International Civil Aviation Organization

The Eighth Meeting of the APANPIRG ATM Sub-Group

Video Teleconference, 23 – 27 November 2020

Agenda Item 3: Performance Frameworks and Metrics

APPLICATION OF ATC SEPARATION STANDARDS

(Presented by the Secretariat)

SUMMARY

This paper presents information on the survey conducted to determine which Air Traffic Control (ATC) separation standards were being applied within the Asia/Pacific Region.

1. INTRODUCTION

1.1 In an endeavour to track the effectiveness of the Seamless Air Traffic Management (ATM) element implementation related to the use of tactical (ATC surveillance-based and datalink-supported) ATC separation standards, the ICAO Regional Office issued State Letter T 3/10.1 – AP086/19 (ATM) dated 26 August 2019, with a response date of 01 January 2020 (**Attachment A**).

1.2 The survey requested respondents to advise the minimum horizontal separation standards authorized for use by controllers within Category R (remote), Category T (terminal operations serviced by direct ATS communications and surveillance) and Category S (surveilled by radar, Automatic Dependent Surveillance-Broadcast (ADS-B) or Multilateration (MLAT)). The survey is at **Attachment B**.

1.3 The specific parts from the Seamless ANS Plan referred to in the survey were:

> *7.34 All ATC units should authorise the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as:*
>
> *a) the automation of the ATM system, including automated hand-off between sectors;*
>
> *b) the capability of the ATC communications system;*
>
> *c) the performance of the ATS surveillance system, including data-sharing or overlapping coverage at TOC points; and*
>
> *d) ensuring the competency of air traffic controllers to apply the full tactical capability of ATS surveillance systems.*
>
> *Note 1: the delivery of ATC services should be based primarily on the CNS/ATM capability. When using Annex 10 compliant ATS surveillance, 5NM (enroute) or 3NM (terminal) surveillance-based separations should be authorised within ATC sectors. At the TOC points in such environments, 5-10NM should be authorised with auto hand-off and surveillance data-sharing or overlapping coverage at the TOC point, and 5-20NM without auto hand-off, as determined by an appropriate safety assessment.*
>
> *Note 2: the efficacy, continuity and availability of ATM services should be supported by adherence with regional planning and guidance material regarding ATM automation and ATM contingency systems (regarding ATM contingency operations, refer to the Regional ATM Contingency Plan).*

7.35 Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilised for safety and efficiency reasons within:

a) Category R airspace with the agreement of all ANSPs that provide services:

- *within the airspace concerned; and*
- *within adjacent airspace which is affected by the FLAS; or*

b) Category S airspace with the agreement of all ANSPs that provide services:

- *where crossing track conflictions occur within 50NM of the FIRB; and*
- *ATS surveillance coverage does not overlap the FIRB concerned, or ATS surveillance data is not exchanged between the ATC units concerned.*

2. DISCUSSION

Response

2.1 The response from Asia/Pacific States and administrations to latest survey had been poor, with only 13 replies (30% of administrations). The responses are provided in **Attachment C**. The data in Attachment C has been coloured so that red text indicates non-compliance with the Asia/Pacific Seamless ANS Plan expectations, while green text means compliance.

