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Airspace Management and Improvement in the Asia/Pacific Region

EASA/ARISE+ Airspace Design Workshop

Singapore

19 – 21 February 2019

Shane Sumner

Regional Officer ATM/AIM

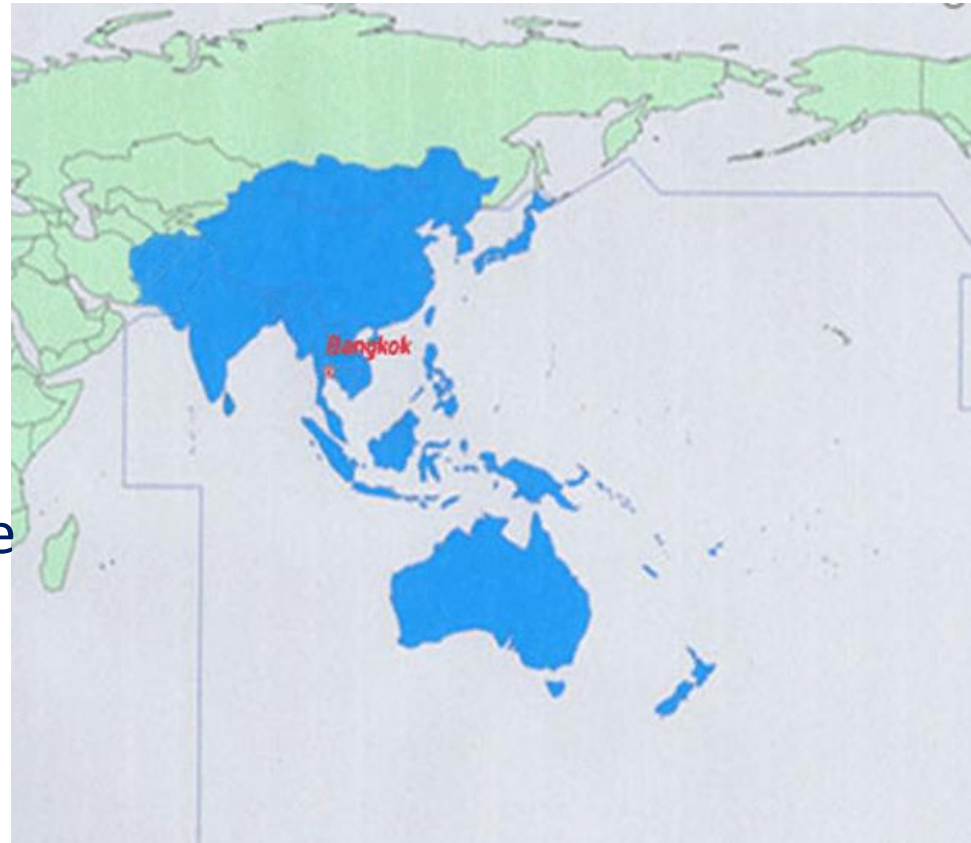
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Topics

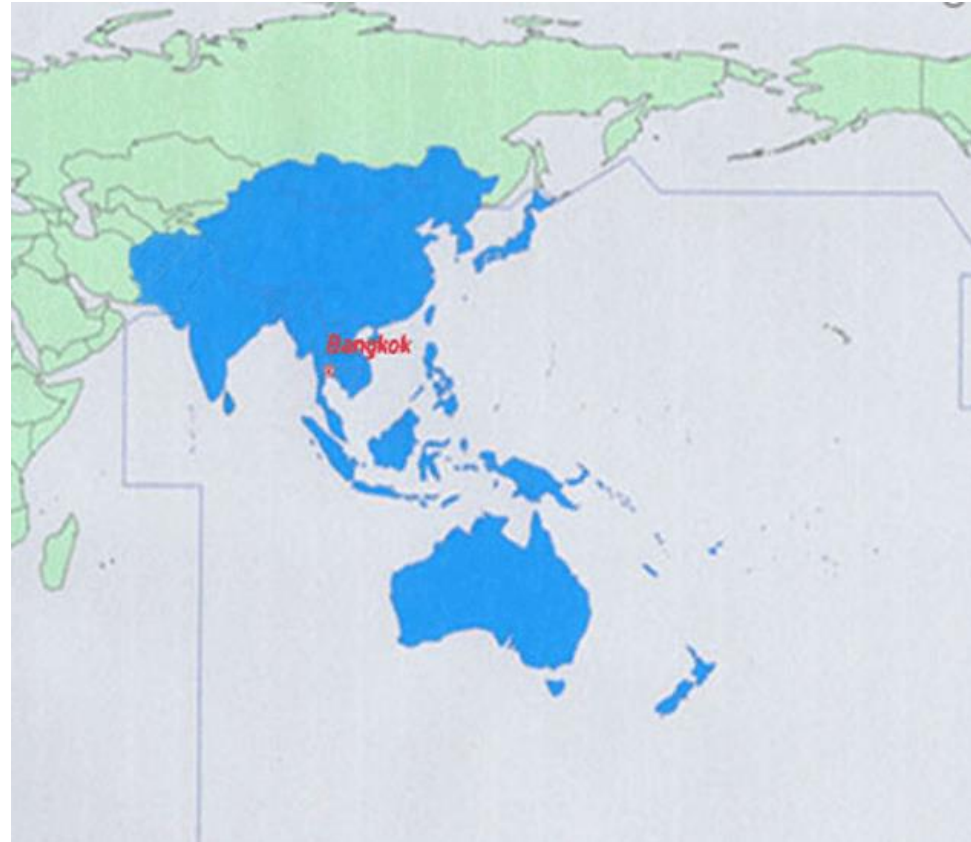
- Challenges
- ICAO Global Provisions for Airspace Planning
- Asia/Pacific Regional Airspace Planning
- ATS Routes and Nav Specs





Topics

- ATC Separation and FLAS
- Civil/Military Cooperation Aspects
- Ballistic Rocket Launch





