



International Civil Aviation Organization

**The 18th Meeting of the Regional Airspace Safety Monitoring Advisory Group
(RASMAG/18)**

Bangkok, Thailand, 01 – 04 April 2013

Agenda Item 5: Airspace Safety Monitoring Activities/Requirements in the Asia/Pacific Region

FUKUOKA FIR T10 LONGITUDINAL SEPARATION SAFETY ASSESSMENT

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SUMMARY

This paper presents the report of safety assessment of 10 minutes longitudinal time separation without mandatory application of Mach Number Technique on all routes current structure and traffic volume including PACOTS within Fukuoka FIR.

This paper relates to –

Strategic Objectives:

A: *Safety – Enhance global civil aviation safety*

Global Plan Initiatives:

GPI-2 Reduced vertical separation minima

1. INTRODUCTION

1.1 Japan is planning the introduction of 10 minutes longitudinal time separation without Mach Number Technique (MNT) on all routes current structure and traffic volume including PACOTS (Pacific Organized Track System) within the Fukuoka FIR. However, the safety of this separation has been verified only on the condition that position reports are obtained at least every 40 minutes [1], but not all routes meet this requirement. This paper provides the final result of safety assessment of the pre-implementation of 10 minutes longitudinal time separation without MNT in Fukuoka FIR.

2. DISCUSSION

2.1 A gain-loss distribution analysis is common in the safety assessment of longitudinal time separation, which has been used for deciding 40 minutes maximum position report interval within Fukuoka FIR. Using this method, the risk of collision on some routes does not satisfy the Target Level of Safety (TLS), because the flight time between waypoints is much greater than 40 minutes. However, the conventional method tends to overestimate the risk of collision, so a revised method is applied to estimate the risk of collision more accurately. A revised method considers the relative speed effect for a pair of aircraft. The method itself has been reviewed and discussed in the previous IPACG meeting [2], and ICAO RASMAG meeting [3]. It was also reviewed by ICAO SASP meeting [4], concluded that this algorithm appears to be valid. More details can be found in References [4] and [5].

2.2 The data used in this investigation was obtained between May 2011 and April 2012. Flight data processing system data (FDPS) is used to extract aircraft flying ATS routes and true air speed (TAS) information. ADS message and ATO (Actual Time Over Fix) data are used to obtain the actual time at each waypoint. The flight time differ among the routes, so routes are classified into three segments; NOPAC, PACOTS and ATS South as shown in **Figure 1**. In addition, the flight time of westbound routes and eastbound routes differ due to the wind, so the risk of collision is calculated separately in NOPAC and PACOTS. In total, five route segments are considered this time, as summarized in **Table 1**. Note that the interval of position report in PACOTS is every 10 degrees longitudinal.

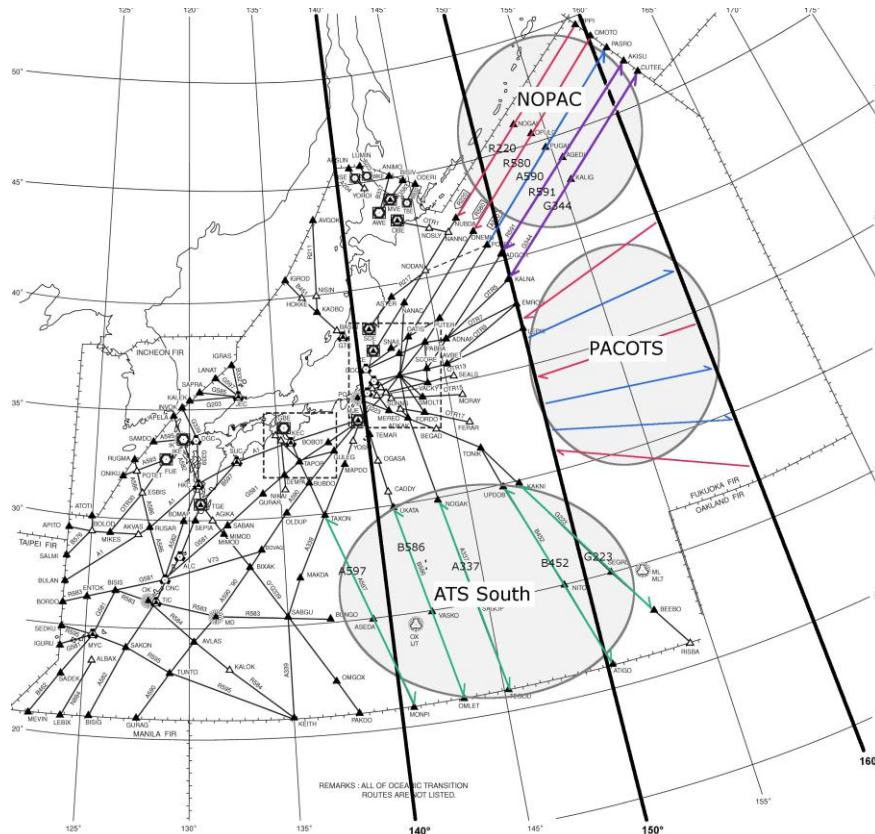


Figure 1: Route segments considered

Route segments	NOPAC east	NOPAC west	ATS South	PACOTS east	PACOTS west
Direction	Eastbound	Westbound	North/South	Eastbound	Westbound
Route	A590, R591, G344	R220, R580, R591, G344	A597, B586, A337, B452, G223	Track 1, 2, 3, 4, 11, 12, 14, 15, UPR	Track A-M, UPR
Number of flights	23,558	24,960	15,437	40,548	16,095
Number of pairs applying time-based separation	8,736	7,041	9,692	7,954	2,414
Number of pairs within 30 min. initial time separation	1,260	1,211	681	558	82
Ratio of aircraft with installed ADS-C	73.1 %	78.0 %	70.5 %	84.1 %	84.2 %
Average flight time	37.45 min	44.00 min	40.30min	54.06 min	68.42 min

