

Performance Based Navigation

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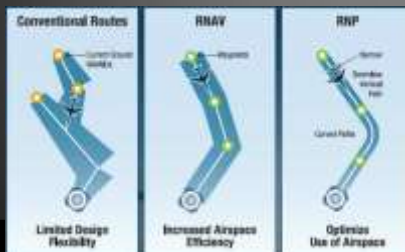


What is PBN?

Aircraft required navigation capability redefined, from **sensor-** to **performance-based navigation (PBN)**



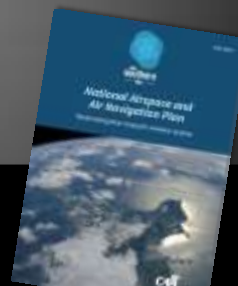
Built on **area navigation (RNAV)**



Utilising modern **technology**

NZ PBN Programme

- 2003 – Naverus RNP AR approaches at Queenstown
- 2004 – Airways “NZ Domestic RNP Programme” initiated
- 2006 – Airways “Strategic Vision of ATM in NZ”
- 2007 – Airways PBN procedures = Auckland arrivals
- 2009 – Rules Support: “PBN Implementation Plan – NZ”
- 2014 – New Southern Sky (National Airspace & Air Navigation Plan)
- 2015 – CAA revise AC91-21, and PBN Implementation Plan
- 2018 – Airways complete PBN Implementation at controlled aerodromes



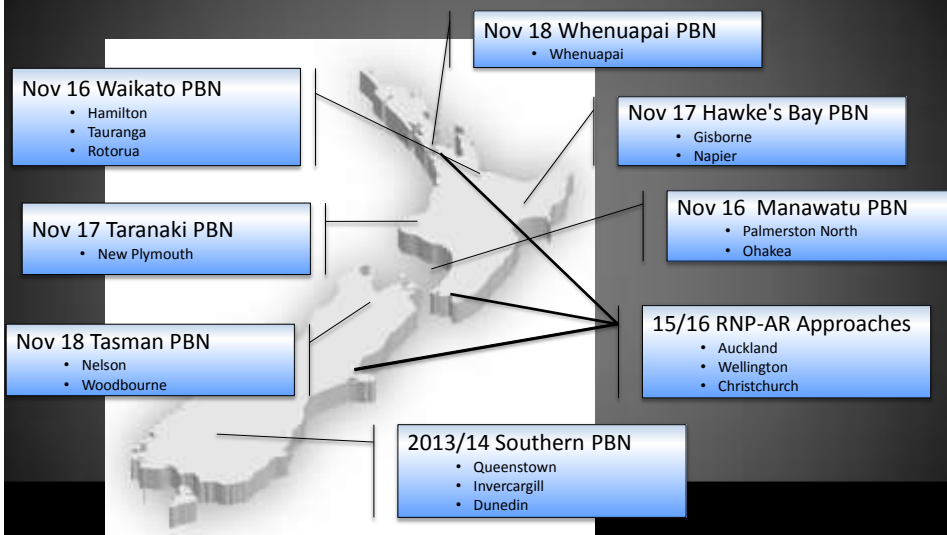
What's been Delivered

NZ PBN Operations

- Enroute Legs = **RNAV 2**
- International Arrivals & Departures AA, WN, CH = **RNAV 1**
- Regional Arrivals & Departures NV, QN, DN = **RNP 1**
- Approaches at all controlled aerodromes = **RNP APCH**
 - Approach with Vertical guidance (APV) if operators are capable
- Approaches at AA, RO, CH = **RNP AR**
- Departures at WN and QN = **RNP AR**
- PBN-enabled ATM Flow Management via **CAM** and **AMAN**
- **Fully-separated RNP 1 SIDs / STARs / RNP AR APPs = QN**
- Advanced-RNP concept design PM = **A-RNP**



Implementation Timeline



Expedition and Noise



QN – PBN Benefits

MONTH	CAM Ground Delay	In-flight Delay	Number of Aircraft	AVG Delay per Aircraft
AVG PRIOR NOV 2012	550mins	2,400mins	360	6:15mins
NOV2014	56mins	435mins	468	:56secs

