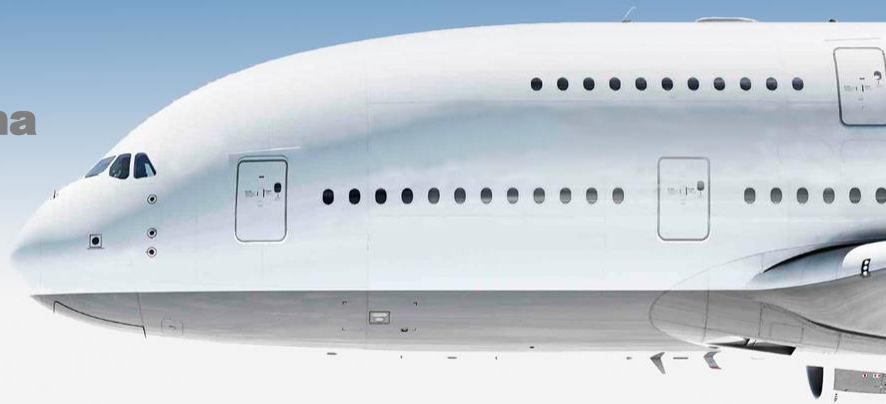
空中交通流量管理

Air Traffic Flow Management

《ICAO 在中国》研讨会/ICAO Webinar for China

Beijing, 26-28 January 2021



李文新/RSO前任流量管理官员

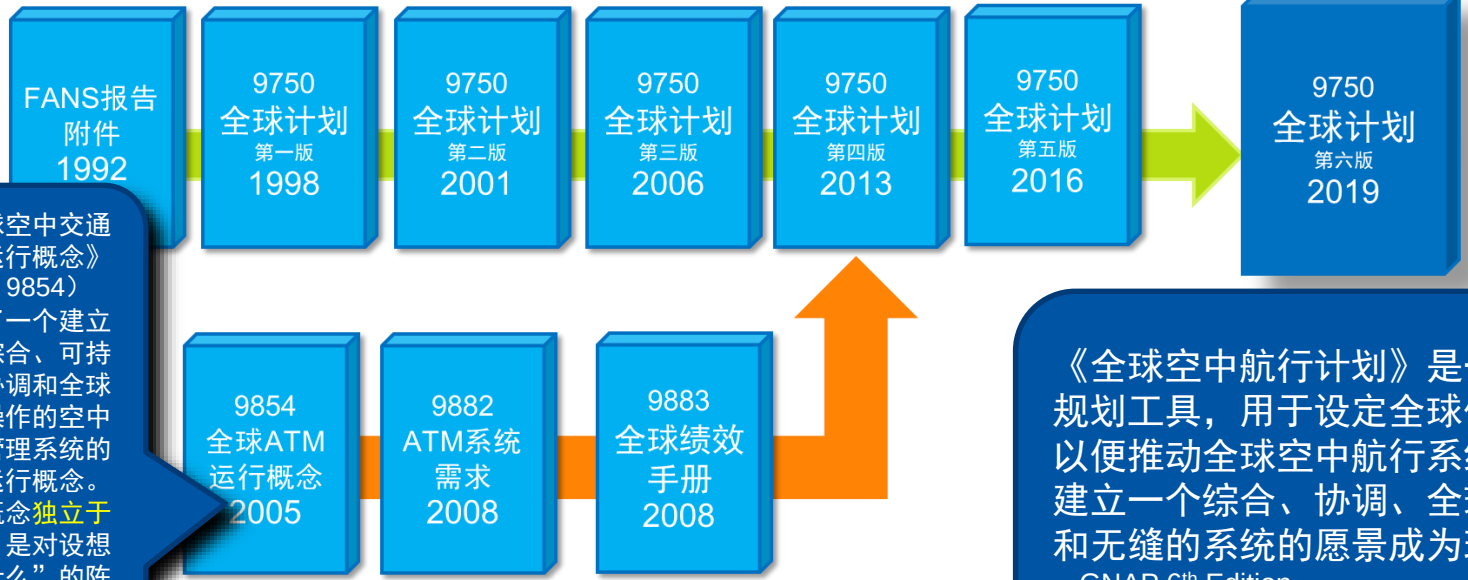
Mr. LI Wenxin/Former RSO ATFM Officer

内容 Agenda

- 空中交通管理中的ATFM
  ATFM in ATM CONOPS
- ATFM/CDM 概要
  ATFM/CDM Basics
- 在全球及地区实施ATFM/CDM
  Global/Regional ATFM Implementation
- 亚太区 ATFM/CDM项目
  ATFM Projects in APAC
- 结语
  Conclusion

空中交通管理中的ATFM
ATFM IN ATM CONOPS

全球空中航行计划
Global Air Navigation Plan



《全球空中交通管理运行概念》（Doc 9854）提出了一个建立一个综合、可持续、协调和全球可互操作的空中交通管理系统的共同运行概念。运行概念独立于技术，是对设想的“什么”的陈述。

《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。
-- GNAP 6th Edition

ICAO GANP PORTAL

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Global Strategic | Global Technical | Regional | National | Login

WELCOME TO THE GLOBAL AIR NAVIGATION PLAN PORTAL

The GANP Portal is a web portal where all aviation stakeholders will be able to find the most relevant information related to the GANP

THE GLOBAL AIR NAVIGATION PLAN

The Global Air Navigation Plan (Doc 9750) is the ICAO's highest air navigation strategic document and the plan to drive the evolution of the global air navigation system, in line with the Global Air Traffic Management Operational Concept (GATMOC, Doc 9854) and the Manual on Air Traffic Management System Requirements (Doc 9882). It also supports planning for local and regional implementation.

In order to better communicate with technical and high-level managers and to not leave any State or stakeholder behind, a multilayer structure, tailored for the various audiences, is proposed for the sixth edition of the GANP. This multilayer structure of four layers; two global levels, a regional level and a national one, would also provide a framework for alignment of regional, sub-regional and national plans.

