Australian Implementation of PBN in the En route Environment

18 April 2024

Development of PBN airspace

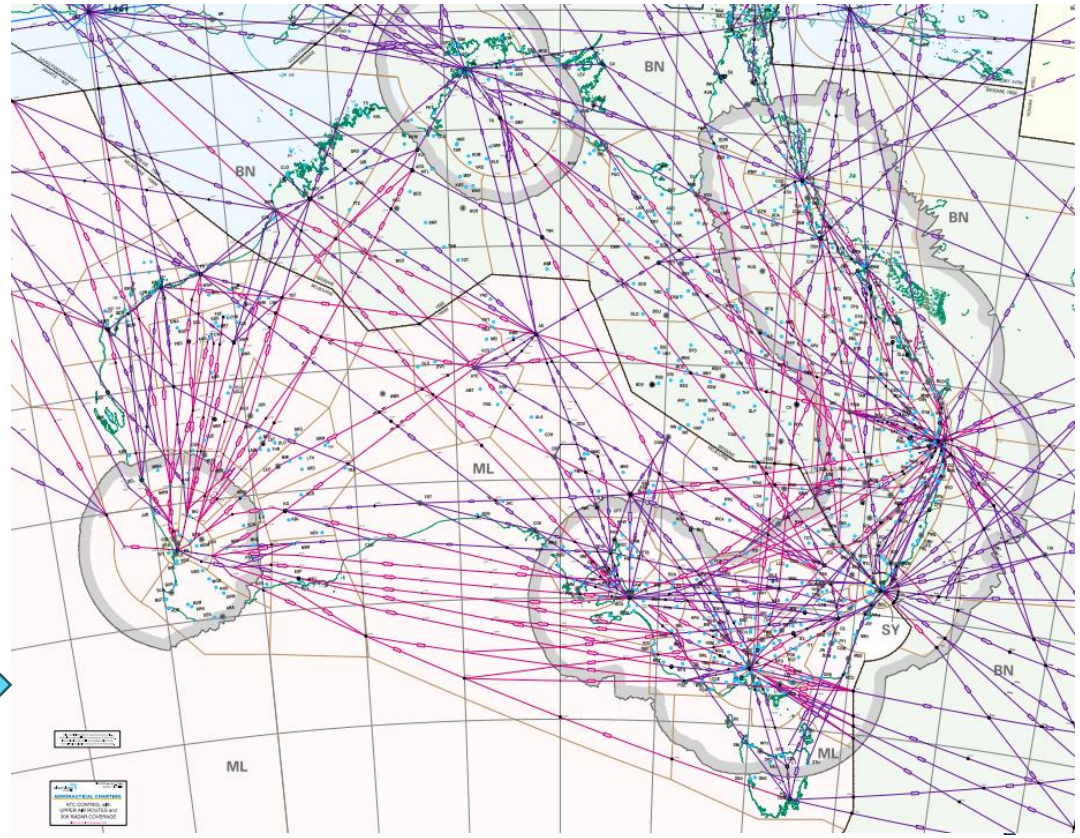
Australian continental airspace previously had a large terrestrial NAVID network. However due to the vast, sparsely populated areas in the interior, land-based navigation aids are very costly and difficult to maintain.

This drove the uptake of GNSS based navigation at an early stage, to improve flexibility and efficiency for aircraft operators and reduce costs associated with maintaining our large terrestrial network.

Following the implementation of GNSS based navigation, the terrestrial network was rationalized to the minimum amount of NAVAIDs required to form the ’Back-up Navigation Network' (BNN). The BNN has subsequently been further reduced over time.

