GPS & Australian Aviation

CGSIC
International Information Session
Nashville, Tennessee
16 September 2013
Contents

- Australian Aviation Context
- GPS and Aircraft Navigation
- GPS and Aircraft Surveillance
- Fitment Mandates in Australia
- Thanks and Thoughts
Aviation Growth

2005 - 2025 Cumulated Growth

Fig. 2-5: Long-term Forecasts in Worldwide Traffic Growth
Australia’s ATC Environment

Approximately 5000 nm

Radar Separation

Procedural Separation + ADS-B
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User Preferred Route

2.4 < 29 mins * 8 flights = 0.3 < 3.8 flt hours/day
0.3 < 3.8 hr @ 11 tonne/hr = 3.3 < 41.8 tonne/day
3.3 < 41.8t * 10.8 * 59 * 1.48 = $ 3,112 < 39,420 AUD
3.3 < 41.8t * 3.3 = 10.9 < 138 tonne CO₂
User Preferred Route …

- Pioneered in 2000 across the Pacific Ocean by:
  - Qantas
  - United Airlines
  - Air New Zealand

- Available for routine daily service across Pacific and Indian Oceans

- Used routinely by:
  - Qantas, United Airlines, Air New Zealand
  - Pacific Blue, Air Canada, LAN Chile, Emirates

- Aircraft types
  - Boeing - B787, B777, B747
  - Airbus – A380, A340, A330

- Being trialled domestically on Perth – Cairns (B737-800 / A330)
Brisbane – RNP Concept

3 RNP-AR APP to RWY 19
2 curved & 1 ILS overlay

3 RNP-AR APP to RWY 09
2 curved & 1 ILS overlay

RNav/ILS
RNP-AR
Four Consecutive Arrivals

Instrument weather conditions (IMC)

VOZ & UAE flights RNav onto the ILS

QFA536, a B737-800, conducted an RNP-AR approach

Descending flight

5NM range rings are centred on the runway threshold
Level Off
Brisbane TMA RNP-AR Ops

24 Months of Operations
Two aircraft types (B738 & A320)

Track Keeping:
- 7,532 flights (2,404,276 data points) analysed
- Straight flight – 20m (1 std dev)
- Manoeuvring – 42m (1 std dev)
- B737-800 wingspan 36m

Economic Savings
- 3,200 RNP Arrival/Approach otherwise ILS (due weather)
- 55,946 track miles avoided; 699,325 kg fuel saved
- 2,237,840 kg CO2 not emitted
- PLUS efficiency of Continuous Descent Arrival/Approach

In routine daily use at 16 airports; typically 110 operations per day
RNP Departures

- Terminal Procedures assure terrain clearance

- Area assessed depend on Navigation Accuracy & Integrity

- High Accuracy / Integrity allows going around high terrain (not over)

- Allows greater payload
ATC Trombone

4 Dimension Trajectory Management
- Path to threshold known at TOD
- Required time of Arrival (RTA)
- use FMS to optimise aircraft operation
- ATC Flow Modelling & Management
- More accurate TMA wind information
The more efficient green RNP/APV - GLS guided procedure compared to typical vectored red track currently used at Sydney.
Performance Based Navigation (PBN)

- RNAV
  - RNAV 10 / RNP 10
  - RNAV 5 (BRNAV)
  - RNAV 2 (RNAV A)
  - RNAV 1 (PRNAV, RNAV B)

- RNP
  - RNP 4
  - RNP 2
  - RNP 1
  - RNP APCH (0.3)
  - RNP AR APCH
  - Advanced RNP

Harmonise existing
Europe & USA approvals

New navigation capabilities

Oceanic: RNP-4
RNAV-10 protracted transition

En Route: RNP-2
RNAV-5 transition within radar

Arrival: RNP-1
RNAV-1 for short transition

NPA: RNP-APCH / RNAV(GNSS)

