



Agenda Item 5: ATM Systems (Modernisation, Seamless ATM, CNS, ATFM)

ESTABLISHMENT OF ADS-B OUT EXCLUSIVE AIRSPACE

(Presented by Singapore)

SUMMARY

This paper presents the plan to establish ADS-B out exclusive airspace in phases to fulfil the objectives of the Asia Pacific Seamless ANS Plan with the aim of enhancing safety and optimizing airspace use.

1. INTRODUCTION

1.1 The 12th Air Navigation Conference had recommended that “States recognize the effective use of automatic dependent surveillance — broadcast (ADS-B) and associated communication technologies in bridging surveillance gaps and its role in supporting future trajectory-based air traffic management operating concepts, noting that the full potential of ADS-B has yet to be fully realized”. The Asia Pacific Seamless ANS Principles, as endorsed by the APANPIRG also urged the implementation of ADS-B to improve ATS surveillance coverage, redundancy and multiple tracking capability.

1.2 With ADS-B surveillance coverage, the level of safety is expected to increase with the improvement in air traffic control (ATC) situational awareness. ATC will be able to monitor aircraft tracking and detect any aircraft deviation from an assigned track in a procedural airspace. Under contingency scenarios, ADS-B also serves to supplement existing conventional radar surveillance as another viable form of surveillance source.

1.3 In order to harmonise, compliment and achieve continuous ADS-B airspace with adjacent FIRs, Singapore plans to extend the requirement of aircraft to be ADS-B equipped when operating within Singapore FIR. To be introduced in phases, the momentum to achieve a continuous airspace for ADS-B operations will be beneficial in the long term and serves as a stepping-stone for future ATM initiatives.

2. PHASED IMPLEMENTATION PLAN

2.1 Following the establishment of ADS-B out exclusive airspace in portion of Singapore FIR in Dec 2013, ADS-B has brought about enhanced safety, optimized use of airspace and benefitted many airspace users, especially when it was introduced alongside other ATM initiatives such as Performance Based Navigation (PBN). With expanded coverage and extensive use of ADS-B and PBN, there is potential for such benefits to increase.

2.2 ADS-B provides a highly accurate and effective means for air traffic controllers to provide air traffic surveillance services beyond the range of conventional radar coverage. By equipping aircraft with ADS-B, aircraft operators can also expect a return on their equipment investment through increased level of safety, efficiency from the enhancement of airspace capacity such as optimal Flight Level allocation for cruising and reduction of delay for allocation of Flight Levels.

2.3 Singapore is adopting a phased implementation approach to allow aircraft operators to plan ahead their equipment fitment to support ADS-B operations. The level of ADS-B equipage at FL290 and above was ~99% in the North-Eastern portion of Singapore FIR and ~97% for the whole of FIR (Dec 2019).

2.4 The phased implementation plan is as follows:

- Phase 1 - From April 2021, Singapore will designate ADS-B airspace in the rest of the Singapore FIR at and above FL290 for ATC monitoring. There is no requirement for aircraft to be ADS-B equipped.
- Phase 2 – From January 2022, Singapore will operationalize ADS-B out exclusive airspace and require aircraft operating at and above FL290 in the North-Eastern portion of the Singapore FIR to be ADS-B equipped. This requirement will be extended to the whole Singapore FIR from Jan 2023.

2.5 The implementation of ADS-B airspace will bring about benefits in achieving a cross-border harmonization with Seamless ATM. For instance, Indonesia has mandated the ADS-B Out aircraft equipage in January 2018 at or above FL290 for Jakarta and Ujung Padang FIRs. Similarly, Viet Nam have established mandatory ADS-B Out aircraft equipage for whole lower and upper Hanoi FIR and Ho Chi Minh FIR in July 2018 for aircraft having maximum take-off weight of 15,000kg or heavier.

Conclusion

2.6 ATM modernization cannot be done in isolation and cooperation between States is essential to ensure interoperability. With the implementation of ADS-B out exclusive airspace in Singapore FIR, Singapore endeavors to collaborate with neighboring States/Administrations for future ATM initiatives. These efforts will help to support the ASBU ASUR-B0/1 of the ICAO Asia Pacific Seamless ANS Plan and eventually achieve a harmonised contiguous ADS-B airspace in the region.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any other relevant information on regional ADS-B implementation.