Mixed Mode

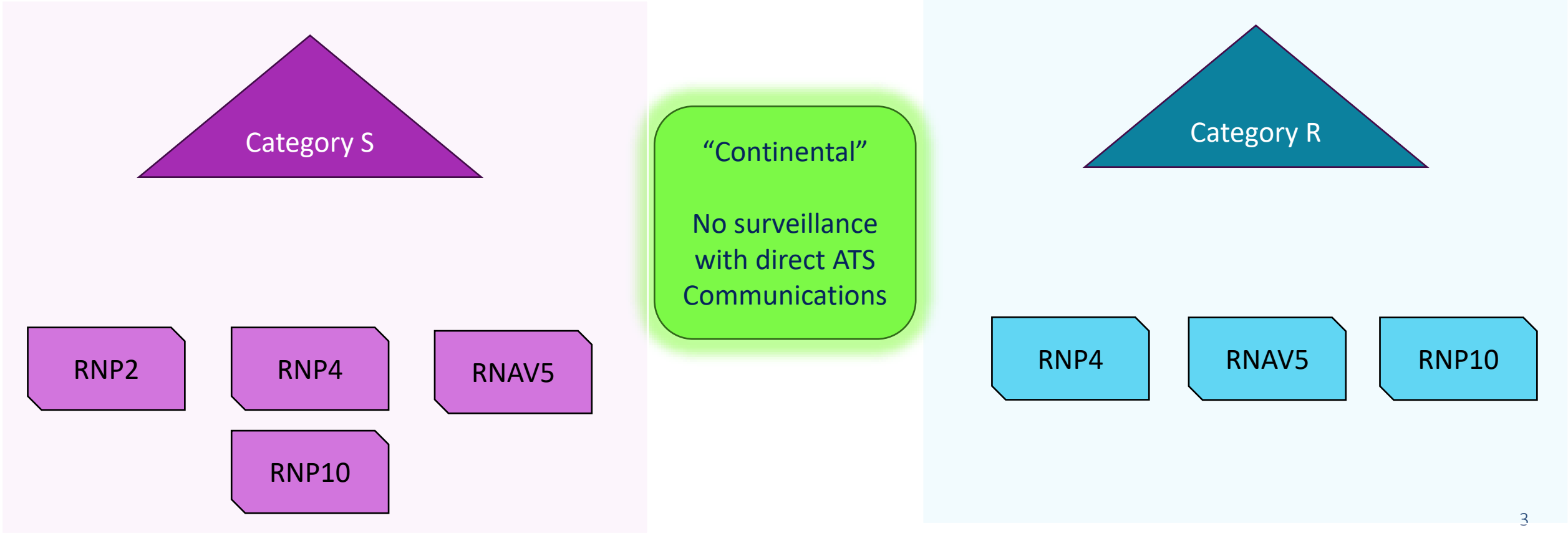
Terrestrial NAVAID distribution



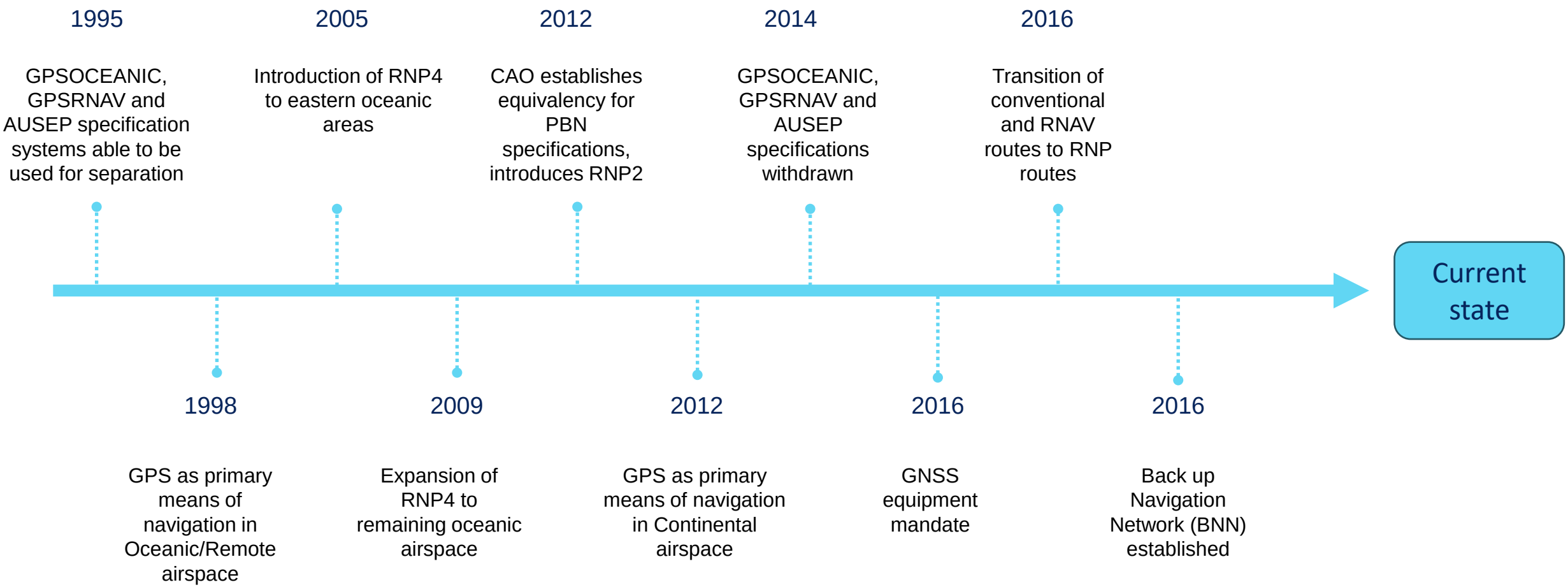
Development of PBN airspace

RNP specifications

Only a selection of RNP specifications are used within enroute portions of Australian Airspace.



Timeline of PBN establishment



Development of PBN airspace

PBN in Airspace planning and design

Safety by Design

Manage increasing demand

Reduce ATC Task load demand

Stakeholder efficiency expectations

Reduce environmental impact

Community noise expectations

Approval

Evolution of operational approval process & methodology

Pre-2012

- PBN approvals for *each* specification were issued by Legal instrument and Civil Aviation Safety Regulation (CASR) Part 91U. (En route RNP10 and RNP4)
- Aircraft operators needed to make an application for approval to operate to *any* PBN specification
- Resource intensive process of review of documentation and systems to demonstrate ability to comply with the regulations

2012 - 2021

- New Regulations published via Civil Aviation Order (CAO) 20.91 contained 'deeming provisions'
- Established equivalency for old GPSRNAV, GPSOCEANIC and AUSEP specifications
- RNP2 and RNAV5 specifications did not require a specific approval – an operator was 'deemed' to be authorized to conduct operations if they can demonstrate that they meet certain criteria through self-assessment
- RNP4 and RNP10 still required approval to conduct operations under CASR Part 91U
- International registered aircraft are recognized under CASR Part 129 and issued with a Foreign Air Transport Aircraft Operators Certificate (FATOC) that recognizes the approval from their State of Registry

