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*Performance Based Communication
and Surveillance (PBCS)
Implementation Plan
2018*



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References

ICAO Doc 9869

ICAO Doc 4444

ICAO Doc 10063

National Airspace and Air Navigation Plan

Civil Aviation Rules

Airways Manual of Air Traffic Services – Oceanic Services (Amd 41 2016)

ICAO Doc 7030 Proposed Revision – PAC and MID-ASIA

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1.1

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1. Introduction

Performance Based Communications and Surveillance (PBCS) ensures that communication and surveillance data links meet suitable performance specifications so air traffic services in Oceanic airspace can be provided safely.

This implementation plan provides the background to PBCS, and proposes a plan for its introduction. The plan also outlines the likely impacts on the various participants within the New Zealand aviation system.

If you have any questions relating to the contents of this document, please direct these to:

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2. Background

The ICAO Performance Based Communications and Surveillance (PBCS) concept is aligned to Performance Based Navigation (PBN). While PBN applies required navigation performance (RNP) and area navigation (RNAV) specifications to the navigation element, PBCS applies required communication performance (RCP) and required surveillance performance (RSP) specifications to communication and surveillance elements.

Figure 1, below, provides an overview of the performance-based communications, navigation, and surveillance (CNS)/ATM model, which outlines the relationship of the performance-based specifications among CNS elements supporting an ATM operation. It shows how reduced Longitudinal or Lateral Separation is enabled safely by application of appropriate RNP, RSP and RCP standards. If any of the underlying performance standards are not met, then the system must revert to a less demanding ATM operation, such as the application of larger separations.

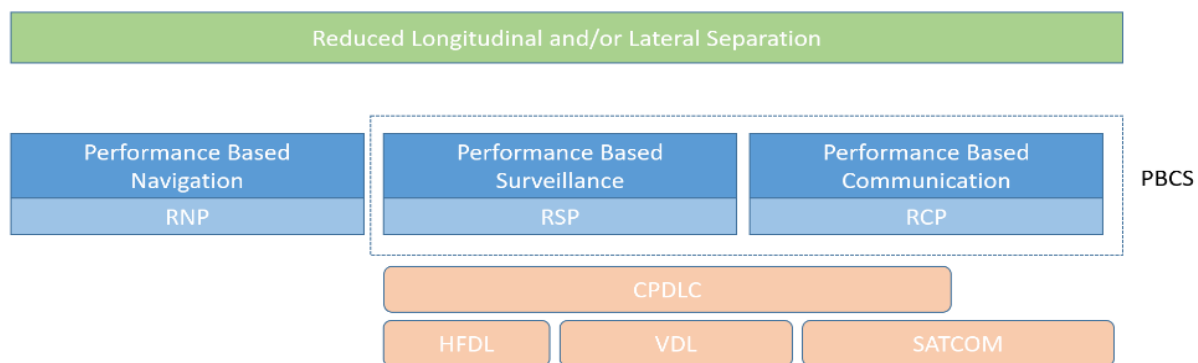


Figure 1 – PBCS and PBN standards enabling an ATM service

3. Required Communication Performance (RCP) and Required Surveillance Performance (RSP)

The RCP and RSP specifications shown in Figure 1 prescribe the functional, safety and performance requirements for all components of communication and surveillance systems, i.e. transaction times, continuity, availability and integrity.

An example of the RCP₂₄₀ and ₄₀₀ specifications (safety criteria), as per the ICAO PBCS manual, are given below.

Note: RCP transaction time is the time taken for the controller to issue the instruction and receive the response from the Aircraft

RCP specification	RCP transaction time (sec)	RCP continuity (probability)	RCP availability (probability)	RCP integrity (acceptable rate/flight hour)
RCP 240	240	0.999	0.999 0.9999 (efficiency) (See Note 3)	10^{-5}
RCP 400	400	0.999	0.999	10^{-5}

In addition, the required PBCS monitoring programme will support hazard identification as well as safety risk assessment and management. It also supports exchange of safety information on a regional and global basis, and brings New Zealand into line with other states and Flight Information Regions.