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PROPOSAL FOR AMENDMENT OF THE REGIONAL SUPPLEMENTARY PROCEDURES, MIDDLE EAST/ASIA REGION (Doc 7030/5)

(Serial No.: APAC-S **20/XX** – MID/ASIA Chapter 5/ MID/ASIA 5-3)

a) **Regional Supplementary Procedures:**

MIDDLE EAST/ASIA (MID/ASIA) REGIONAL SUPPLEMENTARY PROCEDURES

b) **Proposed by:**

TBD

c) **Proposed amendment:**

Include carriage of ADS-B Out requirements within the: Auckland Oceanic, Bangkok, Beijing, Brisbane, Chennai, Colombo, Delhi, Dhaka, Fukuoka, Guangzhou, Ha Noi, Ho Chi Minh, Honiara, Hong Kong, Incheon, Jakarta, Kabul, Karachi, Kathmandu, Kolkata, Kota Kinabalu, Kuala Lumpur, Kunming, Lahore, Lanzhou, Male, Manila, Melbourne, Mumbai, Nauru, New Zealand, Phnom Penh, Port Moresby, Pyongyang, Sanya, Shanghai, Shenyang, Singapore, Taipei, Ujung Pandang, Ulaanbaatar, Urumqi, Vientiane, Wuhan, Yangon Flight Information Regions into the MID/ASIA Regional Supplementary Procedures.

Editorial Note: Amendments are arranged to show deleted text using strikethrough (~~text to be deleted~~), and added text with grey shading (text to be inserted).

1. On page MID/ASIA 5-3

Insert the following in the MIDDLE EAST/ASIA (MID/ASIA) REGIONAL SUPPLEMENTARY PROCEDURES, Chapter 5:

5.5 Automatic Dependent Surveillance – Broadcast (ADS–B)

5.5.1 Carriage and operation of ADS–B OUT

5.5.1 With the exception of state aircraft, all aircraft operating within the following FIRs shall carry and operate ADS–B OUT equipment within designated portions of airspace and the conditions mandated by the State with responsibility for the FIR concerned: Auckland Oceanic (West of 180°), Bangkok, Beijing, Brisbane, Chennai, Colombo, Delhi, Dhaka, Fukuoka, Guangzhou, Ha Noi, Ho Chi Minh, Honiara, Hong Kong, Incheon, Jakarta, Kabul, Karachi, Kathmandu, Kolkata, Kota Kinabalu, Kuala Lumpur, Kunming, Lahore, Lanzhou, Male, Manila, Melbourne, Mumbai, Nauru, New Zealand, Phnom Penh, Port Moresby, Pyongyang, Sanya, Shanghai, Shenyang, Singapore, Taipei, Ujung Pandang, Ulaanbaatar, Urumqi, Vientiane, Wuhan, Yangon.

5.5.2 The portions of airspace referred to in 5.5.1 may only be designated under the following circumstances:

- a) a safety or performance benefit is clearly defined;
- b) appropriate prior consultation with affected airspace users and affected Air Traffic Control (ATC) units has been undertaken;
- c) conduct of a safety assessment, which includes, inter alia, a human factors review and the display of data into the ATC workstation;
- d) appropriate pilot and ATC training; and

- e) promulgation of the airspace mandate with appropriate notice, and in accordance with the provisions of Annex 15.

Amend the following in the MIDDLE EAST/ASIA (MID/ASIA) REGIONAL SUPPLEMENTARY PROCEDURES, Chapter 5:

~~5.5.1~~ 5.5.3 The procedures contained in ~~5.5.2 to 5.5.3~~ 5.5.4 to 5.5.5 shall be applicable in those portions of the following FIRs where an ADS-B based ATS surveillance service is provided:

Auckland Oceanic (West of 180°), Bangkok, Beijing, Brisbane, Chennai, Colombo, Delhi, Dhaka, Fukuoka, Guangzhou, ~~Hanoi~~ Ha Noi, Ho Chi Minh, Hong Kong, Honiara, Incheon, Jakarta, Kabul, Karachi, Kathmandu, Kolkata, Kota Kinabalu, Kuala Lumpur, Kunming, Lahore, Lanzhou, Male, Manila, Melbourne, Mumbai, Nauru, New Zealand, Phnom Penh, Port Moresby, Pyongyang, Sanya, Shanghai, Shenyang, Singapore, Taipei, Ujung Pandang, ~~Ulan Bator~~ Ulaanbaatar, Urumqi, Vientiane, Wuhan and Yangon.