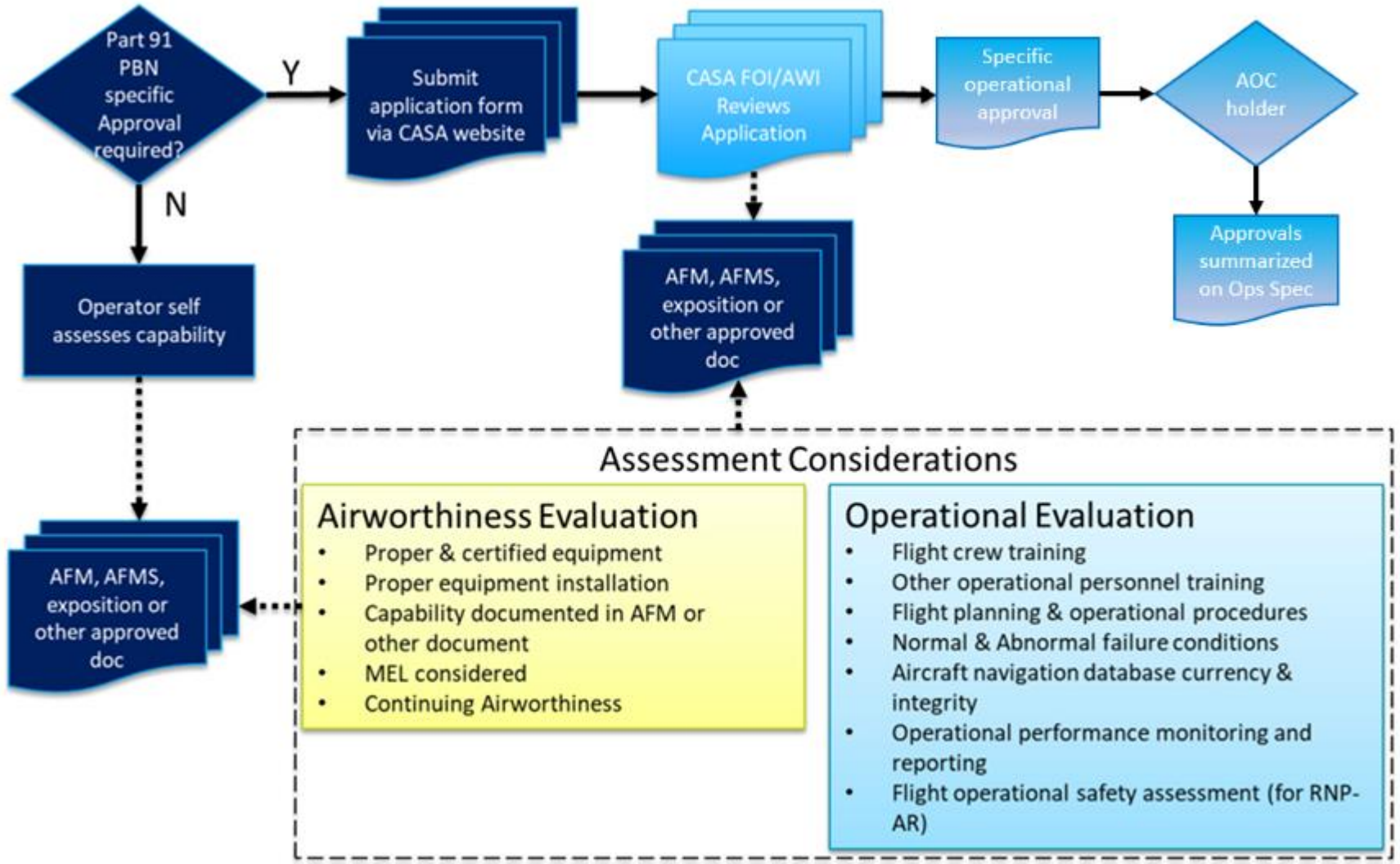
2021- current

- Current regulations moved from CAO 20.91 and CASR Part 91U, to CASR Part 91 and CASR Part 91 Manual of Standards (MOS)
- RNP2, RNP4, RNAV5 and RNP10 do not require specific approval – an operator is deemed to be authorized to conduct operations if they can demonstrate that they meet certain criteria through self-assessment
- International registered aircraft are recognized under CASR Part 129 and issued with a Foreign Air Transport Aircraft Operators Certificate (FATOC) that recognizes the approval from their State of Registry

[Part 91 of CASR General operating and flight rules | Civil Aviation Safety Authority (casa.gov.au)]

Approval

Current Civil Aviation Safety Authority (CASA) Operational approval process



Approval

Approval for ATCOs

9.6.4 PBN authorisations

9.6.4.1 PBN, flight planning and applicable standards

When Item 10 and 18 of a flight plan have the appropriate codes entered, you may use the following tolerances and standards:

PBN Authorisation	Flight Plan		Applicable Tolerance		Applicable STDs			Pilot Procedures	
	Item 10a	Item 18	7 CEP	14 CEP	D1-D8 DEP 8	5NM dependant (RNP 1 SID/STAR)	GNSS/DME based entry/ exit for lateral separation table	* GNSS Arrival	In lieu of DME for INST APCH SID/ STAR
RNP AR APCH	G + R + I	PBN/T1 PBN/T2			YES	YES	YES	YES	YES
RNP APCH	G + R	PBN/S1 PBN/S2			YES	YES	YES	YES	YES
RNP 1	G + R +D + I	PBN/O1			YES	YES	YES	YES	YES
	G + R	PBN/O2			YES	YES	YES	YES	YES
RNP 2	G + Z	NAV/ RNP2	YES		YES		YES	YES	YES
RNP 4	G + R	PBN/L1		YES	YES		YES	YES	YES
RNP 10 /RNAV 10	G + R	PBN/A1		YES			YES	YES	
	I + R						YES if also DME		
RNAV 5	I + R	PBN/B5		YES			YES if also DME		
	G + R	PBN/B2					YES	YES	
	I + G + R	PBN/B1					YES	YES	