Figure 2, below, shows a RCP and RSP being used during the provision of an Air Traffic Service. The RSP defines the performance of the ongoing ATM surveillance, while the RCP is used when communicating instructions with the aircraft.

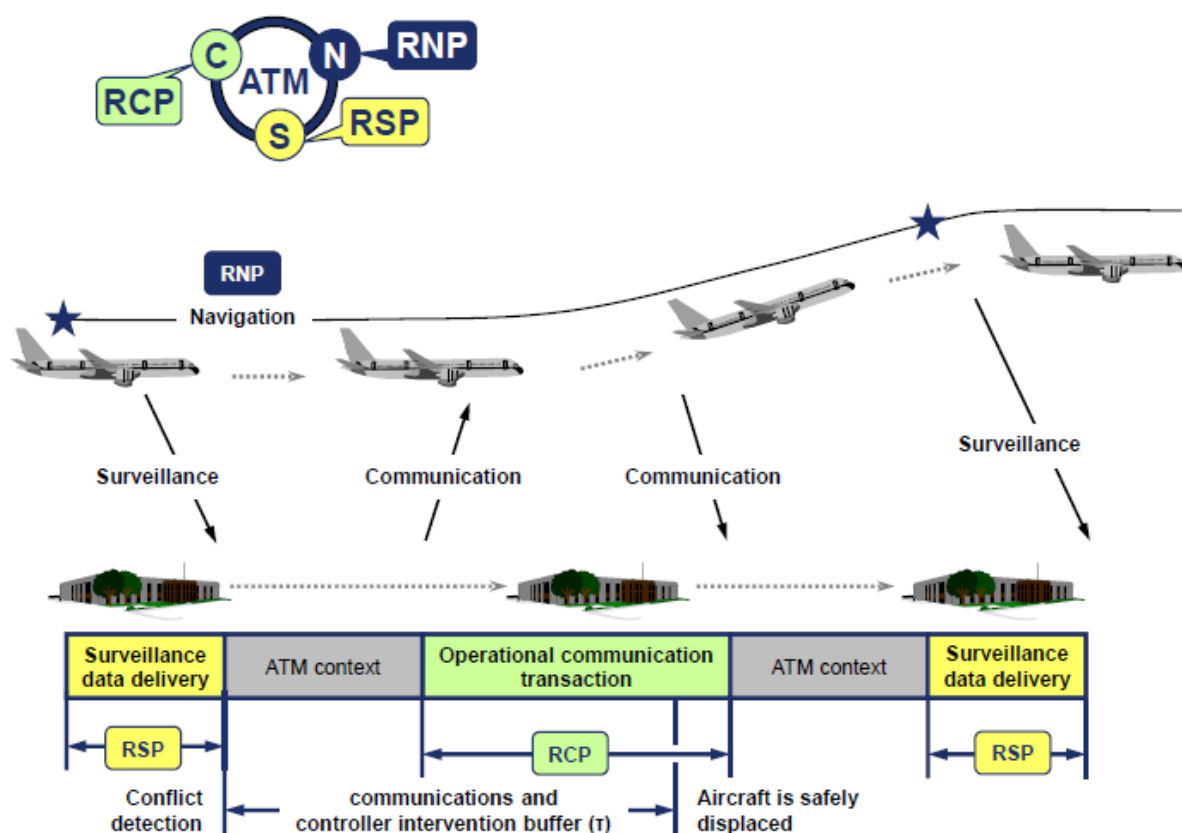


Figure 2 – Operational Use of an RSP and RCP specification

The importance of interface management for air traffic service providers and aircraft operators is highlighted in the PBCS concept. When communication and surveillance services are negotiated, the air traffic service provider and aircraft operator should establish appropriate Service Level Agreements (SLAs) that support the performance requirements for the Air Traffic Service. This should ensure initial and ongoing compliance by the contracted Communications Service Provider (CSP) and Satellite Service Provider (SSP) with the functional, safety and performance requirements described in the RCP and RSP specification.

