

PBN and APV Implementation in Australia



Australian Government
Civil Aviation Safety Authority

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safe skies for all

ICAO Resolution A36-23, 36th Session, September 2007

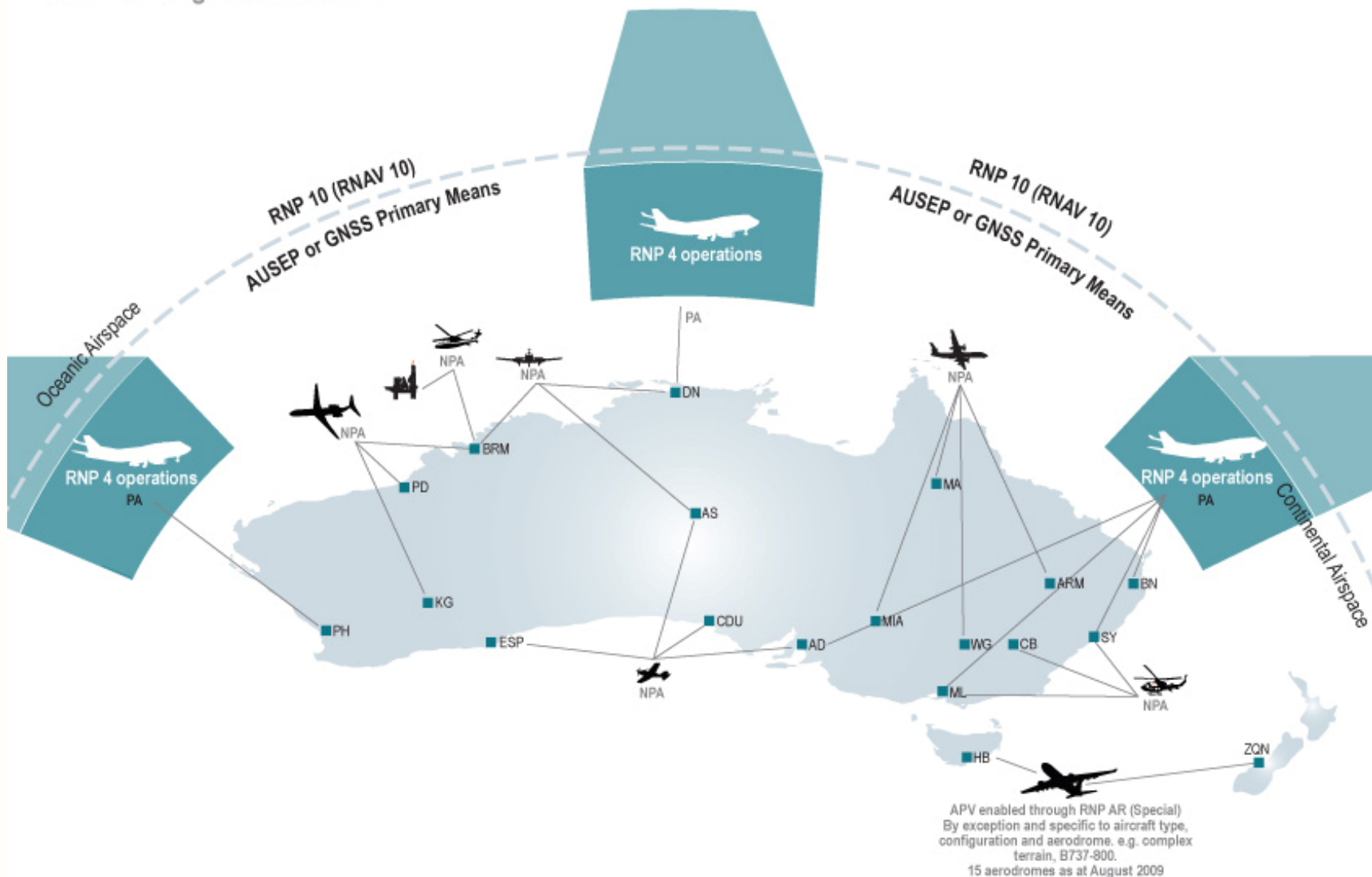
- ICAO has recommended the implementation of
 - Performance-Based Navigation (PBN)
 - Approaches with Vertical Guidance (APV)
- PBN Implementation Plans to be complete by September 2009
- APV Implementation to be complete 30% by 2010, 70% by 2014 and 100% by 2016
- GNSS PNT is the key enabling technology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