* To conduct a GNSS Arrival the aircraft requires an azimuth aid.

Note: For PIFR consult FPL for navigational capability and FPAs

Manual of Air Traffic Services (MATS):

Manual of Air Traffic Services (MATS) - Airservices (airservicesaustralia.com)

Provides authorization to ATC to use various PBN based separation standards.

Airservices National ATS Procedures Manual

Provides a summary table to assist ATC to quickly cross check flight planning with available standards.

Description of flight plan inclusions for items 10a and 18 can be found in Australia's AIP:

Aeronautical Information Package (AIP) - Airservices (airservicesaustralia.com)

These are aligned to ICAO Doc 4444 (FPL 2012)

PBN Airspace

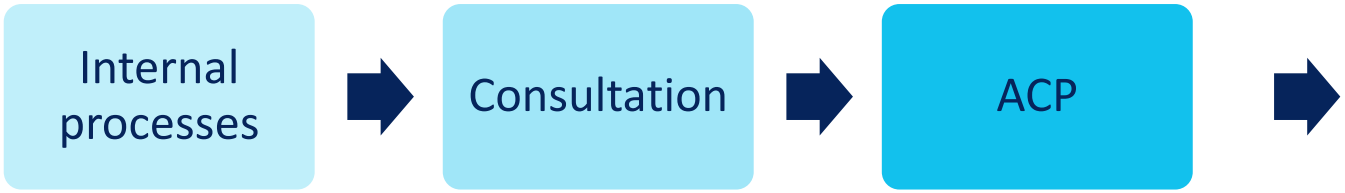
Airservices Flight Path Design Principles

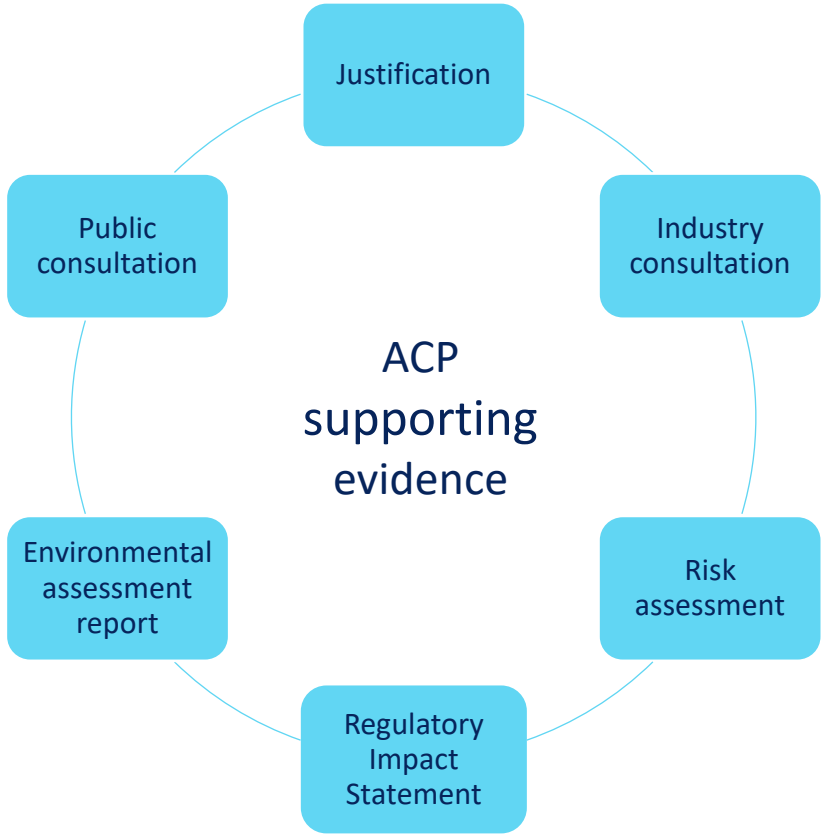
Safety and Compliance	Noise and Community	Efficiency and Environmental	Operational	Internal Approval
Safety of air navigation must be the most important consideration	Concentration of aircraft	Sites of National Environmental Significance, other sensitive habitats, and registered heritage sites	Design flight paths to facilitate access to all appropriate airspace users	Once design principles have been met change is submitted to the Airspace Governance Panel
Flight path design must comply with Australian and International design standards	Noise Abatement Procedures	Design flight paths that deliver operational efficiency and predictability	Consider flight paths that optimise airport capacity and meet future airport requirements	AGP approves change, progress to regulatory approval
	Current and expected future noise exposure			