CSP and SSP arrangements will form part of the authorisation criteria for aircraft operators' PBCS applications.

4. Assessing and applying a RCP or RSP specification

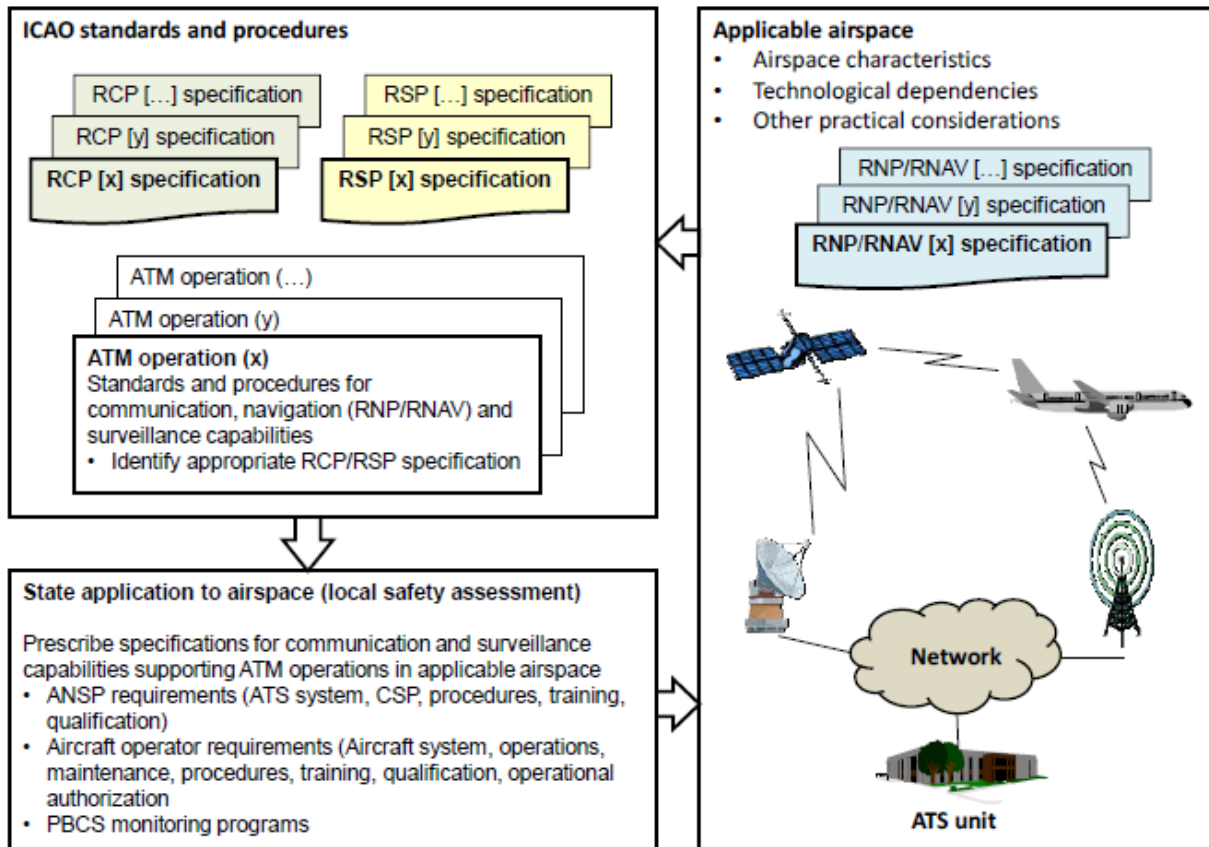


Figure 3 – Assessing and applying a RCP or RSP Specification

Figure 3 provides a synopsis for assessing the need for a Required Communication Performance (RCP) and Required Surveillance Performance (RSP) specification in a particular airspace.

