International Civil Aviation Organization

EIGHTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION AND SURVEILLANCE SUG-GROUP (CNS SG/18) OF APANPIRG

Asia and Pacific Regional Sub-Office, Beijing, China
(21 – 25 July 2014)

Agenda Item 6: Navigation

6.1) Updates on national PBN implementation plan and PBN implementation issues

UPDATE ON PBN IMPLEMENTATION IN THE NEW ZEALAND (NZZC) AND AUCKLAND OCEANIC (NZZO) FIR

(Presented by New Zealand)

SUMMARY

This paper updates progress by New Zealand to implement PBN and issues encountered.

1. INTRODUCTION

1.1 New Zealand's regulatory body (CAA) first published the New Zealand PBN Implementation Plan in December 2009 in accordance with ICAO Assembly Resolution A36-23. Since that time PBN implementation has progressed substantially. A number of aerodrome approach and departure procedures and associated en-route airways have been re-designed to various PBN criteria.

1.2 The practical application of PBN has led to some variations to the original plan and led to a number of issues that have highlighted the link between PBN and other airspace concept enablers. These issues and their solutions are also summarized.

2. DISCUSSION

PBN plan summary

2.1 New Zealand's PBN Implementation Plan identifies a three phase approach which progresses navigation from a mixed mode environment through an increasingly exclusive environment to a mature PBN environment.

2.2 The plan identifies both RNAV and RNP specifications that will be applied though out the three phase transition. In summary:

- Enroute Oceanic (OCS): RNP/RNAV 10 and RNP 4;
- Enroute Domestic: RNAV 2 moving to RNP/RNAV 1 in the mature system;
- Terminal Arrivals/Departures: RNAV 1/Basic RNP 1 to begin with Advanced RNP 1 included by maturity; and
- Approach procedures: RNP APCH including Baro-VNAV and RNP AR APCH

2.3 The plan also summarizes a move away from ground based navigation to a mature GNSS based system with contingent ground based infrastructure (VOR/DME/ILS). Communication and surveillance are also summarized with increasing use of datalink domestically and a move away from PSR/MSSR to WAM/ADS-B.

Progress

2.4 From a 2009 baseline of RNP10 and RNP4 operations in Auckland Oceanic (NZZO) FIR, a limited number of RNAV SID/STARs/RNAV (GNSS) approach procedures and one location with RNP AR approaches in the New Zealand (NZZC) FIR, additional implementation has been:

- 2012 Enroute re-designation to RNAV 2;
- 2012 NZAA RNAV Z and RNAV (RNP AR) X/Y 'short' approaches;
- 2012 NZQN/NZNV RNP 1 SIDs and STARs and RNAV (RNP) departure procedures;
- NOV 2013 NZDN RNP 1 SIDs and STARs; and
- NOV 2014 NZAA/NZCH RNAV SIDs

2.5 Progress planned for the next 3 years includes:

- RNAV SIDs/STARs and RNP AR approaches for NZWN;
- RNP AR approaches for NZCH;
- Remaining regional SID/STAR and approach re-design through to end 2018
- En-route designation to RNAV2 and RNP2 specification;
- Introduction of Advanced RNP arrival procedures as required for user eligibility; and
- RNP2 operations in NZZO

Issues

2.6 A major issue has been the impact of other airspace concept enablers on PBN implementation and vice versa. Main areas affected in the NZZC FIR have been:

- Surveillance – RNAV procedure requirement vs. coverage;
- Aircraft eligibility vs. PBN procedure specification; and
- Controller workload/obligations under PBN and automated support

Surveillance

2.7 Surveillance is highlighted throughout ICAO PBN material as a means of enablement through the mitigation of risks:

Doc 9613 PBN Manual 3.2.4: *The complexity of determining route spacing and separation minima is affected by the availability of a radar surveillance service and the type of communications used. If an ATS surveillance service is available, this means that the risk can be mitigated by including requirements for ATC intervention.*

2.8 New Zealand has used this guidance when applying criteria and highlights the dependency in its implementation plan:

PBN Implementation Plan – New Zealand: *RNAV specifications do not require on board navigation performance monitoring and alerting. RNAV tracks (e.g.: RNAV 5, RNAV 2, RNAV 1) will normally require monitoring by ATC surveillance systems to achieve desired performance and separation safety standards. This requirement implies near universal surveillance coverage for RNAV specifications. In oceanic airspace this surveillance is provided by ADS-C and in domestic airspace by a network of radar systems (PSR & MSSR). The surveillance of domestic airspace will also include WAM (Wide Area Multilateration) and ADS-B when these systems are approved and operational.*

2.9 The roll out of PBN enroute began in the south of the country where surveillance coverage at the time was limited to a single MSSR. With limited coverage in the region (from above FL150 through to non-existent) there was the potential for implementation to be delayed using RNAV 2 until the introduction of WAM. An alternative solution was found with the application of RNP 1 SIDs from the point of departure to a point within existing surveillance coverage and the same (RNP1) for STARs but in reverse.

