Japan

Australia-China

JAXA QZSS Master Station
Mount Stromlo, Canberra
SOME LINKS

  - Asia Pac Reference Frame
  - Sea Level Monitoring
  - Geo Magnetic Study
- [www.igs.org](http://www.igs.org)
- Australian Augmentation Study
  - [http://www.ignss.org/LinkClick.aspx?fileticket=dKQ6MsXGBAw%3D&tabid=56](http://www.ignss.org/LinkClick.aspx?fileticket=dKQ6MsXGBAw%3D&tabid=56)
AMSA DGPS

Coverage of AMSA's DGPS Service
(42 dBu V/m Contour)

Legend
- DGPS Aids
- Aids to Navigation Coverage

Coordinate Systems - GEOGRAPHICAL
Please note distance measurements in this coordinate system will not be accurate.

Conversion: 1 Nautical Mile = 1.853 Km

Distance Scale: 0 - 800 Kilometres
ITS

- Intelligent Transport Systems
  - Multiple integrated systems
    - GNSS, SBAS, 4G, radar, infrared, sim video,
  - Fully imported vehicle fleet

- International systems
  - National use
    - Incompatible or not available e.g. SBAS
    - Unauthorised frequencies and/or interference

- No risk assessments
GNSS VISIBILITY IN AUSTRALIA

- GPS, GLONASS, Galileo, Beidou
- IRNSS
  - GAGAN
- MSAS
- QZSS
- KSS?
- Non Government systems
THE TRANSITION TO A SPACE-BASED CNS INFRASTRUCTURE
OneSKY PROGRAM

- Airservices OneSKY Australia program
- From 2018, Australia will be providing air traffic control services using the most advanced and integrated air traffic control system in the world.
- Through collaborating with the Department of Defence, it will unify Australian skies under a new, harmonised air traffic management system.
TODAY’S AIRCRAFT

No ADF or DME
PBN Concept

- SIDs
- RNP 1
- RNP 4
- RNP 2
- STARs
- RNP 1
- RNP APCH or RNP AR APCH
CNS EQUIPMENT MANDATES

**GNSS**
6 Feb 2016
Mandatory GNSS equipment for IFR flight
Performance Based Navigation (PBN)

**RNP**
26 May 2016
RNP across Australia
200+ Navaids removed

**BNN**
Back up network – to support transition

**ADS-B**
2 Feb 2017

**COMS**
HF remains
Data link in place
Sat Com Voice for ATC – to be approved
PBN at Work

Noise vs Carbon?
Aerodromes with RNAV (GNSS)

272 Aerodromes
600+ RNAV (GNSS) Approaches

Approved in 1998
May 2016
200+ NDBs, VORs, DMEs to be removed

Remaining ground aids (BNN) to support TSO C129 GPS + provide (limited) backup
  TSO C129 requires conventional aid alternate
ADS-B in Australia
SYDNEY GLS
“I HATE GPS”

- Aston Carter - US Secretary of Defence
- Understandable concern
- 2-4 Billion users around the world
- Impact on GPS funding?
  - Only 21 Sv committed for ICAO
- Development of alternative systems
  - Accelerated R&D?
- How many GPS devices in your household??!
Two billion GNSS units now in use

Many multi-system with augmentation

Aviation a minor user <0.1%

Now critical infrastructure

timing
power
phones
finance
ITS

+++ + + + + + + + +
GNSS VULNERABILITIES

- Interference
- Solar Flares
- US GPS funding
  - Reduction in GPS constellation <24 satellites?
- Hostilities
- Back up systems
  - Existing Ground aids – e.g. DME RNAV
  - Inertial systems, E Loran?
  - US – VOR as interim solution – US HLS Mandate!
  - **Locata** – Australian invention
  - USAF = Multiple GNSS systems – all in view
AVIATION GNSS RISKS

- Aircraft installation!
  - Almost all issues noted are aircraft related
    - Receiver design, installation, software issues
    - Filtering, antennae position, out of date software

- Data integrity
  - data base issues – new Part 175 rule

- Human Factors
  - 467 page GNSS Pilot Manuals!
  - VFR into IFR – GNSS made this worse
  - Receiver differences between aircraft
  - Pilots unaware, or uncertain of issues

- External threats – jamming, spoofing
SBAS ISSUES

- Australia can see a number of SBAS satellites
  - MSAS, GAGAN, WAAS, China?
- Most GNSS receivers SBAS capable
  - Some can deselect the SBAS
  - Some cannot deselect – manufacturer option
    - Paper to ICAO – FAA advised
- Software issues – receivers not updated
- MSAS issue – Sv 137
  - Total loss of navigation
  - Need for advice on issues by providers
MH 370 SEARCH

- Search for aircraft is continuing
- New contract for underwater search
  - Redefined search area
  - Drift plots on wreckage found?
- Continued support of investigation efforts
- Involvement in Global Tracking initiative
SUMMARY

- Australian transitioning to a space-based CNS infrastructure
- Need national reporting, location system
- Safety risks for ITS not designed for Australia
- Continued development of GNSS receivers
  - Multi-constellation Multi-frequency
  - Long implementation times for new fitment
- Deployment of a national SBAS?
- Continued R&D into alternate technologies and multi-constellation solutions for all users
Ian Mallett
+61 2 6217 1736   +61418 259 626
ian.mallett@casa.gov.au

Ed Williams
+61 2 6268 5442   +61411 251 461
ed.williams@airservicesaustralia.com
QUESTIONS AND DISCUSSION
ARE YOU SURE THE GPS IS WORKING?

THE END OF WESTERN CIVILISATION