The potential need for an RCP/RSP specification is two-fold:

- the operational introduction of one or more new air traffic management (ATM) operations may prescribe an RCP/RSP specification (e.g. the introduction of reduced lateral and longitudinal separation minima or trajectory based operations); and
- the introduction of a new communication media technology may require an evaluation against the existing RCP/RSP specification (e.g. SATVOICE)

In New Zealand, Oceanic reduced separation operations will require both a RSP (for surveillance using ADS-C) and an RCP (for ATC-Aircraft communications using CPDLC).

See also section 5 and 6.

5. New Zealand Oceanic airspace

The New Zealand airspace that is envisaged for PBCS is the Auckland Oceanic Flight Information Region (FIR). This is the environment where Airspace Services (Separations) that are identified in PANS-OPS (ICAO Doc 4444) as requiring PBCS, are currently used.

The applicable Longitudinal and Lateral Performance Based Separation Minima and RNP types and their respective RSP and PCP requirements from PANS-OPS (ICAO Doc 4444) are shown below:

LONGITUDINAL SEPARATION

<i>Separation minima</i>	<i>RNP</i>	<i>RCP</i>	<i>RSP</i>	<i>Maximum ADS-C periodic reporting interval</i>
93 km (50 NM)	10	240	180	27 minutes
	4	240	180	32 minutes
55.5 km (30 NM)	2 or 4	240	180	12 minutes
5 minutes	2 or 4 or 10	240	180	14 minutes

LATERAL SEPARATION

For a minimum spacing between tracks of 42.6 km (23 NM) a navigational performance of RNP 4 or RNP 2 shall be prescribed. The communication system shall satisfy required communication performance 240 (RCP 240) and the surveillance system shall satisfy required surveillance performance 180 (RSP 180).¹

Airways has been applying the RNP10 50NM separation since the implementation of the Oceanic Control System in the 1990s, and the RNP4 30NM separation since 2007. Safety cases for both the 50NM and 30NM separations were prepared before they were implemented.²

PBCS specifically calls for the RCP240 and RSP180 requirements which previously were implicitly defined in the standard. Since 2009 Airways has been monitoring performance against both RSP180 and RCP240 and has taken a global lead in both PBCS monitoring and the development and managing of the Central Reporting Agency (CRA) problem reporting website.

Airways is not proposing adopting any new separation standards as a result of PBCS. In effect, PBCS makes it safer to apply the separations that are already in-use, largely by giving the controller better knowledge of aircraft PBCS capabilities (via the Flight Plan). Airways has already upgraded its Oceanic Control System to allow this information to be presented on-screen to the Oceanic Controllers.

Airways withdrew the application of 30Nm and 50NM longitudinal separations from a specific operator's fleet in 2009 when monitoring determined that the performance of their aircraft had fallen below 95% normal operations for RCP240 and RSP180. In this respect, PBCS principles are already being applied in NZ Oceanic airspace.

¹ Note that Airways in fact use a 30NM lateral separation according to MATS-OS

² Airways plan to implement the RNP2 20NM lateral standard for climb through and also the ADS-C CDP longitudinal standard later in 2017. These new separations will be the subject of dedicated safety cases.

**PBCS AUTHORISATION = ELIGIBILITY FOR REDUCED SEPARATION (30 & 50 NM)
IN AUCKLAND OCEANIC AIRSPACE**

6. Aircraft equipage

For aircraft currently equipped for CPDLC and FANS/1A, there should be no need to change. PBCS imposes standards and monitoring on the performance of such equipment to ensure it is sufficient for the airspace service (separation) being provided. Equipment that fails to perform to the required standards will require troubleshooting and rectification by the Operator. Experience to date shows that HFDL does not meet the PBCS RCP240 standard.