Table 1: PACOTS route segments considered

2.3 Once the distribution was determined, only aircraft pairs within 30 minutes initial time separation are considered. The calculated risk of collision is shown in **Table 2**. The risk of collision on all routes satisfies the TLS, though the risk of collision on PACOTS west was close to the TLS.

Route	Risk of collision
NOPAC east	0.219E-9
NOPAC west	2.566E-9
ATS South	2.278E-9
PACOTS east	0.925E-9
PACOTS west	4.460E-9
TLS	5.000E-9

Table 2: Calculated risk of collision

2.4 To examine the risk of collision in more detail, the relationship between the average flight time and the risk of collision on each route segment is shown in **Figure 2**. This figure shows that route segments with longer flight time tend to show higher risk of collision. Therefore, to reduce the expected risk of collision, it is effective to reduce the maximum position report interval so reporting is more frequent; otherwise 10 minutes separation can be applied less often. Thus the criteria should be determined considering convenience as well as the safety.

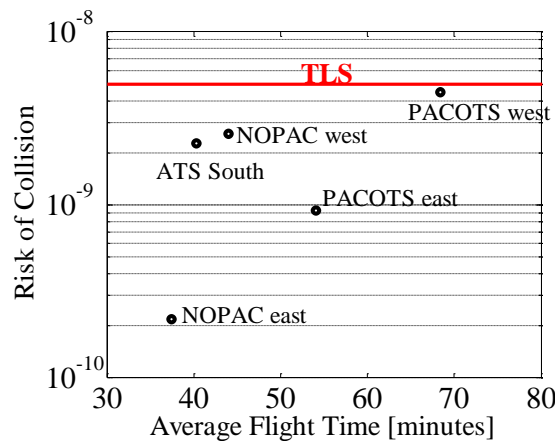


Figure 2: Relationship between average flight time and risk of collision

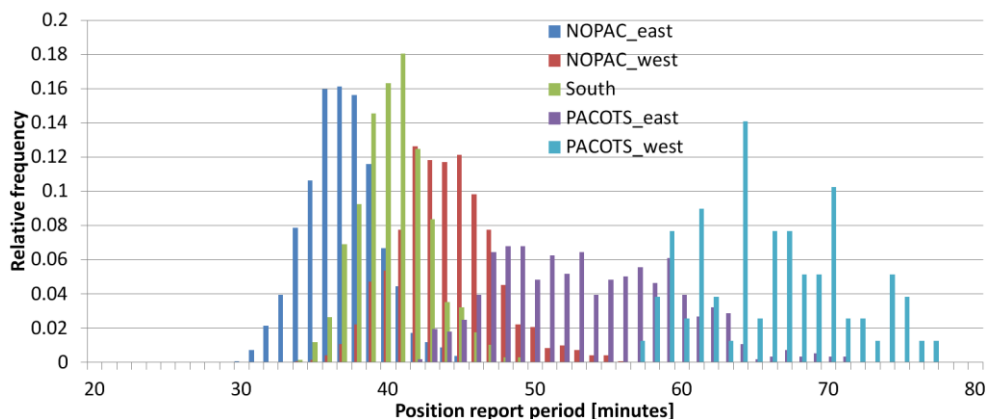


Figure 3: Relative frequency of position report period for initial time separation of 30 minutes or less

3. Conclusions

3.1 According to the safety assessment, 10 minutes longitudinal time separation without MNT can be introduced on all ATS routes at current structure and traffic volume including PACOTS within Fukuoka FIR. However, the risk of collision depends on many factors such as traffic volume, weather condition, and navigation performance. Therefore, after the implementation of the new procedure, the risk of collision has to be monitored continuously. In order to introduce the 10 minutes time-base separation without MNT, JCAB have amended ICAO Regional Supplement Procedures (Doc. 7030) and get approval from ICAO but the implementation date and the operational procedures of 10 minutes longitudinal time separation without MNT is not yet determined.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matters as appropriate.

References

- [1] “Application of 10 min separation minimum without MNT within Fukuoka FIR,” IP/16, IPACG/32, Honolulu, Hawaii, USA, 10-14 May, 2010.
- [2] “Risk Analysis of 10 Minutes Longitudinal Time Separation on PACOTS Routes,” WP/08, IPACG/35, Sapporo, Japan, 7-11 November, 2011.
- [3] “Refined Calculation Method for Risk Analysis of Longitudinal Time Separation,” WP/03, ICAO RASMAG/16, Bangkok, Thailand, 20-24 February, 2012.
- [4] “Improved Calculation Method for Risk Analysis of Longitudinal Time Separation,” IP/06, ICAO SASP-WG/WHL/21, Seattle, USA, November, 2012.
- [5] R. Mori, “Safety Assessment for Reduced Time-Based Separation Minima on Oceanic Routes”, Journal of Mechanical Systems for Transportation and Logistics, Vol. 4, No. 1 (2011), pp. 39-49.

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