ICAO UNITING AVIATION

ATM for APAC| 交流分享

introduction to Air Traffic Management of ICAO Asia/Pacific Regional Sub-office

国际民航组织亚太地区分办事处空中交通管理相关事务介绍

Xu Zhi Feng 徐志峰

ICAO Regional Officer ATM , Asia &Pacific Regional Sub-office

国际民航组织亚太地区空中交通管理官员

从问题出发，浅析ICAO亚太地区ATM工作的基本逻辑和路径

ICAO INNOVATION

Brief Analysis of the underlying logic and path of the ICAO APAC ATM Farmwork based on the 9 questions.

1

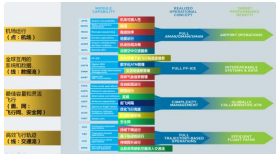
国际民航组织如何划分目标层级?

Setting the Strategies from the Different Levels

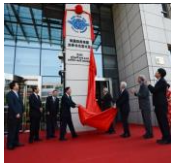
目标的制定与分层和分级

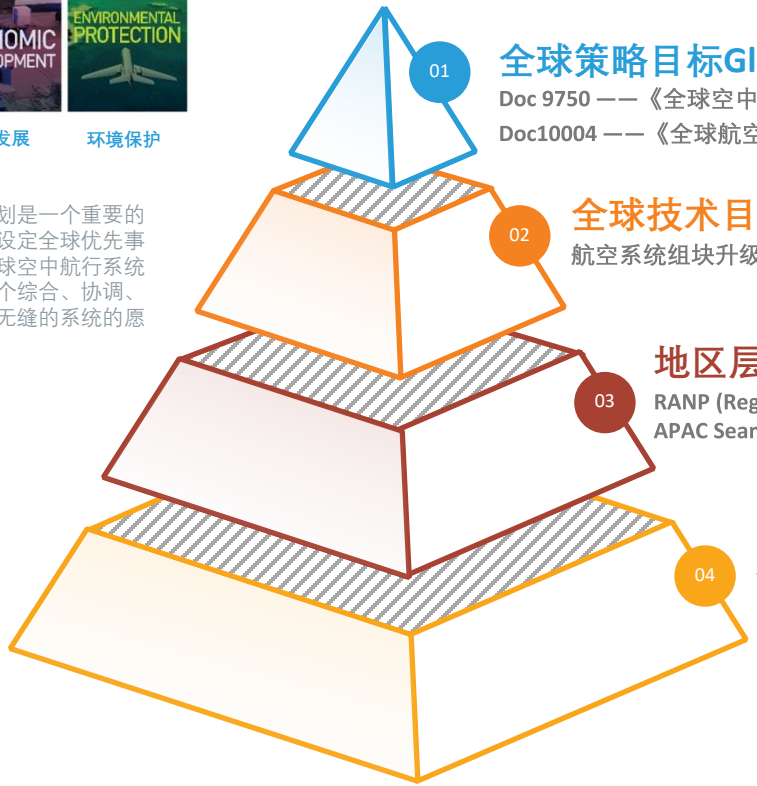
Goal setting, stratification, and grading

安全　能力和效率　安保和简化手续　经济发展　环境保护



全球空中航行计划是一个重要的规划工具，用于设定全球优先事项，以便推动全球空中航行系统的发展和建立一个综合、协调、全球可互操作和无缝的系统的愿景成为现实。





全球策略目标Global Strategic Goals

Doc 9750 ——《全球空中航行计划》GANP (Global Air Navigation Plan)

Doc10004 ——《全球航空安全计划》GASP (Global Aviation Safety Plan)

全球技术目标Global Technical Goals

航空系统组块升级(ASBU)框架和基本构建组块(BBB)框架

地区层面的目标Reginal Goals

RANP (Reginal Air Navigation Plan) 《地区航行计划》

APAC Seamless ANS Plan （V3.0） 《亚太地区无缝空中航行计划》

国家层面的目标National Goals

各国制定的基于本国发展需求的航行计划

全球空中航行计划的国家层面是国家的责任。

ICAO INNOVATION

2

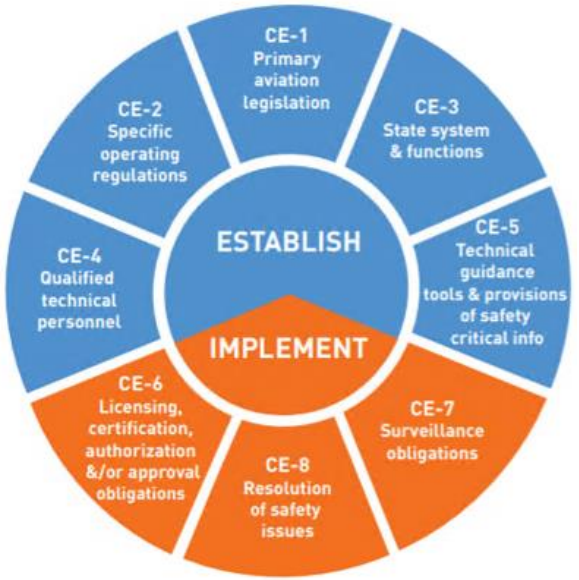
如何发现问题，识别地区需求?

Identify issues and demands.

ICAO普遍安全监督审计计划中与空管相关的项目
USOAP CMA Protocol Questions related to ANS

- 共122个协议问题相关a total of 122 Protocol Questions
- ANS领域的USOAP CMA活动涉及七个领域的立法和监管规定，包括运营和监督活动，即：

1) 空中交通管理Air Traffic Management (ATM),
2) 空中交通服务程序Procedures for Air Navigation Services: Aircraft Operations (PANS-OPS
3) 空中情报服务Aeronautical Information Services (AIS),
4) 航图Aeronautical Charts (Chart),
5) 通导监Communications, Navigation and Surveillance (CNS),
6) 航空气象服务Aeronautical Meteorology (MET), and
7) 搜寻与救援Search and Rescue (SAR).



ICAO INNOVATION

USOAP : Universal Safety Oversight Audit Programme 普遍安全监督审计计划
CMA : Continuous Monitoring Approach 持续监控方法

亚太地区各国参与USOAP审计结果

USOAP ANS EI Report

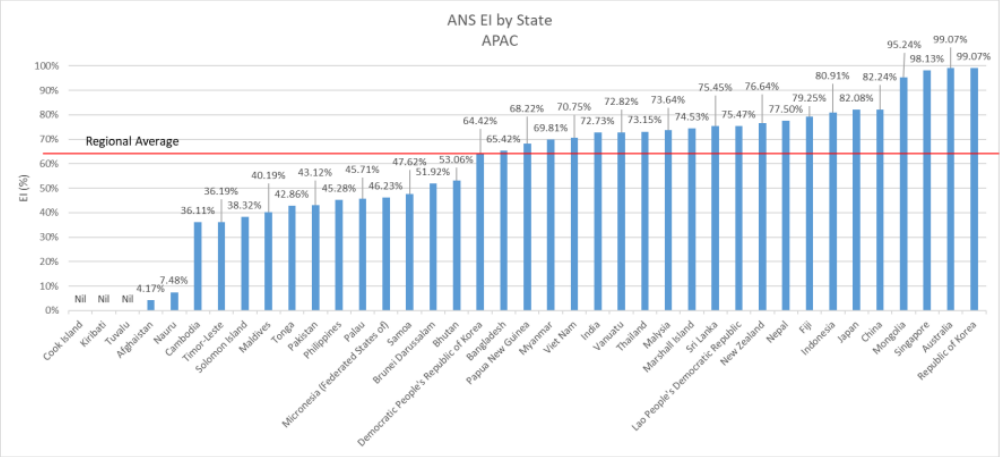


Figure 1: USOAP ANS EI Comparisons by State (September 2023)

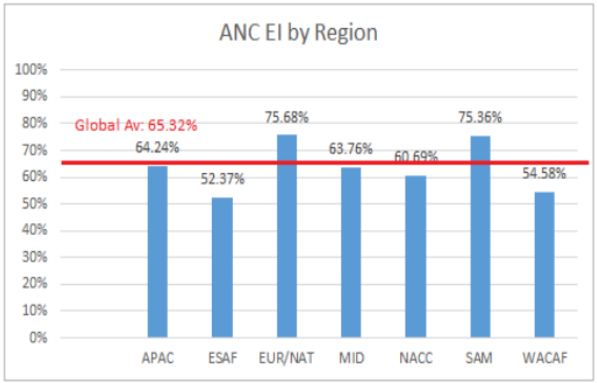


Figure 3: ANS EI by Region (September 2023)

ICAO | INNOVATION

亚太地区面临哪些问题?

What are the problem areas troubling APAC ATM?

