



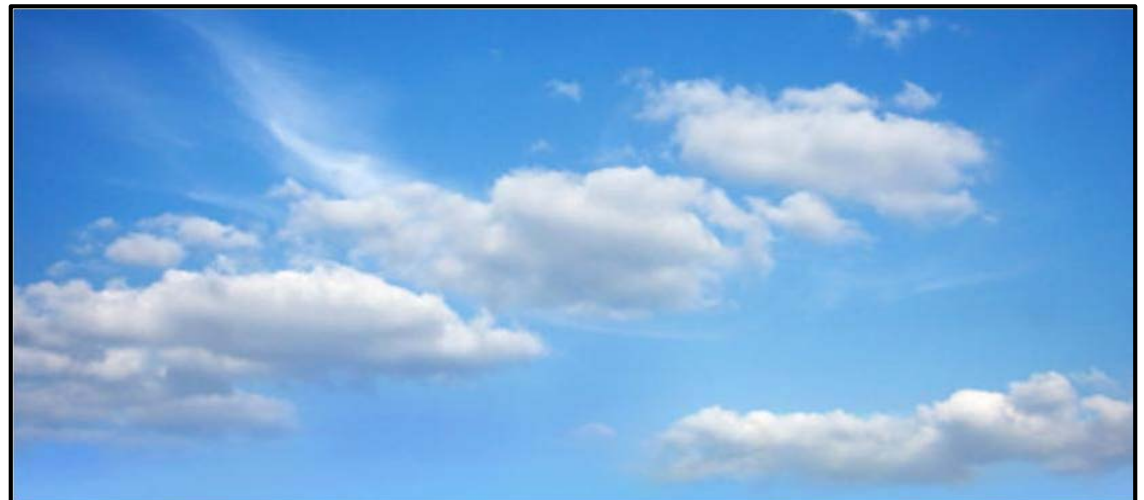
34th Airline/ATS Safety Forum

Performance Based Navigation (PBN)

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Outline

- Performance Based Navigation (PBN)
- RNP1 - including Albury
- Future applications
- Workshop



Background

- ICAO Global Air Navigation Plan specifies PBN as the highest priority and GNSS as the core technology.
- Australia has been implementing equipment mandates since 2010 to enable PBN (RNP and RNAV) approvals.



What difference does it make?

Increased efficiency and safety:

- Reduced enroute separation standards:
 - RNP2 = 15NM between aircraft
 - RNP4 = 29/30NM between aircraft
- Optimal levels
- Lower workload



Separation development

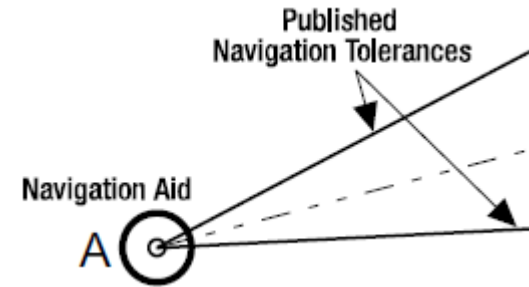
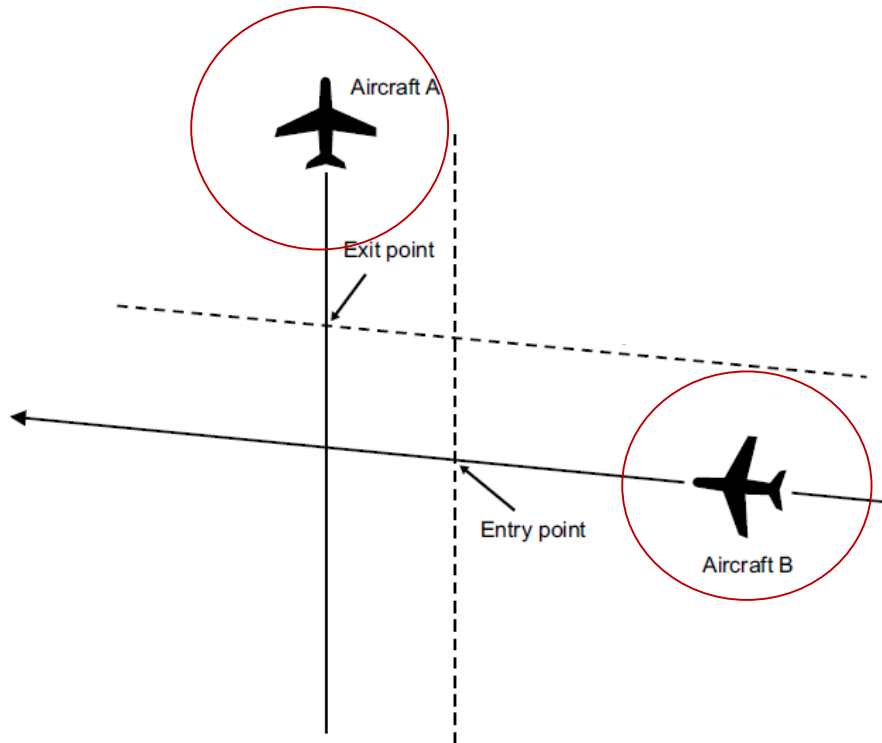
- Navigation
- Communication
- Surveillance



- In some cases, airspace considerations such as route and traffic density.