Most arrivals ever recorded

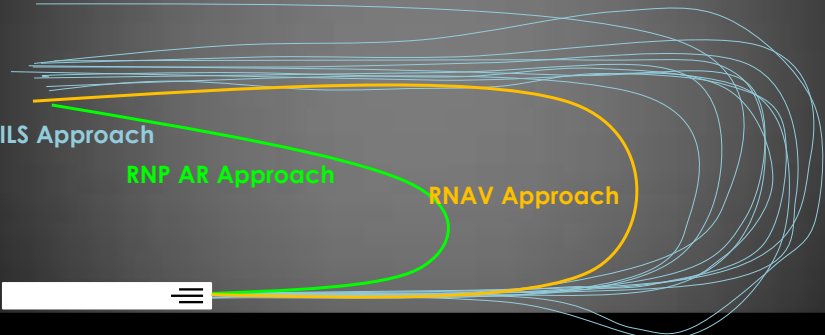
- ✓ Ground Delay down 90%
- ✓ Inflight Delay down 82%
- ✓ Jet payloads up 5-15 pax
- ✓ Fewer diversions
- ✓ Network more predictable
- ✓ Available capacity up 200%
- ✓ ATC workload reduced
- ✓ ATC training pass rate up



Auckland RNP AR Approach

Auckland is the largest and busiest airport in New Zealand, with a capacity of 45 movements/hour on a single runway, and 15 million passengers/annum.

- Reduce Track Miles / Flight Time / Fuel Burn / CO₂ Emissions

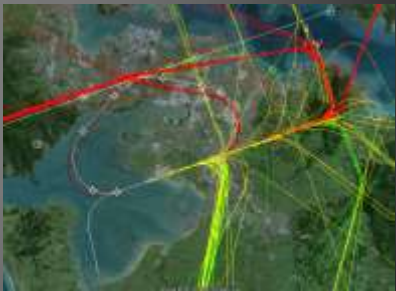


AA - PBN Benefits

	Track Miles	Minutes/year	Fuel (kg)	CO ₂ (tonnes)
Savings over a year	200,000	40,000	1,500,000	4,800

Reductions in:

- ✓ Track miles
- ✓ Flight time
- ✓ Fuel burn
- ✓ CO₂ emissions



Lessons Learned

PBN Implementation is complex; Consultation & Communication is key

- Education – for all stakeholders and levels
- Collaboration - CAA, Airways, Airports, Operators, GA, GroupEAD
- Regulation – AIC, AIP, AC in place
- Aircraft Capable - 70%+ PBN capable
- Resources – People/Skills, Time, Dollars
- Training – for Pilots and ATC
- CANSO – knowledge, regulations, fleet equipage, resources, training
- Effort required but Rewards are huge!

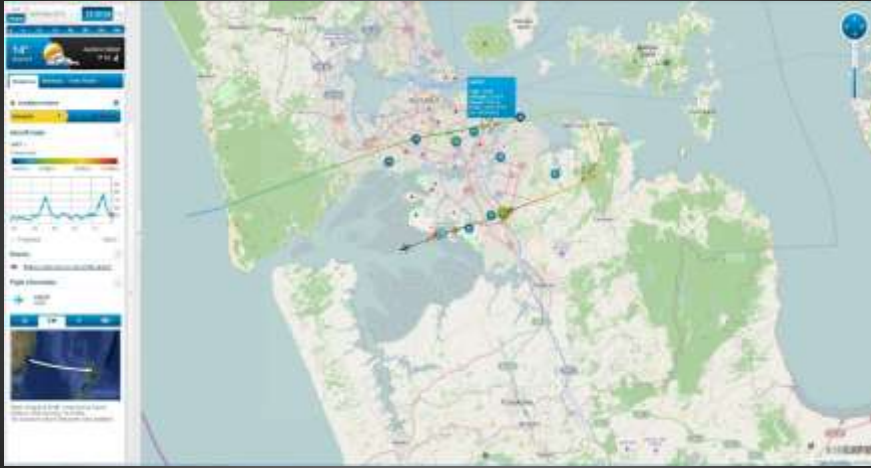


How to Prepare for PBN?

- Be open and transparent
- Reach out to your communities; be genuine
- Keep channels of communications open, and keep communicating
- Educate – learn about PBN benefits, issues, plans
- Engage – CAA, Airways, Operators, GA, Community
- Resource – dedicated PBN specialist



Casper



PBN Links

- ICAO PBN
<http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx>
<http://store1.icao.int/index.php/performance-based-navigation-pbn.html>
- Eurocontrol PBN Training Module
http://pbnwbt.ecacnav.com/pbn_package_site/
- NZCAA PBN info
<http://www.caa.govt.nz/pbn/pbn.htm>
- ACI-NA
<http://www.aci-na.org/content/revised-white-paper-regarding-airport-roles-pbn-flight-procedures-released>



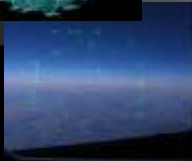
Questions?