不当的管制间隔运用

Inappropriate Separation

碎片化的空域结构

Fragmented airspace

空域利用效率不足

Airspace capacity

飞行情报服务不足

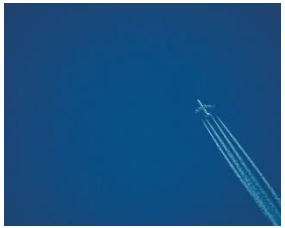
Aeronautical Information Services

空管应急响应机制不够完善

ATM Contingency Operations

航天发射影响民航安全

Space vehicle launch and re-entry



军民航协作不够紧密

Lack of Civil/Military cooperation

安全评估不够完善

ATM change safety assessment

ICAO INNOVATION

2023年空管方面遇到的主要挑战
Key ATM Challenges in 2023

1

军民航合作有待加强

CIVMIL cooperation

2

空域应急运行能力有待提高 Airspace Contingency Operations

3

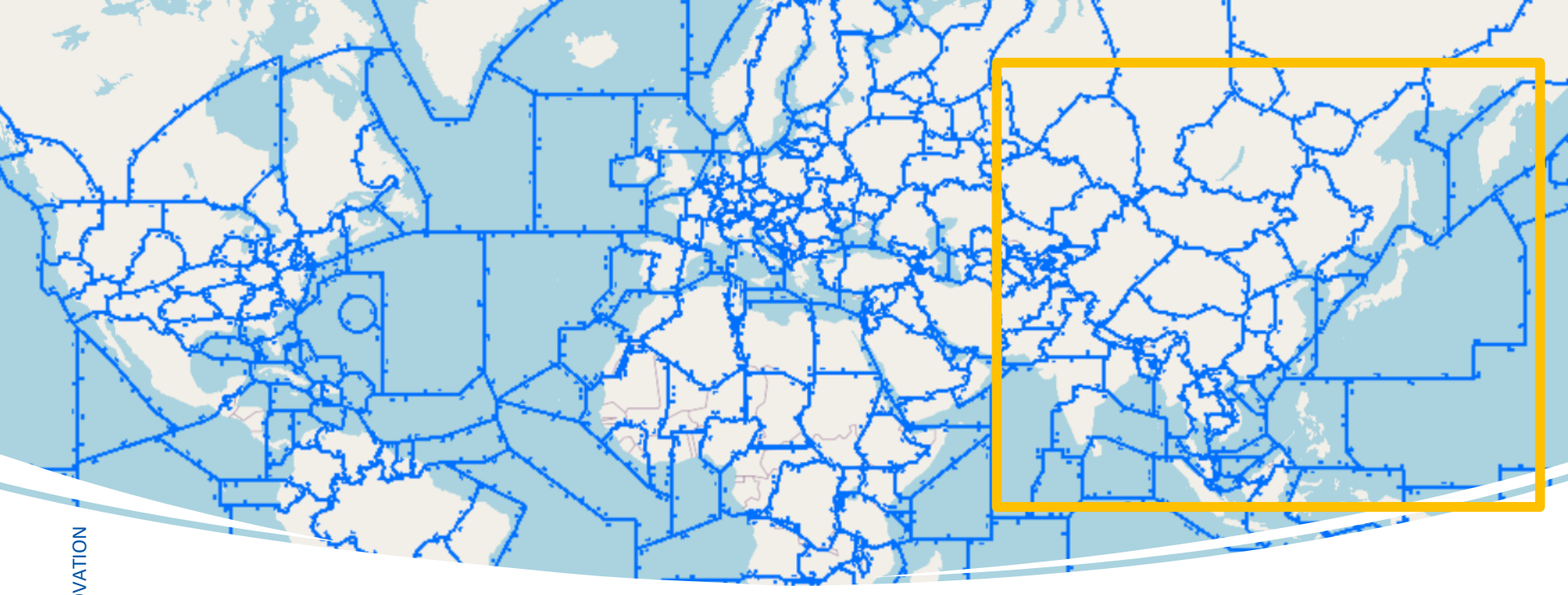
亚太国家对各类调查数据的反馈不积极

Continuing overall inadequate response from States regarding data

4

ASBU Block 0及无缝航行计划第一阶段要素实施进展缓慢

Slow implementation of GANP Block 0/Seamless ATM Plan Phase 1 elements

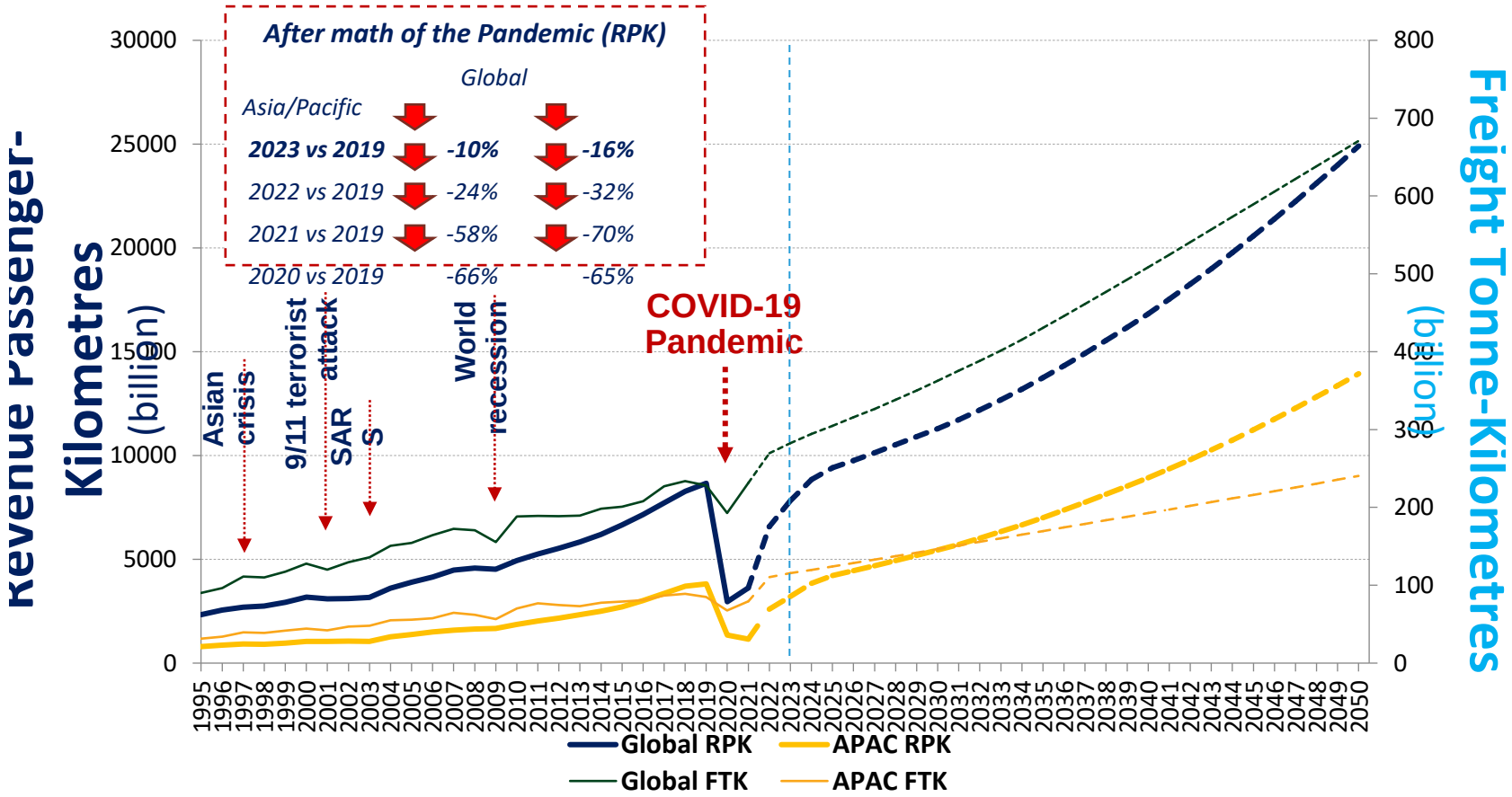


ICAO INNOVATION

空域碎片化

- Fragment Airspace and FIRs.

Global traffic: The Pandemic and Recovery
世界交通：疫情过后的恢复



ICAO INNOVATION

3

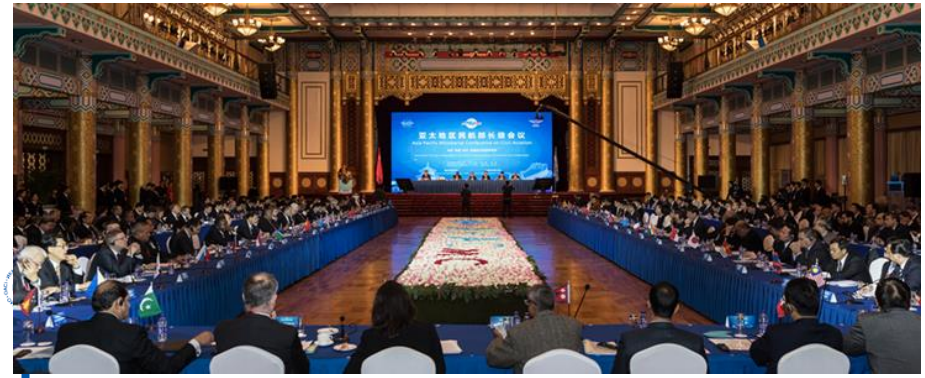
制定目标框架和实施方案

Develop a goal framework and implementation plan

亚太地区区域构架
APAC Regional Bodies

2018年1月31日至2月1日在北京举行的民航部长级会议通过《北京宣言》。

Adoption of the Beijing Declaration at the Ministerial Conference on Civil Aviation, held in Beijing from 31 January to 1 February 2018



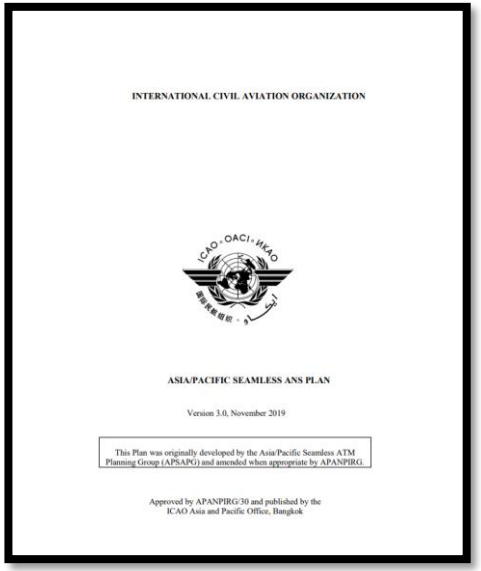
《亚太地区无缝空中航行计划》
Asia/Pacific Seamless ANS PLAN

The objective of Seamless ATM is the safe and interoperable provision of harmonized and consistent air traffic management service provided to a flight, appropriate to the airspace category and free of transitions due to a change in the air navigation service provider or Flight Information Region.

无缝空中航行的目标是：安全和可互操作地为航班提供协调一致的空中交通管理服务，适用于对应的空域类别，并且不会因空中导航服务提供商ANSP或飞行情报区FIR的变化而发生改变。

No Country Left Behind

不让任何一个国家掉队


INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC SEAMLESS ANS PLAN

Version 3.0, November 2019

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

Approved by APANPIRG/30 and published by the ICAO Asia and Pacific Office, Bangkok

ICAO INNOVATION

从问题导向和需求导向出发，制定实施计划

Develop the plan from a problem-oriented and demand-oriented perspective

制定整体目标 —针对性

Asia/Pacific Regional Air Navigation Plan objectives.

搭建技术框架 —选择性

The Seamless ANS performance framework, with a focus on technological and human performance within ASBU Block 0 elements, non-ASBU elements, and civil-military cooperation elements;

部署落实方案—地区性

Deployment plan with specific operational improvements, transition arrangements, expected timelines and implementation examples;

评估成本与效益—可行性

Overview of financial outcomes and objectives, cross-industry business and performance/risk management planning.