Independent vs dependent (lateral)

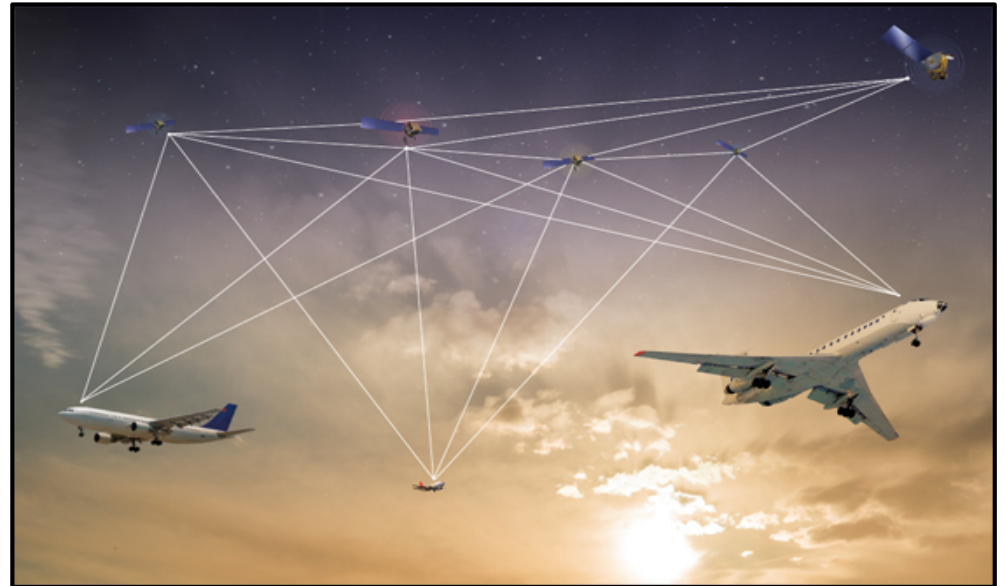
Independent – per aircraft, per airspace



Independent vs dependent (lateral)

Dependent –

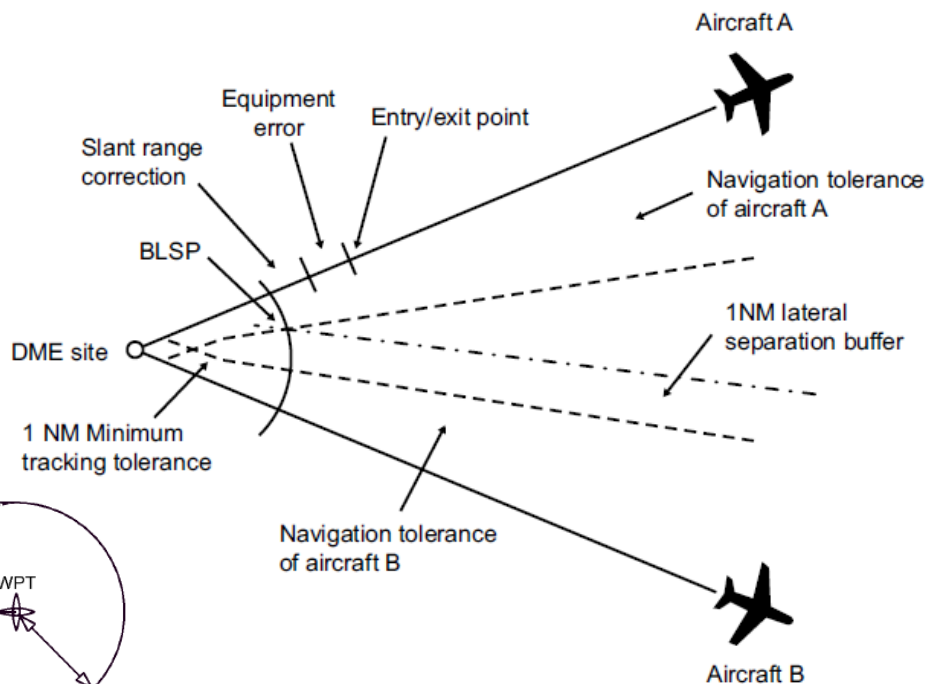
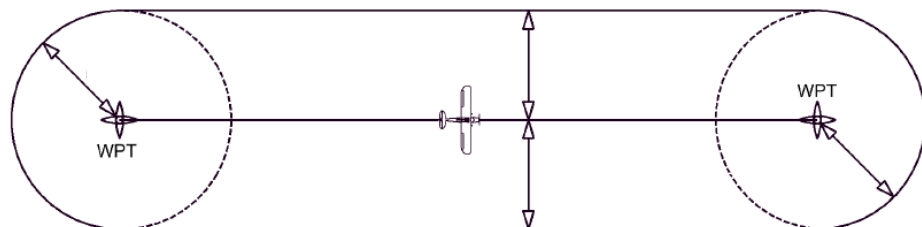
- both aircraft have to meet the requirements of the standard
- all conditions must be met.