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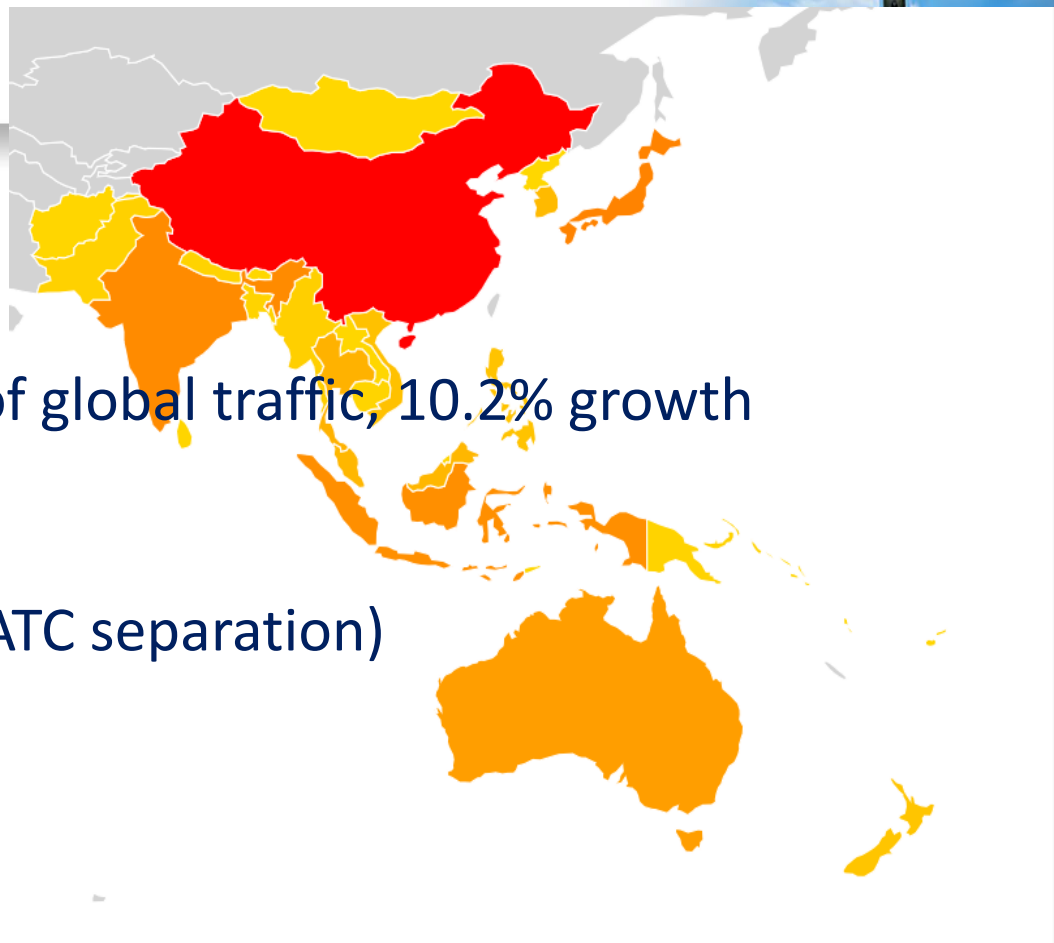
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CHALLENGES

Challenges

- Demand
 - Largest Region: 33% of global traffic, 10.2% growth
- Capacity Constraints
 - Airspace (AOM, SUA, ATC separation)
 - Airports

