PBN Implementation

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PBN Implementation Programme Manager
PBN Implementation

Scope:

- What, Why, When?
- How to PBN?
  - Needs / Plan
  - Collaborate
  - Educate
  - Regulate
  - Resource
  - Implement
- Workshop
What is PBN?

“PBN represents a shift from sensor-based to Performance-Based Navigation”
Global Standards

Area Navigation
Old RNP Specs:
B-RNAV
P-RNAV
AUSEP
RNP / RNAV
US RNAV
RNP 10
RNP 4

Harmonise standards for Safety & Efficiency

Globally Harmonised Navigation Specifications
ICAO PBN Nav-Specs

Navigation Specifications

RNP Specifications
(includes a requirement for on-board performance monitoring and alerting)

- Designation
  - RNP 4
  - RNP 2
  - Oceanic & Remote navigation applications

- Designation
  - RNP 2
  - RNP 1
  - A-RNP
  - RNP APCH
  - RNP AR APCH
  - RNP 0.3
  - En-route & Terminal navigation applications

RNAV Specifications
(no requirement for on-board performance monitoring and alerting)

- Designation
  - RNAV 10
  - Oceanic & Remote navigation applications

- Designation
  - RNAV 5
  - RNAV 2
  - RNAV 1
  - En-route & Terminal navigation applications
Why PBN?

PBN is a ‘Perfect Flight’ enabler:

→ **Safety** - consistent, predictable
→ **Access** - around terrain
→ **Capacity** - traffic / payload
→ **Efficiency** - time, fuel, nav-aids
→ **Environment** – noise and CO₂

→ **Socio-Economic**! 
Safety

• PBN *Consistent and Predictable* Flightpaths
  – Coded procedures
  – Less RTF, less ‘head-down’
  – Strategic vs tactical workload
  – Global navigation standards

• ICAO CFIT studies show:
  – Straight-in Approach = 25 x Safer than Circling
  – Vertical Guidance = 8 x Safer again for APV
Efficiency

- Access
- Capacity
- Track-shortening
- **Consistent and Predictable** Flightpaths, enable:
  - Continuous Climb/Descent Operations (CCO/CDO)
  - 4D **Trajectory Based Operations** (TBO)
    - Collaborative Flow Manager (CFM)
    - Arrival Manager
    - Airport Collaborative Decision Making (A-CDM)
    - Departure Manager
Access & Capacity
Access & Capacity (video)
Queenstown Case Study

- Traffic capacity up (from 5 to 12 aircraft/hr)
- Delays down 80-90%
- Jet payload up 5-15 pax
- Fewer diversions
- Savings since Nov 2012:
  - NZ$3m Fuel burn
  - 7.5m kg CO₂ emissions
- Local economy
Track-shortening

Auckland - largest busiest airport in New Zealand
- capacity 45 movements/hour, single runway
- moving 15 million passengers/annum.

PBN = less Track Miles / Flight Time / Fuel Burn / CO₂ Emissions
Track-shortening (video)
Auckland Case Study

- Lessons in community engagement & noise

- Track Miles 14 NM / APCH
- Fuel Burn 2,000 tonne / year
- CO2 Emissions reduced 6,500 tonnes
- Operator Savings $5.5 million / year
- Passenger Value of Time $4.5 mil / yr
## Efficiency Forecast Impact:

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<th>LOCATION</th>
<th>RWY</th>
<th>No. FLT (IMC)</th>
<th>Distance per flight</th>
<th>Total Distance</th>
<th>Time (mins per flight)</th>
<th>Total Time</th>
<th>Total Fuel</th>
<th>FUEL $ SAVINGS</th>
<th>CO₂ Kg SAVED</th>
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<td>ANNUAL TOTAL:</td>
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<td>111 NM</td>
<td>317,779 NM</td>
<td>32</td>
<td>87,105 min</td>
<td>3,397,076 kg</td>
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<td>10,735 tonne</td>
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**Monthly:**
- 7,259 min
- 283,090 kg