MULTILAYER STRUCTURE OF THE GANP

Click a level to navigate

GLOBAL STRATEGIC

GLOBAL TECHNICAL

REGIONAL

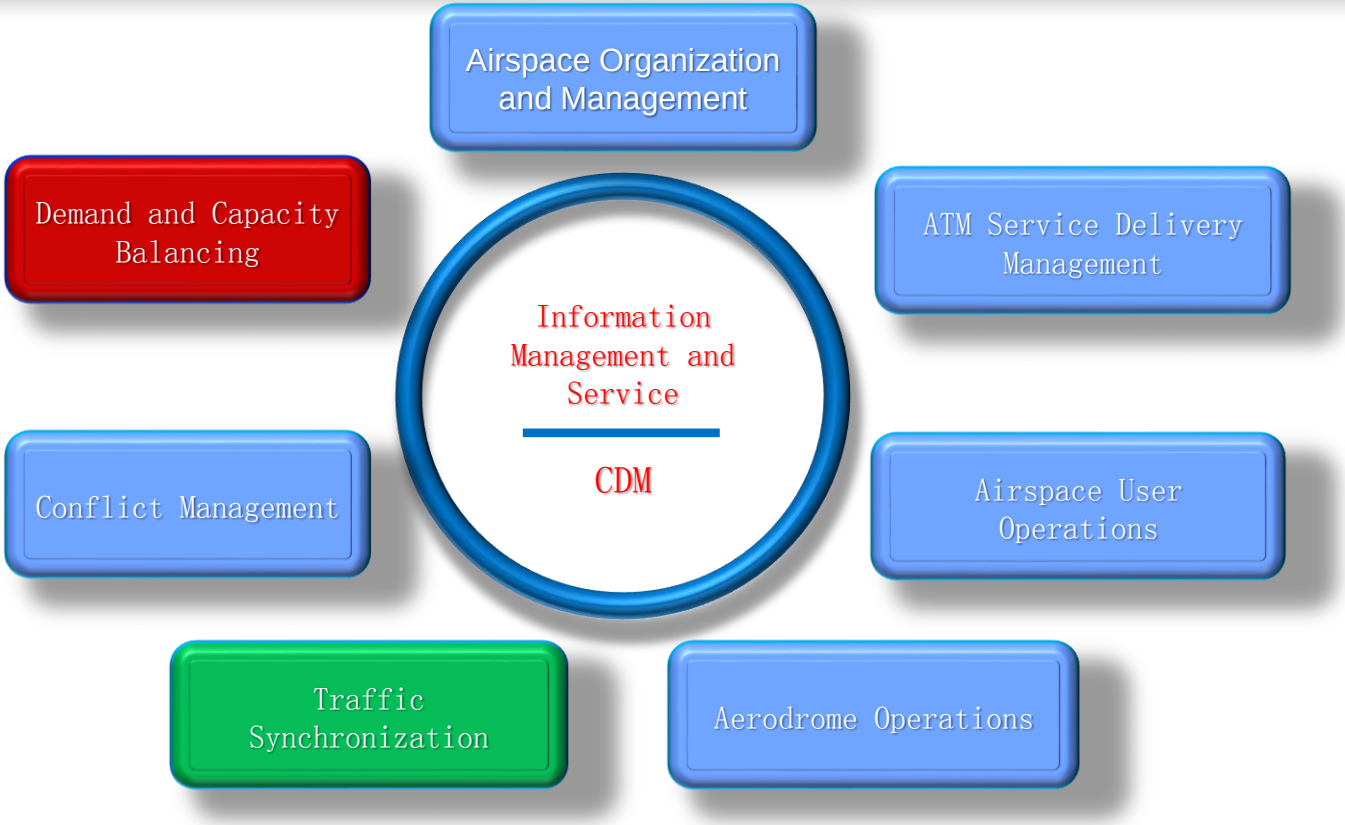
NATIONAL

The GANP drives the evolution of the global air navigation system to meet the ever growing expectations of the aviation community. The purpose of the GANP is to equitably accommodate all airspace users operations in a safe, secure and cost-effective manner while reducing the aviation environmental impact. To this end, the GANP provides a series of operational improvements to increase capacity, efficiency, predictability, flexibility while ensuring interoperability of systems and harmonization of procedures. The GASP supports the implementation of the GANP by promoting the effective implementation of safety oversight and a safety management approach to oversight, including safety risk management to permit innovation in a managed way.

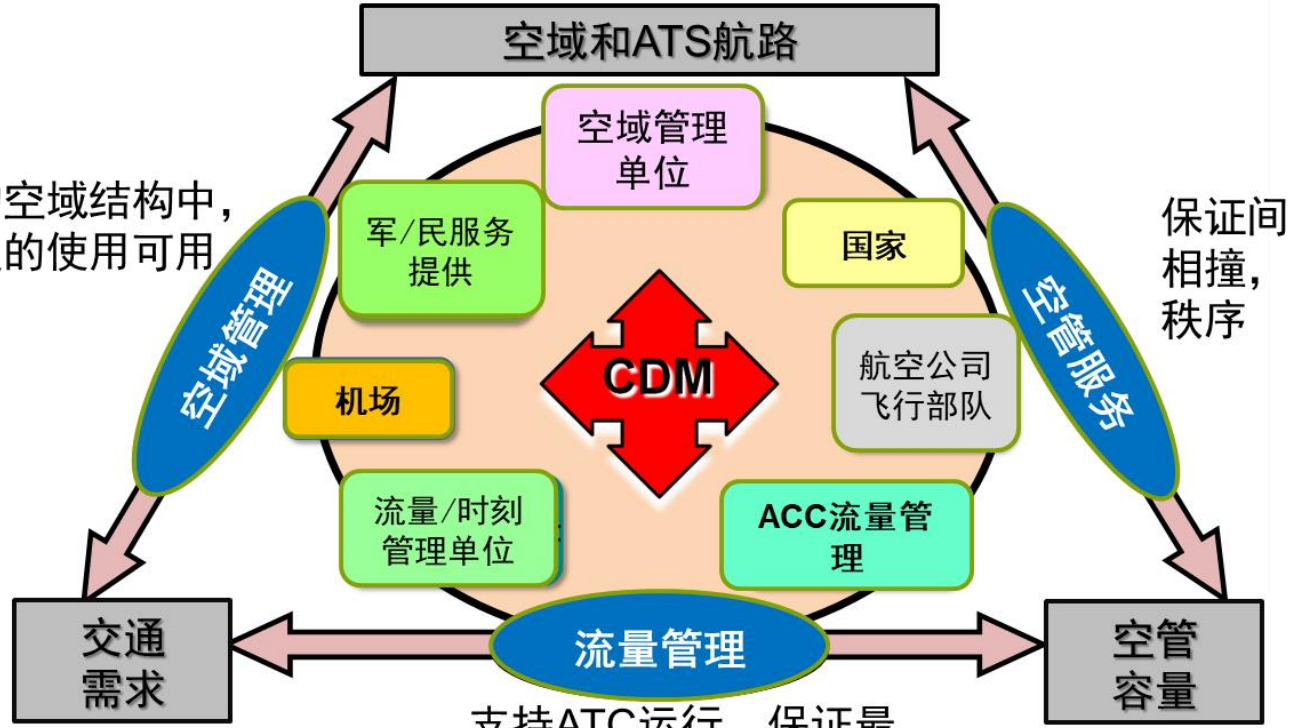
To access previous editions of the GANP, please click here.