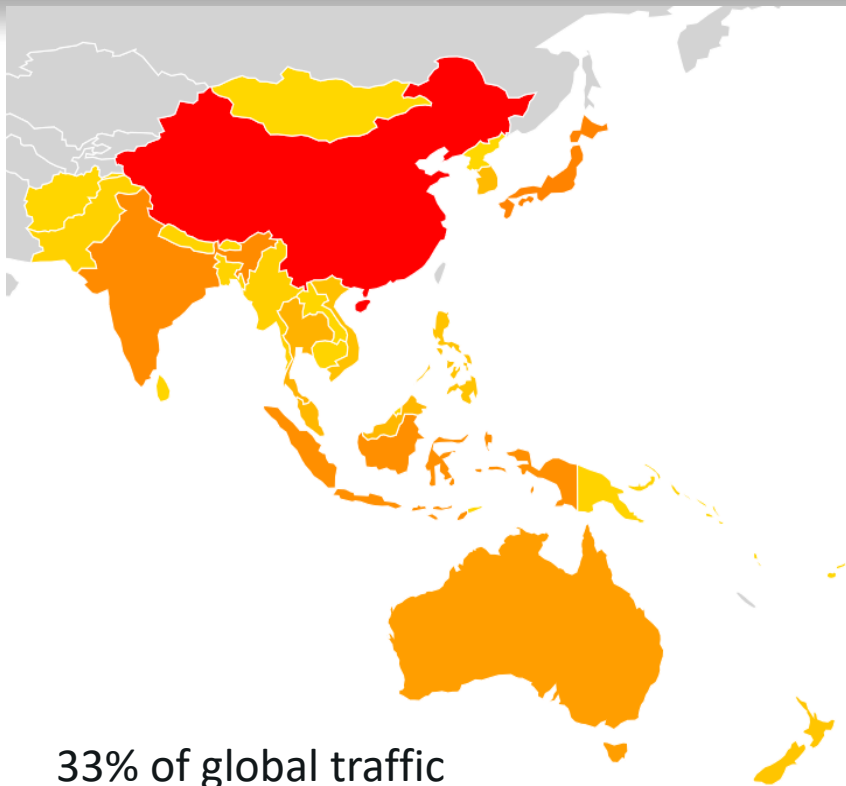




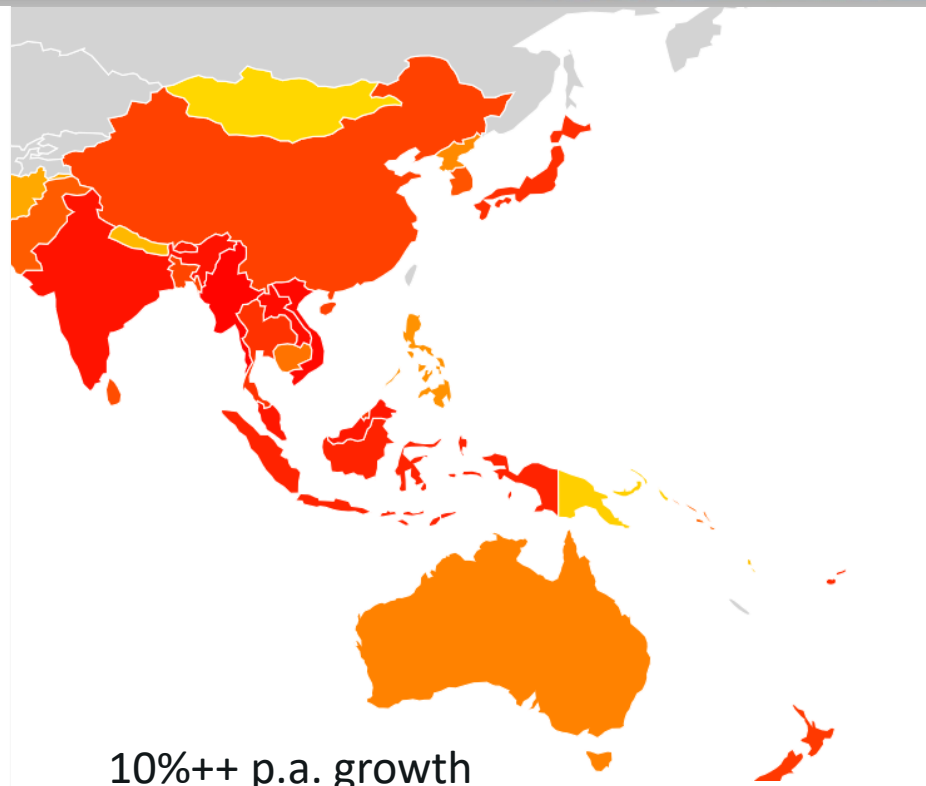
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33% of global traffic



10%++ p.a. growth



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ICAO GLOBAL PROVISIONS FOR AIRSPACE PLANNING



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International Standards
and Recommended Practices



ICAO Global Provisions

- **Annex 11 - *Air Traffic Services***
- **Standards and Recommended Practices (SARPS)**

Annex 11 to the Convention on International Civil Aviation

Air Traffic Services

Air Traffic Control Service
Flight Information Service
Alerting Service

Fifteenth Edition, July 2018



This edition supersedes, on 8 November 2018, all previous editions of Annex 11.

For information regarding the applicability of the Standards and Recommended Practices, see Foreword.

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International Standards
and Recommended Practices



ICAO Global Provisions

- **Annex 11 - *Air Traffic Services***
- *pertains to the establishment of airspace, units and services necessary to promote a safe, orderly and expeditious flow of air traffic*

Annex 11 to the Convention on International Civil Aviation

Air Traffic Services

Air Traffic Control Service
Flight Information Service
Alerting Service

Fifteenth Edition, July 2018



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ICAO Global Provisions

- **Doc 4444 PANS-ATM**
- **Procedures**
- Chapter 2 *Safety management*
- Chapter 3 *ATS system capacity and ATFM*
- Chapter 4 *General provisions for ATS*
- Chapter 5 *Separation methods and minima*
- Chapter 8 *ATS surveillance services*
- Chapter 10 *Coordination*



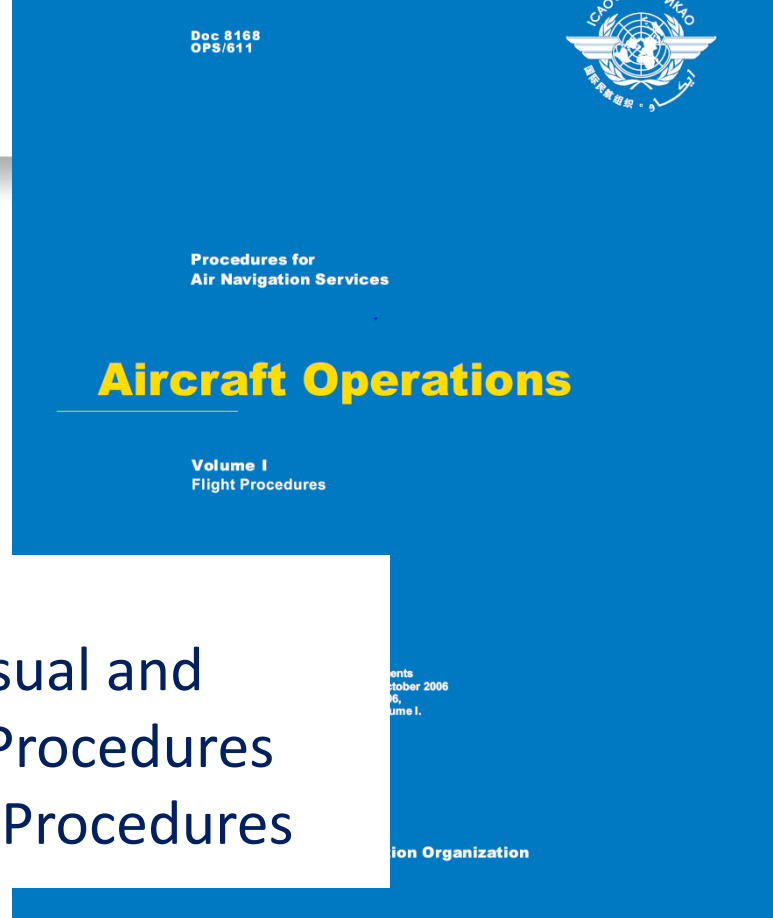


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ICAO Global Provisions

- **Doc 8168 PANS-OPS**
- *Procedures*
- Volume I Flight Procedures
- Volume II Construction of Visual and Instrument Flight Procedures
- Volume III Aircraft Operating Procedures





ICAO Global Provisions

- **Doc 9426 ATS Planning Manual**
 - Part 1 Planning Factors
 - Part II Methods of ATS Applications
 - Part III Facilities
 - Part IV ATS Organization
- Last update 1992....