Although an existing NZ registered aircraft may already be equipped for PBCS, it will still be necessary to obtain operator authorisation from the CAA (see also PBCS authorisations section below). Once approved, such equipment will form part of the MEL for operations in PBCS airspace (as per ICAO Annex 6, Chapter 7.1.3).

It may also be necessary to update an aircraft's FMS and related systems software to provide the aircrew with the PBCS capability alerting and awareness, as per the PBCS authorisation requirements.

7. Flight planning

When planning to operate in airspace that includes PBCS, a PBCS-approved aircraft must file the relevant Indicators in the Flight Plan. In New Zealand, this will then enable the Oceanic controller to apply reduced separations to this aircraft.

The New Zealand AIP will be updated by March 31 2018 to reflect these changes to the flight planning requirements, and an Advisory Circular will be issued in advance.

The regional supplement (ICAO document 7030) will also be updated to reflect the PBCS status of the Auckland Oceanic FIR.

8. Monitoring and troubleshooting

Ongoing monitoring of PBCS performance of aircraft, once they are approved, is central to PBCS. This ensures that aircraft maintain the ability to deliver suitable communication and surveillance performance for the Air Traffic Service being provided. If an aircraft or operator falls below the threshold, it may be redirected to less advantageous separation standard and/or routing that has less stringent communication and surveillance performance requirements.

In New Zealand, Airways currently monitors all CPDLC equipped aircraft in the Auckland Oceanic airspace, and reports this data to a Central Reporting Agency (CRA) for analysis. This data is currently available on a 6 month per-aircraft/operator summary basis at the fans-cra.com website. We will review the content and frequency to ensure that reports are provided according to accepted international standards.

The monitoring programme also involves operators, CSP and SSPs finding the cause of substandard performance so that corrective action can be taken to improve performance. For example, we are aware of cases where individual airframes have shown significantly worse performance than the rest of an operator's fleet. The problem has been traced to installation issues or satellite provider misconfigurations.

The worldwide monitoring program, facilitated by Central Reporting Agencies (CRAs) also maintains a list of recommended software versions for various aircraft, to address known issues.

9. PBCS Authorisation – NZ Registered Operator

It is envisaged that NZ registered aircraft operators may seek PBCS Authorisation from the CAA, in order to take advantage of Air Traffic Services that require such approval.

The exact requirements for this will be determined by the CAA, but are likely to include:

- Aircraft capabilities, software versions and PBCS integration with Flight Management Systems.
- Statements of RCP and RSP Compliance from Aircraft Manufacturers and/or evidence of past RCP/RCP performance
- Participation in Monitoring Programs
- Evidence of agreements with CSPs and SSPs for performance level assurance
- Aircrew training in PBCS awareness, and procedures for loss of PBCS capability

Authorised operators must demonstrate sufficient ongoing performance of their equipment, crew training and maintenance of the equipment.

10. PBCS authorisations – Part 129 Operator

Foreign operators holding PBCS authorisations from their state of registry will also wish to access PBCS services within Auckland Oceanic Airspace. It is envisaged that New Zealand would accept foreign authorisations, and will monitor them when they are within NZ Airspace.

If their PBCS performance is below that required for the Air Traffic Services being provided, they may be denied such services despite their approval from their State of Registry.

11. PBCS in foreign airspace

To be offered air traffic services in foreign airspace with PBCS requirements, a NZ registered operator must generally provide evidence of PBCS authorisation from CAA New Zealand. This may affect operators entering the Mid-Asia, Pacific and North Atlantic regions. A lack of authorisation from CAA may disadvantage those operators by restricting them to less direct routings involving wider separation standards, or less efficient cruising altitudes.

12. Other services and applications

There are other future applications for PBCS, which are not specifically covered by this document.