全球空中交通管理运行概念
Global ATM CONOPS


空域组织与管理
需求与容量平衡
空管服务提供的管理
信息管理与服务
协同决策
冲突管理
空域用户运行
交通同步
机场运行

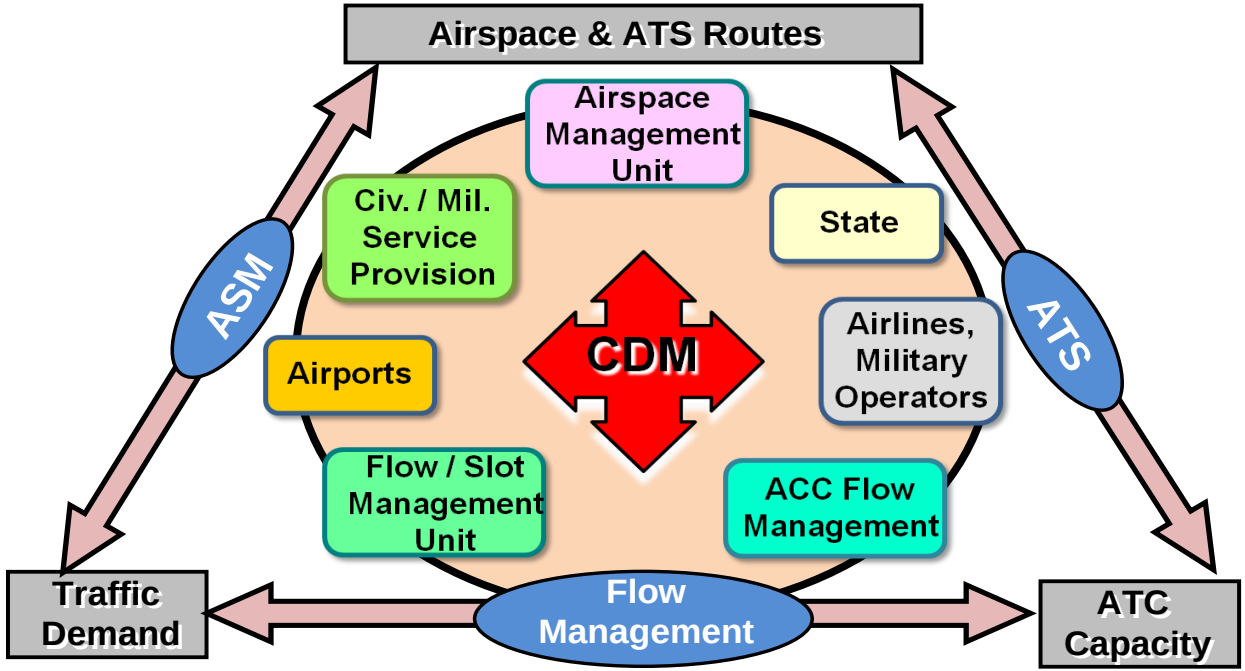

Airspace Organization and Management
Demand and Capacity Balancing
ATM Service Delivery Management
Information Management and Service
CDM
Conflict Management
Airspace User Operations
Traffic Synchronization
Aerodrome Operations

在给定的空域结构中，最大限度的使用可用空域

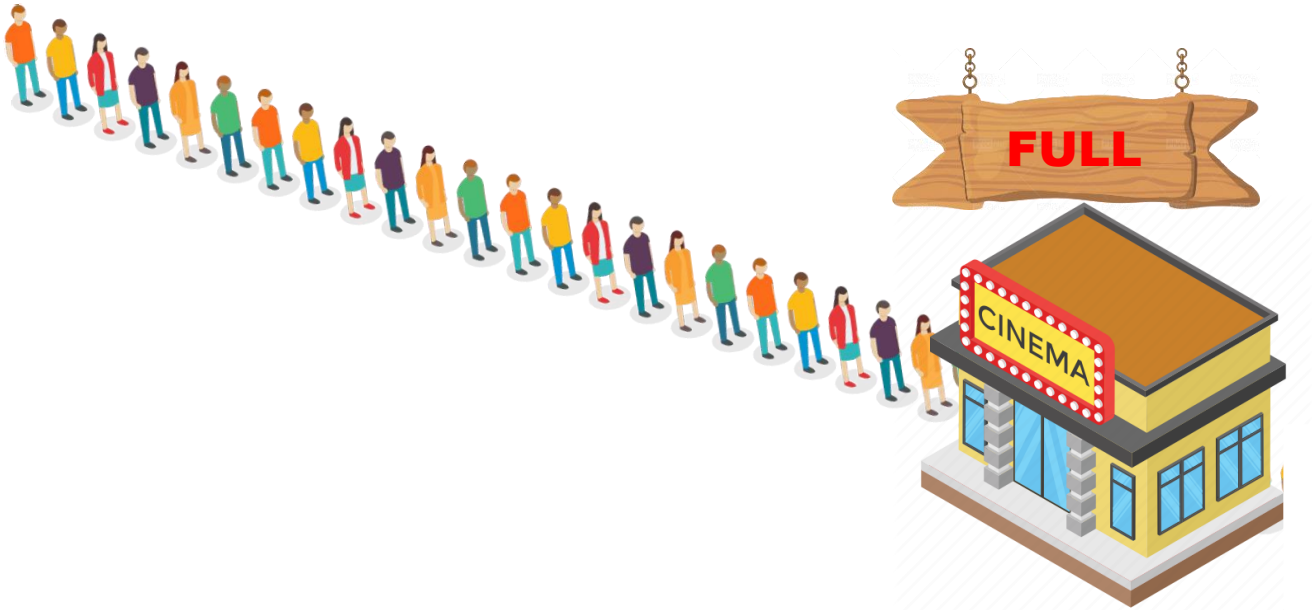


保证间隔，避免相撞，保证空中秩序

支持ATC运行，保证最佳的空中交通流。万不得已时采取限流措施


Airspace & ATS Routes
Airspace Management Unit
Civ. / Mil. Service Provision
State
ASM
ATS
CDM
Airports
Airlines, Military Operators
Flow / Slot Management Unit
ACC Flow Management
Traffic Demand
Flow Management
ATC Capacity