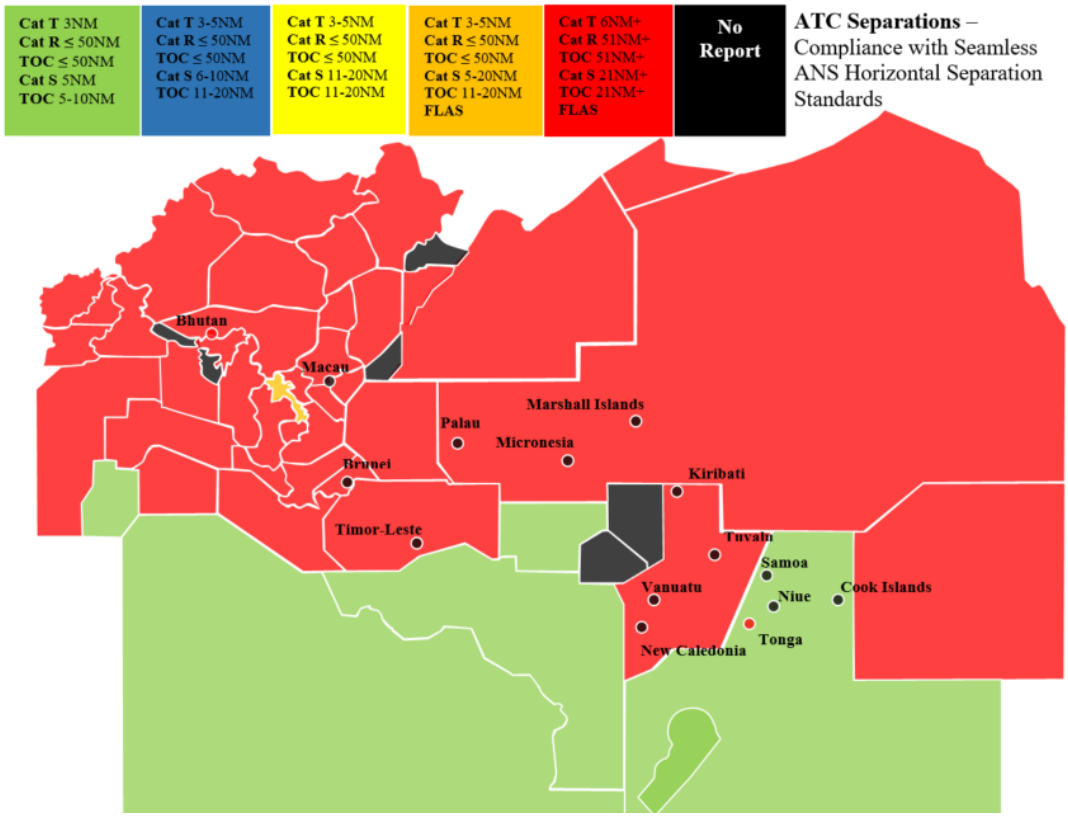

Figure 1: Compliance with Seamless ANS Horizontal Separation Standards, 2020

2.2 **Figure 1** provides an indication as at March 2020 of the efficiency of ATC separations as they are theoretically being applied within Flight Information Regions (FIRs) and at Transfer of Control (TOC) points.

2.3 States and Administrations that did not respond were as follows:

Bangladesh, Brunei Darussalam, Cook Islands, DPR Korea, Kiribati, Marshall Islands, Micronesia (Federated State of), Nauru, Nepal, New Caledonia, Palau, Samoa, Solomon Islands, Timor-Leste, Tuvalu and Vanuatu.

2.4 Given the survey response after re-circulation, there still remained many States and Administrations that had not responded. This survey requires few resources, and yet it is important to understand how efficient the region is when matching the service delivery with both the capability of the aircraft, and the existing or planned ground systems.

2.5 The survey questions circulated were expected to provide greater clarity on the separation standards used in the region. Remote, Surveillance and Terminal airspace separations will be surveyed and tracked. States are reminded to respond on separation standards for only inbound flights at FIR TOC points.

2.6 In particular, the Regional Office has determined that there are significant weaknesses in many Asian State's application of terminal separations, so this area has now been included in the survey. Very few States appear to be using the standard 3NM terminal airspace separation standard consistently in all surveillance-based ATC sectors. This, and the failure to implement proper Air Traffic Flow Management (ATFM) where necessary, sequencing mechanisms such as Arrival Manager (AMAN) and efficient Standard Terminal Arrival Routes (STARs) and use of runways for both arrivals and departures, has meant that many terminal airspace operations were operating well below their actual capability. This has resulted in many gains made en-route with Performance-based Navigation (PBN) being lost in the terminal airspace with adverse effects on ATC workload, and significant losses in terms of economics and environmentally.

2.7 An example is shown in **Figure 2**, where aircraft are manoeuvred in a 'trombone' pattern when the controller is not confident of the sequence, which is inefficient and workload-intensive for both pilots and ATC. Instead, the more organised STAR-based approach in **Figure 3** is recommended so Continuous Descent Operations (CDO) might be possible, subject to vectoring to adjust the distance between aircraft.