SATVOICE – The performance of SATVOICE is governed by specification RCP400. However, it is not currently used in New Zealand for the provision of an Air Traffic Service. The use of SATVOICE is currently under review by CAA, so operators are advised to ensure that any SATVOICE system installed in their aircraft meets RCP 400, and must continue to meet Long Range Communications Systems (LRCS) requirements unless specifically authorized by CAA.

RPAS – There is an emerging standard called Required Link Performance (RLP), which uses the same PBCS concept for the communication between a Remotely Piloted Aircraft and its ground control station.

13. ICAO APAC Region PBCS implementation strategy and North Atlantic implementation

The ICAO Asia-Pacific region has resolved to introduce PBCS. The following is an extract from the APAC Regional PBCS Implementation Strategy

States are urged to take appropriate measures to develop, establish, implement and promulgate, through advisory circular or other relevant State instruments, necessary policies and procedures to enable operators conducting flights in airspace where separations are dependent on Performance-Based Communication and Surveillance (PBCS) to start using required communication performance (RCP) / required surveillance performance (RSP) indicators in the flight plan as soon as possible.

...

The application of existing and planned RNAV and RNP-based 50 NM and 30NM longitudinal and 30NM lateral separation minima should continue, subject to the conditions that:

- a. PBCS monitoring is in place; and*
- b. Performance-based horizontal separation using PBCS designators in flight plans is implemented as soon as practically possible;*
- 3. Common implementation dates are applied by States using PBCS indicators to establish performance-based separation in adjacent airspace, supported by joint submission of Proposals for Amendment (PfA) to ICAO Doc 7030 – Regional Supplementary Procedures; and*
- 4. States that apply or plan to apply 30 NM and/or 50 NM longitudinal separation minima and/or 30 NM or 23 NM lateral separation minimum are urged to implement the ATM system capability to process and use ICAO PBCS flight plan indicators to determine aircraft eligibility for performance based horizontal separation by **not later than 29 March 2018**;*

...

A number of these conditions have already been met. The Airways Oceanic Control System is already prepared to accept PBCS indicators in the flight plan, PBCS monitoring is already ongoing and the results are being reported to the global Reporting Agencies. The requirement for "ICAO Doc 7030 – Regional Supplementary Procedures" has also already occurred, with Proposed for Amendments (PfA) agreed by the ICAO regional office for both the PAC and MID-ASIA regions.

In parallel, the North Atlantic Region has been proposing a PBCS mandate for this entire airspace. Planning is well advanced, and this is also due to come into effect on 29 March 2018.

14. PBCS outcomes and benefits

PBCS will contribute to performance-based safety outcomes in New Zealand. The outcomes and benefits, for each group of aviation participants, are listed below:

Operators

Operators with PBCS authorisation have unrestricted access to airspace where PBCS RCP and RSP standards are in place – for example the North Atlantic (NAT), where it is anticipated PBCS will be a requirement for access to the route structure.

In the Pacific, there will be less need to change altitude or route. This is due to the application of Reduced Separation between PBCS approved aircraft to resolve possible conflicts.

Airways

Showing the controller the aircraft's capabilities on-screen will enable confident, safer decision making in applying Reduced Separations

Strategic and tactical use of reduced separation will reduce controller workload.

Compliance with ICAO Document 4444.

CAA

Additional authorisations and oversight of operators and ANSPs

Visibility and oversight of surveillance and communications performance, enabling safety assessments to be made.

Greater assurance that ATM services are being provided in accordance with PANS-OPS