**Monthly:**
- $370,847
- 895 tonne
- $589,583
Efficiency

Actual Impact:
Actual Impact:

In-flight delay per month
(Auckland and Wellington combined)

Minutes of delay

0 5,000 10,000 15,000 20,000 25,000 30,000


AMAN from Apr14
Taxiway WIP from 19Oct15
User Preferred Routes (UPR) and Dynamic Airborne Reroute Procedures (DARP)

- 65% of Airways’ Oceanic traffic utilises User Preferred Routes
- Users may utilise DARP airborne, within NZZO
- ASPIRE - Asia and Pacific Initiative to Reduce Emissions
  - Singapore Airlines save 2,536 tonnes CO₂/annum, New Zealand & Australia.
Environment

Air Transport Action Group (ATAG)

- Global aviation industry = 1,397 airlines with 25,000 aircraft serving 3,864 airports
- Traffic is managed by 173 ANSPs
- 2% of Human-induced CO$_2$ emissions
- 12% of Transport CO$_2$ emissions
  - 0.5% of Trade Volume
  - 35% of Trade Value

“Deliveries of fresh produce from Africa to the UK alone supports the livelihoods of 1.5 million people, while producing less CO2 than similar produce grown in the UK, despite the energy used in transport.”

Industry Commitment: By 2050 net aviation CO$_2$ emissions will be 50% of 2005 levels

How? Technology, Operations, Infrastructure, Additional technologies & biofuels

http://www.atag.org/facts-and-figures.html
NextGen Benefits
Once all planned programs are in place, FAA expects NextGen to deliver $134 billion in direct airline, industry, and passenger benefits (passenger value of time and carbon dioxide emissions) through 2030.

Society Benefits $80.1 Billion
- $79.7 billion passenger value of time
- $400 million reduction in carbon dioxide emissions

Airline Benefits $51.4 Billion
- $77.1 billion reduction in crew and maintenance costs
- $14.3 billion fuel savings
- $2 billion FAA efficiencies (e.g., System Wide Information Management)

Industry Benefits $2.4 Billion
- $200 million additional airline flights
- $200 million additional airport passengers

Modernizing European airspace will bring massive benefits
Modernization of Europe’s air navigation system will help increase the growth, competitiveness, productivity and connectivity of the European economy. Reforms to shorten routes and improve efficiency will cut delays and emissions, and unlock billions in economic benefits.

- New employment: 1 million jobs
- Productivity increase: €717 per job

Airspace transformation will generate tangible benefits to European tourism, trade and the knowledge economy.

- Number of hotel stays: +1.26%
- Trade in services: +2.19%
- R&D expenditures: +4.68%
- Number of patent applications: +5.54%
- Employment in transport and travel services: +1.30%

National Airspace and Air Navigation Plan
Modernising New Zealand’s Aviation System

The National Airspace and Air Navigation Plan sets a pathway to modernise all aspects of our aviation system and position it for the future. Modernisation of the aviation system will bring huge benefits – valued at $2 billion over 20 years as a result of shorter and more efficient flight paths, and improved safety and reliability.
Drivers

Industry Declaration in support of Performance-based Navigation (PBN)

We, as representatives of the air transportation community,

- Announcing our commitment to seek continual improvements to the safety, access, capacity, efficiency and environmental sustainability of the air transportation system,
- Recognizing that Performance-based Navigation (PBN) provides a catalyst for these improvements to air traffic operations, while enabling a streamlined and cost-effective solution throughout the flight.
- Recognizing the work of ICAO in promoting and pursuing globally harmonized Area Navigation (RNAV)
- Recognizing that Resolution 965-23 of the 39th ICAO General Assembly whereby States, in their capacity as PBN procedures in accordance with the established timetable.

We resolve:

To support the timetable set out by ICAO for the global implementation of PBN, and to:
- To collaborate to facilitate the implementation of PBN, and
- To assist States and other stakeholders in their development and execution of a comprehensive PBN implementation plan.

We call upon:

- All leaders of the civil aviation community, to fully implement PBN in the shortest possible time.
- The international community, to fully support PBN implementation.