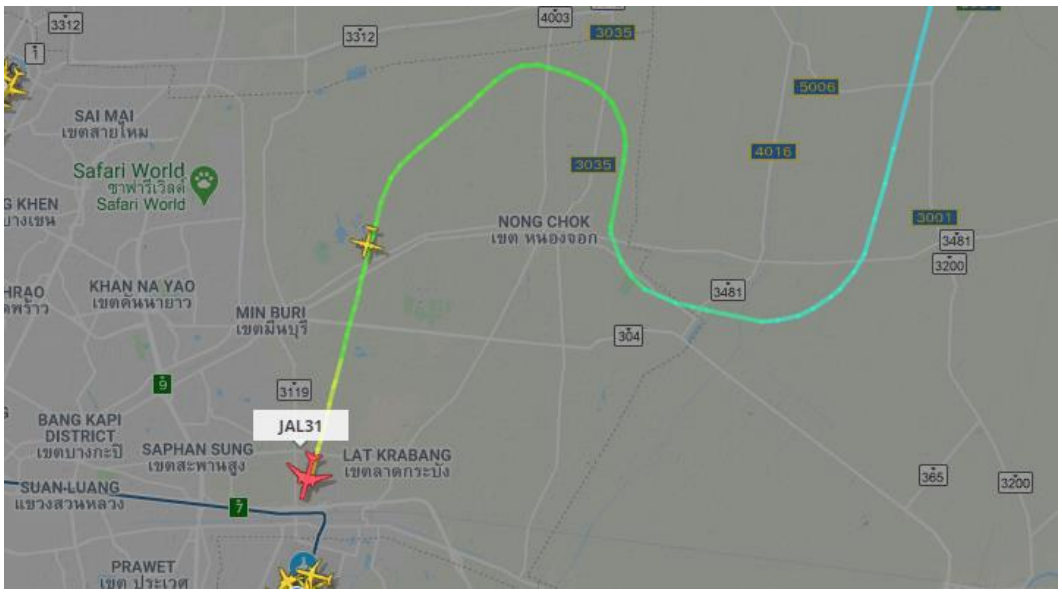

Figure 2: 'Trombone' Approach

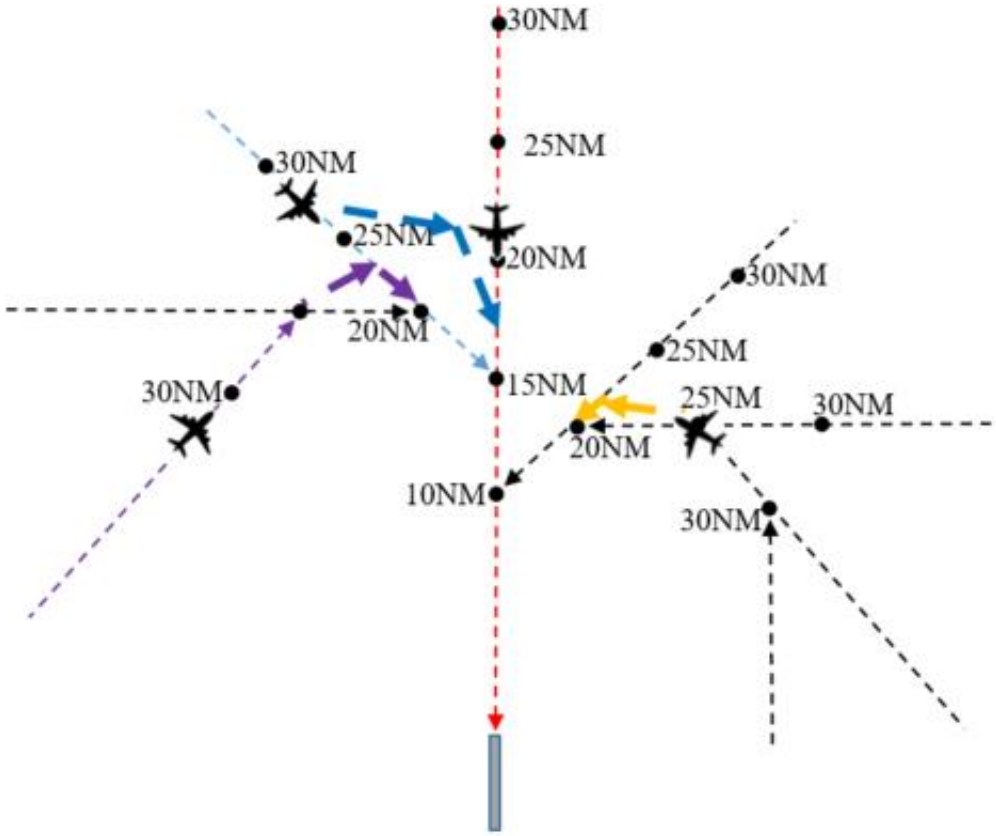

Figure 3: STAR-Based Approach, with AMAN Distance-to-Run Chevrons

Regional Guidance Material

2.8 States were urged to refer to the following guidance on the ICAO Regional Office website referring to the correct PBN specification for spacing in Category R airspace. In particular, there was no need for Air Traffic Control (ATC) to be concerned about the specific PBN specification in Category S airspace because the separation service should be conducted using ATC surveillance – in this case the PBN specification is for the 'N' (navigation) not the 'ATM':