~~5.5.2~~ 5.5.4 An aircraft carrying 1 090 MHz extended squitter (1090ES) ADS-B equipment shall disable ADS-B transmission unless:

- a) the aircraft emits position information of an accuracy and integrity consistent with the transmitted value of the position quality indicator; or
- b) the aircraft always transmits a value of 0 (zero) for one or more of the position quality indicators (NUCp, NIC, NACp or SIL); or
- c) the operator has received as exemption granted by the appropriate ATS authority.

Note.-The following documents provide guidance for the installation and airworthiness approval of ADS-B OUT system in aircraft and ensure compliance with a) above:

1. *European Aviation Safety Agency (EASA) AMC 20-24; or*
2. *European Aviation Safety Agency (EASA) CS-ACNS (Subpart D – Surveillance – SUR); or*
3. *FAA AC No. 20-165A (or later versions) – Airworthiness Approval of ADB-B; or*
4. *Configuration standards reflected in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia.*

~~5.5.3~~ 5.5.5 Downlinked ADS-B data shall not be used by an ATS system for determining aircraft position when any of the position quality indicators (NUCp, NIC, NACp or SIL) have a value of 0 (zero).

d) **Date when proposal received:**

XX November 2020

e) **Proposer's reason for amendment:**

Since 2011, the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) has agreed to a number of Conclusions designed to facilitate the enhancement of Air Navigation Services (ANS) within performance-based airspace. APANPIRG endorsed the concept of airspace mandates to improve the safety and efficiency of airspace, as long as there was appropriate consultation and a performance benefit to airspace users. The Conclusions are as follows:

APANPIRG/22 (2011)

C 22/8 ADS-B Airspace Mandate

That, States intending to implement ADS-B based surveillance services may designate portions of airspace within their area of responsibility:

- a) mandate the carriage and use of ADS-B equipment; or
- b) provide priority for access to such airspace for aircraft with operative ADS-B as equipment over those aircraft not operating ADS-B equipment.

C 22/36 Amendment to Regional Supplementary Procedures on ADS-B

That, the Regional Supplementary Procedure Doc7030 MID/ASIA Chapter 5 be amended in accordance with the established procedure to include regional requirements on ADS-B as provided in the Appendix N to the report on Agenda Item 3.4.

APANPIRG/23 (2012)

Conclusion 23/5 – Asia/Pacific Air Navigation Concept of Operations Mandates

That, States intending to implement Performance-Based Navigation and Safety Nets may, after appropriate consultation with airspace users, designate portions of airspace within their area of responsibility:

- a) as providing priority for access to such airspace for aircraft with prescribed Performance-Based Navigation (PBN) specifications and supporting data-link equipage (ADS-C/CPDLC); and/or
- b) mandating the carriage and use of an operable Automatic Dependent Surveillance-Contract/Controller Pilot Data-link Communications Systems (ADS-C/CPDLC) system, and mode A/C and/or mode S transponder.

While it is recognised that States may introduce restrictions and performance-based measures over their sovereign territory, mandates over the High Seas need to be implemented in line with regional air navigation agreements; in this case through APANPIRG. Thus it is necessary to introduce an amendment to the Regional Supplementary Procedures (ICAO Doc 7030) for Asia/Pacific FIRs that allows States to designate portions of performance-based airspace when they are able to provide the performance benefit and in accordance with aircraft equipage and capability.

The level of ANS capability and aircraft equipage varies throughout the Asia/Pacific, so it is intended that States will designate airspace when possible, in either exclusive or ‘non-exclusive’ (mixed mode with lower priority for non-equipped aircraft), as appropriate.

f) Proposed implementation date of the amendment:

Upon approval by Council.

g) Action by the Secretary General:

The proposal has been circulated to the following States and International Organizations:

Afghanistan	Micronesia	ACI
Australia	Mongolia	CANSO
Bangladesh	Myanmar	IACA
Bhutan	Nauru	IAOPA
Brunei Darussalam	Nepal	IATA
Cambodia	New Zealand	IBAC
China	Pakistan	IFALPA
Hong Kong,China	Palau	IFATCA
Macao, China	Papua New Guinea	EUROCONTROL
Cook Islands	Philippines	
DPR Korea	Republic of Korea	
Fiji	Samoa	
India	Singapore	