Specialised: RNP Special at Operator Request

GPS is a powerful enabling technology
ADS-B above FL 290
VHF Voice Radio

ADS-B Installation at Esperance

ADS-B antennas

Satellite Comms Link to ATC centre
ADS-B Installation at Longreach
Some ADS-B installations are in remote areas.
ADS-B cohabitates with other services
ATC Feedback

Greater probability of optimum altitude

Flexibility to accommodate weather

Less ATC intervention

Greater visibility increases Safety

55% of Domestic Flights

91% of International Flights
Alliance Airlines paves the way for early ADS-B fitment

24-04-2012 - Alliance Airlines has fitted automatic dependant surveillance broadcast (ADS-B) technology to four of its Fokker 100 aircraft operating in Western Australia, paving the way for the forward fitment to the remainder of its fleet.

ADS-B is a satellite-based traffic surveillance technology that enables aircraft to be accurately tracked by air traffic controllers and other pilots without the need for conventional radar.

Airservices Australia, the country’s air navigation services provider, continues to urge airlines and operators to fit their aircraft with ADS-B sooner rather than later, noting those who have already seeing the benefits.

“Like many operators, we were suffering from the heavy congestion in areas of Western Australian airspace and we saw ADS-B as a solution,” said Alliance Airline’s Managing Director, Scott McMillan.

“It’s been very quick to see the savings from ADS-B, not only from a cost point of view but it also has meant an increase in safety and better service to our customers. I expect our remaining Fokker 100s will all be fitted by the end of this year – a year ahead of the mandate.”
Broome

ADS-B Receivers near regional airports
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Fitment Mandates

PBN IFR Navigation:
- Using GPS as enabling technology
- Forward fit: 6 Feb 2014; Retrofit: 4 Feb 2016

ADS-B Out
- Aust aircraft operating at/above FL290: 12 Dec 2013
- IFR Aircraft registered on/after 6 Feb 2014
- IFR Aircraft registered before 6 Feb 2014 retrofit 2 Feb 2017

Navigation & ADS-B Carriage Requirements:

PBN Approval Requirements:
**Fitment Mandates**

**ARE YOU FITTED?**

**ADS-B**

Mandatory fitment deadlines for ADS-B technology in Australian airspace are fast approaching.

<table>
<thead>
<tr>
<th>Where do you fit?</th>
<th>On or after</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>All flights at/above FL290</td>
<td>12 December 2013</td>
<td>Must be ADS-B capable</td>
</tr>
<tr>
<td>Addition to Australian register</td>
<td>6 February 2014</td>
<td>Must be ADS-B capable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GNSS navigation required</td>
</tr>
<tr>
<td>Replacement transponder</td>
<td>6 February 2014</td>
<td>Must be ADS-B transponder</td>
</tr>
<tr>
<td>Operating 500NM from Perth</td>
<td>4 February 2016</td>
<td>Must be ADS-B capable</td>
</tr>
<tr>
<td>IFR aircraft (aerial work/private operations)</td>
<td>4 February 2016</td>
<td>GNSS navigation required</td>
</tr>
<tr>
<td>Operate to BNE, SYD, PER or MEL</td>
<td>4 February 2016</td>
<td>Mode S transponder required</td>
</tr>
<tr>
<td>All IFR aircraft</td>
<td>2 February 2017</td>
<td>Must be ADS-B capable</td>
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Thanks

GPS improved with time:
- Robustness - 27 Satellite geometry
- Accuracy - Equivalent User Range error decreased
- Availability – Practical Purposes 100%

Women and Men who pioneered / operate GPS:
- You have our Sincere thanks for the truly exceptional Service

Politicians & Administrators:
- GPS gives immense Safety, Environment and Economic benefit
- Ubiquitous in all aspects of life
- Easy to take for granted
- GPS needs to be protected, fostered, replenished, grown
Ed Williams
Airservices Australia

Ed.Williams@AirservicesAustralia.com