2.10 With PBN implementation continuing ahead of the Airways surveillance modernization plan, the issue of surveillance coverage remains for other regions. Airways, the regulator and airspace users continue to investigate alternatives such as RNP1 SIDs/STARs and using RNP 2 en-route for non-surveillance routes.

ATM system and surveillance

2.11 The need for surveillance with RNAV 1 and 2 procedures implies that controllers will monitor and assist when navigation performance is degraded (either system or individual aircraft). The ATM systems is affected by way of its ability to support the controller in meeting the above obligation:

Doc 9613 PBN Manual 2.3.5.8 ATM systems: *The evolution of a State's ATM system to meet the needs of PBN implementation must be considered. If route spacing is reduced and or if different separation minima are used, various factors must be considered in the ATM system evolution, e.g. the impact on the alert limits of conflict detection tools.*

2.12 New Zealand's ATM system conformance monitoring criteria are universal and set very wide based on pre-PBN route conformance. New Zealand navigation operations are still considered mixed mode for equipage. Additionally 'off-track' routing still occurs due weather avoidance, tracking efficiency or sequencing requirements. The setting of narrow criteria to support PBN spacing and separation has the potential to create numerous false alerts in this environment.

2.13 New Zealand's ATM system alerting has also been affected by the implementation of PBN. With the introduction of PBN based RNP AR 'short' approaches at NZAA aircraft are sequenced concurrently for the same runway threshold using both the 'long' straight in approach (via 12 NM final) and the short approach. The only alerting support provided by the ATM system is conflict alerting. There is no FPL trajectory based merge point prediction, therefore no assistance for determining spacing when aircraft are in a constant turn.

2.14 There is increasing demand from controllers to balance workload against the responsibilities that exist under PBN. Airway's is aware of this but yet to formally begin the process of reviewing conformance monitoring criteria and alerting tools to support PBN.

Aircraft Eligibility

2.15 Aircraft eligibility to fly PBN designated procedures has also affected PBN implementation. Examples include:

- In applying RNP1 in the southern region, some operators became excluded as either their aircraft did not have on board conformance and monitoring or their crews were not yet trained for RNP operations. This issue remains for the proposed application of RNP 2 enroute in non-surveillance airspace; and

- Access to RNP AR approaches. Although not excluding users from accessing PBN procedures, the inability of some users to carry out RNP AR procedures (particularly the ability to fly radial fix turn legs on 'short' approaches due lack of equipage) has hampered them from obtaining the full benefit of the system

2.16 To resolve ineligibility for RNP1, such flights used the contingent conventional route structure while their aircraft/aircrew we made eligible. This imposed some restrictions on operations due to the alternative separation criteria applied. A similar approach will be used for RNP 2.

2.17 To resolve ineligibility for RNP AR approaches, the affected user group is looking at obtaining certification for an equivalent Advanced RNP approach. This would be done with regulator oversight and would involve flying the RNP AR 'short' approaches in suitable conditions to prove the eligibility of the user's aircraft and crews for the A-RNP.

ATM system and aircraft eligibility

2.18 Aircraft eligibility has also impacted on controller workload. The inability of the ATM system to always assign the correct SID/route/STAR combination have increased controller workload as they have had to manually determine an aircraft's capability and input the applicable procedures into the system.

2.19 Examples of these manual processes have been:

- For the application of RNP 1 SIDs and STARs in the Southern region: A system based on ATC recognition of affected flights. This resulted in coordination, FPL modification and re-clearance of ineligible aircraft. This also resulted in and the application of alternative separation; and

- For the application of RNP 1 SIDs at NZDN: A pilot based notification system for non-GNSS aircraft. This resulted in ATC FPL modification, co-ordination with the approach unit and re-clearance of the flight.

2.20 It is important to note though that impact on workload was partially alleviated by the implementation of the ICAO 2012 FPL before the main body of PBN work began. This gave greater granularity with regards to aircraft equipage and RNAV/RNP capability. However the retrieval of such information remained manual and did not in itself indicate day to day capability of a flight to carry out a particular procedure

2.21 A long term solution will be provided by enhancing the ATM system to use the ICAO 2012 FPL information in conjunction with a new allocation algorithm to select the SID/enroute/STAR/approach the aircraft would most likely fly. Day to day variability of aircraft/aircraft eligibility would remain and the ultimate decision on what combination to fly would remain with the aircrew. The accuracy of this system to predict will be further enhanced by the retiring of legacy aircraft – thus reducing the variation in equipage.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

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