Current GNSS Applications for aviation operations include

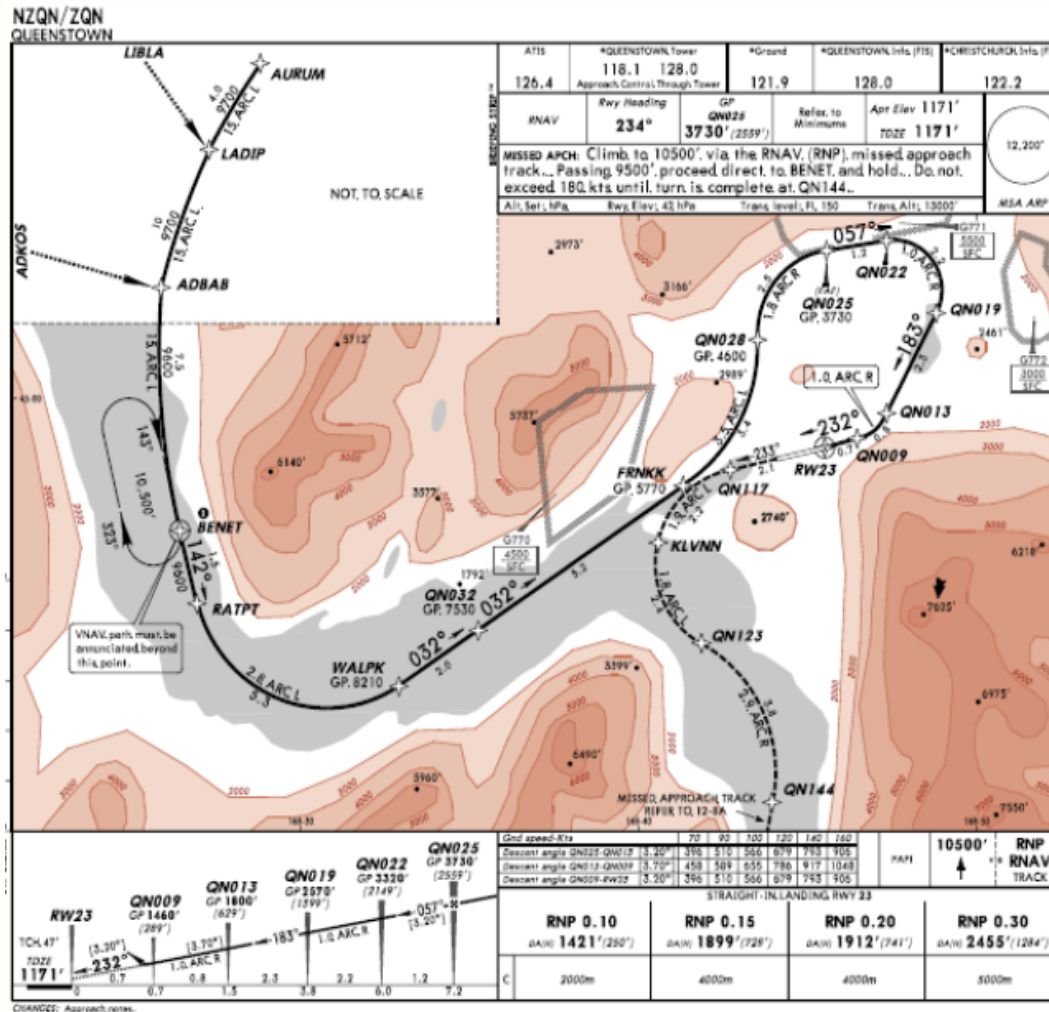
- RNAV (GNSS)
 - Over 530 approaches in Australia
 - Airfield as well as helipad approaches
 - LNAV only
- RNP AR (Special) approach procedures
 - 16 aerodromes
 - LNAV/VNAV approach operations
 - Arrival and departure operations