亚太地区性能目标领域

Key Performance Objectives for a Performance-oriented ATM System

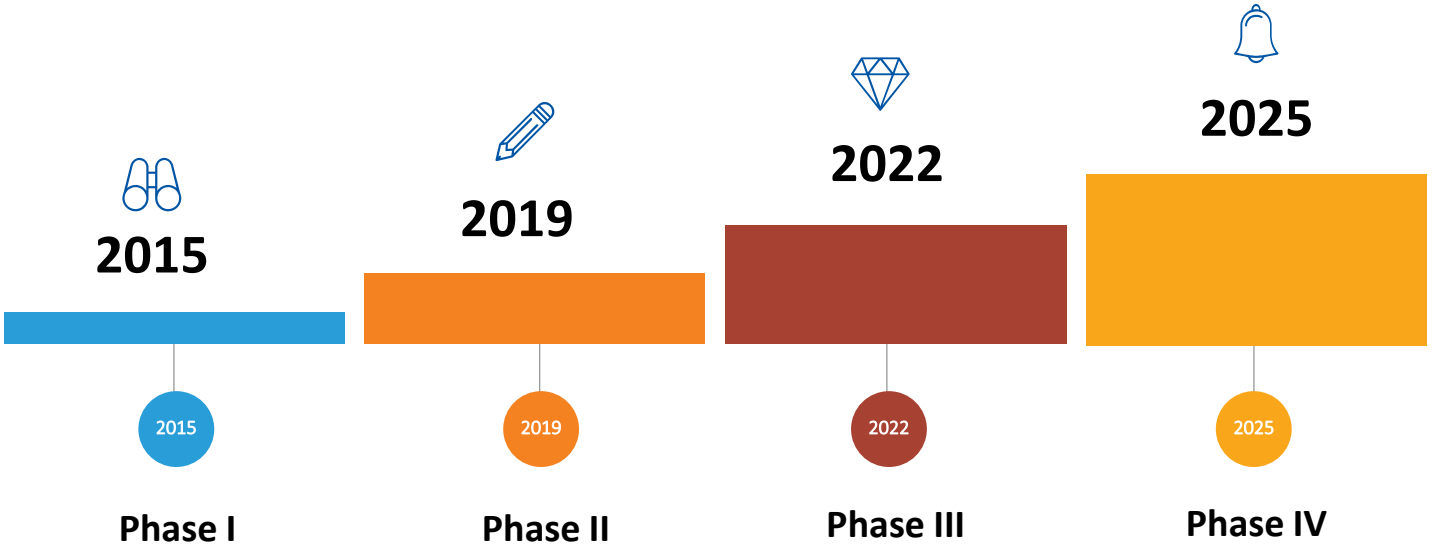
PARS | Preferred Aerodrome/Airspace and Route Specifications

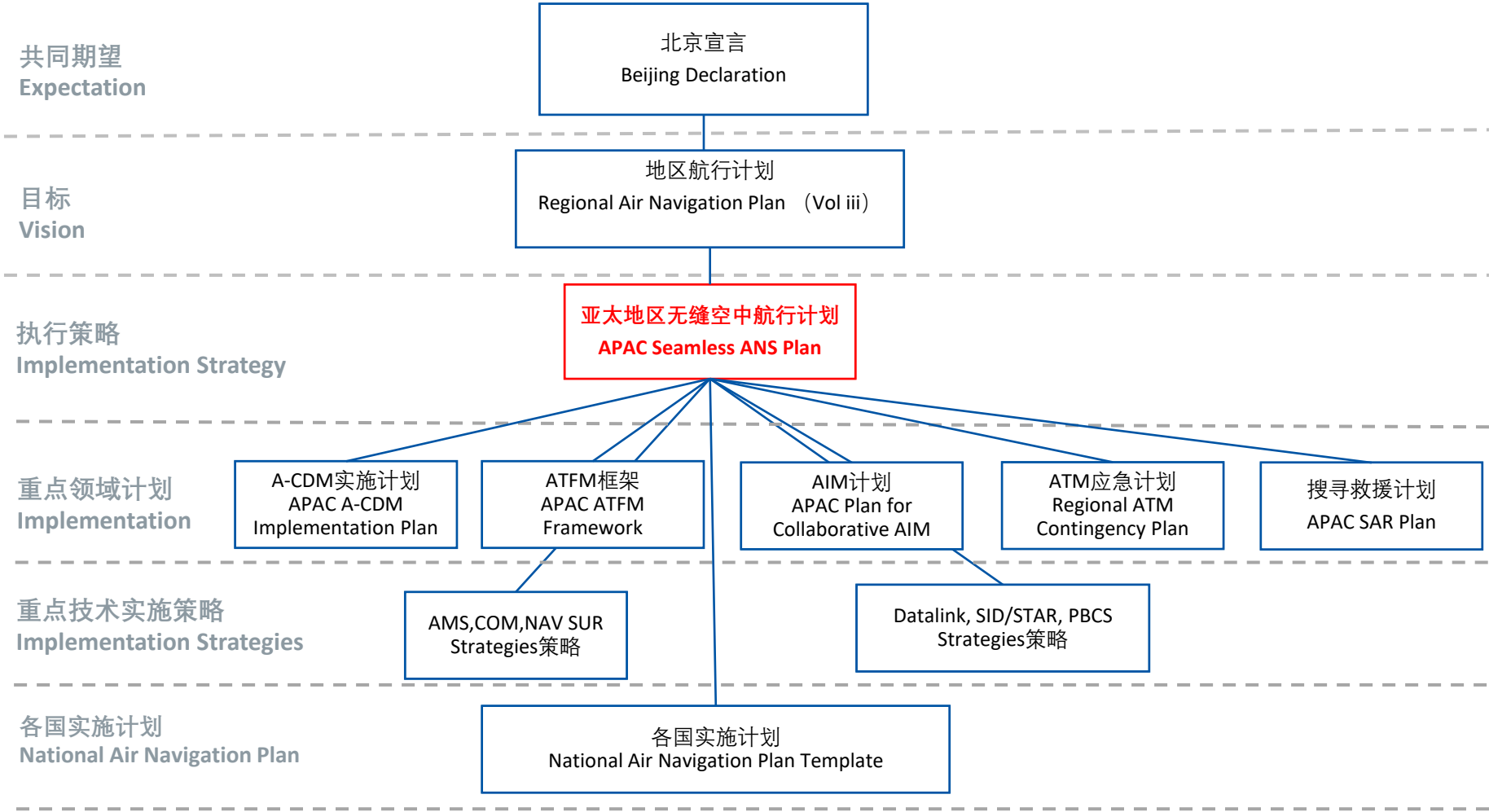
- **目标领域：**航空基础设施建设要求；
- **针对对象**：国家监管机构和空域管理机构，以及飞行程序设计者和飞机运营商。

PASL | Preferred ATM Service Levels

- **目标领域：**空中导航服务水平标准；
- **针对对象**：航行导航服务提供商（ANSP）。

PARS/PASL的阶段性实施计划
Implementation Plan




共同期望
Expectation
北京宣言
Beijing Declaration
目标
Vision
地区航行计划
Regional Air Navigation Plan （Vol iii）
执行策略
Implementation Strategy
亚太地区无缝空中航行计划
APAC Seamless ANS Plan
重点领域计划
Implementation
A-CDM实施计划
APAC A-CDM
Implementation Plan
ATFM框架
APAC ATFM
Framework
AIM计划
APAC Plan for
Collaborative AIM
ATM应急计划
Regional ATM
Contingency Plan
搜寻救援计划
APAC SAR Plan
重点技术实施策略
Implementation Strategies
AMS,COM,NAV SUR
Strategies策略
Datalink, SID/STAR, PBCS
Strategies策略
各国实施计划
National Air Navigation Plan
各国实施计划
National Air Navigation Plan Template