https://www.icao.int/APAC/Documents/edocs/Establishing%20the%20Correct%20PBN%20Specifications%20for%20ATS%20Routes.pdf

Contingency Separations

2.9 In the past, an example of an Air Navigation Service Provider (ANSP) unfortunately reverting to a 10-minute longitudinal separation standard due to the failure of a radar was highlighted to the ATM/SG. This caused a significant increase in workload and delays, and is a reminder to States that they should have considered the best available ATC separation to use in the case of partial degradations like this.

2.10 Assuming controllers are trained appropriately and there are no safety issues impeding the application of the standard under the normal implementation safety case, there appears to be no impediment for ATC to apply 20NM minimum separation longitudinally within Very High Frequency (VHF) coverage instead, based on the PANS ATM excerpt:

5.4.2.3.3.1 Aircraft on the same track

a) 37km (20NM), provided:

1) each aircraft utilizes:

i) the same 'on track' DME station when both aircraft are utilizing DME; or

ii) an 'on track' DME station and a collocated waypoint when one aircraft is utilizing DME and the other is utilizing GNSS; or

iii) the same waypoint when both aircraft are using GNSS.

2.11 Even in Category S surveillance airspace, controllers are normally using longitudinal distances between aircraft of 20-30NM, dependent on the circumstances, while using the minimum 5NM for tactical measures such as crossing traffic or climbs and descents. Therefore, the use of a 20NM backup based on DME and/or GNSS would appear to be a suitable contingency reversion if surveillance is not available, and there does not appear to be any reason why greater longitudinal separations are used in Asia/Pacific's Category S airspace.

2.12 When improvements to ATS surveillance (and presumably communications) are made, a core principle of the *Asia/Pacific Seamless ATM Plan* is to ensure that the operational benefits are provided to airspace users, to provide some return for the cost of the improvements. However, in many cases, no benefit is provided other than safety monitoring of procedural separations.

2.13 An example of this is the implementation of Automatic Dependent Surveillance-Broadcast (ADS-B) services in the Bay of Bengal (BOB) from Sittwe, Coco Island and Port Blair (and in the near future, from Great Nicobar Island). As long ago as December 2015, this provided complete surveillance coverage of ATS routes M770, P646 and L507 in the northern BOB, and in the vicinity of the Andaman Islands (**Figure 4**).