ATFM/CDM概要
ATFM/CDM BASICS


FULL
CINEMA


Seats
Available
CINEMA

ATFM Measures

Collaboration

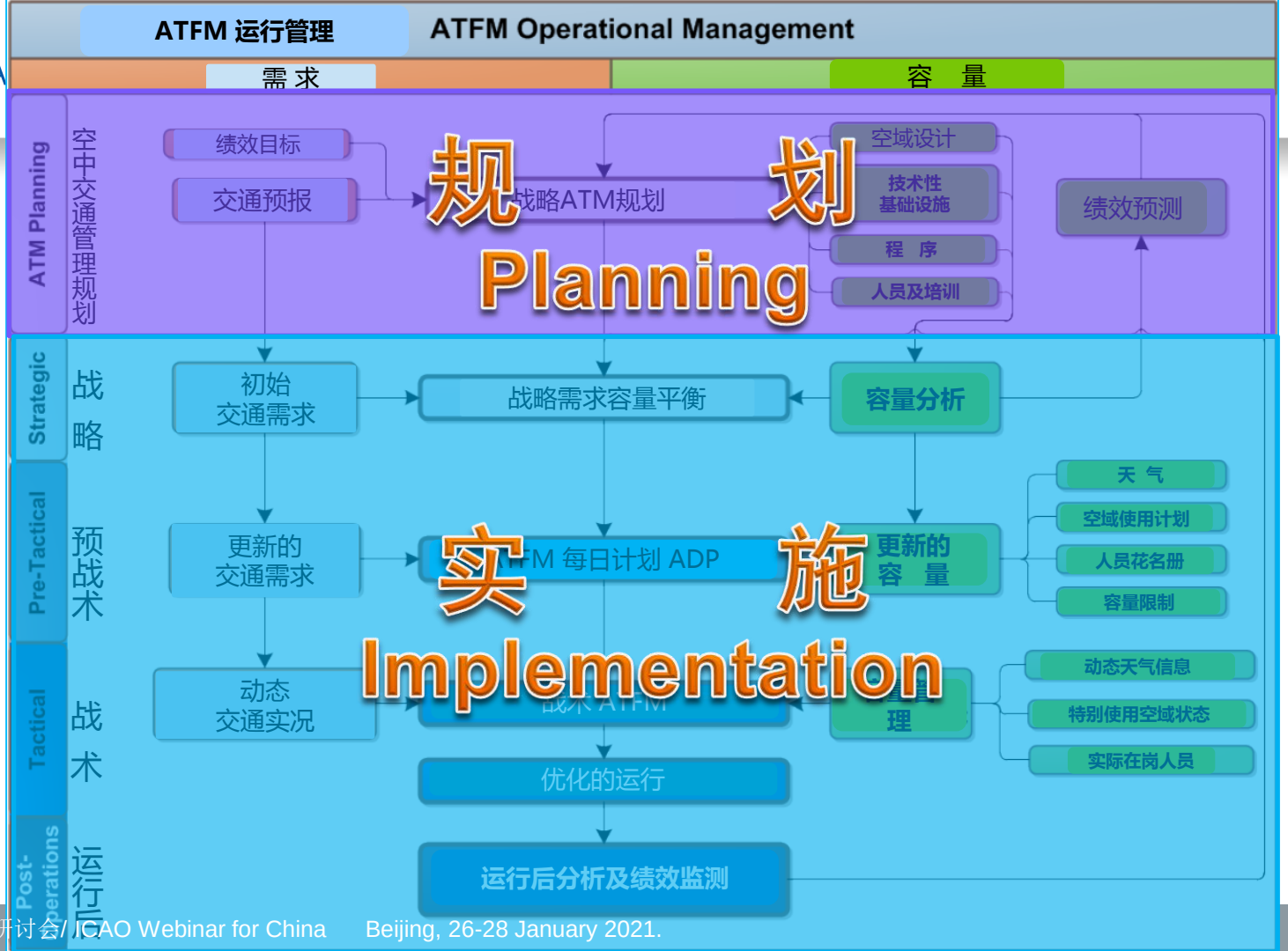
Post Ops Analysis

Table II-4-1. Summary of ATFM measures

ATFM measure	*Constraint*			*Control mechanism*	*Time frame*	*Requirements to be effective*
	Airport arrivals	*Airport departures*	*Airspace*			
GDP	X	X	X	CTOT	Pre-tactical and tactical	Participation in percentage and distance
Re-route			X	Flight path change to avoid constraint	Pre-tactical and tactical	Access to airspace and published routes
Ground stop	X			Prevent departures from specific aerodromes to address existing tactical load on an arrival aerodrome	Tactical	
MIT/MINT	X		X	Time- or distance-based separation on a single stream of traffic	Tactical	
MDI	X		X	Time-based separation from departures from the same aerodrome	Tactical	
Fix balancing	X		X	Flight path change to avoid	Tactical	
Level capping			X	Flight path change to avoid	Tactical	

ATFM 措施 (§ 4.5.1, Doc.9971)

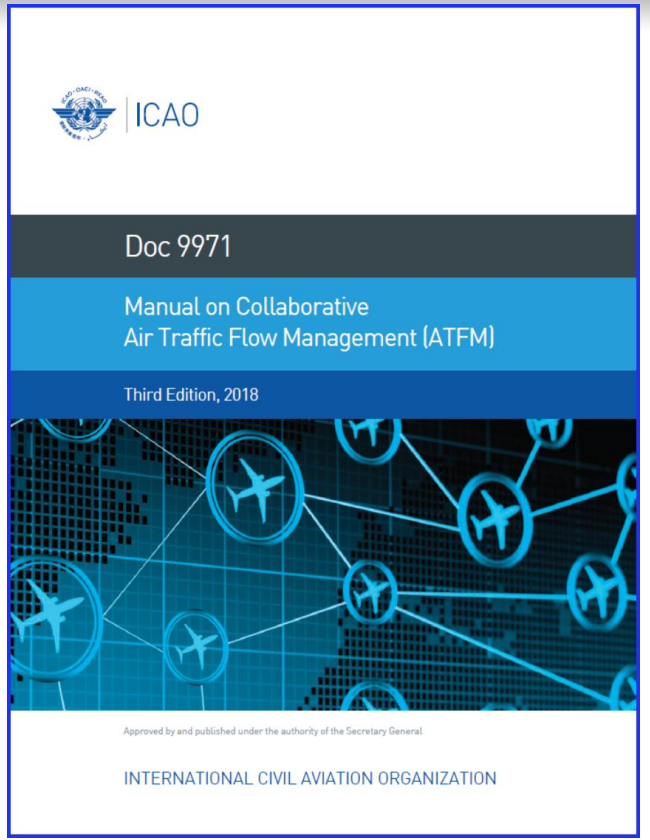
流量措施	限制			控制机制	时间域	生效要求
	到港	离港	空域			
GDP	✓	✓	✓	CTOT	预战术/战术	一定比例及一定距离的参与
Re-Route			✓	改变飞行路径以避免限制	预战术/战术	进入空域及公布航路
Ground Stop	✓			停止特定机场的起飞以解决到达机场已实施的“战术”超载	战术	
MIT/MINT	✓		✓	在单一交通流上的基于时间/距离的间隔	战术	
MDI	✓		✓	同一机场基于时间间隔的起飞	战术	
Fix Balancing	✓		✓	改变飞行路径以规避	战术	
Level Balancing			✓	改变飞行路径以规避	战术	


ATFM 运行管理
ATFM Operational Management
需 求
容 量
ATM Planning
空中交通管理规划
绩效目标
交通预报
战略ATM规划
空域设计
技术性基础设施
程 序
人员及培训
绩效预测
规 划
Planning
Strategic
战 略
初始交通需求
战略需求容量平衡
容量分析
Pre-Tactical
预战术
更新的交通需求
ATFM 每日计划 ADP
更新的容 量
天 气
空域使用计划
人员花名册
容量限制
实 施
Implementation
Tactical
战 术
动态交通实况
战术 ATFM
理
动态天气信息
特别使用空域状态
实际在岗人员
优化的运行
Post-Operations
运行后
运行后分析及绩效监测