4

目标导向如何实现逻辑闭环？

Logic closed-loop in goal-oriented

20

目标导向中的逻辑闭环
Logic closed-loop in goal-oriented

全球

全球空中航行计划
全球空中安全计划

全球报告

地区

北京宣言+
亚太地区无缝
空中导航服务计划

地区实施监控

差距
分析

行动
计划

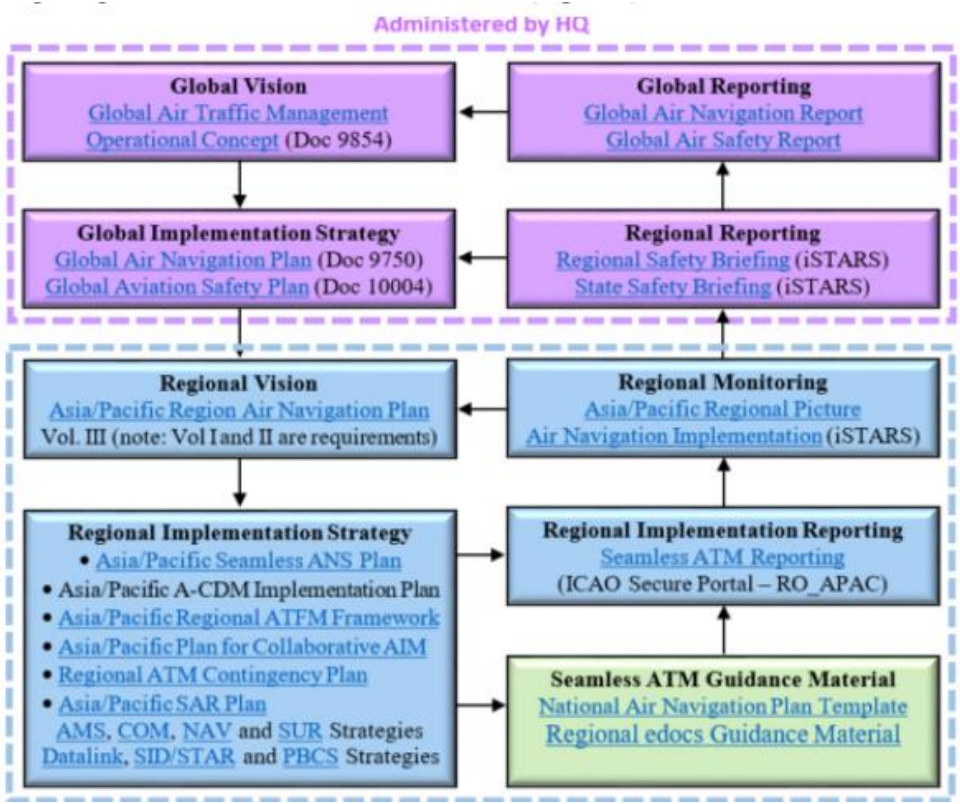
国家

国家实施空中交通管理

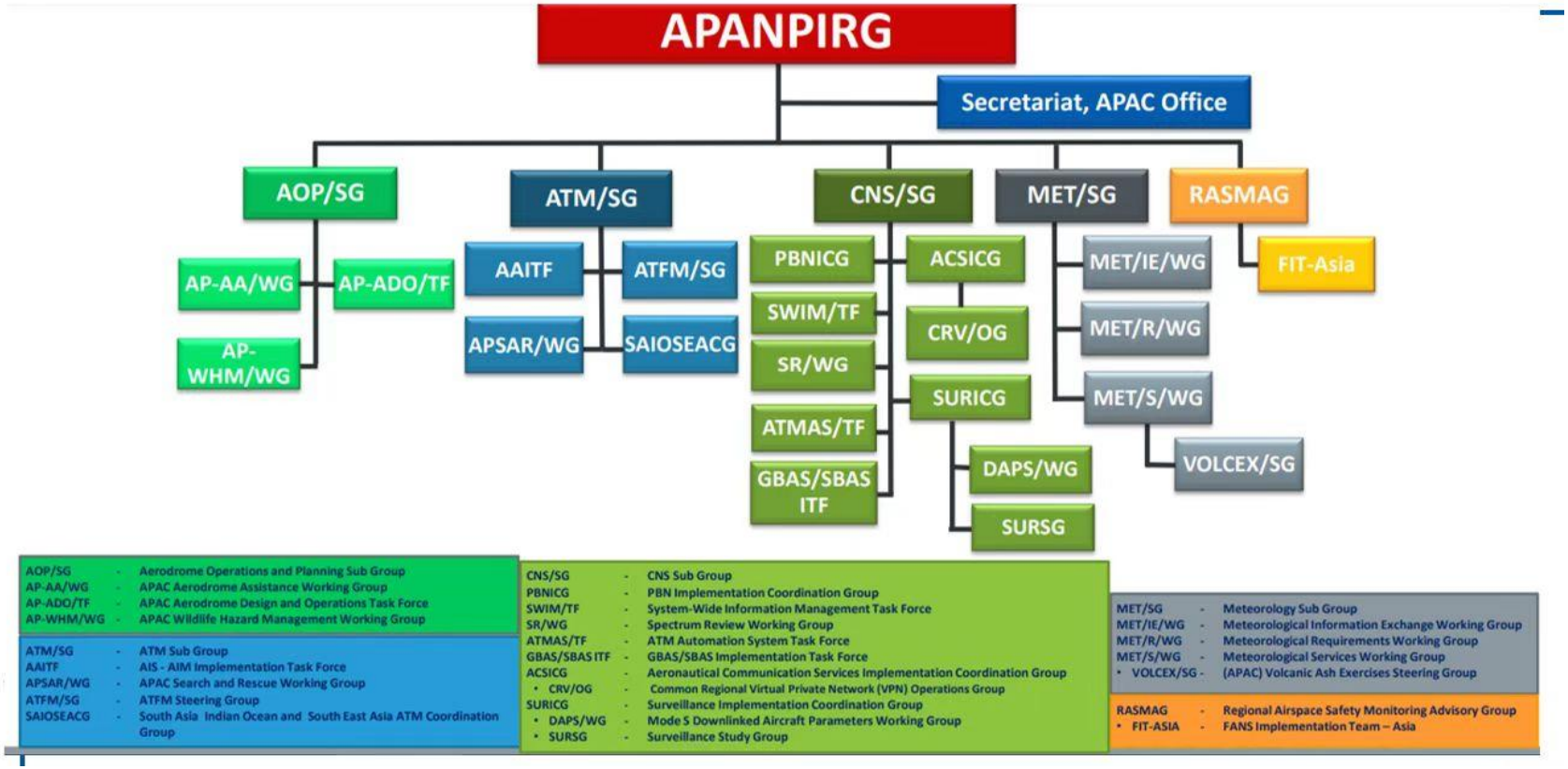
ICAO INNOVATION

各目标间的协同、互补机制

Collaboration and complementarity mechanisms among various objectives



亚太航行规划和实施地区小组 APANPIRG

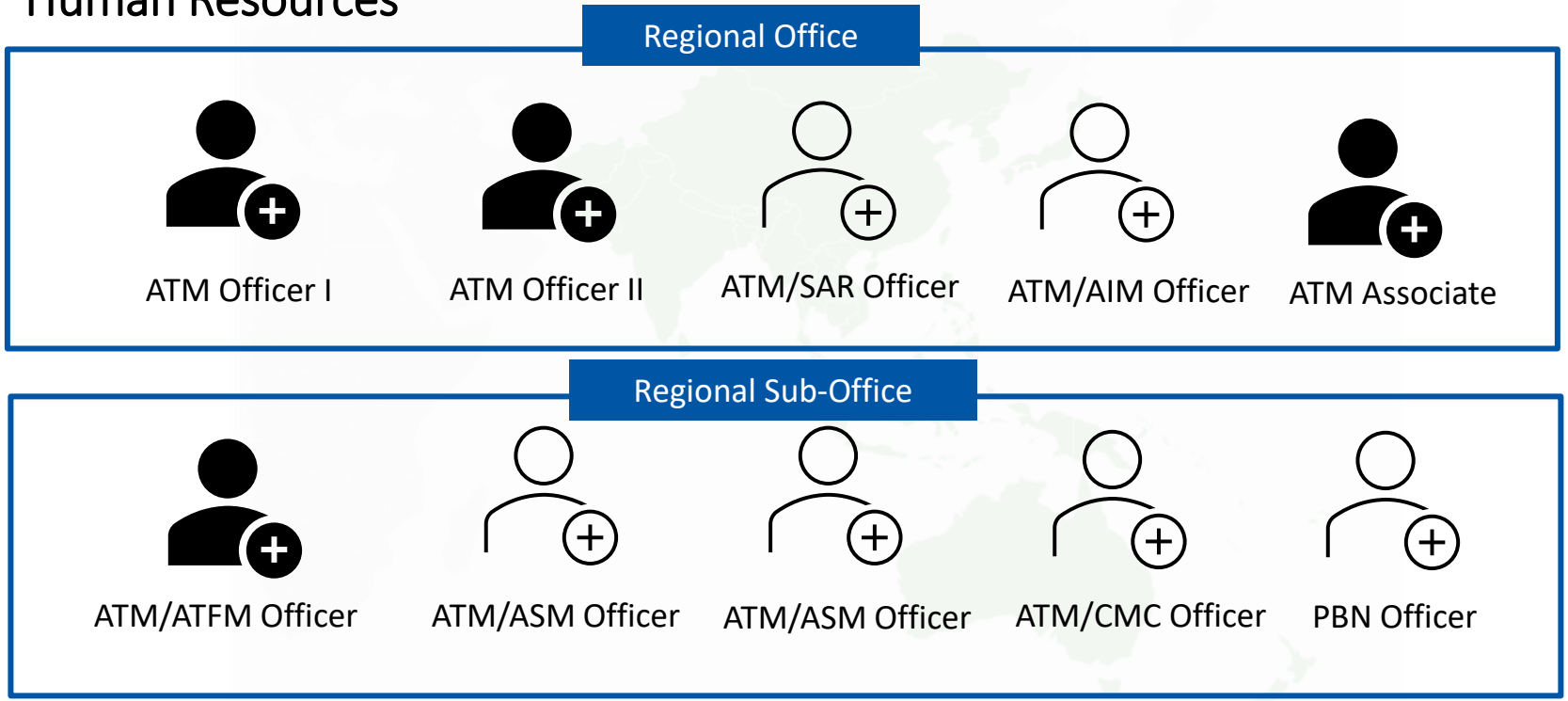


5

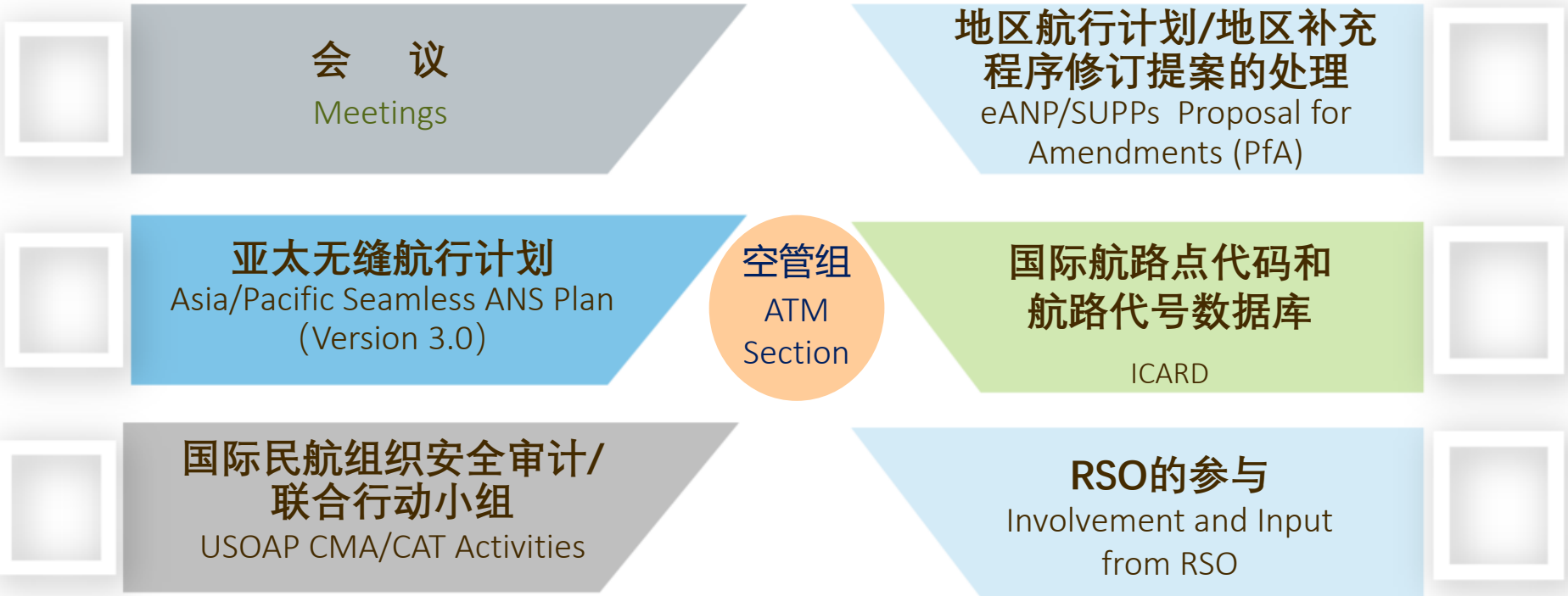
ATM工作组应当如何对接方案并认领任务？

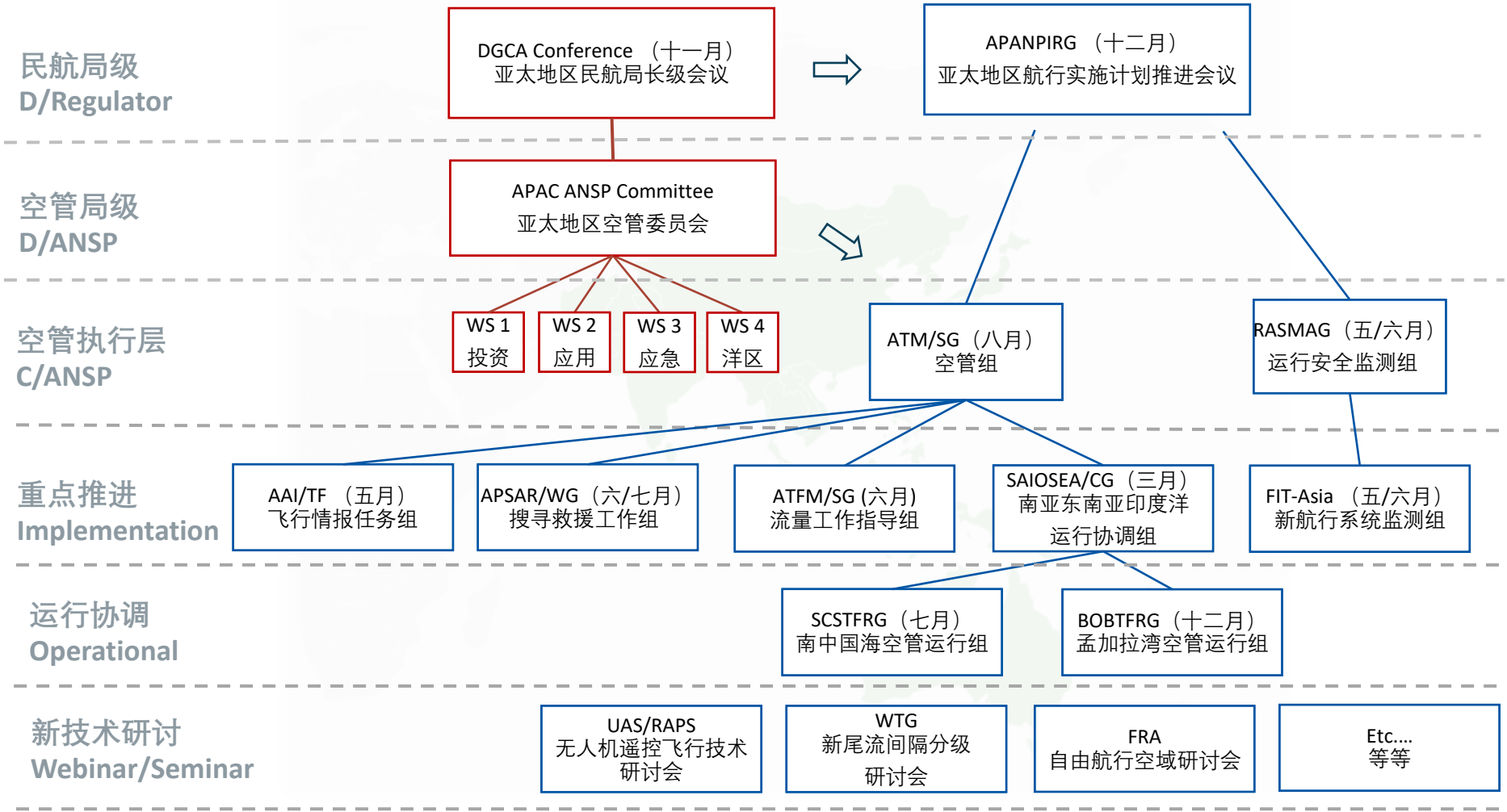
How should the ATM Section interface with the strategies and claim tasks?