Future



- **Comms** – Digital Clearances, D-ATIS, Mode-S
- **Navigation** – No NDBs, Advanced RNP, RNP vs RNAV, GBAS, SBAS, Multi-Constellation Multi-Frequency GNSS
- **Surveillance** – Aireon Global ADS-B, Multi-static PSR
- **Air Traffic Management** – Strategic, Time-based, Remote
- **Aircraft Fleet** – RF-leg capable; ARINC-424 avionics; RPAS, Augmented and Synthetic Vision



Pending PBN

CHRISTCHURCH RNAV (GNSS) APCH RNP 1.1	RNP APCH	15/10	17Sep15
AK AIR BD - AARNS, THOM, GARRA Transitions	RNAV 1	15/10	17Nov15
Implementation			
	NavSpec	AIRAC	Effective
CHRISTCHURCH INT - MDGL Transition	RNP 1	16/4	11Mar16
CHRISTCHURCH RNP AR Approaches x2 - RWY02/20	RNP AR	16/4	11Mar16
WELLINGTON RNAV 1 SD Departures x8 (to 54)	RNAV 1	16/4	11Mar16
WELLINGTON RNP AR APCH (6 STARs)	RNP AR	16/4	23Apr16
WELLINGTON RNAV Visual APCH (review)	Visual	16/4	23Apr16
Hamilton SDs & STARs x6	RNP 1	16/12	10Nov16
Hamilton RNAV(GNSS) Approach (shorten)	RNP APCH	16/12	10Nov16
Tauranga SDs & STARs	RNP 1	16/12	10Nov16
Tauranga RNAV(GNSS) Optimisation	RNP APCH	16/12	10Nov16
Robinson SDs & STARs	RNP 1	16/12	10Nov16
Robinson RNAV(GNSS) Approach (to allow Round)	RNP APCH	16/12	10Nov16
Robinson RNP AR SDs Nodes	RNP AR	16/12	10Nov16
Palmerston North SDs & STARs	RNP APCH	16/12	10Nov16
Palmerston North RNAV (GNSS) - Optimise	RNP APCH	16/12	10Nov16
Palmerston North Coastal Visual APCHs	Visual	16/12	10Nov16
Ohakea SDs & STARs	RNP 1	16/12	10Nov16
Ohakea RNAV(GNSS) RWY01, 15, 31 (New), 2	RNP APCH	16/12	10Nov16
Ohakea Coastal Visual APCH	Visual	16/12	10Nov16
Wanganui SDs/STARs/APCHs???	TBD	16/12	10Nov16

Implementation	NavSpec	AIRAC	Effective
New Plymouth SDs & STARs	RNP 1	17/12	09Nov17
New Plymouth Lateral	-	17/12	09Nov17
New Plymouth RNAV(GNSS) Approach Review	RNP APCH	17/12	09Nov17
Haarlem SDs & STARs	RNP 1	17/12	09Nov17
Haarlem Lateral	-	17/12	09Nov17
Haarlem RNAV(GNSS) Approach Review	RNP APCH	17/12	09Nov17
Dunedin SDs & STARs	RNAV 1	17/12	09Nov17
Dunedin Lateral	-	17/12	09Nov17
Dunedin RNAV(GNSS) Approach Review	RNP APCH	17/12	09Nov17
Implementation			
	NavSpec	AIRAC	Effective
Robinson SDs & STARs	RNP 1	18/12	09Nov18
Robinson Lateral	-	18/12	09Nov18
Robinson RNAV(GNSS) Review	RNP APCH	18/12	09Nov18
Woodbourne SDs & STARs	RNP 1	18/12	09Nov18
Woodbourne RNAV(GNSS) Review (A-RNP?)	RNP APCH	18/12	09Nov18
Whangarei SDs & STARs	RNP 1	18/12	09Nov18
Whangarei RNAV(GNSS) RWY02/21	RNP APCH	18/12	09Nov18

*"NavSpec" "RNP APCH" will be superseded as "RNAV(GNSS)" until advised

Unpublished Approaches, e.g. OLL, DL, HK, WL, PL, NL, WL, HP, WC, WL, AS, and RT.
 New Developments: RNP 1, A-RNP, RNP multi, RNP 0.1/0.2, additional PBN
 Pending PBN Programmes only - Dunedin RNAV 1 & 2a Two Positions (TTP) added



PBN Nav-Specs

Area Navigation

Old RNP Specs:

B-RNAV

P-RNAV

AUSEP

RNP / RNAV

US RNAV

RNP 10

RNP 4

... unsafe, inefficient
costly & confusing