GNSS in lieu of VOR

Provides VOR like separation for aircraft operating at locations without navigation aids

- Dependent
- Complicated
- 'Safe side'



GNSS in lieu of VOR

Navaid - GNSS table conditions for use

- a) in CTA;
- b) when GNSS information is from an approved SCNS;
- c) when turns in track at the common waypoint or navaid are not greater than five degrees;
- d) when the GNSS aircraft is:
 - i) tracking via a published waypoint, navaid or a waypoint that has been flight planned; and
 - ii) established on track to or from the common waypoint or navaid from which separation will be applied using the phrase 'CONFIRM (or REPORT) ESTABLISHED ON THE [(three digits)] GNSS TRACK [BETWEEN (waypoint) AND (waypoint)]';
- e) using DME, when the DME is co-sited with the azimuth navaid;
- f) where DME is not available, using the DME lateral separation point as the distance of the BLSP from the azimuth navaid; and
- g) using VOR columns for TACAN.

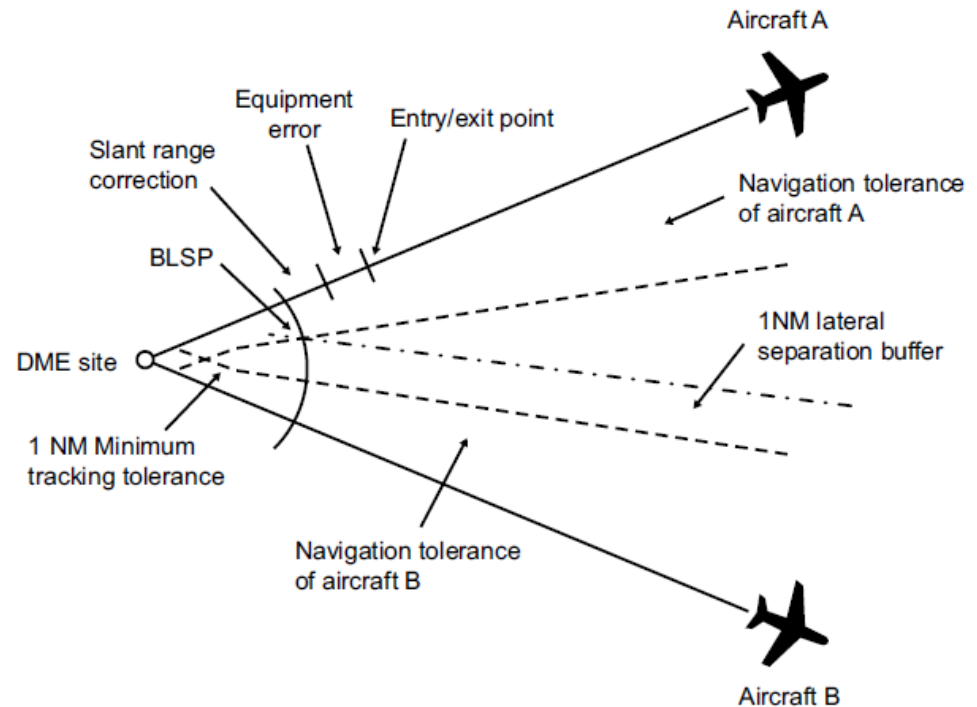
Note 1: Aircraft may not be established on track outbound from a fly over waypoint.

Note 2: Distances are corrected for DME slant range and equipment error.