空管组岗位设置
Human Resources



亚太办空管组主要工作 Related Works of ATM Section, APAC




民航局级
D/Regulator
空管局级
D/ANSP
空管执行层
C/ANSP
重点推进
Implementation
运行协调
Operational
新技术研讨
Webinar/Seminar
DGCA Conference （十一月）
亚太地区民航局长级会议
APANPIRG （十二月）
亚太地区航行实施计划推进会议
APAC ANSP Committee
亚太地区空管委员会
WS 1
投资
WS 2
应用
WS 3
应急
WS 4
洋区
ATM/SG（八月）
空管组
RASMAG（五/六月）
运行安全监测组
AAI/TF （五月）
飞行情报任务组
APSAR/WG（六/七月）
搜寻救援工作组
ATFM/SG (六月)
流量工作指导组
SAIOSEA/CG（三月）
南亚东南亚印度洋
运行协调组
FIT-Asia （五/六月）
新航行系统监测组
SCSTFRG（七月）
南中国海空管运行组
BOBTFRG（十二月）
孟加拉湾空管运行组
UAS/RAPS
无人机遥控飞行技术
研讨会
WTG
新尾流间隔分级
研讨会
FRA
自由航行空域研讨会
Etc....
等等

空管运行会议/研讨会议

中层级会议

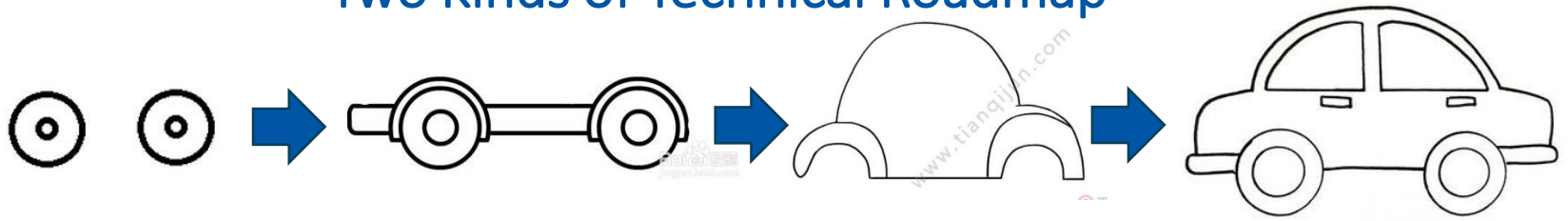
高级别会议

6

如何搭建技术框架？

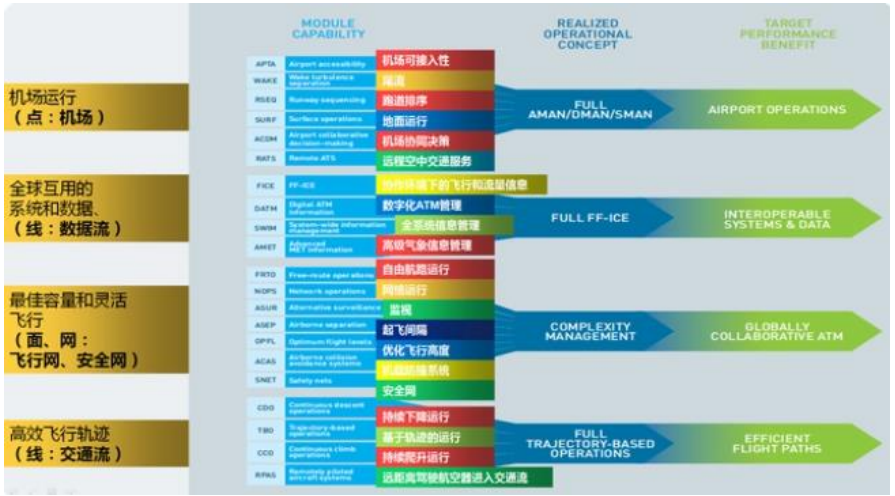
Technical Framework

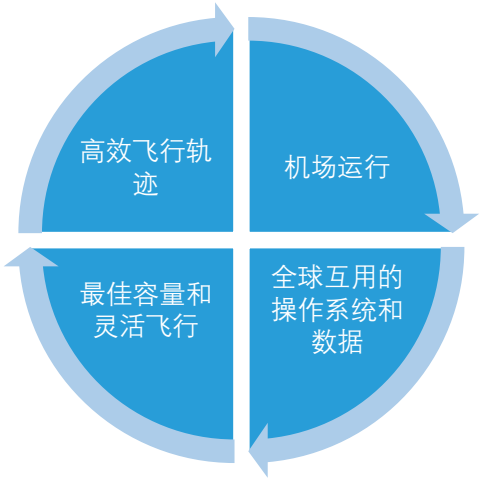
两种技术框架?
Two Kinds of Technical Roadmap



INNOVATION

技术路线图Technical Roadmap
ASBU |航空系统组块升级





INNOVATION

Technology Roadmap | 技术路线图
Priority—优先级排序

Priority 1 — 亟须部署

- critical upgrade assignment based on whether the implementation of an element could bring most benefit to the region or regional upgrade by States and is essential to achieve the service level required globally;

Priority 2 — 尽快推进

- recommended upgrade for those elements which would bring benefits to the region and generally to be implemented from 2022, but States are encouraged to implement earlier if beneficial; and

Priority 3 — 鼓励发展

- assigned to those elements which may not be universally implemented in the Asia/Pacific Region.

7

基于什么样的规则框架？

Rules to follow

Regulation Framework 国际民航组织规章框架

芝加哥公约 Convention

- 国际航空法规 Basic International Aviation Legislation
- 签约国批准后需要遵守 Approved by **Contacting States**

公约附件 Annex to Con.

- 标准和建议措施 Standards and Recommended Practices
- 应纳入各国内的民航规章 Included in Domestic **Regulation**

航行服务程序 PANS

- **Complement to SARPs**对标准和建议措施的补充及细化
- **Worldwide application**全球推荐的航行服务运行程序

文件及通告 Doc./Cir.

- 专项运行手册 Manual
- 技术指导材料 Technical Guidance

芝加哥公约 – 主权
Chicago convention – Sovereignty

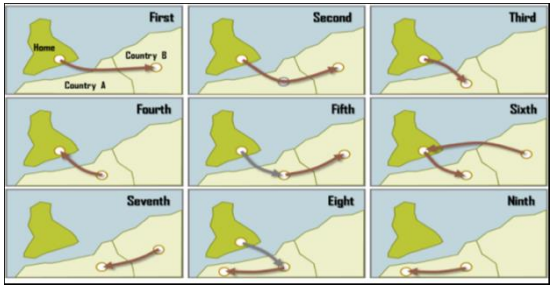
条款1　*“Article 1”*

缔约国承认每个国家对其领土上空的领空享有完全和唯一的主权。

The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.

国家间航空服务协定
Air Service Agreement
between States

自由航行权Freedoms of the air



芝加哥公约 – 标准和建议措施
Chicago convention - SARPs

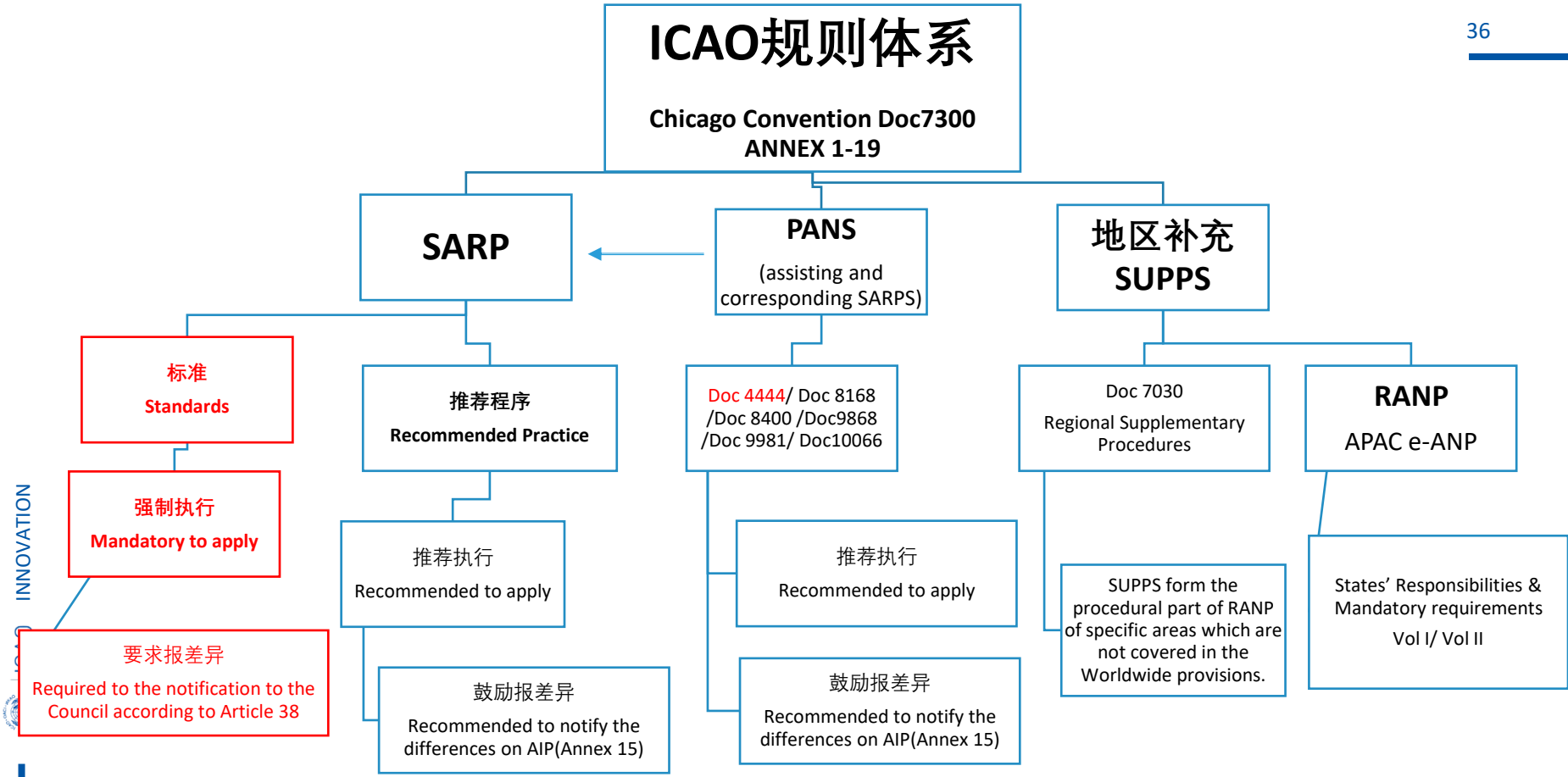
条款38 *“Article 38”*

任何国家如认为对任何上述国际标准和程序，不能在一切方面遵行，或在任何国际标准和程序修改后，不能使其本国的规章和措施完全符合此项国际标准和程序，或该国认为有必要采用在某方面不同于国际标准所规定的规章和措施时，应立即将其本国的措施和国际标准所规定的措施之间的差别，通知国际民用航空组织