AIR TRAFFIC SERVICES PLANNING MANUAL

FIRST (Provisional) EDITION — 1984



*Approved by the Secretary General
and published under his authority*

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ICAO Global Provisions

- Doc 9992 – Manual on the Use of PBN in Airspace Design
- *airspace concept and PBN benefits*
- *Phases of airspace design – (planning, design, validation, implementation)*

Doc 9992
AN/494



Manual on the Use of Performance-based Navigation (PBN) in Airspace Design

Approved by the Secretary General
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First Edition — 2013

International Civil Aviation Organization



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APAC REGION AIRSPACE PLANNING



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APAC Procedures

- **Doc 7030 *Regional Supplementary Procedures* (MID/ASIA and PAC Regions)**
- Procedures *complementing* SARPS and PANS, and/or
- PANS procedures, including separation minima, in airspace over the high seas

Doc 7030



Regional Supplementary Procedures

Approved by the Council
and published by authority of the Secretary General

Fifth Edition — 2008

International Civil Aviation Organization



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APAC *Procedures*

- **Doc 7030 *Regional Supplementary Procedures***
(MID/ASIA and PAC Regions)
- Example:
- RNP-based separations in high seas airspace
- RNAV 10/RNP 10, RNP 4, RNP 2

Doc 7030



Regional Supplementary Procedures

Approved by the Council
and published by authority of the Secretary General

Fifth Edition — 2008

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Asia/Pacific Region Airspace Planning

- **Asia/Pacific Regional Air Navigation Plan (Volume II)**
- **Specific Regional Requirements**
 - *Homogeneous ATM Areas and Major Traffic Flows*
 - *Regional ATS Routes Network*

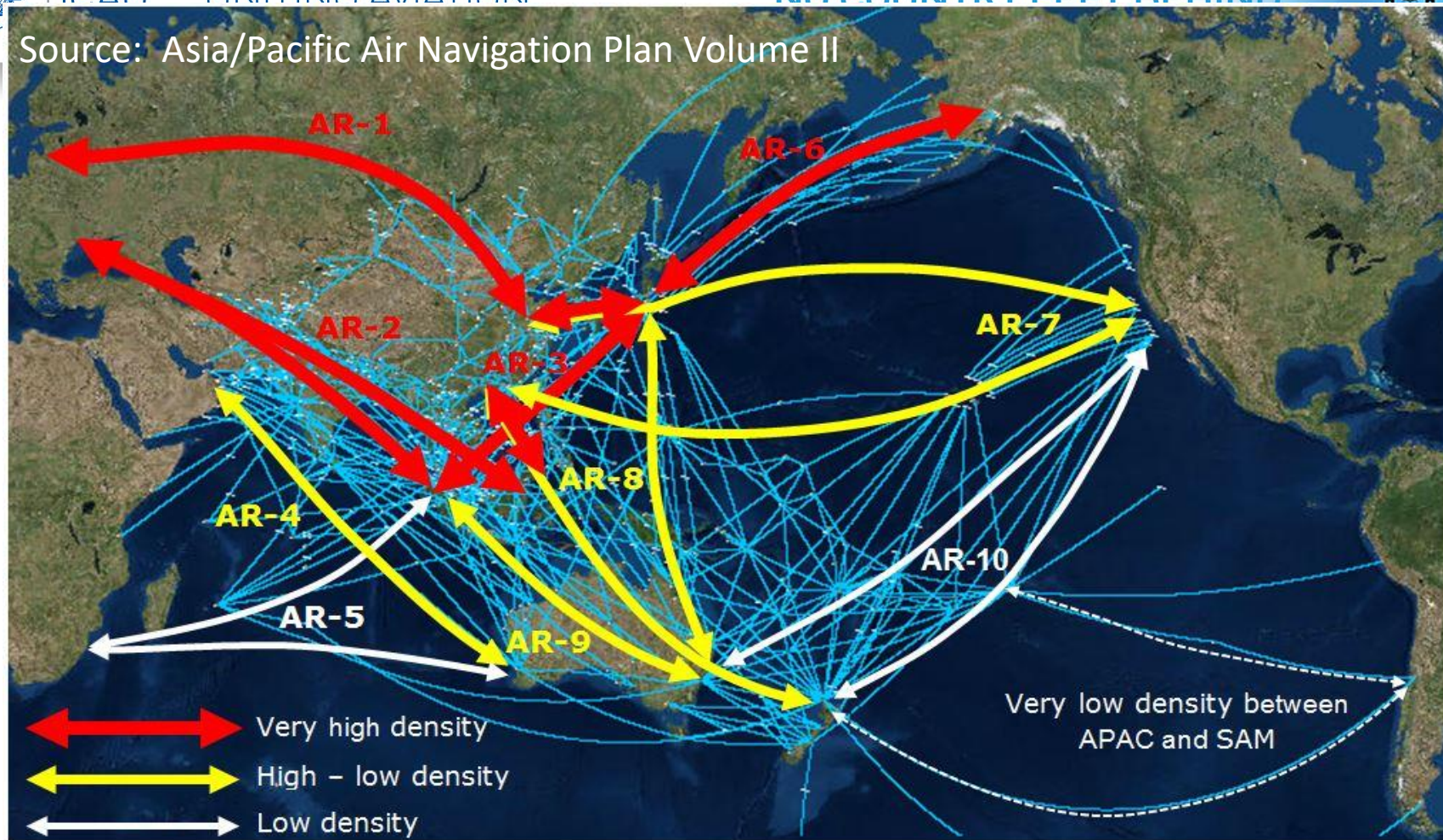
APAC AIR NAVIGATION PLAN

VOLUME I





Source: Asia/Pacific Air Navigation Plan Volume II





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Asia/Pacific Region Airspace Planning

- Asia/Pacific Seamless
ATM Plan

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ASIA/PACIFIC SEAMLESS ATM PLAN