Approval of PBN Airspace

Approval of airspace design by the regulator

Approval from the regulator requires an Airspace Change Proposal (ACP) to be submitted by the airspace change proponent to CASA Office of Airspace Regulation (OAR).





Approval of PBN Operations

Approval of airspace design by the regulator

OAR staff have been trained in PBN Airspace Design principle and see the benefits and advantages using this criteria. They do not assess changes to ensure they comply with PBN airspace specifications. That is Airservices regulatory requirement under CASR Part 173.

Initial Review

- Operational: safety, efficiency, equitable access
- Other considerations: economic impact, national security, is the change is realistic and achievable

Safety

- Analysis of the current operating environment, key existing safety issues and impact of the change
- Analysis of the Risk Assessment to ensure the types of airspace users, density of traffic, meteorological conditions, topography and any other factors relevant to the design have been considered.

Regulatory impact

- Cost of implementation versus benefits to all airspace users

Compliance

- Is the airspace design in accordance with the current legislation, procedures, government and CASA policy and strategy
- Aircraft operation implications for the *Environment Protection and Biodiversity Conservation Act 1999*

Training for PBN Operations

Training for ATCOs

Due to Australia's long history with PBN operations and staged implementation over many years, implementation training material has been difficult to locate to provide insights for the working group.

Current ab initio ATC PBN training is treated holistically and integrated in the separation training theory and practical for both ATC college and on-the-job training syllabi.

Things to consider when developing PBN training for ATC:

- Applicable PBN separation standards (minima and associated conditions), that may be applied between RNP aircraft
- Mixed mode operation with different aircraft navigation capability ie PBN and non-PBN aircraft, or aircraft with different PBN approvals
- Interpreting aircraft fitment and capability from the flight plan information
- Interpreting ATS System indications of aircraft capability to ATC
- Practical application of PBN separation, eg establishing and monitoring the separation standards
- Transition of standards between different CNS environments eg surveillance and VHF to non-surveillance and HF/Data link and vice versa
- Transition from designated RNP airspace to non-RNP airspace
- Transition to alternate separation standards should a condition of the standard no longer be met (eg ADS-C failure or overdue reports)