Indonesia	Solomon Islands
Japan	Sri Lanka
Kiribati	Thailand
Lao PDR	Timor Leste
Malaysia	Tonga
Maldives	Tuvalu
Marshall Islands	Vanuatu
	Viet Nam

This proposal has been circulated to United States for information.

h) Secretariat comments:

The amendment of Doc 7030 in respect of ADS-B OUT requirements for MID/ASIA Region, provides a framework for the State/Administration to establish performance based airspace, with consideration of such matters as existing and proposed airspace user equipages, mandate timing, definition of airspace volumes (both vertical and horizontal), exclusive or non-exclusive application, exemption provisions and management of State aircraft.

The amendment is specifically intended to enable State/Administrations to promulgate airspace mandates over the High Seas, and to encourage a regional approach to the establishment of such mandates, where it is appropriate to do so and recognizing that it is not practical for the Asia/Pacific Region to establish Sub-Regional or Region-wide simultaneous mandates. This is in accordance with the concept of the Seamless ANS and performance-based approaches, as well as the Aviation System Block Upgrade (ASBU) initiative and Global Air Traffic Management Operational Concept (ICAO Doc 9854).



PROPOSAL FOR AMENDMENT OF THE REGIONAL SUPPLEMENTARY PROCEDURES, PACIFIC (PAC) REGION (Doc 7030/5)

(Serial No.: APAC-S 20/XX – PAC Chapter 5/ PAC 5-2)

a) **Regional Supplementary Procedures:**

PACIFIC (PAC) REGIONAL SUPPLEMENTARY PROCEDURES

b) **Proposed by:**

TBD

c) **Proposed amendment:**

Include carriage of ADS-B Out requirements within the: Anchorage Oceanic, Auckland Oceanic, Nadi, Oakland Oceanic and Tahiti Flight Information Regions into the Pacific Regional Supplementary Procedures.

Editorial Note: Amendments are arranged to show deleted text using strikethrough (~~text to be deleted~~), and added text with grey shading (**text to be inserted**).

1. On page PACIFIC 5-2

Insert the following in the PACIFIC (PAC) REGIONAL SUPPLEMENTARY PROCUDURES, Chapter 5:

5.5 AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B)

5.5.1 Carriage and operation of ADS-B OUT

5.5.1 With the exception of state aircraft, all aircraft operating within the following FIRs shall carry and operate ADS-B OUT equipment within designated portions of airspace and the conditions mandated by the State with responsibility for the FIR concerned: Anchorage Oceanic, Auckland Oceanic (East of 180°), Easter Island, Nadi, Oakland Oceanic and Tahiti.

5.5.2 The portions of airspace referred to in 5.5.1 may only be designated under the following circumstances:

- a) a safety or performance benefit is clearly defined;
- b) appropriate prior consultation with affected airspace users and affected Air Traffic Control (ATC) units has been undertaken;
- c) conduct of a safety assessment, which includes, *inter alia*, a human factors review and the display of data into the ATC workstation;
- d) appropriate pilot and ATC training; and
- e) promulgation of the airspace mandate with appropriate notice, and in accordance with the provisions of Annex 15.

~~5.5.1~~ 5.5.3 The procedures contained in ~~5.5.2 to 5.5.3~~ 5.5.4 to 5.5.5 shall be applicable in those portions of the following FIRs where an ADS-B based ATS surveillance service is provided:

Anchorage Oceanic, Auckland Oceanic (East of 180°), Easter Island, Nadi, Oakland Oceanic and Tahiti.

~~5.5.2~~ 5.5.4 An aircraft carrying 1 090 MHz extended squitter (1090ES) ADS-B equipment shall disable ADS-B transmission unless:

- a) the aircraft emits position information of an accuracy and integrity consistent with the transmitted value of the position quality indicator; or
- b) the aircraft always transmits a value of 0 (zero) for one or more of the position quality indicators (NUCp, NIC, NACp or SIL); or
- c) the operator has received an exemption granted by the appropriate ATS authority.