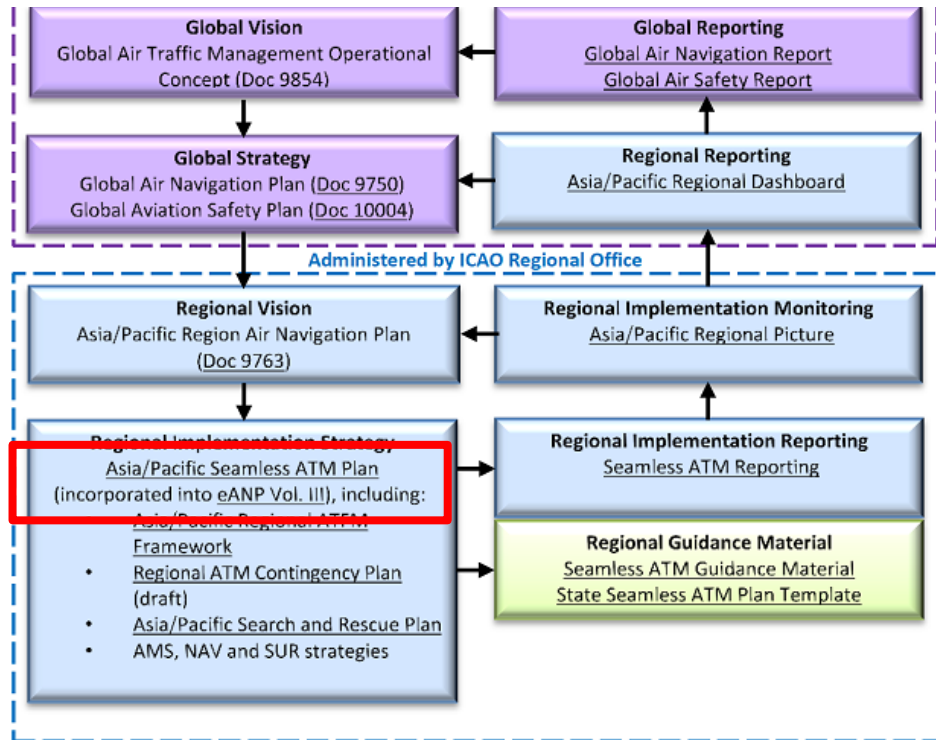
Version 2.0, September 2016

This Plan was developed by the Asia/Pacific Seamless ATM Planning Group (APSAPG) and amended by APANPIRG

Approved by APANPIRG/27 and published by the
ICAO Asia and Pacific Office, Bangkok



Asia/Pacific Seamless ATM Plan



ASIA/PACIFIC SEAMLESS ATM PLAN

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Asia/Pacific Seamless ATM Plan

- **Airspace Categories:**
- **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



ASIA/PACIFIC SEAMLESS ATM PLAN

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Asia/Pacific Seamless ATM Plan

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



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Asia/Pacific Seamless ATM Plan

- **Airspace Categories:**
- **Category T:** terminal operations serviced by direct ATS communications and surveillance.



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Asia/Pacific Seamless ATM Plan

- **Performance Improvement Plan**
- Preferred Aerodrome/Airspace and Route Specifications (PARS)
- Preferred ATM Service Levels (PASL)
- Phased implementation



ASIA/PACIFIC SEAMLESS ATM PLAN

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Asia/Pacific Seamless ATM Plan

- **Phase I** – Expected implementation November 2015
- **Phase II** – Expected implementation November 2019
- **Phase III** – Expected implementation November 2022



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Asia/Pacific Seamless ATM Plan

- Includes performance expectations for *inter alia*:
- Airspace specifications and capacity determination
- Continuous Climb Operations/Continuous Descent Operations (CCO/CDO)
- RNP 1 SID/STARS
- RNP 2 ATS route specifications
- Precision approaches e.g. GBAS (and others)
- ATC separation minima



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Asia/Pacific Seamless ATM Plan

- Phase I (Nov 2015)
- References high density airports (>100K movements per annum), high density FIRs and busiest city-pair routes:
 - a) South Asia: Delhi, Mumbai;
 - b) Southeast Asia: Bangkok, Hanoi, Ho Chi Minh, Jakarta, Kuala Lumpur, Kota Kinabalu, Manila, Sanya, Singapore, Vientiane; and
 - c) East Asia: Beijing, Fukuoka, Guangzhou, Hong Kong, Kunming, Incheon, Shanghai, Shenyang, Taipei, Wuhan.



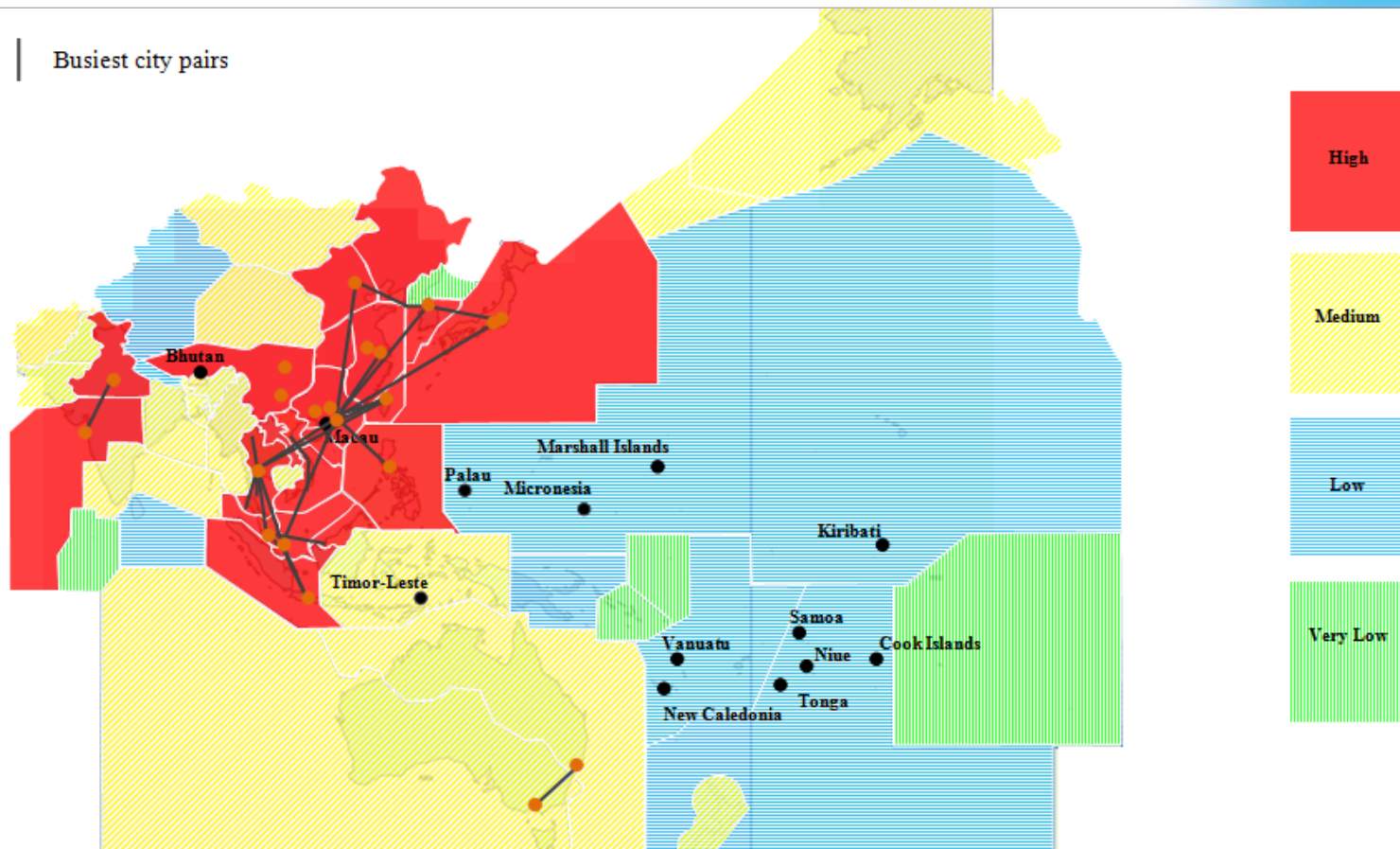
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Busiest city pairs





