

**Cir 324
AN/186**



Guidelines for Lateral Separation of Arriving and Departing Aircraft on Published Adjacent Instrument Flight Procedures

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ACRONYMS AND ABBREVIATIONS

ADS-B	Automatic dependent surveillance — broadcast
ANSP	Air navigation services provider
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
ATT	Along-track tolerance
BV	Buffer value(s)
CNS	Communications, navigation and surveillance
CRM	Collision risk model
DCPC	Direct controller-pilot communications
Ft	Foot
GNSS	Global navigation satellite system
HAZID	Hazard identification
IAF	Initial approach fix
IAP	Instrument approach procedures
IFP	Instrument flight procedure
IFR	Instrument flight rules
ILS	Instrument landing system
Kt	Knot
Min	Minute
LOCA	Lateral obstacle clearance areas
MLAT	Multilateration
NM	Nautical mile
OAS	Obstacle assessment surface
OCH	Obstacle clearance height
OR	Operational requirement
PBN	Performance-based navigation
Ref	Reference
RNAV	Area navigation
RNP	Required navigation performance
RNP APCH	Required navigation performance — approach
RNP AR APCH	Required navigation performance — authorization required — approach
SASP	Separation and Airspace Safety Panel
SID	Standard instrument departure
STAR	Standard instrument arrival
SUA	Special use airspace
TLS	Target level of safety
TMA	Terminal airspace
VHF	Very high frequency
WP	Working paper

Chapter 1

OVERVIEW

1.1 INTRODUCTION

1.1.1 This circular presents guidelines and supporting material for the implementation of separation minima developed for arriving and departing aircraft on published adjacent IFPs. This material supports provisions included in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), Chapter 5, 5.4.1.2.1.4. (see Chapter 2 of this circular). It provides for two separation minima:

- a) lateral separation between certain PBN-capable aircraft utilizing IFPs (ref. PANS-ATM, 5.4.1.2.1.4.1 a)); and
- b) lateral separation between aircraft on IFPs using protected areas (ref. PANS-ATM, 5.4.1.2.1.4.1 b)).

1.1.2 Work on the development of minima to laterally separate aircraft on published adjacent IFPs was initiated during the 12th SASP Working Group of the Whole (SASP-WG/WHL/12) in November 2007 (see ref. 1*). The amendment proposed to separate aircraft from other aircraft by requiring that the protected areas do not overlap (ref. *Procedures for Air Navigation Services — Aircraft Operations*, Volume II — *Construction of Visual and Instrument Flight Procedures* (PANS-OPS, Doc 8168)).

1.1.3 Further work on the subject, particularly related to the safety assessment, was presented at the 13th and 14th meetings of SASP (SASP-WG/WHL/13 and SASP-WG/WHL/14) in May and November 2008, respectively, (see refs. 2 to 9). The 14th meeting marked the beginning of extensive work on safety assessment by collision risk modelling for PANS-ATM, proposed paragraph 5.4.1.2.1.4.1 a) (see refs. 10 to 13 for pertinent WPs presented at SASP-WG/WHL/15).

1.1.4 Examples of New Zealand's use of non-overlapping protected areas as a basis for PANS-ATM proposed paragraph 5.4.1.2.1.4.1 b) can be found at Appendix A to this circular.

1.2 SCOPE

The material in this circular is limited to the application of:

- a) lateral separation minima for arriving and/or departing aircraft being separated on published IFPs;
- b) lateral separation minima between aircraft on published adjacent IFPs (SID, STAR, IAP, including holding patterns); and
- c) lateral separation minima for use primarily in terminal areas where procedural control is exercised.

* References 1 to 25 can be found in Appendix D of this circular.

1.3 DOCUMENT STRUCTURE

The two paragraph provisions, i.e. 5.4.1.2.1.4.1 a) and b), of the proposed PANS-ATM amendment at 5.4.1.2.1.4 are reflected in the document structure in that the single thread of Chapters 1 and 2 splits onto two threads in Chapters 3 and 4 before rejoining in Chapter 5 (see Figure 1-1).