Note.-The following documents provide guidance for the installation and airworthiness approval of ADS-B OUT system in aircraft and ensure compliance with a) above:

- 1. *European Aviation Safety Agency (EASA) AMC 20-24; or*
- 2. *European Aviation Safety Agency (EASA) CA-ACNS (Subpart D – Surveillance – SUR); or*
- 3. *FAA AC No. 20-165A (or later versions) – Airworthiness Approval of ADB-B; or*
- 4. *Configuration standards reflected in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia.*

~~5.5.3~~ 5.5.5 Downlinked ADS-B data shall not be used by the ATC system for determining aircraft position when any of the position quality indicators (NUCp, NIC, NACp or SIL) have a value of 0 (zero).

d) Date when proposal received:

XX November 2020

e) Proposer's reason for amendment:

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APANPIRG/22 (2011)

C 22/8 ADS-B Airspace Mandate

That, States intending to implement ADS-B based surveillance services may designate portions of airspace within their area of responsibility:

- a) mandate the carriage and use of ADS-B equipment; or
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C 22/36 Amendment to Regional Supplementary Procedures on ADS-B

That, the Regional Supplementary Procedure Doc7030 MID/ASIA Chapter 5 be amended in accordance with the established procedure to include regional requirements on ADS-B as provided in the Appendix N to the report on Agenda Item 3.4.

APANPIRG/23 (2012)

Conclusion 23/5 – Asia/Pacific Air Navigation Concept of Operations Mandates

That, States intending to implement Performance-Based Navigation and Safety Nets may, after appropriate consultation with airspace users, designate portions of airspace within their area of responsibility:

- a) as providing priority for access to such airspace for aircraft with prescribed Performance-Based Navigation (PBN) specifications and supporting data-link equipage (ADS-C/CPDLC); and/or
- b) mandating the carriage and use of an operable Automatic Dependent Surveillance-Contract/Controller Pilot Data-link Communications Systems (ADS-C/CPDLC) system, and mode A/C and/or mode S transponder.

While it is recognised that States may introduce restrictions and performance-based measures over their sovereign territory, mandates over the High Seas need to be implemented in line with regional air navigation agreements; in this case through APANPIRG. Thus it is necessary to introduce an amendment to the Regional Supplementary Procedures (ICAO Doc 7030) for Asia/Pacific FIRs that allows States to designate portions of performance-based airspace when they are able to provide the performance benefit and in accordance with aircraft equipage and capability.

The level of ANS capability and aircraft equipage varies throughout the Asia/Pacific, so it is intended that States will designate airspace when possible, in either exclusive or 'non-exclusive' (mixed mode with lower priority for non-equipped aircraft), as appropriate.

f) Proposed implementation date of the amendment:

Upon approval by Council.

g) Action by the Secretary General:

The proposal has been circulated to the following States and International Organizations:

Afghanistan	Micronesia	ACI
Australia	Mongolia	CANSO
Bangladesh	Myanmar	IACA
Bhutan	Nauru	IAOPA
Brunei Darussalam	Nepal	IATA
Cambodia	New Zealand	IBAC
China	Pakistan	IFALPA
Hong Kong,China	Palau	IFATCA
Macao, China	Papua New Guinea	EUROCONTROL
Cook Islands	Philippines	
DPR Korea	Republic of Korea	
Fiji	Samoa	
India	Singapore	
Indonesia	Solomon Islands	
Japan	Sri Lanka	
Kiribati	Thailand	
Lao PDR	Timor Leste	
Malaysia	Tonga	
Maldives	Tuvalu	
Marshall Islands	Vanuatu	
	Viet Nam	

This proposal has been circulated to United States for information.

h) Secretariat comments:

The amendment of Doc 7030 in respect of ADS-B OUT requirements for PAC Region, provides a framework for the State/Administration to establish performance based airspace, with consideration of such matters as existing and proposed airspace user equipages, mandate timing, definition of airspace

volumes (both vertical and horizontal), exclusive or non-exclusive application, exemption provisions and management of State aircraft.

The amendment is specifically intended to enable State/Administrations to promulgate airspace mandates over the High Seas, and to encourage a regional approach to the establishment of such mandates, where it is appropriate to do so and recognizing that it is not practical for the Asia/Pacific Region to establish Sub-Regional or Region-wide simultaneous mandates. This is in accordance with the concept of the Seamless ANS and performance-based approaches, as well as the Aviation System Block Upgrade (ASBU) initiative and Global Air Traffic Management Operational Concept (ICAO Doc 9854).
