PBN and APV Implementation in Australia
ICAO Resolution A36-23, 36th Session, September 2007

- ICAO has recommended the implementation of
  - Performance-Based Navigation (PBN)
  - Approaches with Vertical Guidance (APV)
- PBN Implementation Plans to be complete by September 2009
- APV Implementation to be complete 30% by 2010, 70% by 2014 and 100% by 2016
- GNSS PNT is the key enabling technology for PBN and APV operations
Current GNSS Applications for aviation operations include

- **RNAV (GNSS)**
  - Over 530 approaches in Australia
  - Airfield as well as helipad approaches
  - LNAV only

- **RNP AR (Special) approach procedures**
  - 16 aerodromes
  - LNAV/VNAV approach operations
  - Arrival and departure operations
RNP AR (Special) Approach: Queenstown, New Zealand
Qantas 737-800 RNP-AR Approach into Queenstown New Zealand
PBN Capability – Australian IFR Fleet Analysis

- The majority of aircraft operating in the upper airspace have an RNAV or RNP capability

- The majority of aircraft operating in the lower airspace have an RNP capability which is
  - Provided by an IFR GPS navigator
  - Typically limited to RNP LNAV 0.3nm only
  - Could provide RNP LPV (LNAV and VNAV) with SBAS
  - Have the potential to enable ADS-B surveillance over continental Australia

- By implementing PBN (RNAV and RNP) Australia will be able to provide increased safety and efficiency and reduce the environmental impact of aviation operations (CO2 emissions)
APV Capability – Australian IFR Fleet Analysis

- Australia’s IFR fleet comprises some 3600 aircraft
  - 15% of which are APV capable using barometric vertical navigation (Baro-VNAV)
  - 85% of which are APV capable using augmented GNSS

- By implementing APV using Baro-VNAV Australia will be able to provide APV protection to
  - 15% of the IFR fleet (hulls)...but
  - 97% of fare paying passengers

- By implementing APV using Baro-VNAV and augmented GNSS Australia will be able to provide APV protection to
  - 99% of the IFR fleet (1% of fleet determined too old to retrofit)...and
  - 100% of fare paying passengers

- GBAS and GRAS augmentation technologies were considered but not recommended to support APV operations in Australia
Australia’s concept for implementation of PBN and APV is

- Parallel availability of RNAV and RNP specifications
  - GNSS PNT is the key enabling technology for reduced separation standards
- APV enabled through barometric vertical navigation
  - 200 aerodromes identified for APV Baro-VNAV operations
  - AWIS and 2 APV Baro-VNAV approach designs required for each aerodrome
- ROE to meet ICAO Resolution
  - One AWS/AWIS upgrade/install every 2.7 weeks for 7 years
  - One APV Baro-VNAV approach plate designed and validated every 0.9 weeks for 7 years
- GNSS PNT is the key enabling technology for lateral navigation
PBN IMPLEMENTATION PLAN—AUSTRALIA
Future navigation construct—2008-2012

By exception and specific to aircraft type, configuration and aerodrome, e.g. complex terrain, B737-800. 15 aerodromes as at August 2009
Considerations for Future GNSS Applications

- Australia cannot implement APV through GNSS augmentation without acquiring an SBAS

- Acquisition of an SBAS will enable APV operations (via LPV) for an additional 85% of IFR aircraft enabling LPV for
  - Regional airline operators
  - Fly in Fly Out mining operations
  - SAR/EMS Helicopters
  - Offshore Helicopters
SBAS Offshore Approach Procedure (SOAP)

Lateral Profile

Vertical Profile

Source: Norwegian CAA
Figure 2: Flying the offset to the rig
Summary

- Australia’s plans for implementation of PBN and APV rely heavily on the GNSS
- Australia cannot meet ICAO Resolution 36-23 for the implementation of APV without acquiring an SBAS
- Without an SBAS Australia will be reliant on a dual frequency multi-constellation for full APV implementation circa 2022