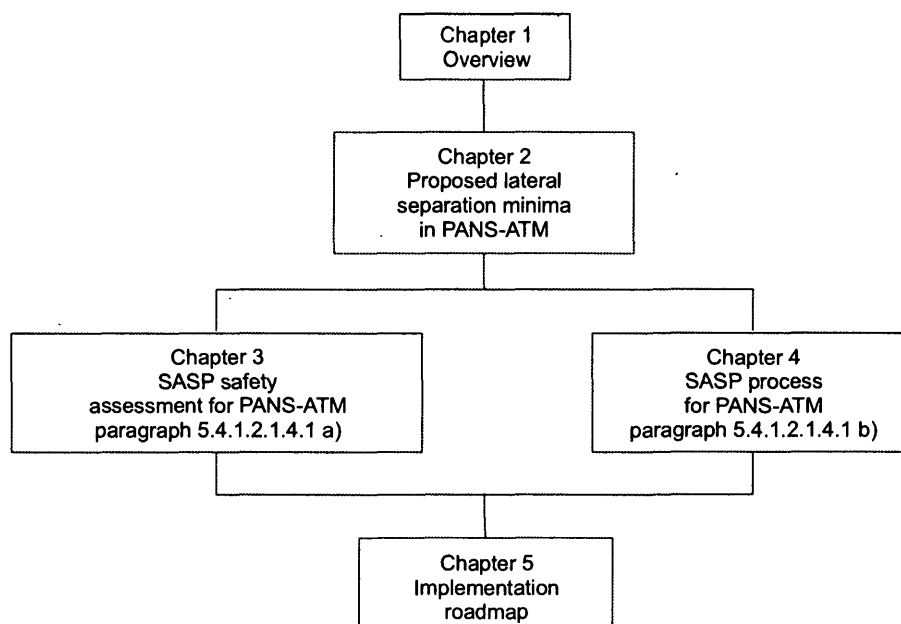


Figure 1-1. Document structure

Chapter 2

PROPOSED LATERAL SEPARATION MINIMA

2.1 INTRODUCTION

This chapter presents an extract of the new PANS-ATM amendment at 5.4.1.2.1.4.

Chapter 5

SEPARATION METHODS AND MINIMA

...

5.4 HORIZONTAL SEPARATION

...

5.4.1 Lateral separation

...

5.4.1.2 Lateral separation criteria and minima

5.4.1.2.1 Means by which lateral separation may be applied include the following:

...

5.4.1.2.1.4 *Lateral separation of aircraft on published adjacent instrument flight procedures for arrivals and departures*

5.4.1.2.1.4.1 Lateral separation of departing and/or arriving aircraft, using instrument flight procedures, will exist:

- a) where the distance between RNAV 1, Basic RNP 1, RNP APCH and/or RNP AR APCH tracks is not less than 13 km (7 NM); or
- b) where the protected areas of tracks designed using obstacle clearance criteria do not overlap and provided operational error is considered.

Note 1.— The 13 km (7 NM) value was determined by collision risk analysis using multiple navigation specifications. Information on this analysis is contained in Circular 324, Guidelines for Lateral Separation of Arriving and Departing Aircraft on Published Adjacent Instrument Flight Procedures.

Note 2.— Circular 324 also contains information on separation of arrival and departure tracks using non-overlapping protected areas based on obstacle clearance criteria, as provided for in the Procedures for Air Navigation Services — Aircraft Operations, Volume II — Construction of Visual and Instrument Flight Procedures (PANS-OPS, Doc 8168).

Note 3.— Provisions concerning reductions in separation minima are contained in Chapter 2, ATS Safety Management, and Chapter 5, Separation Methods and Minima, Section 5.11.

Note 4.— Guidance concerning the navigation specifications is contained in the Performance-based Navigation (PBN) Manual (Doc 9613).

...

2.2 SUA

2.2.1 SUA may contain a variety of activities hazardous to aviation, such as rocket launches, artillery fire and air combat. Due to this great variation, the separation of the activity inside the SUA from the edge of the SUA could not be peremptorily determined by SASP in order to provide generic guidance. Some types of activities may bring the hazardous operation right against the inside edge of the airspace, while others may utilize a buffer to separate aircraft or activities inside the SUA from the edge. The result of this ambiguity led the SASP to conclude that it is impossible to determine a single separation minimum from a SUA that would work in all cases.

2.2.2 For this reason, the new amendment proposal was for application between “aircraft on published adjacent instrument flight procedures in terminal areas”. SASP strongly suggests that States wishing to determine the separation between PBN aircraft generally in terminal areas and the edge of SUAs carry out an individual safety assessment for each related SUA. States may elect to use *as reference only* the separation minima in PANS-ATM, 5.4.1.2.1.4.1 a) and/or 5.4.1.2.1.4.1 b). Depending on the results of the safety assessment, an additional buffer may or may not be used from the edge of the SUA.

Chapter 3

SASP SAFETY ASSESSMENT FOR PANS-ATM PARAGRAPH 5.4.1.2.1.4.1 a)

3.1 INTRODUCTION

This chapter summarizes the safety assessment performed by the SASP to determine the lateral separation minimum, contained in 5.4.1.2.1.4.1 a) of PANS-ATM Amendment No. 3. In this context, this chapter first describes the scope of any SASP safety assessment and then outlines the methodology used to arrive at the lateral separation minimum in 5.4.1.2.1.4.1 a).

3.2 SCOPE OF SASP SAFETY ASSESSMENT

3.2.1 It is useful and necessary to distinguish between assessments undertaken by States for purposes of implementation at the local or regional level and those undertaken by SASP from a global perspective. An assessment undertaken for global purposes does not always contain the information required to address specific local implementation requirements.