GNSS in lieu of VOR

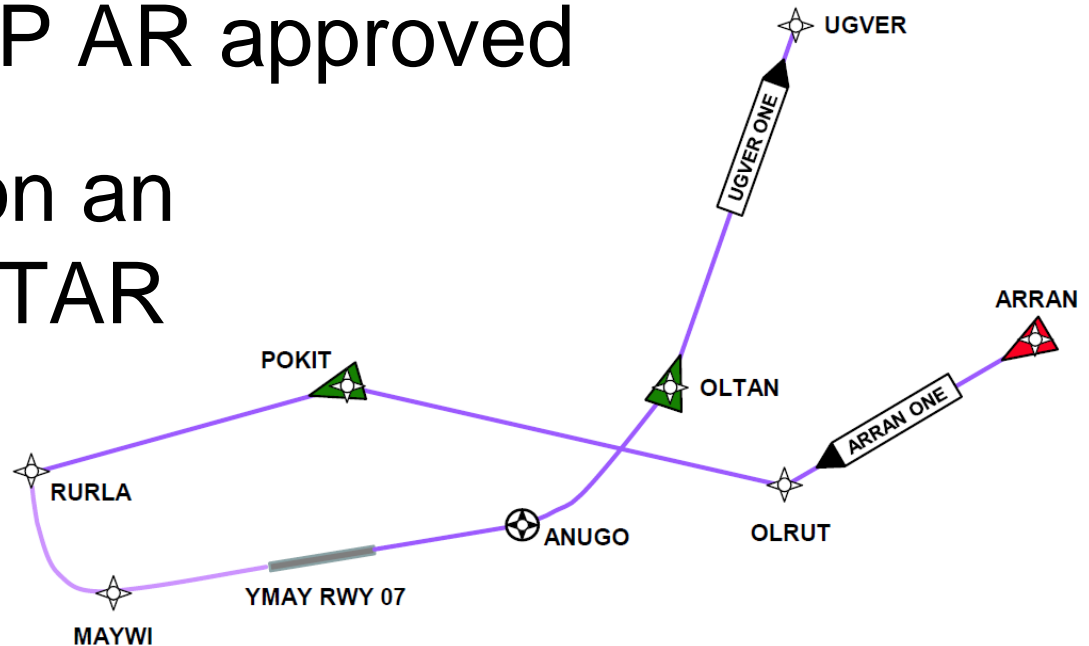
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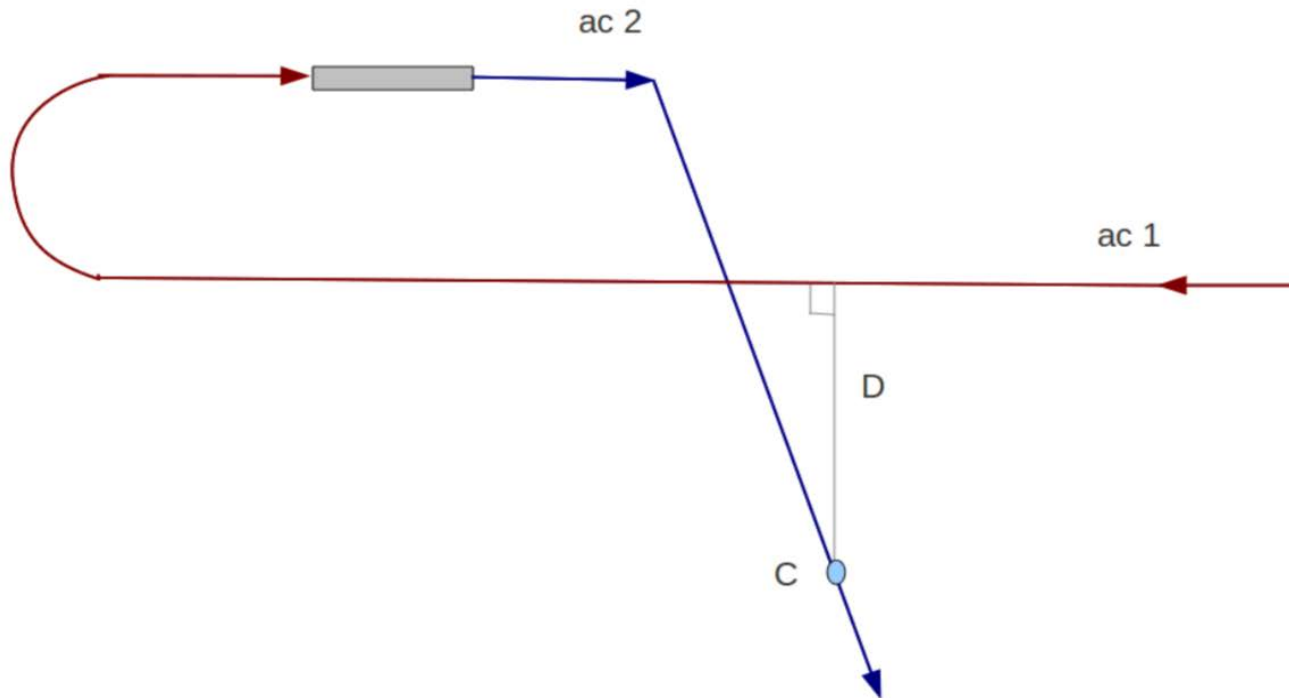
RNP 1

- 5NM between aircraft
- No surveillance required
- RNP 1 or RNP AR approved
- Established on an RNP1 SID/ STAR