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Asia/Pacific Seamless ATM Plan

- Seamless ATM Plan Implementation **Phase 2 (Nov 2019)**:
- Removes distinction between high density airspace/busiest airports
- Builds upon the Phase 1 performance expectations
- References ALL international airports, ALL controlled airspace
- Region-wide harmonization



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ATS ROUTES AND NAV SPECS



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ATS ROUTES AND NAV SPECS

- Seamless ATM Plan expectations *in a nutshell*:
- ATS routes: **RNP 2**
- SID/STAR (and facilitated CCO/CDO): **RNAV 1 or RNP 1**
- ATC Separation
 - per PANS-ATM (Category S and T airspace)
 - RNP 2 ATS Route spacing (Category S and T airspace)
 - RNP 2 (Category R airspace)

| | |
|--|--|
| <p>Category R (remote) airspace – served by ADS-C, CPDLC, HF and space-based ADS-B.</p> <ul style="list-style-type: none"> • <u>Optimal ATM Planning</u> – <u>no</u> fixed ATS routes, Dynamic Airborne Reroute Procedures (DARP) or User Preferred Routes (UPR). • <u>Acceptable ATM Planning</u> – PBN fixed routes using RNP 2 (or less optimally, RNP 4), which had an ATC separation standard. <p><i>Note: RNAV 2, which had no on-board monitoring, may be used in the transition period with RNP 1 and GNSS as an equivalence (APANPIRG Conclusion).</i></p> <ul style="list-style-type: none"> • <u>Poor ATM Planning</u> – PBN fixed routes using the outdated, non-PBCS RNAV 10 (RNP 10) specification. • <u>Unacceptable ATM Planning</u> – use of the RNAV 5 specification, which requires VHF and ground-based navigation aid geometry coverage. | <p>Category S (surveillance) airspace – served by ground-based radar or ADS-B or MLAT, and VHF.</p> <ul style="list-style-type: none"> • <u>Optimal ATM Planning</u> – <u>no</u> fixed ATS routes, free route airspace (FRA). • <u>Acceptable ATM Planning</u> – PBN fixed routes using the RNP 2 or RNAV 2 specification. • <u>Poor ATM Planning</u> – PBN fixed routes using the RNAV 5 specification, or RNP 1, which was designed for terminal airspace (normally, within 40NM of an aerodrome). <p><i>Note: RNAV 5, which had no on-board monitoring, had no ICAO ATC separation standard, and no requirement for a database, GNSS input, or automated waypoint sequencing, as it was originally conceived as a low-end specification (Basic RNAV).</i></p> <ul style="list-style-type: none"> • <u>Unacceptable ATM Planning</u> – use of the oceanic RNAV 10 (RNP 10) or RNP 4 specifications, which were designed for oceanic airspace. |
|--|--|



ATS ROUTES AND NAV SPECS

- RNP (all) Specifications
- Annex 6 requirements = **Operational Approval Required** for operations where RNP is specified
(Operational approval and ANSP performance-monitoring also required for RCP and RSP supporting RNP-separations in Category R airspace)
 - Annex 6 7.1 and 7.3 (Vol I with similar sections in Vol II and III)



ATS ROUTES AND NAV SPECS

- What's the current fleet capability?
- **Category R** Airspace – less than it was before PBCS
 - Poor response by Regulators – aircraft are capable, but no longer enabled due to Regulatory inertia
- **Category S** Airspace
 - Not clearly understood
 - FPL information is not a reliable indicator of pilot/aircraft RNP capability
 - Local requirements and regulatory support not established
 - Significant proportion of APAC traffic growth is with new aircraft – highly likely to be RNP capable.