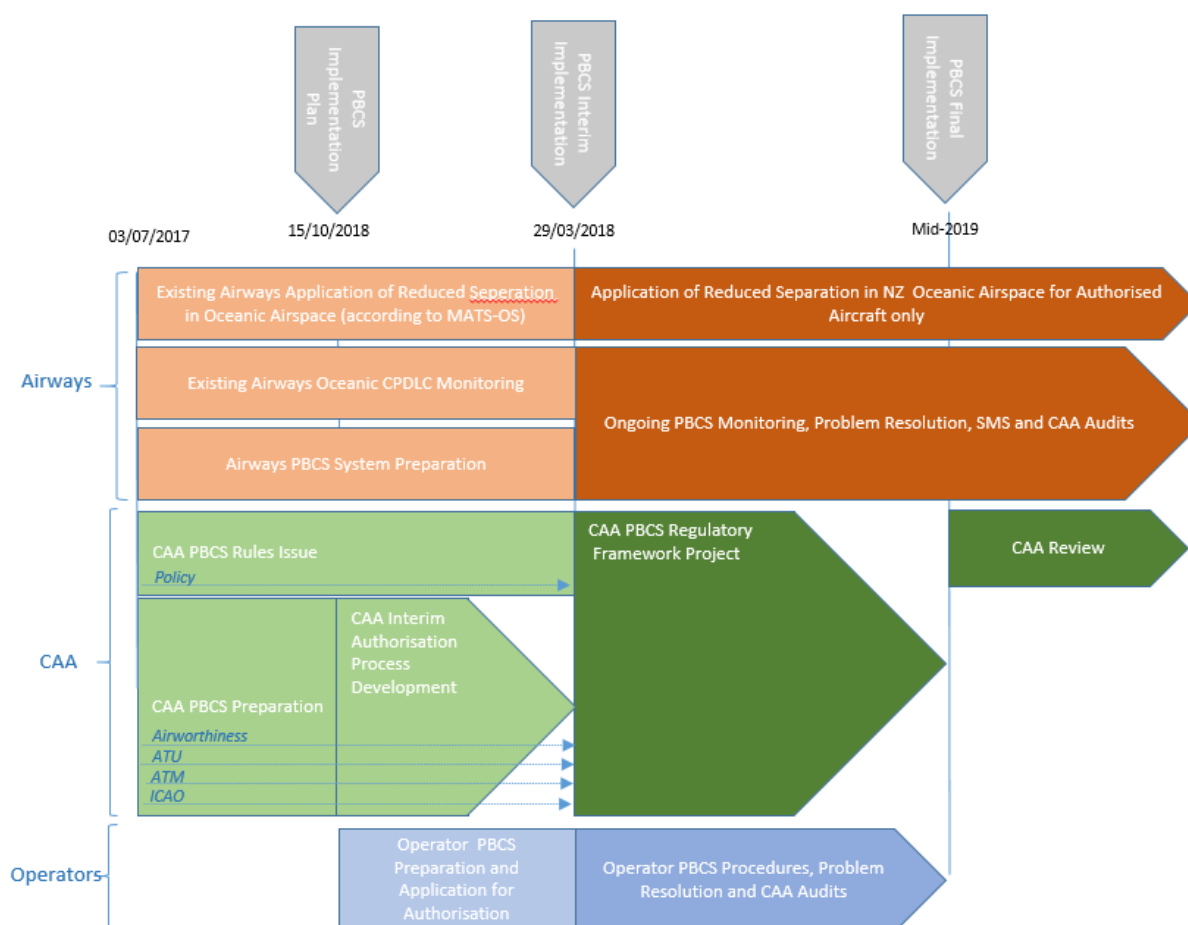
Additional regulatory options to ensure safe standards are maintained.

Compliance with ICAO Document 4444 and 9869.

15. Roadmap and phased introduction

The ICAO Asia Pacific timeframe envisages 29 March 2018 as the date by which APAC states will introduce PBCS.

The timeline below, which includes CAA projects and reviews subsequent to this document, is proposed for New Zealand.