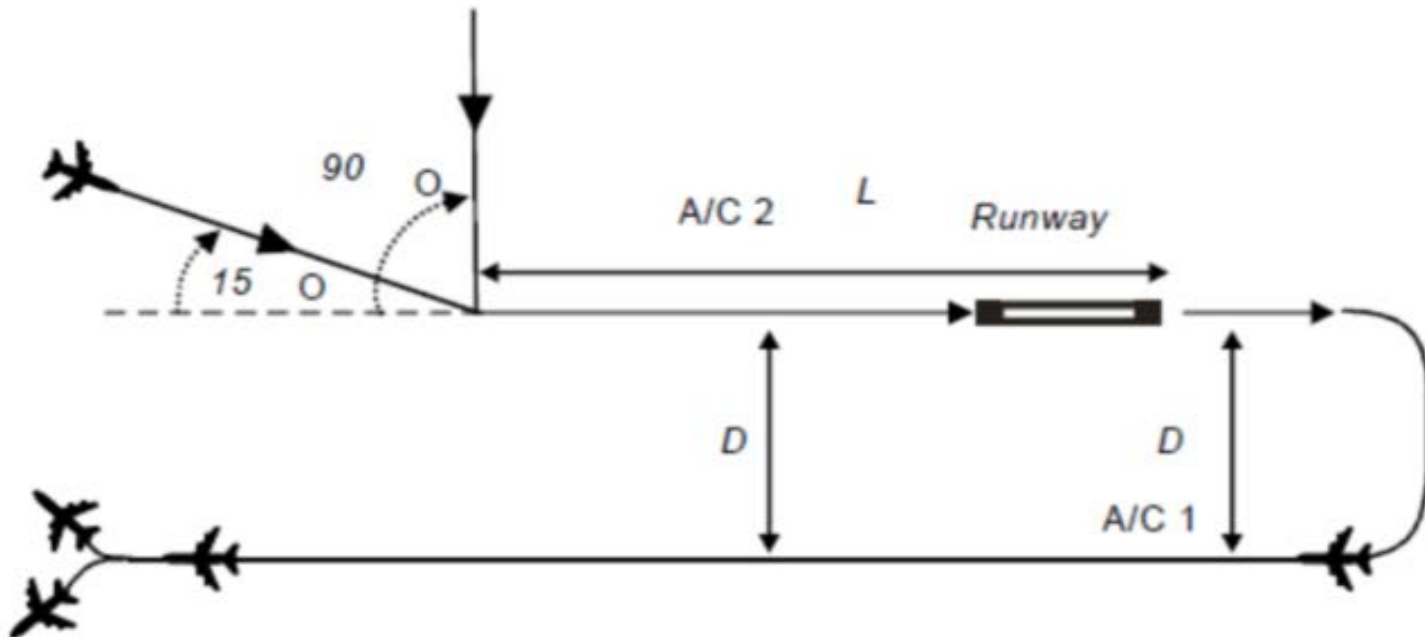
RNP 1

ATC applies an alternate standard when the aircraft are less than 5 NM from each other



RNP 1

Pilot position report at published waypoints establish separation or may be fully separated