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ATS ROUTES AND NAV SPECS

- How do we conform with the Seamless ATM Plan?
 - Category R and Category S airspace
 - SID/STAR
- **Conduct the activities to conform with Annex 6 (Vol I) Chapter 7**
 - Engage with aircraft operators – determine aircraft (and fleet) capability
 - Establish regulatory processes
 - Establish ANSP processes (PBCS performance-monitoring)
- **Develop a State Implementation Plan**



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....and.... A few words about separation



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Separation in Category S and T airspace

- Seamless ATM Plan Expectation
 - Doc 4444 PANS-ATM **surveillance-based** (radar, ADS-B) separation minima (PANS-ATM 8.7.3)
- En-route **5NM**
- Terminal areas **3NM, 2.5 NM**



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Separation in Category R airspace

- Seamless ATM Plan Expectation
 - ICAO Doc 4444 PANS-ATM RNP-based separation minima
 - Nav spec = RNP 2 (supported by RCP and RSP specifications)
 - **30 NM** Longitudinal
 - **23 NM** Lateral



Separation in Category R and S airspace

- Current Situation
 - Large separations applied
 - Surveillance based – 20 NM, 30 NM and more!
 - Category R airspace – 10 minutes longitudinal, 50 NM lateral!
 - **Significantly limits airspace capacity**
 - **significantly higher ATC workload demands**
 - **No benefit for investment on radars (~USD 10 Million + each) and ATM automation system capability**



Cat R/S
Doc 4444
standards:
CAT S TOC
5-10NM

Cat S 10NM

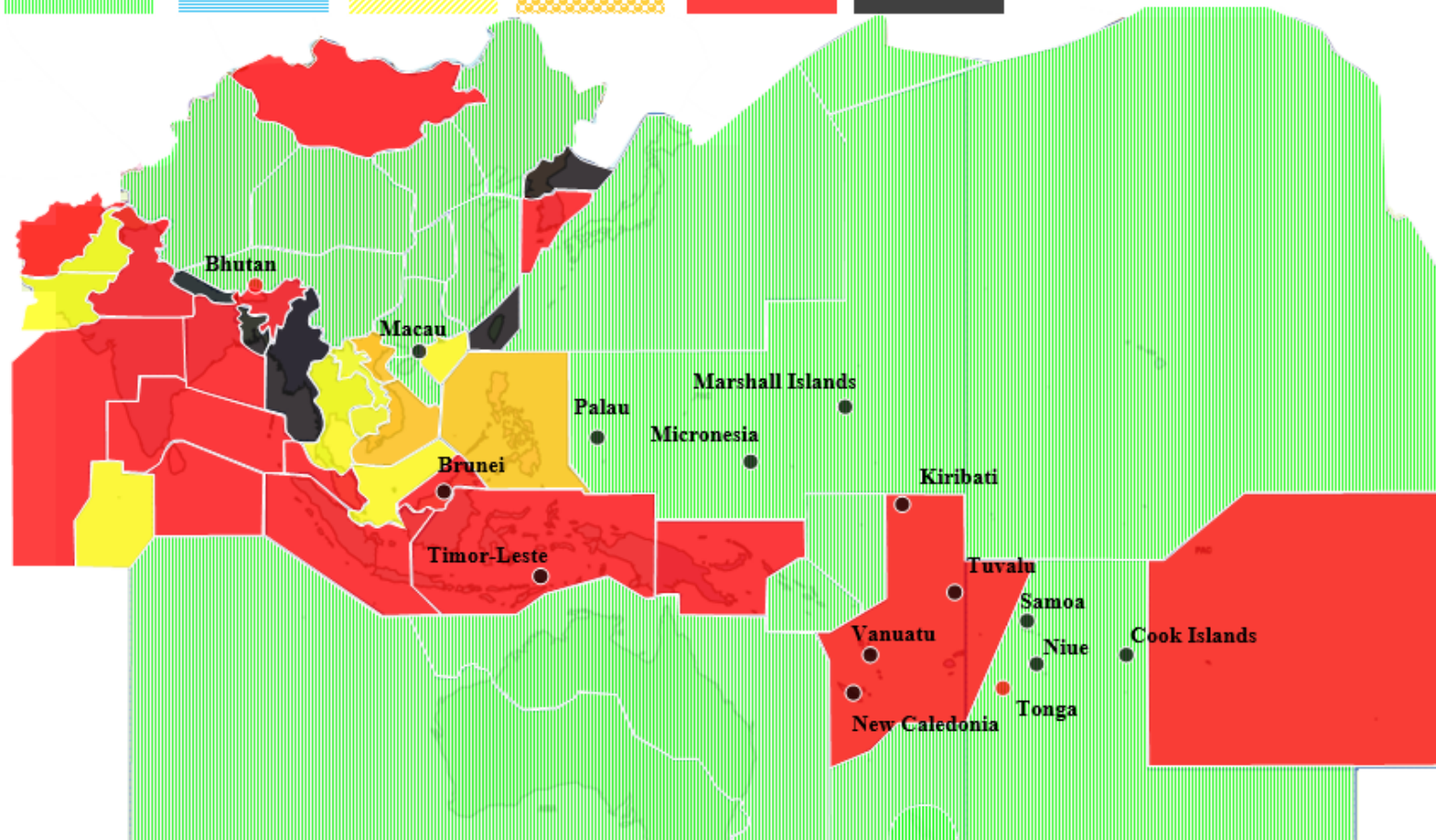
Cat S 11-
19NM; or
TOC
11NM+

Cat R
51NM+; or
FLAS

Cat S
20NM+; or
TOC
20NM+; or
FLAS

No report

ATC Separations –
Compliance with Seamless
ATM Horizontal Separation
Standards





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....and.... Flight Level Allocation Schemes (FLAS)



Flight Level Allocation Schemes (FLAS)

- Current Situation
 - FLAS Restrict levels available 24H, regardless of traffic
 - Impose significant burden on neighbouring FIRS
 - Some FLAS non compliant with Annex 2 Rules of the Air Appendix 3 (Table of Cruising Levels)
 - Rarely (if ever) useful or needed where PANS-ATM separations are correctly applied
 - Seamless ATM Plan performance expectation



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Asia/Pacific Seamless ATM Plan

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



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Asia/Pacific Seamless ATM Plan

7.44

- b) Category S airspace with the agreement of all ANSPs that provide services:
- where crossing track conflicts 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.