Any State which finds it impracticable to comply in all respects with any such international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, shall give immediate notification to the International Civil Aviation Organization of the differences between its own practice and that established by the international standard. …

ICAO规则体系

Chicago Convention Doc7300
ANNEX 1-19



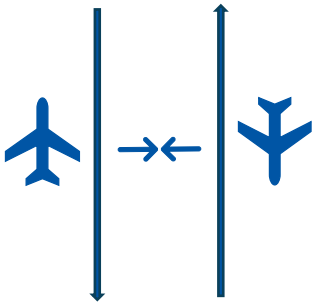
8

在空域管理方面，具体开展哪些工作？

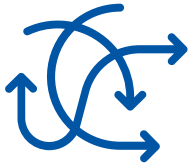
In Airspace Management, how does ATM Section perform the duty?

空域优化
Airspace Optimization

缩小调配和移交间隔
Reduce inbound and transfer Separation



缩小航路间隔
Reduce Lateral Separation



优化空中立交桥
Optimization FLAS/FLOS

开辟新航路
Development New Routes

优化航路运行过程
Performance Improvement

优化管制协调和军民合作
Cooperation and Coordination Improvement

1. 缩小调配和移交间隔
Reduce inbound and transfer Separation

Category R

偏远空域（区域）

Acceptable standard:

≤ 50 NM

Category T

高密度空域（终端）

Acceptable standard:

≤ 5 NM

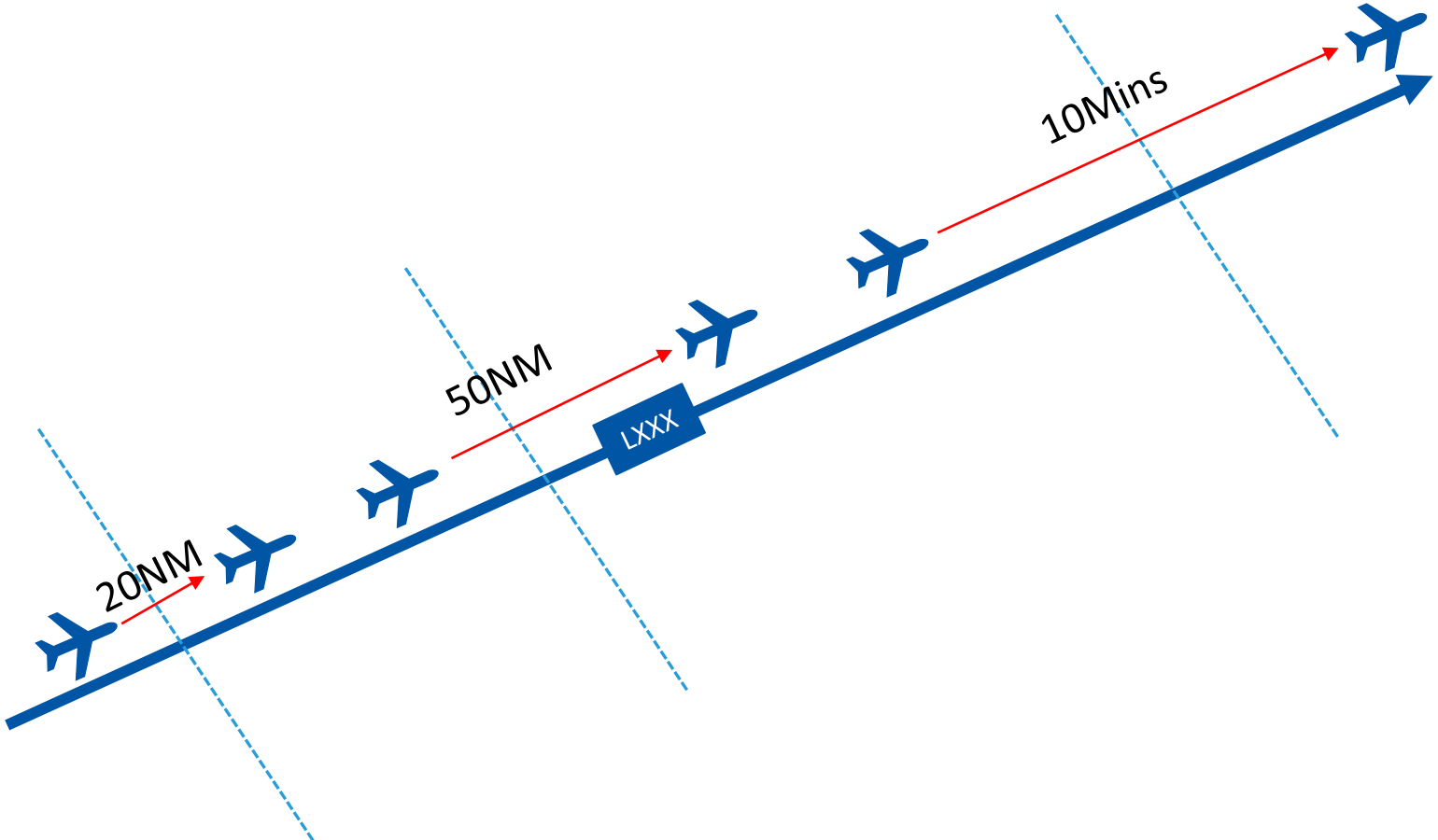
Category S

监视空域（区域）

Acceptable standard:

En-route ≤ 10 NM

亚太现状——同一条航路使用不同移交间隔
Different Transfer Separations being applied on a Route



2. 缩小航路间隔，优化空域容量
Reduce lateral Separation, enhance airspace capacity

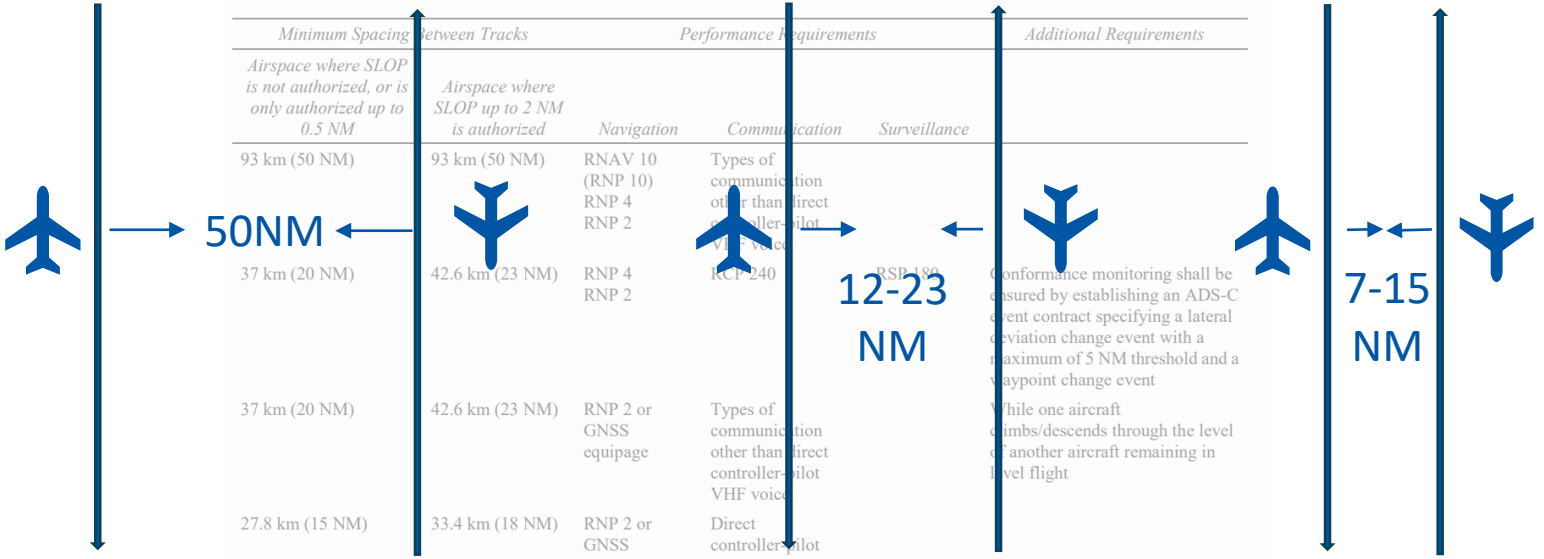
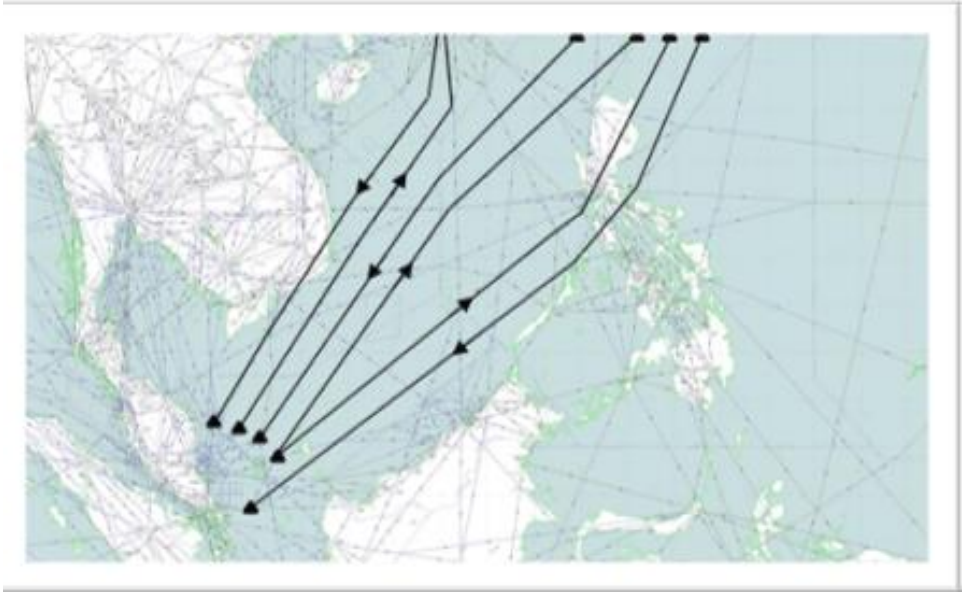