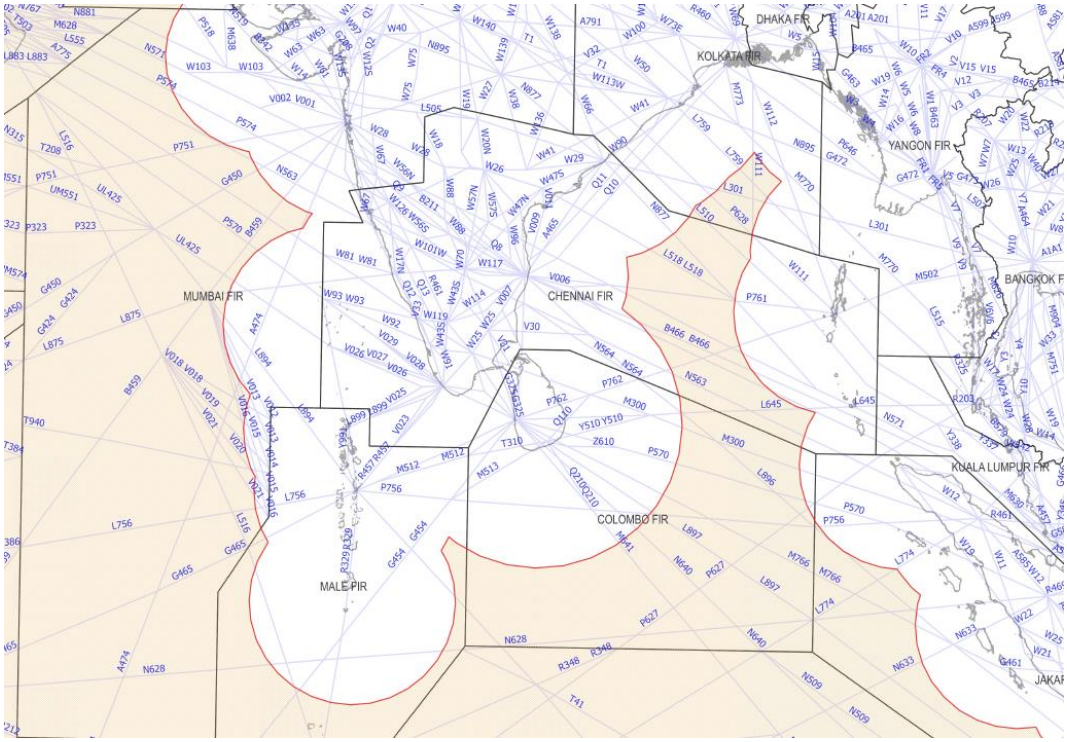

Figure 4: Bay of Bengal ATS surveillance gaps (as at September 2019)

2.14 However, ICAO understands that the longitudinal separation on these ATS routes serving the Major Traffic Flow between Europe and Southeast Asia had not been enhanced to surveillance-based separations as required by the *Asia/Pacific Seamless ANS Plan*. Moreover, the Flight Level Allocation Scheme (FLAS) that restricted the available flight levels for long-range traffic from Africa to Southeast Asia was still in place, despite the expectation in the *Asia/Pacific Seamless ANS Plan* that provides that there should be no FLAS used in these circumstances. ICAO further notes the expected implementation of Space-Based ADS-B within Indian FIRs as at 01 January 2021.

Conclusion

2.15 Almost no State in Asia appears to be applying the proper ATC separation standard based on the provisions of the Seamless ANS Plan and ICAO Document 4444 – *PANS ATM*; therefore, the Asian Region as a whole was failing to deliver the service levels new CNS systems were capable of. However, ICAO notes that China is the first State in Asia to reportedly use FIR-wide *PANS ATM* surveillance-based separation standards (equivalent to 5NM).

2.16 If the TOC points were able to be transitioned in the same manner, China would be the first Asian Region State to universally apply *PANS ATM* standards, as most Pacific Region States have done for many years. Unfortunately, reports continue to reach the ICAO Regional Office of examples of poor cross-border application of separation standards that do not comply with the expectations of the *Asia/Pacific Seamless ANS Plan*.

2.17 There appears to be no specific technical reasons why developed States such as Australia and New Zealand were able to provide more efficient levels of service than States in Asia, using essentially the same CNS/ATM equipment. It would also be inappropriate to suggest that Asian air traffic controllers were not as capable as their counterparts providing services in the Pacific. Therefore, only human decision-making at management level could be responsible for this poor result, indicating a region-wide paradigm shift in organisational culture was necessary.

5.4.1 Lateral separation

5.4.1.1 LATERAL SEPARATION APPLICATION

5.4.1.1.1 Lateral separation shall be applied so that the distance between those portions of the intended routes for which the aircraft are to be laterally separated is never less than an established distance to account for navigational inaccuracies plus a specified buffer. This buffer shall be determined by the appropriate authority and included in the lateral separation minima as an integral part thereof.

Note.— In the minima specified in 5.4.1.2 an appropriate buffer has already been included.

2.18 As the cost of new CNS/ATM systems were generally not providing a commensurate increase of efficiency in service, States should consider the ramifications of this in terms of safety (especially with regards to ATC workload), efficiency for airlines and environmental consequences, which ultimately had a political dimension when the public becomes aware of the comparatively poor performance in Asia. Given the increasing air traffic in Asia in particular, Asian States should recognise the problem and establish policies, rules and procedures for ANSPs to greatly improve the benefits from modern CNS/ATM systems, including training for senior managers so they might recognise the gap between current practice and best practice.

2.19 States/Administrations are urged to review the Separation Standards Letters of Agreement (LOAs) with adjacent FIRs whenever there is an improvement in CNS/ATM systems. Periodic revision of separation standards minima with adjacent FIRs are highly encouraged and should be based technical and operational aspects.