3.2.2 This difference in assessment scope is depicted in Figure 3-1; it suggests, for example, that as it is the local operational environment into which an ICAO Standard is to be integrated, which largely determines safety considerations, the full safety assessment can only be completed for each local implementation. As such, in this case airspace planners need to complement the SASP assessment with a regional or local implementation-focussed assessment. It should be noted that a local implementation assessment may not necessarily require a regional assessment but may be initiated by an ANSP on a case-by-case basis.

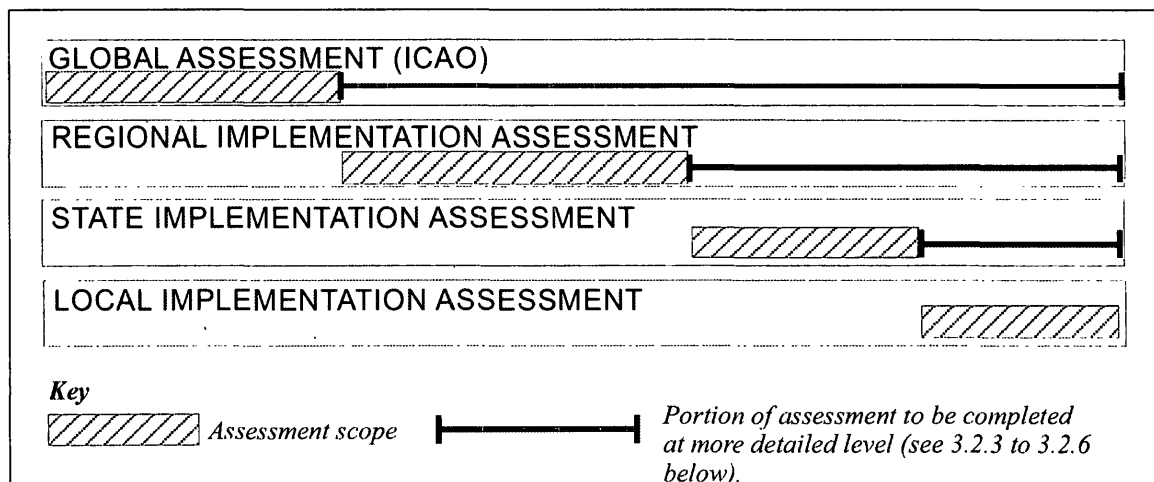


Figure 3-1. Safety assessment scope

3.2.3 States should note that the SASP's assessment was usually based on a number of assumed characteristics related to either the airspace environment or aircraft performance. These characteristics may not necessarily have been the same as those relevant to any particular regional, State or local implementation.

3.2.4 In undertaking regional implementation, a supporting safety assessment should begin with a review of the SASP's global assessment, taking particular note of the assumed characteristics used in that assessment. Where these characteristics are the same or more stringent than those within the region, the region only needs to focus on undertaking an assessment of issues related specifically to regional implementation.

3.2.5 A State assessment need not necessarily follow a regional assessment but could be initiated by a State on its own initiative. In this case, as with the regional assessment, a supporting safety assessment should begin with a review of the SASP's global assessment, taking particular note of the assumed characteristics used in that assessment. Where these characteristics are the same or more stringent than those within the State, then the State only needs to focus on undertaking an assessment of issues related specifically to State implementation.

3.2.6 A local implementation assessment would normally be a supporting activity for a State assessment and would focus specifically on implementation issues such as HAZID. However, there may be circumstances where the ANSP may need to review the SASP's global assessment and/or the regional assessment, taking particular note of the assumed characteristics used in that assessment.

3.3 OBJECTIVE OF THE SAFETY ASSESSMENT

3.3.1 The general objective of the SASP safety assessment was to determine the minimum safe separation between published adjacent IFPs based on any combination of the following operational approvals: RNAV 1, Basic-RNP 1, RNP APCH and RNP AR APCH.

3.3.2 A minimum distance between published adjacent IFPs is considered "safe" when the level of aircraft collision risk does not exceed a TLS of 5×10^{-10} collisions per arrival-departure pair. The resultant separation is considered safe subject to a safety assessment (ref. Annex 11 — *Air Traffic Services*) being undertaken for implementation into a local environment.

3.4 ASSUMPTIONS

3.4.1 Several assumptions were made during the safety assessment by SASP with regard to the operational scenario and CRM.

3.4.2 The first assumption concerned the geometry of the published adjacent IFPs. This is shown in Figure 3-2 where it is assumed that the turn angle for intercepting the intermediate/final approach segment is between 15 and 90 degrees. The departing aircraft flies a certain distance beyond the end of the runway before turning and flying back parallel to the approach segment.

3.4.3 TMA operating aircraft speeds were assumed given that the published adjacent IFPs would be located quite close to the airport where aircraft would climb and descend on published adjacent tracks.

3.4.4 A terminal environment was envisaged assuming 400 air traffic movements per day (200 arriving and 200 departing flights per day).