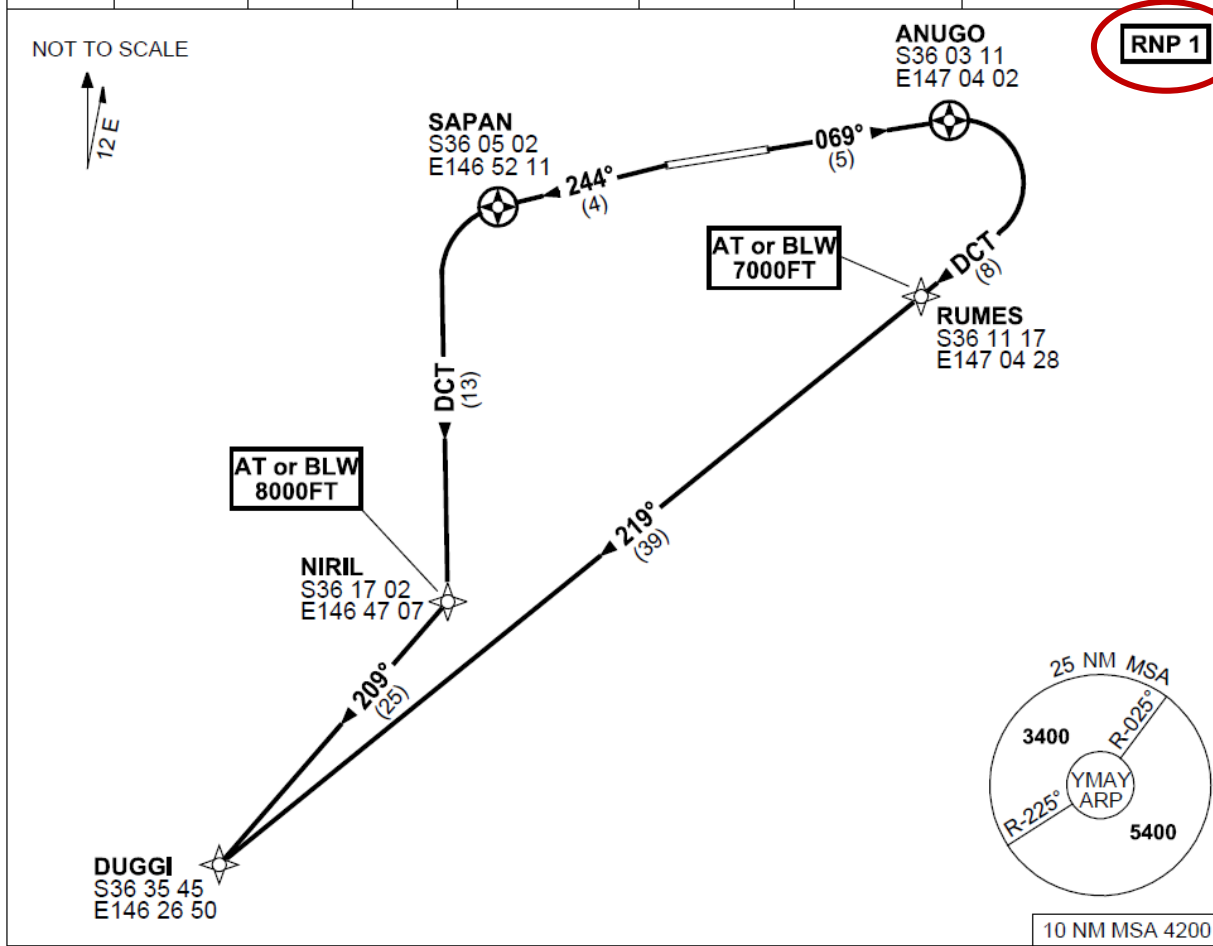


Albury SID

2 MAR 2017

**STANDARD INSTRUMENT DEPARTURES (SID)
DUGGI ONE DEPARTURE (RNAV)
ALBURY, NSW (YMAY)**

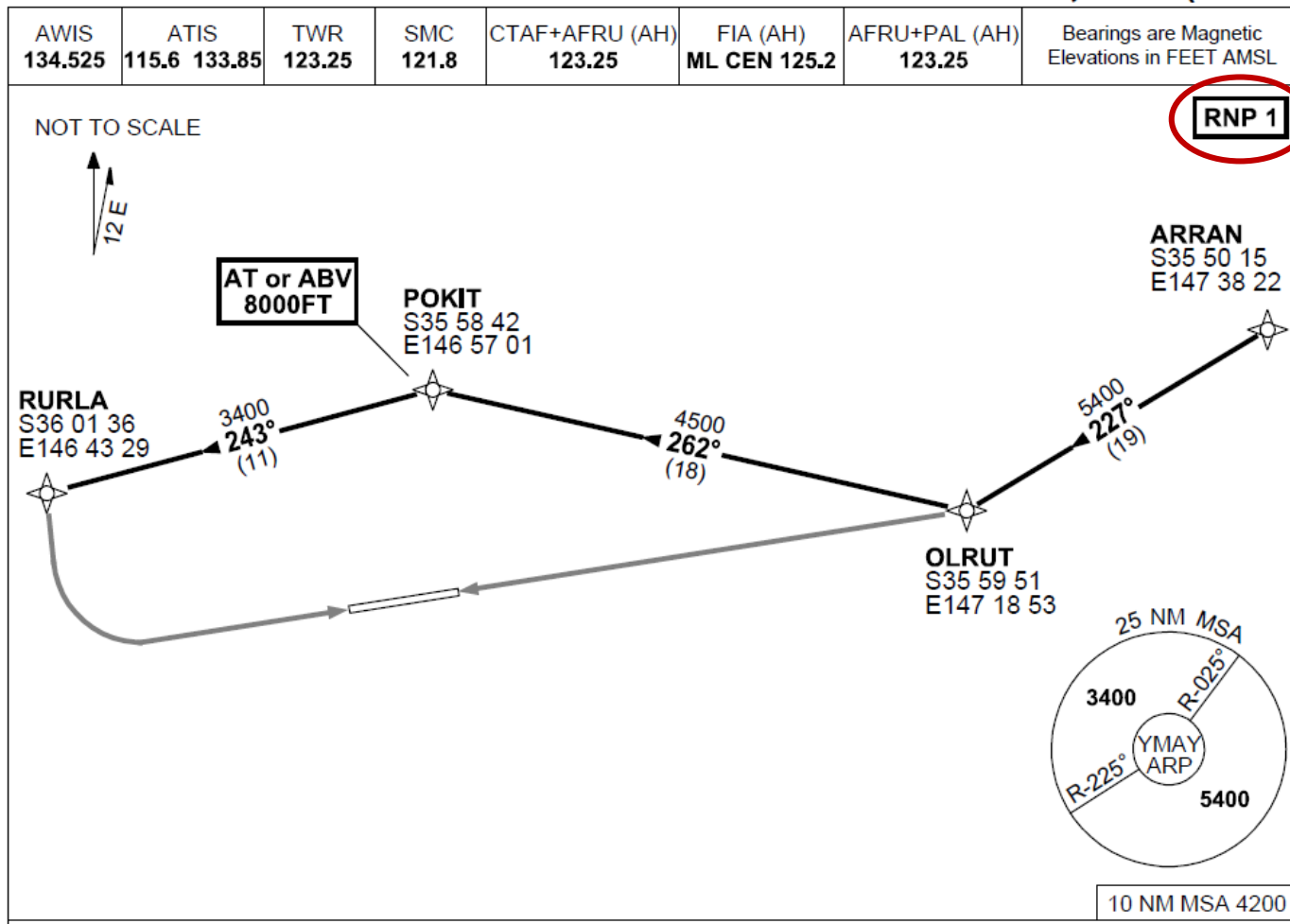
AWIS 134.525	ATIS 115.6 133.85	TWR 