2.20 ICAO will continue to monitor the situation and bring this key aspect of capacity and efficiency to the attention of States through the DGCA Conference and Ministerial forums.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) urge States, particularly those in the Asian Region, to review their CNS/ATM system capability and match this with a service performance, in accordance with the expectations of the Asia/Pacific Seamless ANS Plan; and

c) discuss any relevant matters as appropriate.

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International Civil Aviation Organization
Organisation de l'aviation civile internationale
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Международная организация гражданской авиации
منظمة الطيران المدني الدولي
国际民用航空组织

Ref. T 3/10.1 – AP086/19 (ATM) 26 August 2019

Subject: ATC Separation Standards

Action required: To complete the survey and reply no later than **1 January 2020**

Sir/Madam,

I wish to draw your attention to the current ATC separation standards being applied in your airspace. All ATC units should authorise the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable.

The ICAO Asia/Pacific Regional Office had developed a new survey for circulation (**Attachment B**). The new survey questions were expected to provide greater clarity on the separation standards used in the region. Terminal airspace separations will now be surveyed and tracked. States are reminded to respond on separation standards for only inbound flights at FIR TOC points.

It is necessary to determine how efficient the region is when matching the service delivery with both the capability of the aircraft, and the existing or planned ground systems.

Guidance material to assist States in the interpretation is provided in **Attachment A**. Accordingly, States are urged to complete the ATC Separation Standards Survey **(Attachment B)** no later than **1 January 2020**, and submit to the following email address apac@icao.int with a copy to hchew@icao.int.

Yours sincerely,

Arun Mishra
Regional Director

Enclosures:
A — Guidance Material
B — ATC Separation Standards Survey

Asia and Pacific Office
252/1 Vibhavadi Rangsit Road
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Bangkok 10900
Thailand

Postal Address:
P.O. Box 11
Samyaek Ladprao
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Thailand

Tel.: +66 (2) 537-8189
Fax: +66 (2) 537-8199

www.icao.int/apac
E-mail: apac@icao.int

Guidance Material

Why is the survey necessary (including benefits if known)?

In general, several States were not applying ATC standards correctly, preferring to use larger, less efficient separations, which also affected safety due to the increased ATC workload managing larger spacing, and more conflicts. In this case, ATC had not optimised service levels that new systems were capable of under the *Asia/Pacific Seamless ATM Plan*.

The Combined Eighth Meeting of the South Asia – Indian Ocean ATM Coordination Group and Twenty-Fifth Meeting South East Asia ATS Coordination Group (SAIOACG/8 and SEACG/25, Siem Reap, Cambodia, 26 – 30 March 2018) had been concerned that only 45% of administrations had responded to the survey related to ATC separation standards.

Who is affected by the survey?

The survey applies to all Asia/Pacific States that have an Air Traffic Control (ATC) unit providing area (en-route) or approach control services.

What needs to be done?

State regulators need to determine what horizontal separation standards are approved through discussions with the Air Navigation Service Provider (ANSP), and in accordance with the survey attached to the State Letter. The horizontal separations include those within Category R (remote), Category S (surveilled by radar, Automatic Dependent Surveillance-Broadcast (ADS-B) or Multilateration (MLAT)) and Category T (terminal operations serviced by direct ATS communications and surveillance). Once the data is assembled to answer the survey, this should be transmitted to the ICAO Regional Office in accordance with the details in the State Letter.

Who do you contact if you have more questions, or if you would like to offer assistance to other States on this matter?

Contact (in order of precedence):

1. Mr. Han Chee Chew, Air Traffic Management Officer, hchew@icao.int; or
2. Mr. Len Wicks, Regional Officer ATM/SAR (lwicks@icao.int); or
3. ICAO Asia/Pacific Regional Office, attention ATM Section (apac@icao.int).

……..

Instructions: For each FIR administered by your State or Administration, complete the survey below:

Q1: Noting the categorization of airspace in the Asia/Pacific Seamless ATM Plan paragraph 1 .4 and the performance expectation in paragraph 7.35, both copied below, what minimum horizontal separation standard has been authorized for controllers to use within your Category R, Category S and Category T airspace?

Category R airspace: NM

Category S airspace: NM

Category T airspace (international airports): NM

Remarks:

Q2: What minimum horizontal separation standard has been authorized by Air Traffic Services Letter of Agreement (ATS LOA) or other instrument on each of your Flight Information Region (FIR) transfer of Control (TOC) points?