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CIVIL/MILITARY COOPERATION, SUA AND FUA



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Civil/Military Cooperation, SUA and FUA

- Current APAC Situation
 - ADIZ
 - Non-ICAO airspace affecting civil airspace/traffic
 - Little, if any, justification - technology solutions available
 - Special Use Airspace (SUA)
 - Lack of flexibility/reasonable access
 - Restricted areas in airspace over the high seas
 - Not permitted under the Chicago Convention



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Asia/Pacific Seamless ATM Plan

7.11 All Civil/Military Airspace expectations are as follows:

- a) SUA should only be established after due consideration of its effect on civil air traffic by the appropriate Airspace Authority to ensure it will be:
- used for the purpose that it is established;
 - used regularly;
 - as small as possible, including any internal buffers, required to contain the activity therein;
 - if applicable, operated in accordance with FUA principles; and
 - activated only when it is being utilised; and



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7.11 All Civil/Military Airspace expectations are as follows:

b) SUA should be regularly reviewed to ensure the activities that affect the airspace, and size and timing of such activity are accurately reflected by the SUA type, dimensions, activation notice and duration of activation.



Asia/Pacific Seamless ATM Plan

7.50 Civil/Military Cooperation

- a) Civil/Military ATM expectations are as follows:
- b) a national civil/military body should be formed to coordinate strategic civil-military activities(military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes);
- c) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC Centres;



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Asia/Pacific Seamless ATM Plan

7.50 Civil/Military Cooperation

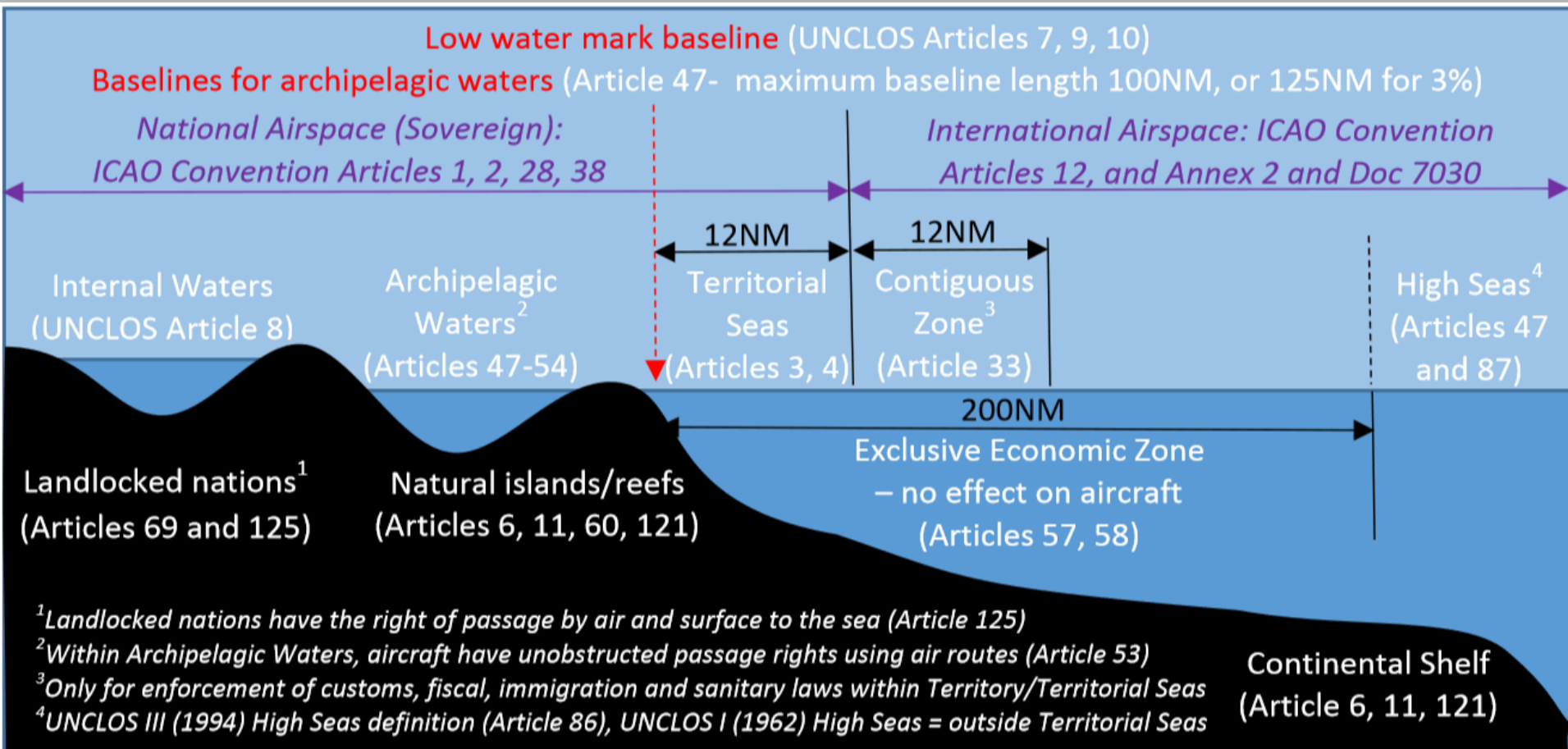
- d) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable;
- e) joint provision of civil/military navigation aids should be encouraged;
- f) common training should be conducted between civil and military ATM units in areas of common interest; and
- g) civil and military ATM units should utilize common procedures as far as practicable.



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BALLISTIC ROCKET LAUNCH AND SPACE RE-ENTRY

- All States with Agencies that conduct ballistic launch or space re-entry activities should
- a) the development of written coordination agreements between the State civil aviation authority and the launch/re-entry agency concerned;
 - b) that strategic coordination is conducted between the State civil aviation authority and any States affected by the launch/re-entry activity at least 14 days prior to the proposed activity, providing notice of at least:
 - i) three days for the defined launch window; and
 - ii) 24 hours for the actual planned launch timing;
 - c) that consideration of affected airspace users and ANSPs is made after consultation, so that the size of the airspace affected is minimized and the launch window is optimized for the least possible disruption to other users; and
 - d) that communication is established with affected ANSPs to provide accurate and timely information on the launch/re-entry activity to manage tactical responses (for example, emergencies and activity completion).



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CAPACITY IMPROVEMENT THROUGH AIRSPACE DESIGN

33% of global traffic

10%++ p.a. growth



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