协作式空中交通流量管理手册

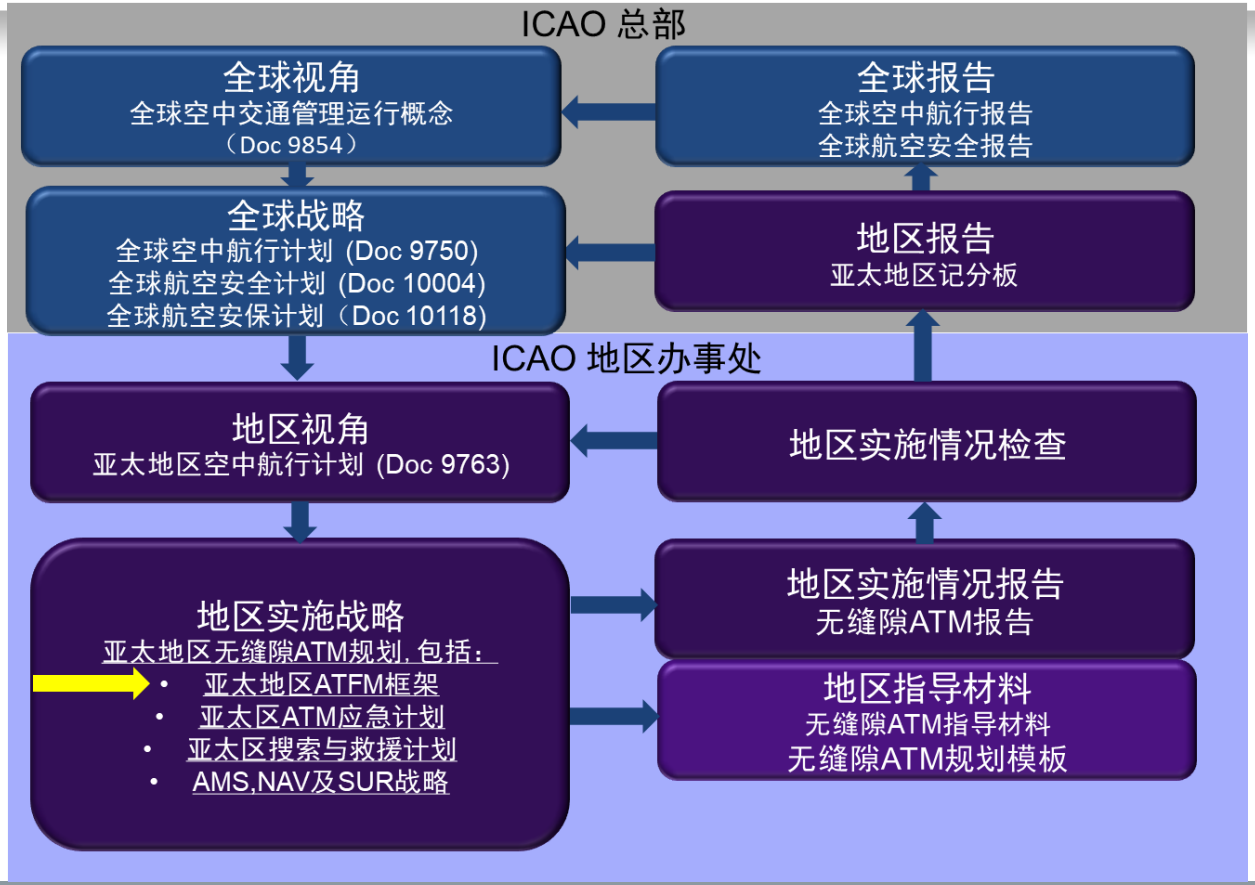
Doc. 9971
《协作式空中交通流量管理手册》
第三版 2018

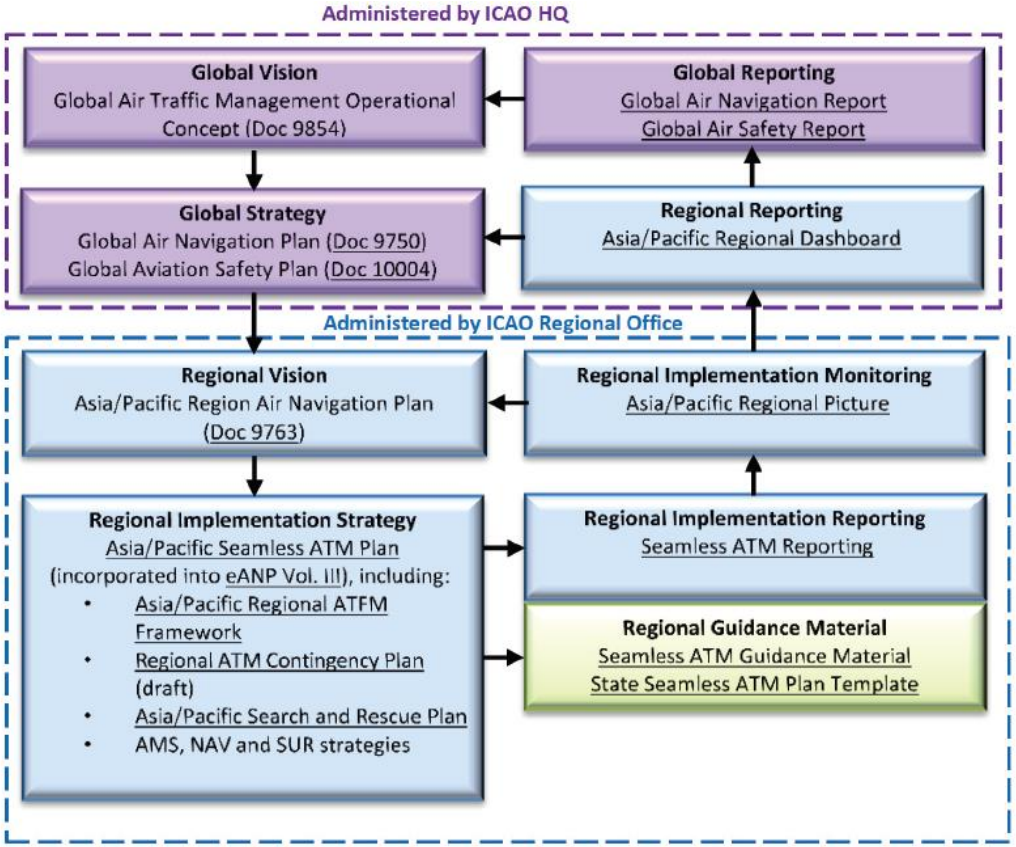
第一部分：CDM
第二部分：ATFM
第三部分：A-CDM



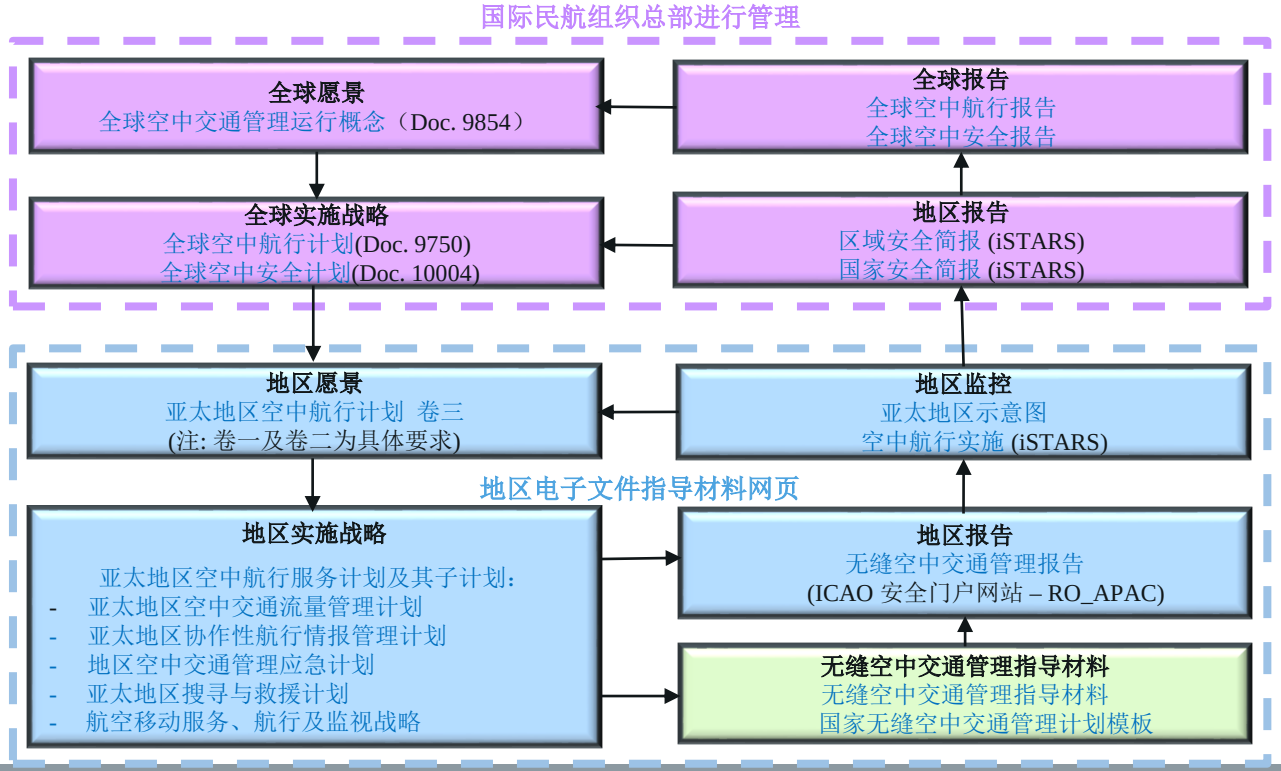
在全球及地区实施ATFM/CDM

GLOBAL AND REGIONAL ATFM/CDM IMPLEMENTATION


ICAO 总部
全球视角
全球空中交通管理运行概念
（Doc 9854）
全球报告
全球空中航行报告
全球航空安全报告
全球战略
全球空中航行计划 (Doc 9750)
全球航空安全计划 (Doc 10004)
全球航空安保计划（Doc 10118)
地区报告
亚太地区记分板
ICAO 地区办事处
地区视角
亚太地区空中航行计划 (Doc 9763)
地区实施情况检查
地区实施战略
亚太地区无缝隙ATM规划, 包括：
• 亚太地区ATFM框架
• 亚太区ATM应急计划
• 亚太区搜索与救援计划
• AMS,NAV及SUR战略
地区实施情况报告
无缝隙ATM报告
地区指导材料
无缝隙ATM指导材料
无缝隙ATM规划模板