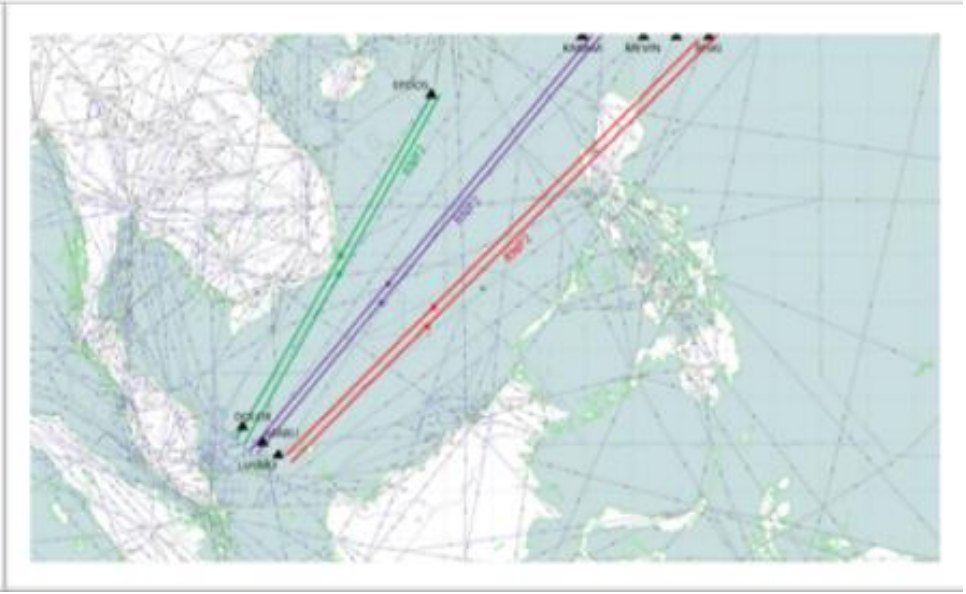
Table 5-2. Lateral separation of aircraft on parallel or non-intersecting tracks or ATS routes

Minimum Spacing Between Tracks		Performance Requirements			Additional Requirements
Airspace where SLOP is not authorized, or is only authorized up to 0.5 NM	Airspace where SLOP up to 2 NM is authorized	Navigation	Communication	Surveillance	
93 km (50 NM)	93 km (50 NM)	RNAV 10 (RNP 10) RNP 4 RNP 2	Types of communication other than direct controller-pilot VHF voice		
37 km (20 NM)	42.6 km (23 NM)	RNP 4 RNP 2	RCP 240	RSP 180	Conformance monitoring shall be ensured by establishing an ADS-C event contract specifying a lateral deviation change event with a maximum of 5 NM threshold and a waypoint change event
37 km (20 NM)	42.6 km (23 NM)	RNP 2 or GNSS equipage	Types of communication other than direct controller-pilot VHF voice		While one aircraft climbs/descends through the level of another aircraft remaining in level flight
27.8 km (15 NM)	33.4 km (18 NM)	RNP 2 or GNSS equipage	Direct controller-pilot VHF voice communications		
16.7 km (9 NM)	22.3 km (12 NM)	RNP 4 RNP 2	RCP 240	RSP 180	While one aircraft climbs/descends through the level of another aircraft remaining in level flight
13 km (7 NM)	19 km (10 NM)	RNP 2 or GNSS equipage	Direct controller-pilot VHF voice communications		While one aircraft climbs/descends through the level of another aircraft remaining in level flight

ICAO INNOVATION

缩小航路间隔，优化空域容量
Reduce lateral Separation, enhance airspace capacity





PANS ATM对于平行航路间隔的要求
Doc 4444 PBN / PBCS Requirement on Lateral Separation

空管需求
ANSP Demands

空域用户利益
Air Space User benefits

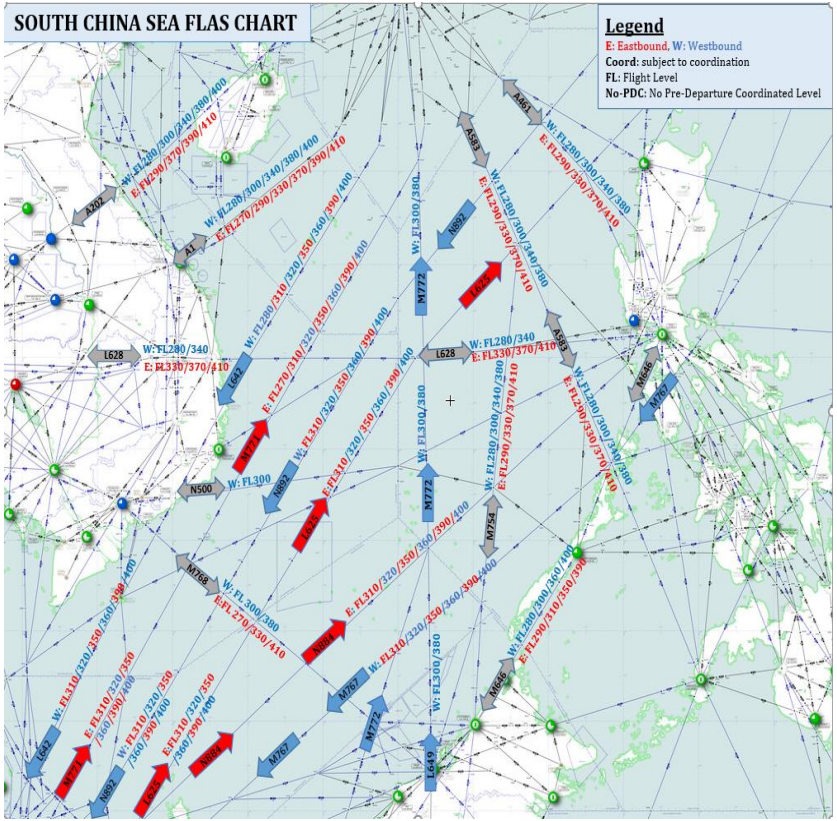
是否制定空域强制要求?
Mandate?