Queenstown night flights 'next season'

New Zealand

RNP good news for Queenstown travellers

3 July 2009

Air New Zealand's ability to fly its domestic and international customers into and out of Queenstown over the busy winter season has been further enhanced with 18 aircraft now fitted with advanced navigation technology.

Required Navigation Performance (RNP) was introduced onto six of Air New Zealand's 737s two years ago, with the initiative so successful that it has now recently been extended to the airline's A320s.

Big fuel savings on Air NZ test flight

Air NZ's "perfect flight" using optimal flying conditions and route was a success in San Francisco today after the airline's A380 was diverted over the Pacific. The flight was a huge step forward for the airline and the aviation industry as a whole.

Fuel savings are around 4 per cent less than usual.
When?

- **ICAO AN37/11**
  - APV approach by 2016
  - ENR, SIDs/STARs
- **GANP ASBU’s**
- **Prioritise:**
  - Safety, Capacity, Access
  - Efficiency
    - Traffic type, volume of movements
- **Business Case – Access, Track shortening**

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**A37-11: Performance-based navigation global goals**

a) States complete a PBN implementation plan as a matter of urgency to achieve:

1) implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones;

2) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014; and

3) implementation of straight-in LNAV-only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more;
Implementing PBN

Collaborate
- Resource
- Plan
- Regulate
- Educate
- Implement
Resource

Human Resource
• ANSP PBN Team
  • Project, SME, ATC, ATMS Software, Policy & Standards, Safety & Risk, IFP Designers, AIM Charting, Comm.’s…
• PBN Implementation Working Group
  • Regulator, ANSPs, Operators, Military, Airports
• Engage with
  • General Aviation, User Groups, Community…

Financial Resource – how much, who pays, when, for what?
Plan

- Assess Environment/s
  - Comms, Navaids, Surveillance, ATC & ATMS
  - Fleet types, equipage, movements, airports, needs
  - Resources (ANSP, Regulator, Operators, Airports, SMEs, $)
- Determine optimal Concept of Operations, e.g.
  - Navspecs: NZ = RNAV 2 Enroute, RNAV 1 SIDs/STARs
    (RNP 1 if no surveillance), RNP APCH
    (RNP AR if operationally advantageous)
- Draft, consult & publish State PBN Implementation Plan
Regulate

- PBN Implementation Plan - overview
- Civil Aviation Rules – revised for PBN
- AIC – inform aviation stakeholders
- Advisory Circular - approvals process
- AIP - clarify PBN usage, means
Educate

- Knowledge – PBN plans, benefits, issues
- Training – in-house, external, all levels
- Collaboration - Operators
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!
PBN Workshop

1. Does your state have a PBN Implementation Plan?

2. Are regulations in place to support PBN?

3. What is your highest PBN priority?

4. Do operators have PBN nav-spec approvals?
   a. What nav-specs?
5. Do you have common nav-specs with adjacent FIRs?
   a. Is a Single Asia-Pacific Sky feasible?
   b. How can we accelerate it?

6. Is PBN being resourced appropriately?
   a. How is funding provided for PBN?
   b. How is training achieved?
   c. Who are your subject matter experts?
“Global Vision, Regional Action”

- APAC region has tremendous economic growth
- ANSP capacity investment = 24mil jobs & US$400bn
- Global solutions exist -> GANP ASBU guidance
- Regional solution -> Seamless ATM Plan guidance

“ATM solutions... safe & efficient air transport... APAC”

- PBN is a key enabler for safety & efficiency
- PBN Implementation... Actions?
What key action can you take?
Kia ora!
PBN Links

- **CANSO Resources**

- **ICAO PBN ikit**
  [http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx](http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx)

- **ACI-NA**
  [http://www.aci-na.org/content/revised-white-paper-regarding-airport-roles-pbn-flight-procedures-released](http://www.aci-na.org/content/revised-white-paper-regarding-airport-roles-pbn-flight-procedures-released)

- **Eurocontrol PBN Training Module**

- **NZCAA PBN**