Administered by ICAO HQ
Global Vision
Global Air Traffic Management Operational Concept (Doc 9854)
Global Reporting
Global Air Navigation Report
Global Air Safety Report
Global Strategy
Global Air Navigation Plan (Doc 9750)
Global Aviation Safety Plan (Doc 10004)
Regional Reporting
Asia/Pacific Regional Dashboard
Administered by ICAO Regional Office
Regional Vision
Asia/Pacific Region Air Navigation Plan (Doc 9763)
Regional Implementation Monitoring
Asia/Pacific Regional Picture
Regional Implementation Strategy
Asia/Pacific Seamless ATM Plan
(incorporated into eANP Vol. III), including:
• Asia/Pacific Regional ATFM Framework
• Regional ATM Contingency Plan (draft)
• Asia/Pacific Search and Rescue Plan
• AMS, NAV and SUR strategies
Regional Implementation Reporting
Seamless ATM Reporting
Regional Guidance Material
Seamless ATM Guidance Material
State Seamless ATM Plan Template

亚太地区无缝空中交通管理计划 APAC Seamless ATM Plan



亚太区协作式ATFM框架

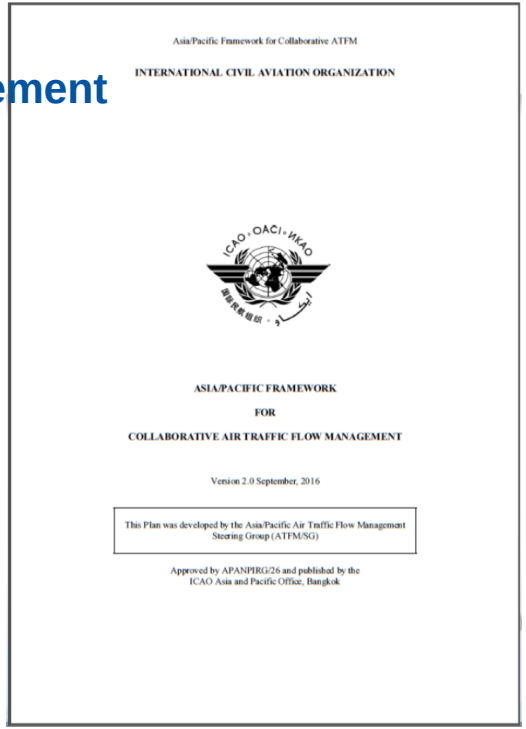
APAC Framework for Collaborative Air Traffic Flow Management

- 目的

  Objective

  - 提供本地区认可的框架，一体化地实现网络化的、可互操作的、多FIR、多国、跨境的协作式ATFM能力

    Provide a regional agreed framework for the harmonized implementation of networked, interoperable, multi-FIR, multi-State, cross-boundary collaborative ATFM capability


Asia/Pacific Framework for Collaborative ATFM

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC FRAMEWORK

FOR

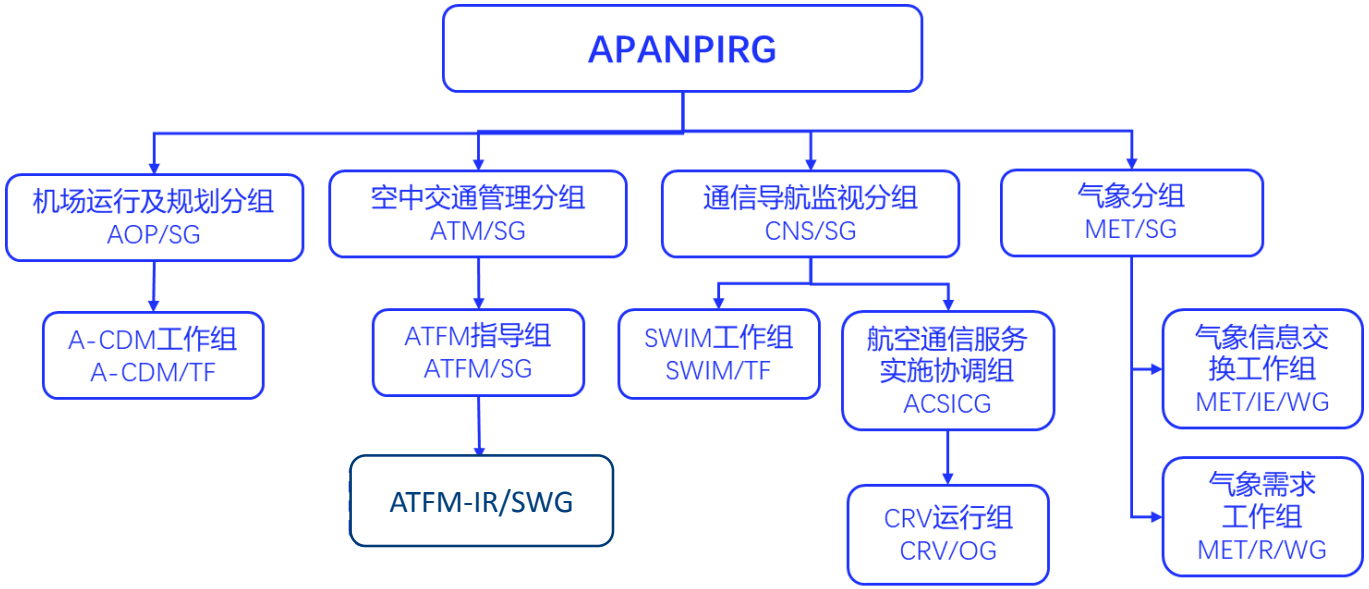
COLLABORATIVE AIR TRAFFIC FLOW MANAGEMENT