123.25	SMC 121.8	CTAF+AFRU (AH) 123.25	FIA (AH) ML CEN 125.2	AFRU+PAL (AH) 123.25	Bearings are Magnetic Elevations in FEET AMSL
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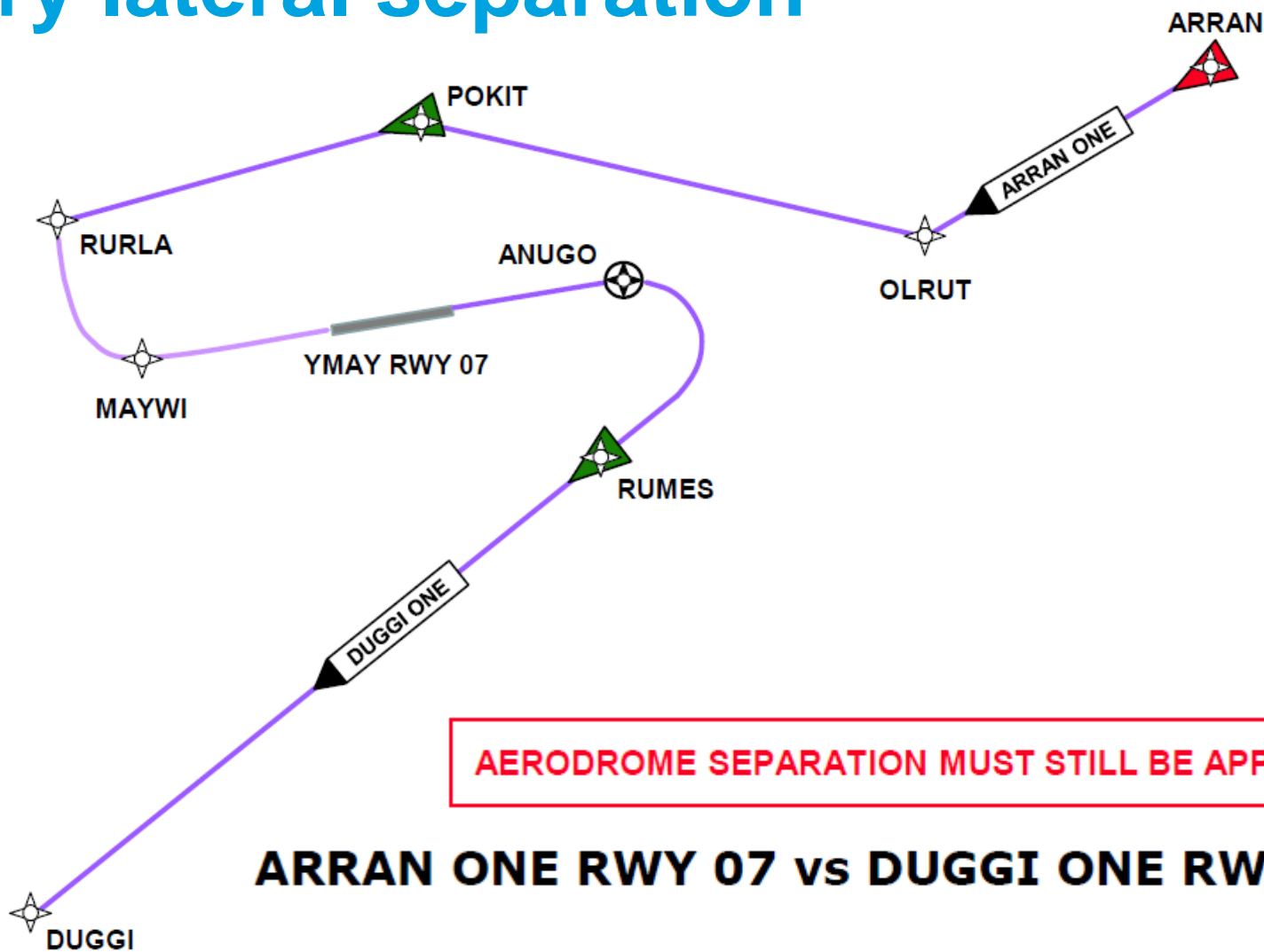
Albury STAR