Category S airspace to Category S FIR TOC Points: NM

Category R airspace to Category S FIR TOC Points: NM

Category R OR Category S airspace to Category R FIR TOC Points: NM

(Note: This question only applies to inbound flights entering the FIRs. If for example your State applies 10NM inbound at the TOC point and the neighbouring State applies 30NM, then respond '10NM').

Remarks:

Q3: Noting the expectations of the Asia/Pacific Seamless ATM Plan paragraph 7.44 copied below, does your Administration apply a Flight Level Allocation Scheme within its FIR(s)?

If so, please provide details.

YES / NO

Details/Remarks:

Excerpts from the Asia/Pacific Seamless ATM Plan

1.4 The Plan does not use 'continental', 'remote' and 'oceanic' areas to refer to an assumed geographical application area, as many Asia/Pacific States have islands or archipelagos that can support a higher density of Communications, Navigation, Surveillance (CNS) systems than in a purely 'oceanic' environment. In accordance with the CONOPS that air navigation services should be provided commensurate with the capability of the CNS equipment, it is important to categorise airspace in this manner, and simplify the numerous references to this capability throughout the Plan. Thus the Plan categorises airspace by reference to its CNS (Communications, Navigation and Surveillance) capability as:

a) ***Category R****: remote en-route airspace with Air Traffic Services (ATS) HF or CPDLC communications and outside the coverage of ground-based surveillance coverage; or*

b) ***Category S****: serviced (or potentially serviced) en-route airspace – by direct (not dependent on a Communication Service Provider (CSP) ATS communications and surveillance; or*

c) ***Category T****: terminal operations serviced by direct ATS communications and surveillance.*

7.35 The delivery of CNS/ATM services should be based primarily on the CNS/ATM capability. All ATC units should authorize the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as:

a) *the automation of the ATM system;*

b) *the capability of the ATC communications system;*

c) *the performance of the ATS surveillance system, including data-sharing or overlapping coverage at TOC points; and*

d) *ensuring the competency of air traffic controllers to apply the full tactical capability of ATS surveillance systems.*

7.44 Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilised for safety and efficiency reasons within:

a) *Category R airspace with the agreement of all ANSPs that provide services:*
   - *within the airspace concerned; and*
   - *within adjacent airspace which is affected by the FLAS; or*

b) *Category S airspace with the agreement of all ANSPs that provide services:*
   - *where crossing track conflictions occur within 50NM of the FIRB; and*
   - *ATS surveillance coverage does not overlap the FIRB concerned, or ATS surveillance data is not exchanged between the ATC units concerned.*

Instructions: For each FIR administered by your State or Administration, complete the survey below:

Q1: Noting the categorization of airspace in the Asia/Pacific Seamless ATM Plan paragraph 1 .4 and the performance expectation in paragraph 7.35, both copied below, what minimum horizontal separation standard has been authorized for controllers to use within your Category R, Category S and Category T airspace?

Category R airspace: NM

Category S airspace: NM

Category T airspace (international airports): NM

Remarks:

Q2: What minimum horizontal separation standard has been authorized by Air Traffic Services Letter of Agreement (ATS LOA) or other instrument on each of your Flight Information Region (FIR) transfer of Control (TOC) points?

Category S airspace to Category S FIR TOC Points: NM

Category R airspace to Category S FIR TOC Points: NM

Category R OR Category S airspace to Category R FIR TOC Points: NM

(Note: This question only applies to inbound flights entering the FIRs. If for example your State applies 10NM inbound at the TOC point and the neighbouring State applies 30NM, then respond '10NM').

Remarks:

Q3: Noting the expectations of the Asia/Pacific Seamless ATM Plan paragraph 7.44 copied below, does your Administration apply a Flight Level Allocation Scheme within its FIR(s)?

If so, please provide details.