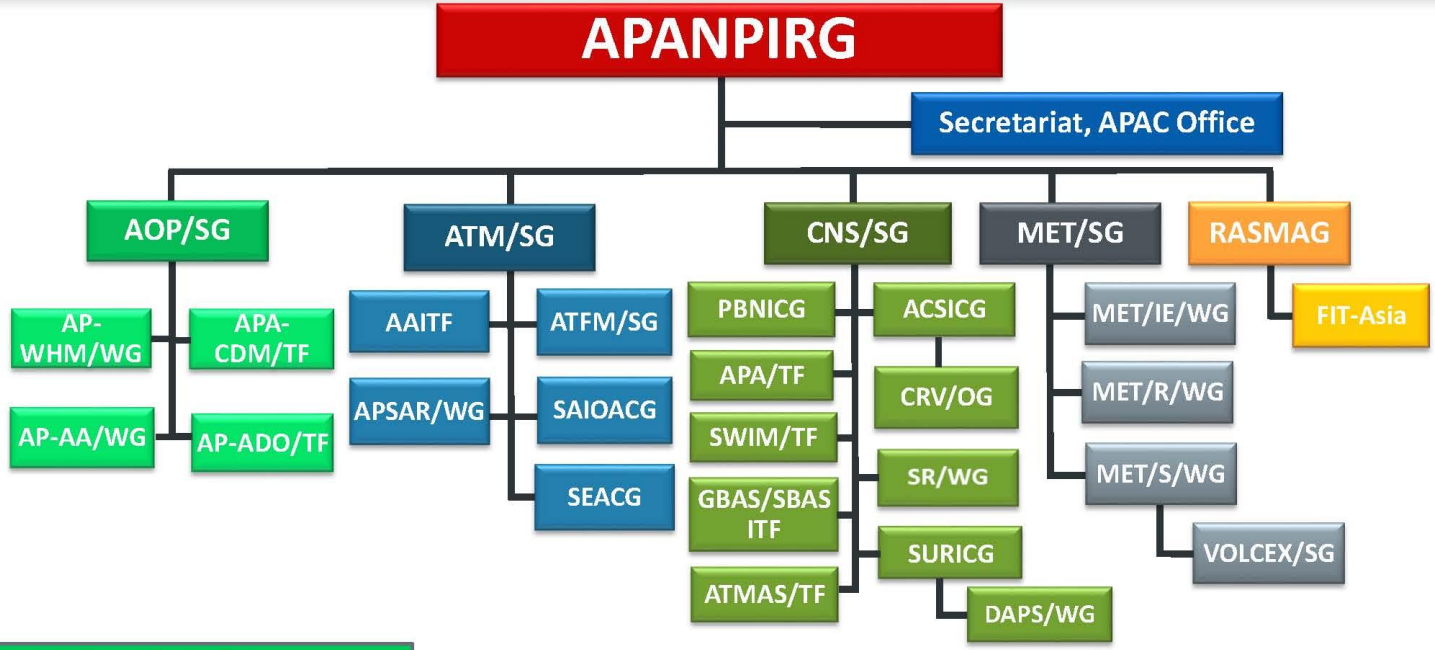
Version 2.0 September, 2016

This Plan was developed by the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG)

Approved by APANPIRG/26 and published by the ICAO Asia and Pacific Office, Bangkok

ICAO亚太区空中航行规划与实施工作组





AOP/SG	-	Aerodrome Operations and Planning Sub Group
APA-CDM/TF	-	APAC Airport Collaborative Decision Making Task Force
AP-ADO/TF	-	APAC Aerodrome Design and Operations Task Force
AP-WHM/WG	-	APAC Wildlife Hazard Management Working Group
AP-AA/WG	-	APAC Aerodrome Assistance Working Group

ATM/SG	-	ATM Sub Group
AAITF	-	AIS - AIM Implementation Task Force
APSAR/WG	-	APAC Search and Rescue Working Group
ATFM/SG	-	ATFM Steering Group
SAIOACG	-	South Asia Indian Ocean ATM Coordination Group
SEACG	-	South East Asia ATS Coordination Group

CNS/SG	-	CNS Sub Group
PBNICG	-	PBN Implementation Coordination Group
APA/TF	-	ATS Inter-facility Data Communication Implementation Task Force
SWIM/TF	-	System-Wide Information Management Task Force
ACSICG	-	Aeronautical Communication Services Implementation Coordination Group
• CRV/OG	-	Common Regional Virtual Private Network (VPN) Operations Group
SURICG	-	Surveillance Implementation Coordination Group
• DAPS/WG	-	Mode S Downlinked Aircraft Parameters Working Group
GBAS/SBAS ITF	-	GBAS/SBAS Implementation Task Force
ATMAS/TF	-	ATM Automation System Task Force
SR/W	-	Spectrum Review Working Group

MET/SG	-	Meteorology Sub Group
MET/IE/WG	-	Meteorological Information Exchange Working Group
MET/R/WG	-	Meteorological Requirements Working Group
MET/S/WG	-	Meteorological Services Working Group
• VOLCEX/SG	-	(APAC) Volcanic Ash Exercises Steering Group

RASMAG	-	Regional Airspace Safety Monitoring Advisory Group
• FIT-ASIA	-	FANS Implementation Team – Asia

亚太区ATFM建设进度表
Regional ATFM Plan Monitoring and Reporting Form

- 亚太区各民航当局应当在每年4月30日之前报告其ATFM的实施状态

APAC Administrations are urged to report their ATFM implementation status at least once annually by no later than 30 April each year.

REGIONAL ATFM PLAN MONITORING AND REPORTING FORM
ATFM PERFORMANCE INDICATORS
The following indicators are based on the Performance Improvement Plan of the Asia/Pacific Regional Framework for Collaborative ATFM, which should be read in conjunction with this form. The information provided will be used by the relevant Regional bodies to assess individual Administration and overall regional compliance with the Framework, and may be used by Administrations to internally evaluate their

	Not implemented = 0 Partial implementation = 0.5 Full implementation = 1	Australia	Bangladesh	Cambodia	China	Hong Kong, China	Macao, China	India	Indonesia	Japan	Malaysia	Maldives	Myanmar
A.	**Administrations Distributing ATFM Measures**												
	Indicate whether your Admininistration has:												
1	Enacted regulations for the implementation of ATFM	0.0		0.5	0.5	1.0		1.0	1.0	1.0	0.0		
2	Ensured the origination, distribution and processing of FPL and ATS messages in accordance with ICAO Doc 4444 PANS-ATM and the Regional Framework for Collaborative ATFM	0.0		1.0		1.0		1.0	1.0	1.0	0.0		
3	Implemented common fixes, terminology and communications in ATFM, AMAN/DMAN and A-CDM systems	0.0		0.5	0.5	1.0		0.5	0.5	0.5	0.0		
4	Implemented meteorological services to support ATM in the terminal area (e.g. Meteorological Service in Terminal Area - MSTA)	0.0		1.0	1.0	1.0		1.0	1.0	1.0	0.0		
5	Established ATFM capability with appropriately trained staff and operating procedures	0.0		0.5	0.5	0.5		1.0	0.5	1.0	0.0		
6	Implemented local procedures for ATFM operations and communication, including phraseology and terminology for ATFM Units, ATS Units, airspace	0.0		1.0	0.5	0.5		1.0	0.5	0.5	0.0		
7	Performaned an analysis of current traffic demand and expected growth for the next 5 years (rolling)	0.0		1.0	1.0	1.0		1.0	0.0	1.0	0.0		
8	Implemented a program of bi-annual strategic airport and airspace capacity, and strategic demand analysis	0.0		1.0	1.0	1.0		1.0	0.0	1.0	0.0		
9	Commenced daily pre-tactical airport and airspace capacity-demand analysis	0.0		0.5	0.5	0.5		1.0	0.5	1.0	0.0		

亚太地区ATFM项目
ATFM PROJECTS IN APAC

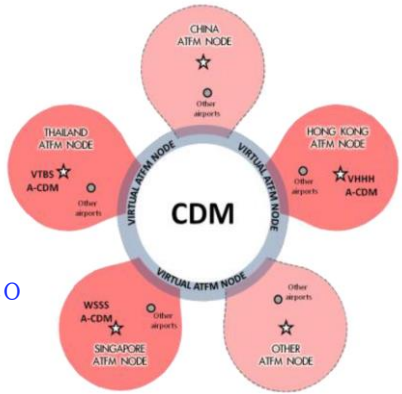
亚太区跨境多结点ATFM合作（AMNAC）

- 项目于2015年由中国香港、新加坡及泰国ANSP共同启动；现已有11个ANSP参加，覆盖38个机场

  The project was initiated jointly by ANSPs of Hong Kong, Singapore and Thailand since 2015, having been participated by 11 NASPs, covering 38 airports

- 项目的重点是构建信息网络和共同操作程序，以使各参与方能够使用地面延误程序（GDP）平衡需求与容量

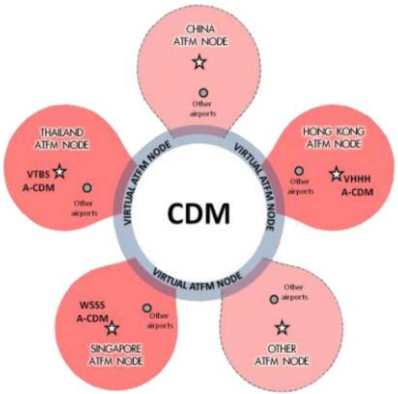
  The main focus has been on building infrastructure - information exchange network and common operating procedure - for using GDP to balance demand and capacity.