空管通导监设备
ANSP
CNS Infrastructure

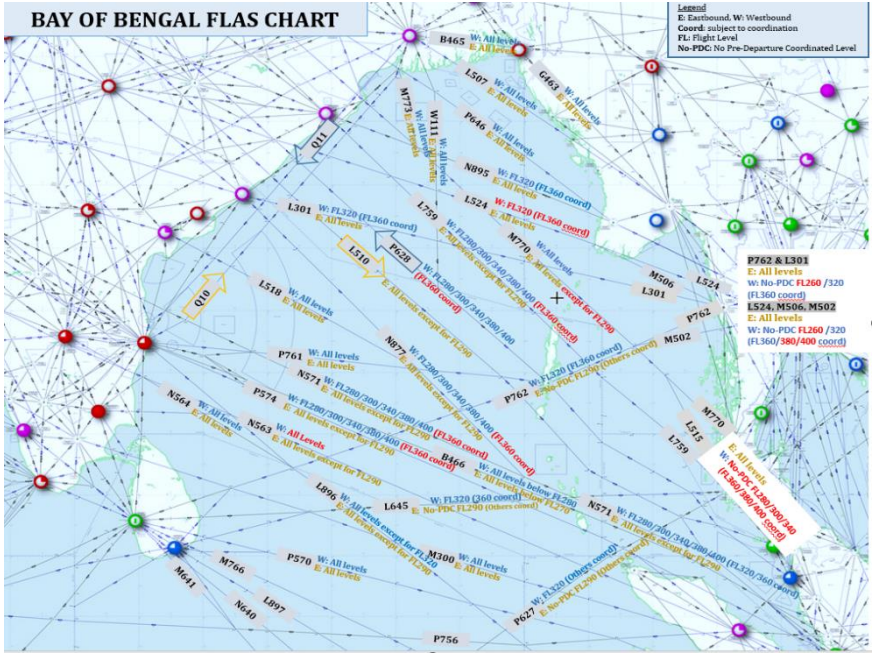
机载设备
Fleet Equipage

优化空中立交桥高度层配置
Optimization FLAS/FLOS

3. 优化空中立交桥高度层配置
Optimization FLAS/FLOS



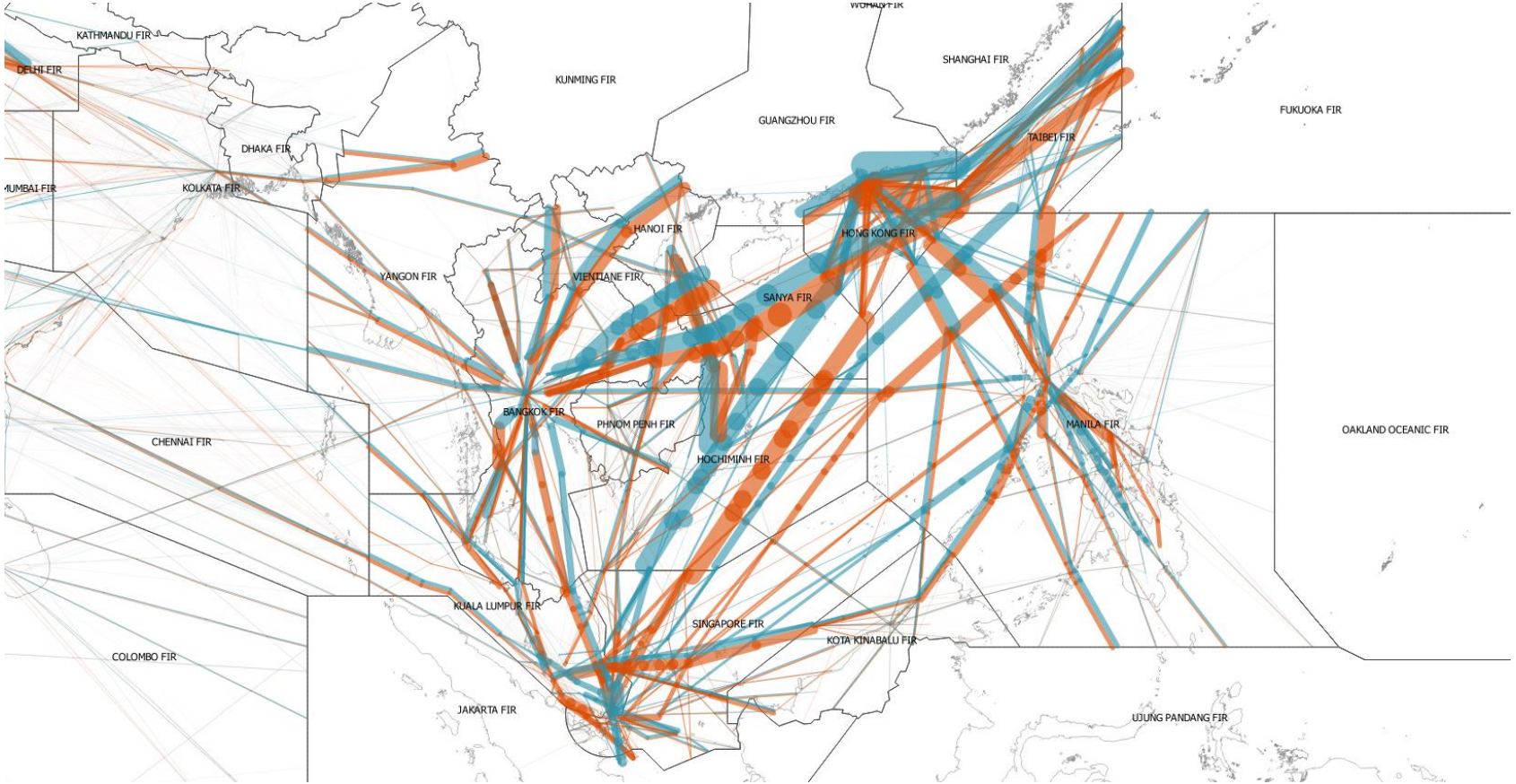
南中国海区域航路高度层分配(FLAS)图



孟加拉湾区域航路高度层分配(FLAS)图

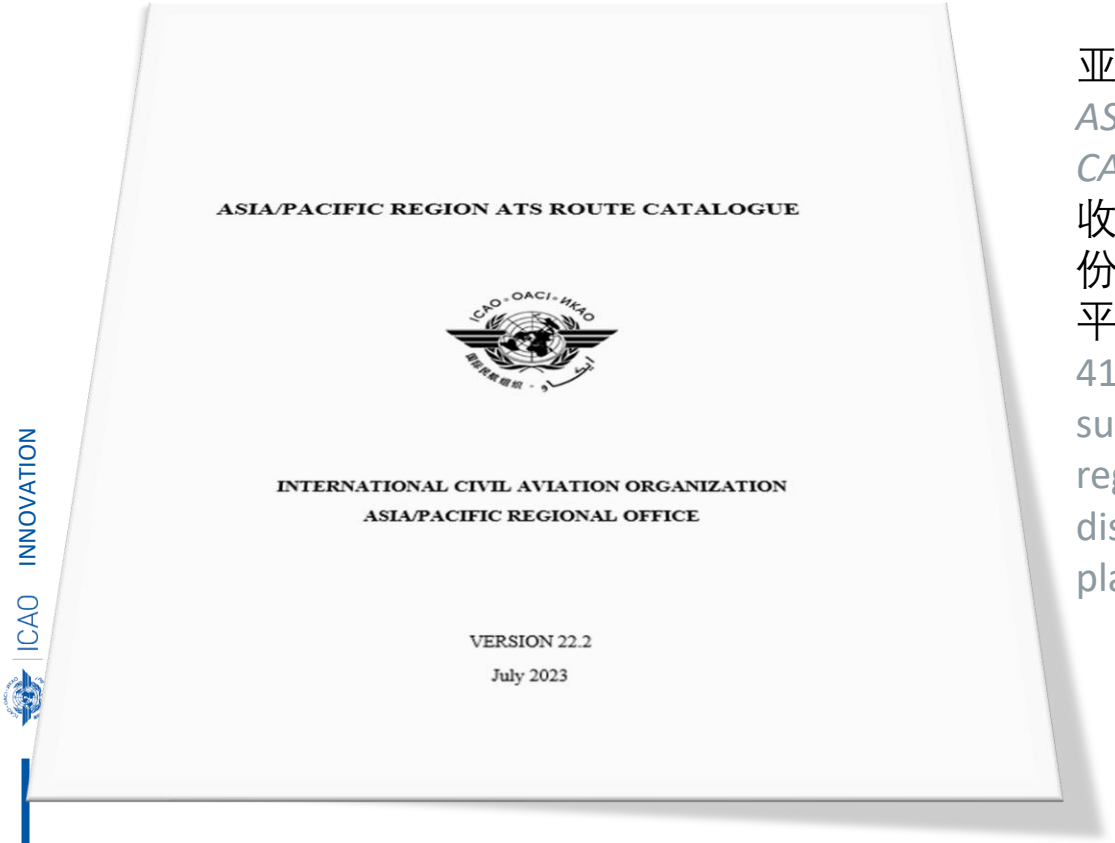
ICAO INNOVATION

3. 优化空中立交桥高度层配置
Optimization FLAS/FLOS



ICAO INNOVATION

4. 开辟新航路
Development New Routes


ASIA/PACIFIC REGION ATS ROUTE CATALOGUE

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA/PACIFIC REGIONAL OFFICE

VERSION 22.2

July 2023

亚太地区航路发展目录

ASIA/PACIFIC REGION ATS ROUTE CATALOGUE

收录了亚太地区各国以及IATA提交的41份计划新开航路方案，在ICAO各会议平台上讨论。

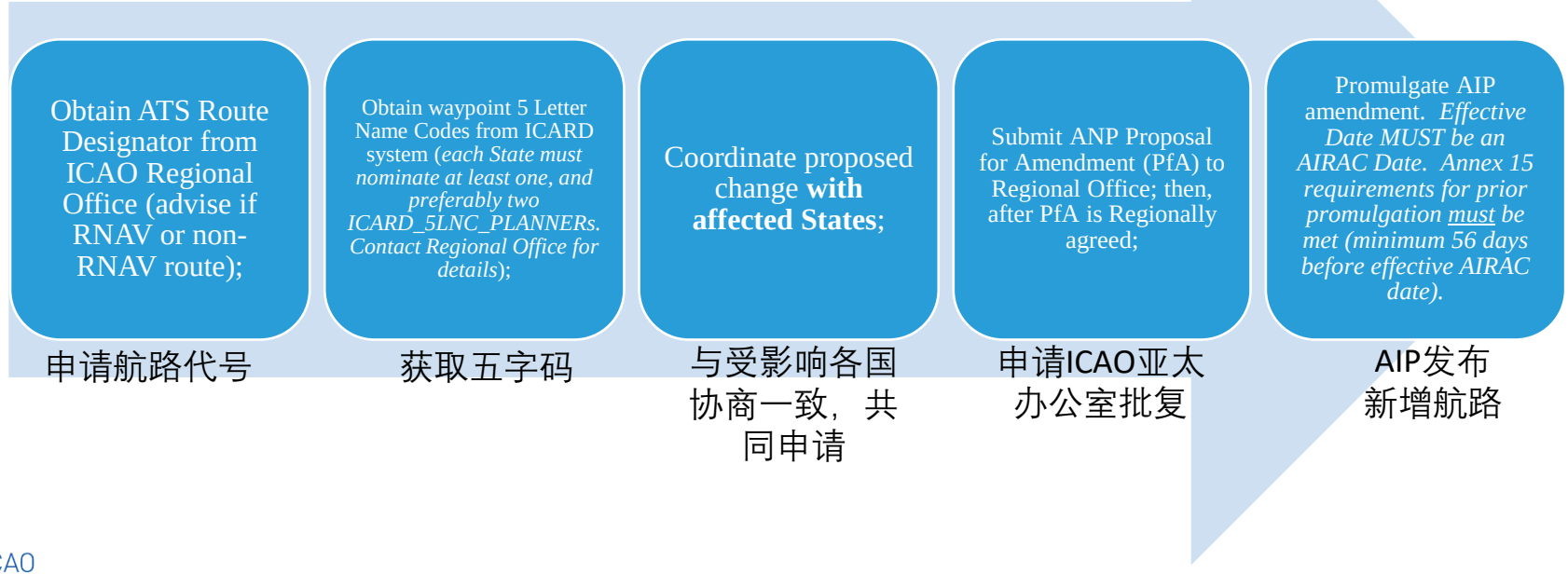
41 planned new route proposals submitted by countries in the Asia Pacific region and IATA were included and discussed on various conference platforms of ICAO.

建立新国际航路流程

What is the PfA process of establishing a cross-border ATS route?

APAC AIR NAVIGATION PLAN (ANP) (icao.int)

PfA template and guidance is also available on this link.



5. 优化航路运行过程
Performance Improvement

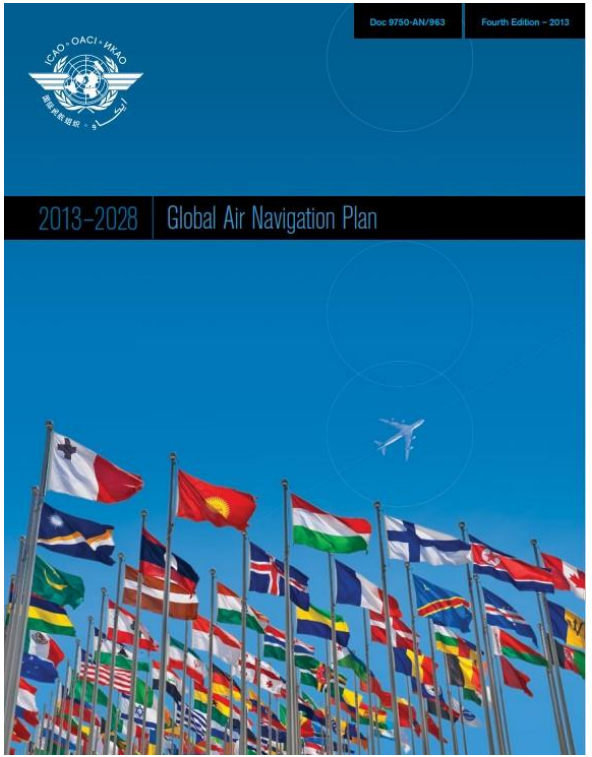
优选方案
Performance Improvement Options

- SID and CCO
- reduced divergence departure procedures
- Reduced longitudinal and lateral separations in the oceanic and remote areas
- User Preferred Routes and Free Route Airspace
- STAR and CDO
- PBN instrument approaches
- parallel approach procedures
- Enhanced wake turbulence separation minima

自由航行空域
Free Route Airspace

- 使空域用户能够飞行最优轨迹
- Enabling airspace users to fly their preferred trajectories
  - ➢ 推动自由航行空域Free Route Airspace (FRA)理念落地

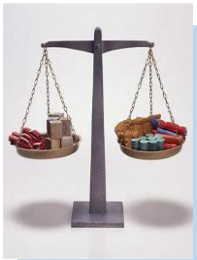
- 利用自由航空域推动更多直飞
- Enhancing Direct Routings with FRA
  - ➢ 建立动态的、灵活的航路 The key is dynamic and flexible ATS route.



6. 优化军民合作
Cooperation and Coordination Improvement

Growing demand vs. Finite capacity

不断增长的需求与有限的空域容量,新的用户需求



Balance between Safety and Efficiency， bilateral needs

安全与效率之间的平衡,双方运行需求的平衡

State responsibility and obligation （state's targets , a member of ICAO)

国家责任和义务

Advanced facilities & equipment ;development of digital & information request reform CMAC

新技术，新装备，促使我们改变

Hence ---*enhance civil-military cooperation & coordination*

Thank You

ICAO | INNOVATION