YES / NO

Details/Remarks:

Excerpts from the Asia/Pacific Seamless ATM Plan

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a) ***Category R****: remote en-route airspace with Air Traffic Services (ATS) HF or CPDLC communications and outside the coverage of ground-based surveillance coverage; or*

b) ***Category S****: serviced (or potentially serviced) en-route airspace – by direct (not dependent on a Communication Service Provider (CSP) ATS communications and surveillance; or*

c) ***Category T****: terminal operations serviced by direct ATS communications and surveillance.*

7.35 The delivery of CNS/ATM services should be based primarily on the CNS/ATM capability. All ATC units should authorize the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as:

a) *the automation of the ATM system;*

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   - *within adjacent airspace which is affected by the FLAS; or*

b) *Category S airspace with the agreement of all ANSPs that provide services:*
   - *where crossing track conflictions occur within 50NM of the FIRB; and*
   - *ATS surveillance coverage does not overlap the FIRB concerned, or ATS surveillance data is not exchanged between the ATC units concerned.*

	Q1: Minimum horizontal separation standard			Q2: Minimum horizomntal separation standard authorized by ATS LOA on each TOC			Q3: FLAS
	Acceptable standard: ≤ 50 NM	Acceptable standard: 5 NM	Acceptable standard: 5 NM	Acceptable standard: ≤ 50 NM	Acceptable standard: ≤ 10 NM	Acceptable standard: ≤ 10 NM	Acceptable standard: No
States/Administration	Category R Horizontal Separation	Category S Horizontal Separation	Category T Horizontal Separation	Category R/S ⇨ R TOC	Category R⇨S TOC	Category S⇨S TOC	FLAS
Afghanistan	N/A	50 NM		N/A	50 NM	50 NM	Yes
Australia	30NM	5NM	3NM	30-50NM	5NM	5NM	No
Bangladesh							
Bhutan	N/A	50 NM		50 NM	50NM	50 NM	
Brunei Darussalam							
Cambodia	N/A	10 NM		N/A	N/A	10 NM or 10 mins	Yes
China	30NM	5 NM		30 NM	30 NM	10 NM	Yes
Cook Islands							
DPR Korea							
Fiji	30 NM RNP 4	10-20 NM		30 NM	20 NM	20 NM	No
French Polynesia	30 NM	10-20 NM		50/100 NM	50/100 NM	100 NM	No
Hong Kong, China	N/A	5NM	3NM	N/A	N/A	50NM/10 mins MNT	N/A
India	50 NM	20 NM		50 NM	50 NM	20 NM	Yes
Indonesia	50NM	5NM	5NM	50-80NM	N/A	10-20NM	No
Japan	30NM	5NM	3NM	30NM	30NM	20NM	Yes
Kiribati							
Lao PDR	10 NM	10 NM		10 - 15 NM	10-15 NM	10-15 NM	Yes
Macao, China	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Malaysia	50 NM	5 NM		50 NM	50 - 80 NM	10 - 20 NM	Yes
Maldives	50 NM	5 NM		50 NM	10 NM	10 NM	No
Marshall Islands							
Micronesia							
Mongolia	10 minutes	30KM/16NM		10 minutes	30KM/16NM	30KM/16NM	Yes
Myanmar	50 NM/10 mins	50 NM/10 mins		50 NM/10 mins	50 NM/10 mins	50 NM/10 mins	Yes
Nauru							
Nepal							
New Caledonia							
New Zealand	30 NM RNP 4	5 NM		30 NM RNP 4; 50 NM RNP 10	5 NM	5 NM	No*
Pakistan	N/A	15 NM		N/A	50 NM or 10 minutes MNT	50 NM	Yes
Palua							
Papua New Guinea	30NM	5NM	5NM	30NM	5NM	N/A	No
Philippines	50NM	5NM	5NM	50NM	50NM	50NM	Yes
Republic of Korea	N/A	5NM	3NM	N/A	N/A	15-30NM/10 mins MNT	Yes
Samoa							
Singapore	50NM	5NM	3NM	50NM/10 mins MNT	N/A	10-50NM/10 mins MNT	Yes
Solomon Islands							
Sri Lanka	50NM/10 mins MNT	10NM	5NM	50NM/10 mins MNT	50NM/10 mins MNT	30NM/10 mins MNT	Yes
Thailand	N/A	5NM	5NM	N/A	7 Minutes	20NM	No
Toimo-Leste							
Tonga	N/A	25 NM		20 mins	N/A	N/A	No
Tuvalu							
United States	30NM	5NM	5NM	30NM	30NM	5NM	No*
Vanuatu							
Viet Nam	50 NM	30 NM		50 NM	50 NM	30 NM	

*NZ responded regarding the Flight Level Orientation Scheme (FLOS), not a FLAS

*United States responded regarding uni-directional routes using all levels, not a FLAS blocking levels for procedural separation

States that responded for 2020 survey

Updated 09 Mar 2020