PBN IMPLEMENTATION PLAN—AUSTRALIA

Current navigation construct



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

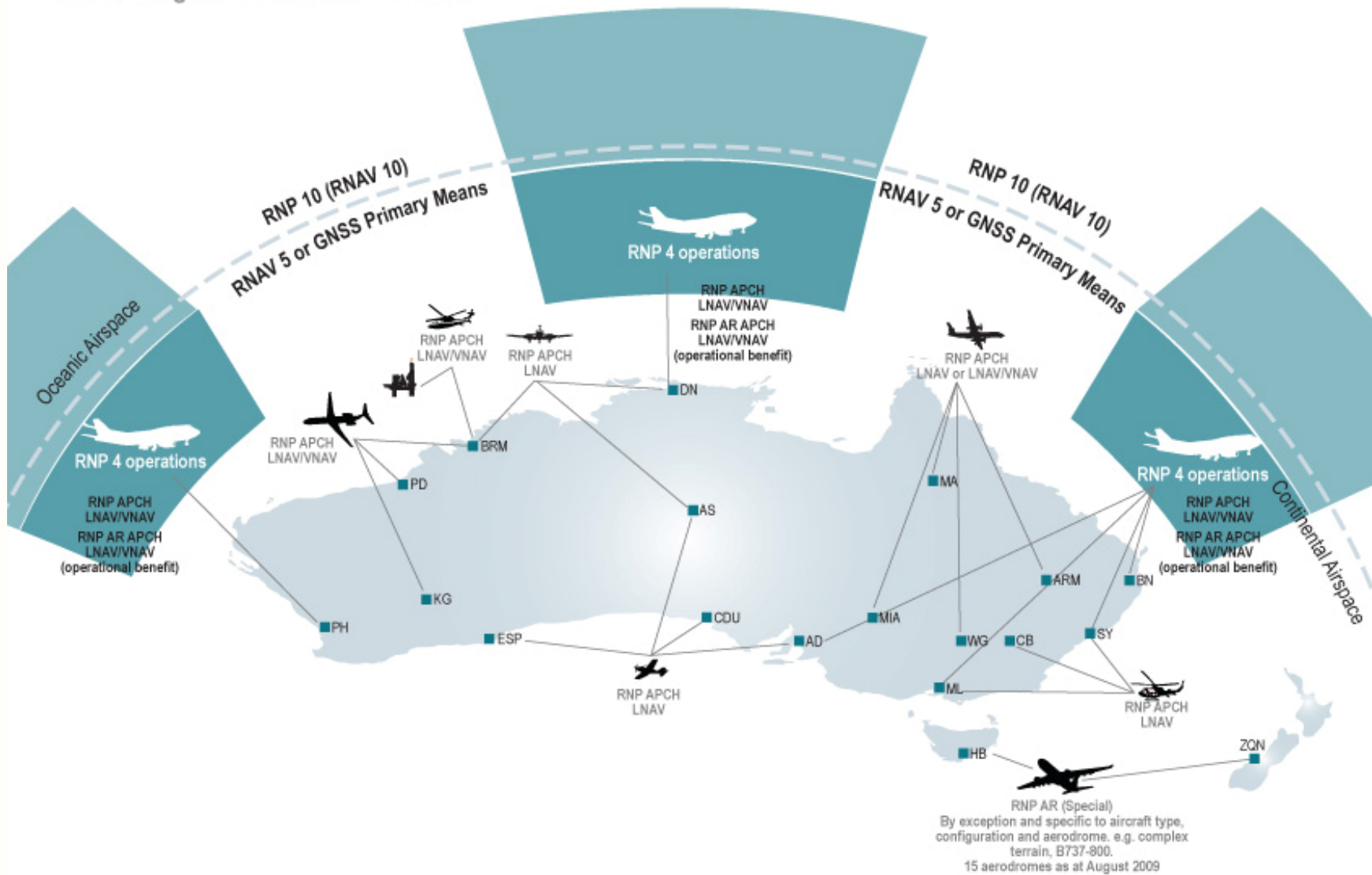
- Australia's IFR fleet comprises some 3600 aircraft
 - 15% of which are APV capable using barometric vertical navigation (Baro-VNAV)
 - 85% of which are APV capable using augmented GNSS
- By implementing APV using Baro-VNAV Australia will be able to provide APV protection to
 - 15% of the IFR fleet (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