亚太区跨境多结点ATFM合作（AMNAC）

Phase 1 – Balancing Demand and Capacity at Arrival Airports		
Stage 1	**Stage 2**	**Stage 3**
• Communication Linkage and Protocols • Information Dissemination	• Demand Prediction Validation • Local Table-Top Exercises • Cross-Border ATFM Procedure Development and Validation through Demonstration Flights	• Limited-Scope Operational Service: Providing ATFM service for planned and ad-hoc events; introduction of Combined ATFM Measure
Phase 2 – Balancing Demand and Capacity in the Airspace		
Stage 1	**Stage 2**	**Stage 3**
Capability development for airspace demand prediction and capacity assessment	Procedure development and trial/implementation for single-constraint demand-capacity balancing	Procedure development and trial/implementation for multi-constraint demand-capacity balancing

Table 1 - Phased Approach to Operational Trial



东北亚ATFM一体化项目（NARAHG）

- 项目于2014年由中国、日本和韩国ANSP共同启动, ICAO RSO予以协助

  The project was initiated jointly by ANSPs of China, Japan and Republic of Korea, supported by ICAO RSO

- 项目的主要目的是构建一体化的技术的及运行的通信规程、程序及工具，支持共同的流量管理及协同决策操作

  The project is to develop the harmonized technical and operational communication protocols/procedures/tools to support the associated agreed ATFM/CDM operations

东北亚ATFM一体化项目（NARAHG）

- 完成“运行概念”第一版
  The completion of the NARAHG CONOPS 1st Edition
- 按照ATFM/IR/SWG会议的约定，开始传递 ADP
  As agreed in ATFM/IR/SWG, ADP exchange has commenced with AMNAC
  - 日本开始于2019年9月 Japan started from September 2019
  - 韩国开始于2020年4月 ROK started from April 2020
- 与其他ANSP的互联 Interaction with other ANSPs
  - 日本与中国香港互联，实施香港机场的流量管理 Japan - Hong Kong for ATFM in HKG
  - 韩国计划与中国香港之间交换CTOT ROK - Hong Kong for CTOT exchange

亚太区ATFM一体化 APAC ATFM Harmonization

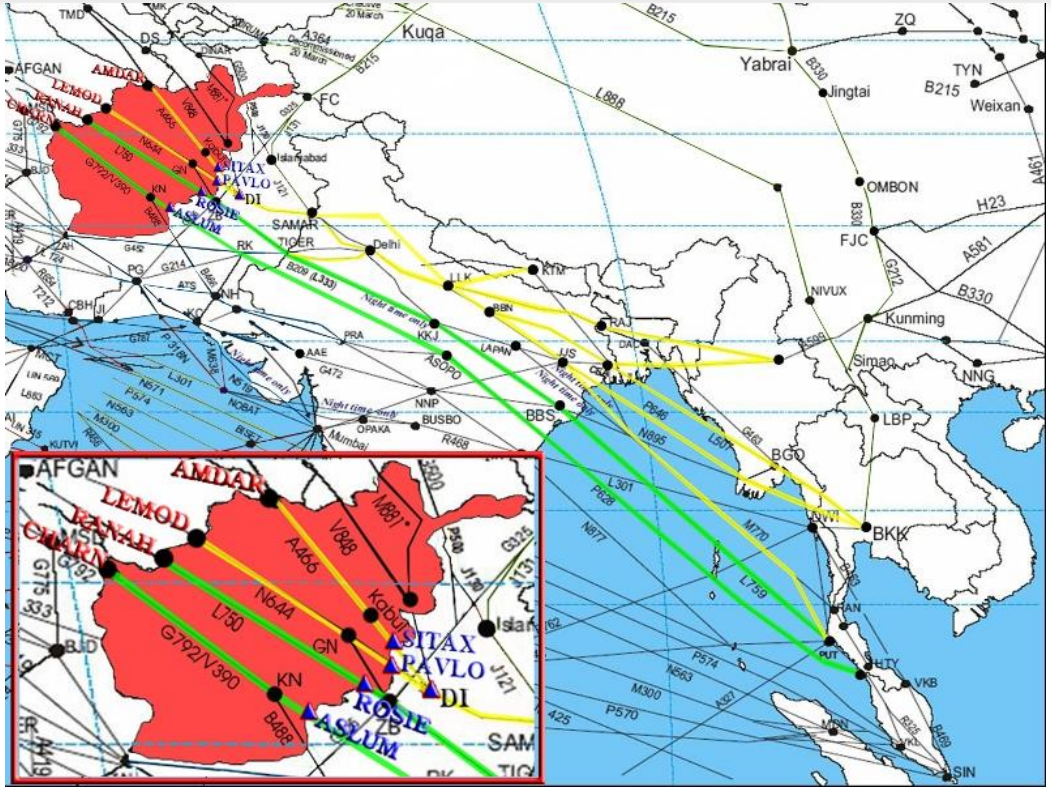
- ATFM/IR/SWG
  - 研究并编写基于AFTN/AMHS的接口控制文件和可互操作的运行概念（I-CONOPS)
    To Develop ATFM/AMHS-based ICD and Interoperability CONOPS
- ATFM/IR/SWG建议的一体化路线图 Roadmap
  - 阶段0： 交换ADP
    Phase 0: ADP exchange
  - 阶段1：用传统规程交换ATFM信息，2019-2022实现
    Phase 1: ATFM Info. exchange on conventional protocol in 2019-2022
  - 阶段2：基于SWIM概念及技术进行ATFM信息交换
    Phase 2: ATFM Info. on SWIM

孟加拉湾ATFM项目 (BOBCAT)

- 项目于2006年7月24日开始试运行, 2007年7月5日正式使用
- AEROTHAI在曼谷使用基于网页的BOBCAT系统，为西向航班提供进入喀布尔FIR的时间、飞行高度及航路

Bay of Bengal Cooperative ATFM System (BOBCAT)

https://www.bobcat.aero



BOBCAT 进展 BOBCAT Update

- 据IATA统计，自2007年07月 – 2018年12月, 节省燃油超过14.7万吨，减少二氧化碳排放60万吨

  From July 2007 to December 2018, BOBCAT operations has contributed to over 147 million kg of fuel saving or approximately 600 million kg of carbon dioxide emissions, based on IATA estimation.

结语
CONCLUSIONS

ICAO的作用 ICAO's Role

- 确定地区的路线图
  To Decide the Regional Roadmap
- 监测路线图的实施
  To Monitor the Implementation of the Roadmap
- 向有关国家提供实施的支持
  To Support States for Implementation
- 确保亚太区的一体化
  To Ensure Harmonization all over the APAC Region

如何在ICAO中工作 How to Work in ICAO

- 阅读 / 积累 / 传承
  Reading / Accumulation / Inheritance
- 面向过程
  Process - Oriented
- 创新
  Innovation

如何与ICAO工作 How to Work with ICAO

- 战略性、全球及地区性视角，切实的目标
  Strategic Global / Regional Views with Practical Objectives
- 协作 / 合作的意愿
  Willingness of Collaboration / Cooperation
- 标准化，一体化，互操作
  Standardization / Harmonization / Interoperability
- 贡献
  Contribution

ICAO


North American Central American and Caribbean (NACC) Office Mexico City
South American (SAM) Office Lima
ICAO Headquarters Montréal
Western and Central African (WACAF) Office Dakar
European and North Atlantic (EUR/NAT) Office Paris
Middle East (MID) Office Cairo
Eastern and Southern African (ESAF) Office Nairobi
Asia and Pacific (APAC) Sub-office Beijing
Asia and Pacific (APAC) Office Bangkok
THANK YOU