By 29 March 2018 (ICAO Asia Pacific Implementation Date)

1. Issue interim authorisation or letter acknowledging compliance upon request for NZ registered Operators subject to them meeting suitable criteria. In addition to the requirements listed in the "PBCS Authorisations" section, such criteria may also take into account historical performance of aircraft fleets, according to data already collected over a number of years by Airways, and/or be based on another state's requirements.
2. Update Regional Guidance material (Doc 7030) to describe PBCS operations in NZ Oceanic Airspace within the PAC and MID-ASIA regions.
3. Recognise PBCS authorisations from foreign states
4. Allow approved Operators to file PBCS indicators in flight plans. This is assisted by adding the appropriate entries into the AIP.
5. Update Airways procedures to include taking Fight Plan filed PBCS indicators into account when assigning separation in Auckland Oceanic Airspace. This could be initially targeted at aircraft tracking to/from the adjacent PBCS airspace of Oakland, above FL245.
6. Ongoing monitoring of interim authorisations to gauge impact and improvements.

By mid-2019

1. Enable appropriate rule changes to allow full NZ authorisations for PBCS, as determined by the current Rules Issue process underway, and the PBCS Regulatory Framework Project
2. Release an Advisory Circular (or other suitable notification) outlining the PBCS authorisation criteria and process.
3. Commence review of PBCS, to determine if the Outcomes and Benefits described in this document have been realised and the level of Safety and Performance has not deteriorated compared with today, as evidenced by Performance Measurements and Airspace Incidents.

16. What does PBCS require me to do?

Part 121, Part 129 or other operator using CPDLC/FANS1A

If you wish to operate in airspace with PBCS procedures, and take advantage of reduced separation (e.g. Auckland Oceanic) or more efficient cruising levels (e.g. North Atlantic),

- Obtain PBCS authorisation from the CAA as an additional item on your Operational Specification, including
 - Engage with your CSP on SLAs or other suitable methods for meeting performance requirements
 - Obtaining a statement of compliance or other suitable evidence of suitability of your FANS1A aircraft equipage to meet PBCS requirements
 - Obtaining data on the past performance of your fleet from ANSP and/or CRA
- Engage with other regulatory authorities on the requirements for operating PBCS in their airspace.
- Participate in ongoing monitoring of RCP and RCS performance of your fleet
- Be prepared to investigate and correct inadequate performance of your aircraft Communications and Surveillance equipment as reported from the CRA, ANSP or regulator.
- Keep your fleet onboard software up to date to avoid known issues
- Incorporate PBCS indicators into flight planning systems
- Development of maintenance procedures to ensure that PBCS-critical equipment is suitably maintained and available before flight into PBCS airspace
- Be prepared for PBCS to form part of regulatory oversight and inspections
- Contingency operations for loss of PBCS capability

Pilot flying in PBCS airspace

Training on operator PBCS awareness procedures, including what to do in the event of loss of PBCS capability.

ANSP

- Update ATM systems to include PBCS capabilities as notified by Flight Plan
- Update of AIP and Regional guidance
- Review ATC procedures to include use of PBCS capabilities in existing reduced separation airspace, and contingencies for loss of PBCS capability in both single and multiple aircraft.
- Consider PBCS in safety cases for future safety case applications

Air Traffic Controller

- Training on application of PBCS in air traffic management,
- Procedures from moving from a PBCS to non-PBCS environments
- Procedures for loss of PBCS capability, for either single or multiple aircraft scenarios.

Aircraft maintainer/despatcher

- Awareness of procedures concerning PBCS equipment, especially before dispatching an aircraft into PBCS airspace or investigation of performance defects.

CAA

- Development of PBCS-related rules and guidance material
- Issue Authorisation of PBCS to New Zealand Register operators, and notification of this to ANSP and CRAs
- Update of AIP and Regional guidance
- Ongoing regulatory oversight of PBCS including
 - Participate in ongoing monitoring of RCP and RCS performance of State of Registry aircraft.
 - Participate in ongoing monitoring of RCP and RCS performance of Foreign registered aircraft in terms of overall Airspace Safety
 - Regulatory action in the event of persistent or non-actioned inadequate PBCS performance.
 - Incorporation of PBCS into Part 121, Part 135, Part 43, Part 171, Part 172 inspection and audit procedures

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