**STANDARD ARRIVAL ROUTE (STAR)
ARRAN ONE ARRIVAL (RNAV)
ALBURY, NSW (YMAY)**

2 MAR 2017



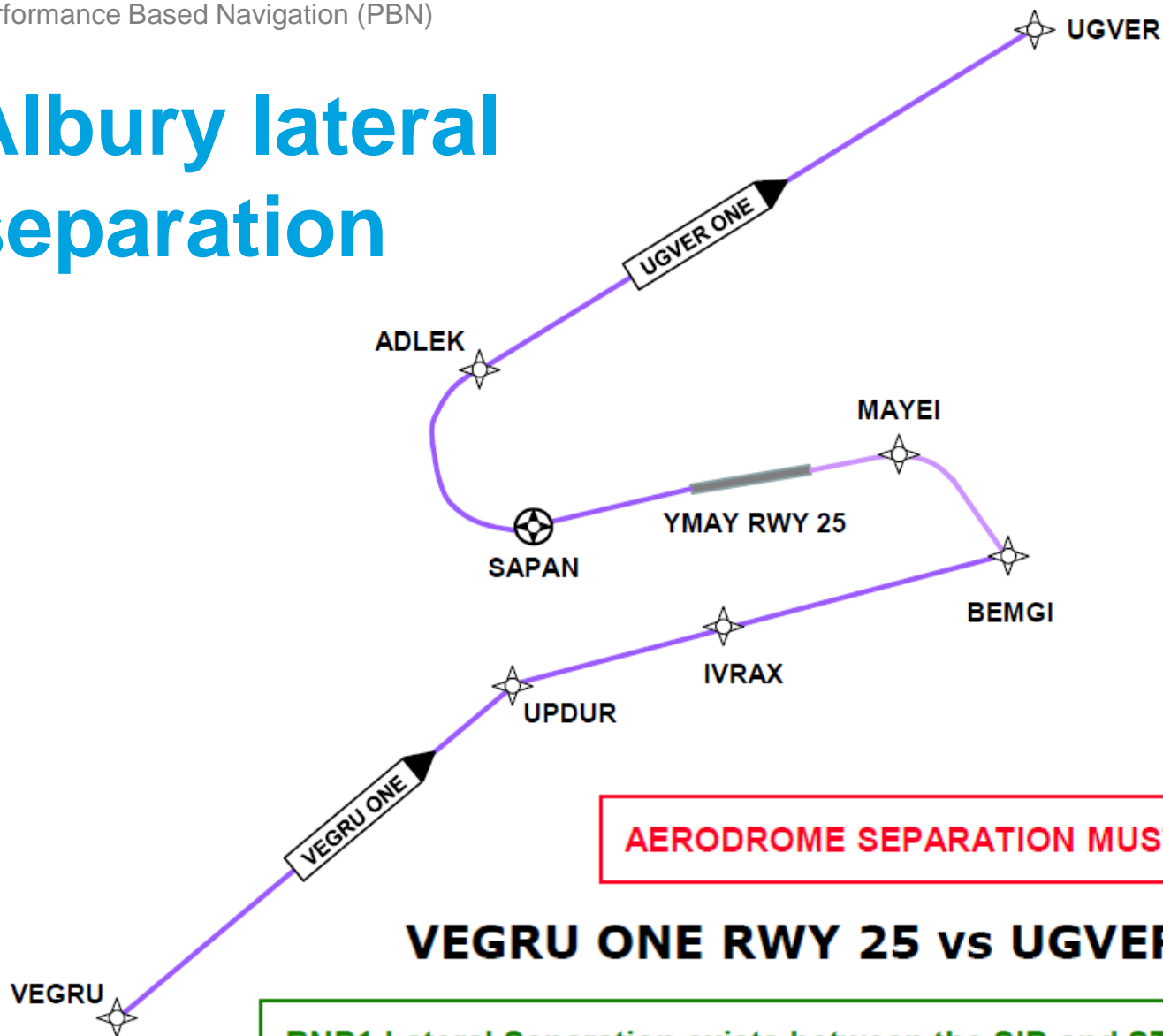
Albury lateral separation



AERODROME SEPARATION MUST STILL BE APPLIED

ARRAN ONE RWY 07 vs DUGGI ONE RWY 07

Albury lateral separation



AERODROME SEPARATION MUST STILL BE APPLIED

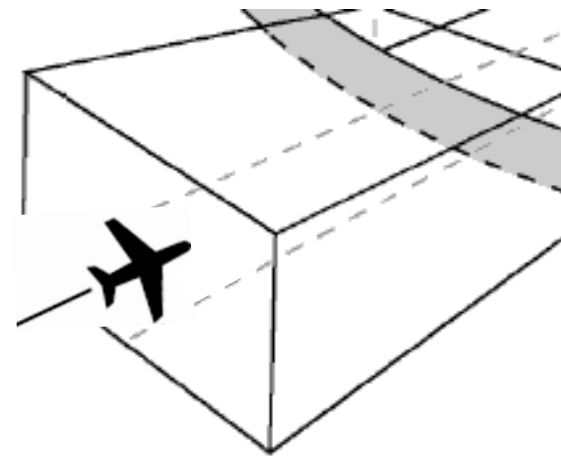
VEGRU ONE RWY 25 vs UGVER ONE RWY 25

RNP1 Lateral Separation exists between the SID and STAR / RNAV-Z shown

Aircraft containment

ICAO - Provided operational error is considered, lateral separation of departing/arriving aircraft using instrument flight procedures, exists where the protected areas of tracks designed using obstacle clearance criteria do not overlap.

We also use this for airspace containment



Workshop

What limitations or pilot practices need to be considered by ATC when making assumptions about navigation?



Workshop

Navigation:

- If multiple navigation sources (eg GNSS and VOR) are available, how does the FMS integrate this information?
- Can the FMS be configured to use a hierarchy of sources?

Workshop

Navigation:

- How does the pilot know what the reference source is? Can they select this?
- How can navigation mode selection occur?

Manual/ automatic (can one override?)

Workshop

Reporting in an air traffic control context:

- Flight planning RNP1 vs RNP2 etc

What assumptions can ATC make about the navigation mode?

- Reporting R/T - VOR radial vs GNSS track

What is the pilot understanding?

Questions?