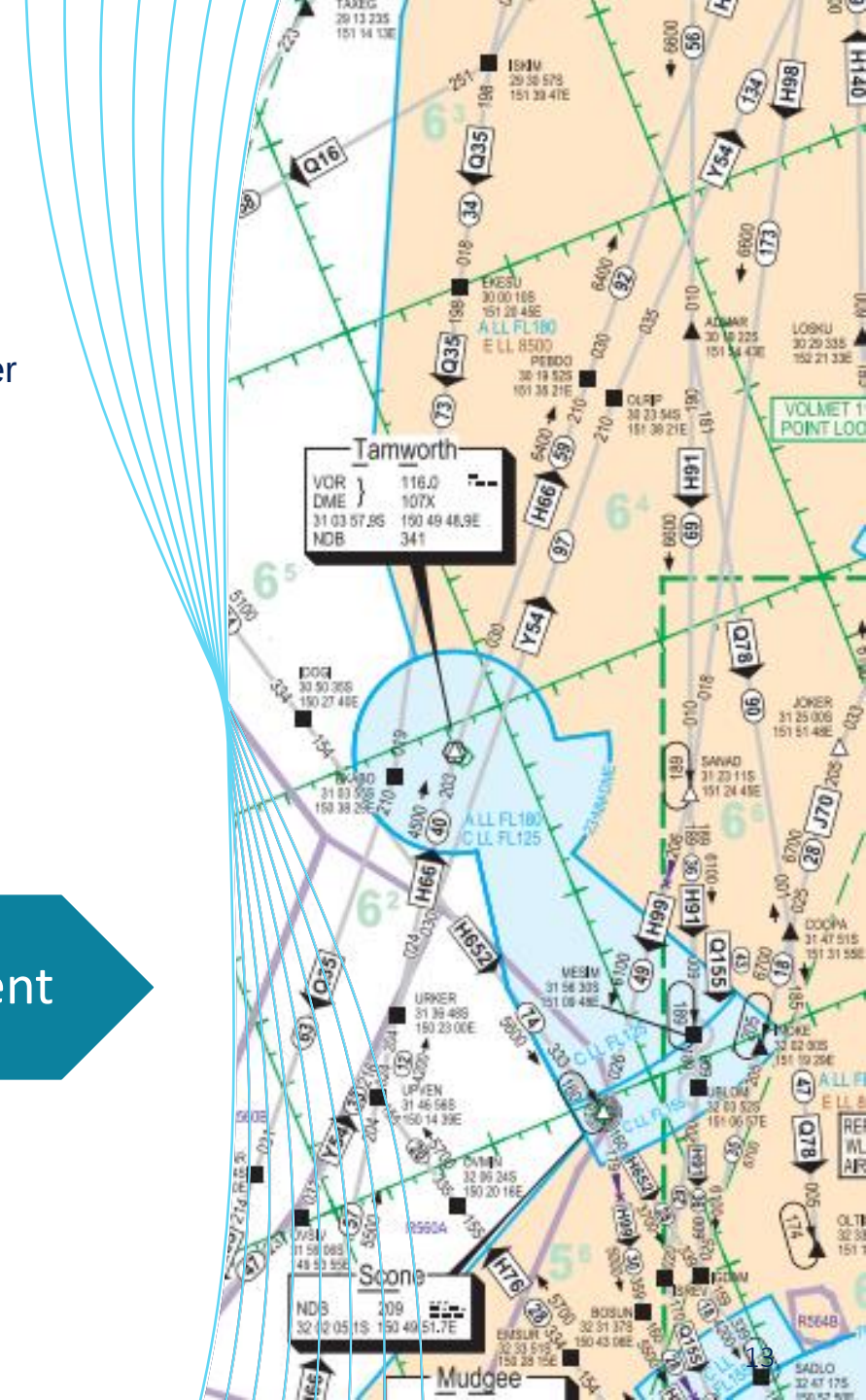
Training for PBN Operations

Training for airspace designers

Airservices airspace designers attend an ICAO accredited PBN course. Additional learning after the initial course is obtained on the job by working through design challenges and mentoring newer designers.

Australia shares our experience to assist our neighboring ANSP's to achieve PBN design outcomes where they may not have the depth of PBN experience to mentor new designers.

Plan → Design → Validate → Implement



Operational experience and benefits

Including problems encountered during the implementation and their mitigation

By far the largest challenge Australia has experienced was the mixed mode environment before the GNSS fitment mandate for civil registered IFR aircraft came into effect in 2016:

- Increased complexity for ATC
- Reduced efficiency for aircraft that were RNP capable when separated from non-RNP capable aircraft outside surveillance coverage - as a larger standard had to be applied rather than a more efficient RNP standard
- Restricted airspace redesign options and opportunities as conventional routes had to be maintained during the transition

Similarly, the benefits of increased surveillance by ADS-B could not be fully realized until all aircraft were fitted with ADS-B capable transponders (ADS-B mandate applies only to aircraft operating above FL280).

Any questions?

Thank you

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