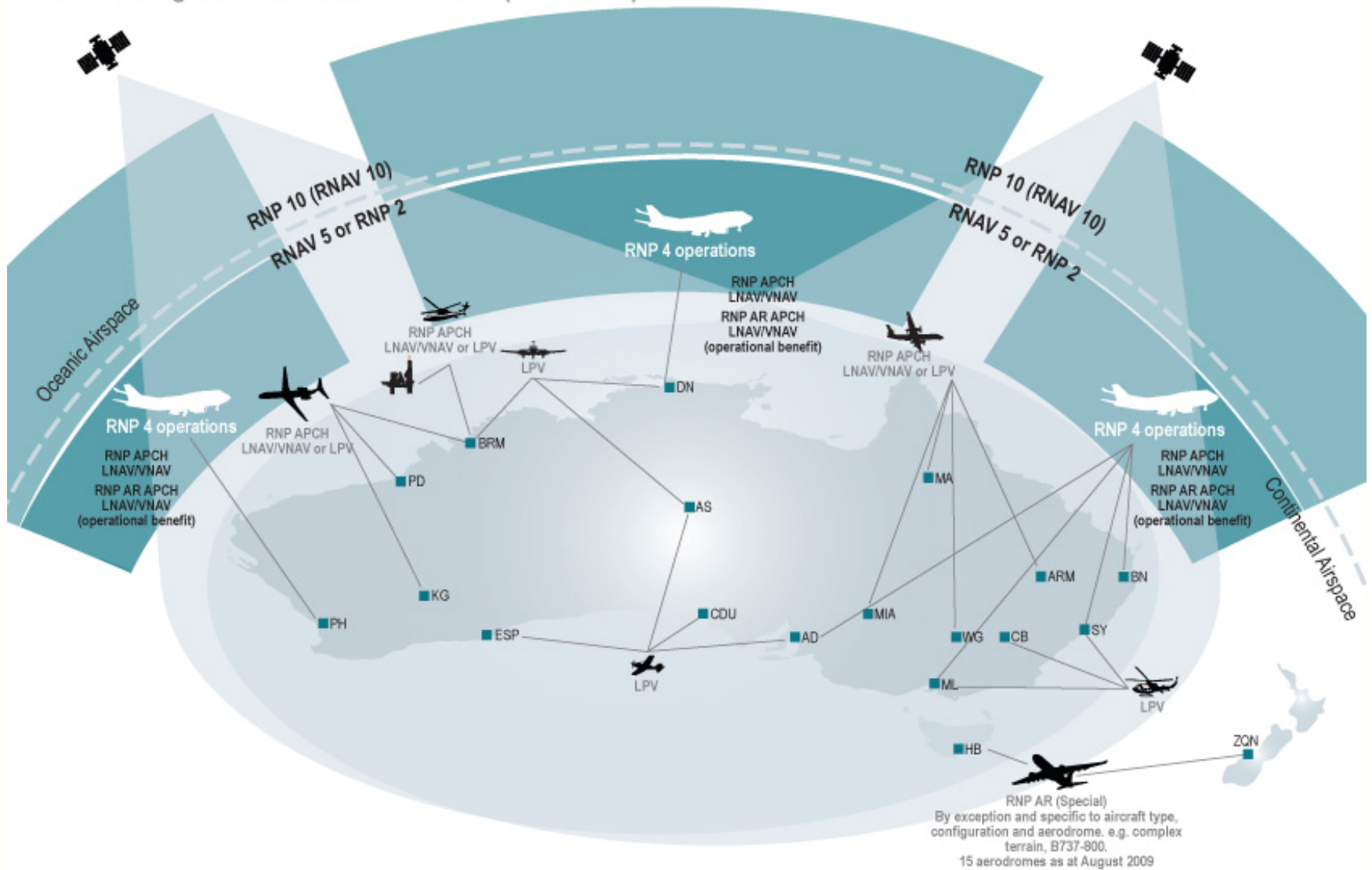


Considerations for Future GNSS Applications

- 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

PBN IMPLEMENTATION PLAN—AUSTRALIA

Future navigation construct—2013-2017 (with SBAS)



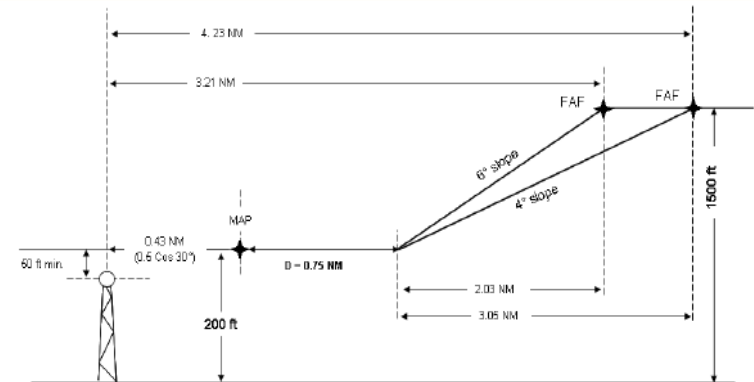
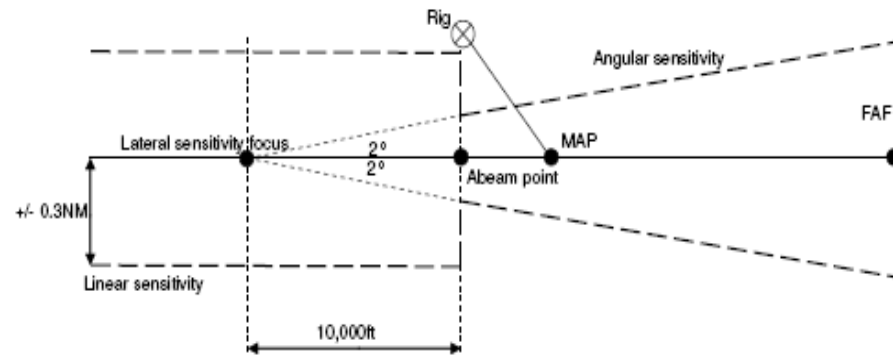
SBAS Offshore Approach Procedure (SOAP)

Lateral Profile



Source: Norwegian CAA

Figure 2: Flying the offset to the rig



Vertical Profile

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

PBN IMPLEMENTATION PLAN—AUSTRALIA

Future navigation construct—2018-2022 (dual frequency, multi-constellation GNSS)

