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Agenda Item 5: ATM and CNS Modernization Systems

PRACTICES AND EXPLORATION OF RUNWAY INCURSION PREVENTION BY CHINA ATMB

(Presented by China)

SUMMARY

This paper presents the overall approach of the Air Traffic Management Bureau of Civil Aviation Administration of China (CAAC ATMB, hereinafter referred to as China ATMB) in systematically advancing runway incursion prevention. Taking East China region as a typical case, it elaborates the practical experience of building an integrated runway incursion prevention system from four dimensions: management mechanism, ATC procedures, infrastructure, and technology application, under complex airport configurations and high-density operation environments. These practices have effectively reduced runway incursion risks and offer value reference and promotion.

1. INTRODUCTION

1.1 Runway incursion (RI) is one of the most concerning high-risk event categories in global aviation safety. According to the ICAO Global Aviation Safety Plan (GASP), runway incursions are listed as one of the five Global High-Risk Categories (G-HRCs) that require priority response. Since 2026, several serious runway safety incidents have occurred globally, including a collision between a landing aircraft and a fire truck resulting in casualties, and an ATC-attributed runway incursion. These incidents indicate that runway incursion risks remain elevated worldwide.

1.2 China ATMB places great importance on runway safety and has integrated runway incursion prevention into the overall air traffic management safety system, guiding regional ATMBs to carry out practices based on local operational characteristics. In recent years, China ATMB has continuously increased investment in technical prevention systems, steadily improving runway safety levels.

1.3 East China is one of the most economically active and busiest air transport regions in China. Several major hub airports in this region face challenges such as complex runway-taxiway layouts and frequent runway crossings. As a key practice area for runway incursion prevention under China ATMB, East China Regional ATMB has implemented a series of comprehensive measures based on regional operational characteristics, and achieved significant phased safety benefits. This paper aims to share these practical experiences and, considering the actual needs of the Asia-Pacific region, put forward recommendations for regional promotion for discussion at the meeting.

2. DISCUSSION

Core Challenges in Runway Incursion Prevention

2.1 Some airports in China adopt closely-spaced parallel runway configurations (centerline spacing less than 760 meters). Arrival and departure aircraft must frequently cross runways to reach parking stands or take-off holding points, significantly increasing runway crossing frequency and conflict probability. Additionally, complex weather conditions and similar visual markings may cause situational awareness deviations for crews or vehicle drivers, creating potential runway incursion risks.

2.2 With continuous growth of air traffic volume, controller workload keeps increasing, elevating the risks of instruction issuance errors or readback monitoring oversights. How to effectively prevent runway incursions in high-density operation environment is a core challenge for China ATMB.

Runway Incursion Prevention Practices in East China

2.3 East China Regional ATMB established a dedicated Runway Safety Task Force in 2017. A multi-level, routine, closed-loop management mechanism has been built to coordinate the implementation of runway incursion prevention measures across the region. The work covers safety situation analysis and education, implementation supervision, and new technology promotion, forming a full-process closed-loop management chain covering policy formulation, implementation, tracking and inspection, and rectification and optimization.

2.4 In terms of ATC procedures, East China ATMB has formulated a series of mandatory requirements for all subordinate units to strictly implement. Core requirements include: Conducting collaborative decision-making with the coordination position before issuing key instructions such as line-up or cross; Confirming clear and correct readback before operating the electronic flight strips (EFS); Issuing dynamic information to aircraft with potential conflict risks to enhance pilots' situational awareness; Conducting continuous monitoring of the aircraft on and around the airport via visual observation or surveillance system.

2.5 In 2021, an end-around taxiway operated at Hongqiao Airport. Arrival aircraft of Category C and below (wingspan less than 36 meters) can taxi directly to the terminal via the end-around taxiway without crossing the runways (as shown in **Figure 1**). In 2025, 65.24% of landing aircraft parking at Terminal 2 used the end-around taxiway, reducing approximately 160 runway crossings per day. No runway incursions caused by aircraft crossing have occurred on the corresponding runway since then, fully demonstrating the safety benefits of infrastructure modification.



Figure 1: End-around Taxiway at Hongqiao Airport

2.6 Following the principle of "tailored measures for each airport", East China Regional ATMB has formulated a clear technical roadmap for airports in its jurisdiction, guided by four development directions: enhancing surface detection capability, enhancing system interoperability, enhancing alert processing capability, and enhancing autonomous situational awareness capability (as shown in **Figure 2**). phased practical results have been achieved: (as shown in **Table 1**)

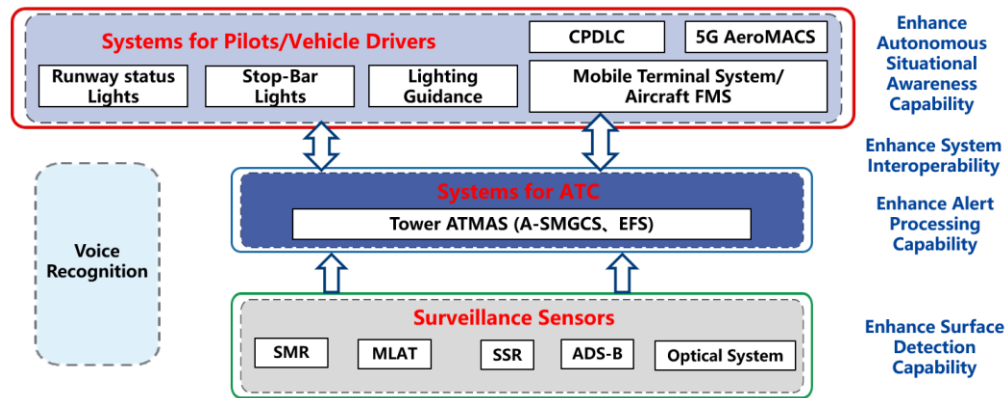


Figure 2: Technical Implementation Approach for Runway Incursion Prevention

Table 1: Phased Practical Results in East China

Technology Direction	Core Measures	Key Benefits
Lightweight Video and Optoelectronic Surveillance	Deploy video and optoelectronic surveillance equipment at critical areas such as runway entry points, to trigger alerts and trend warnings for unauthorized runway	Provides a low-cost technical backup solution for airports without A-SMGCS; rapidly replicable
EFS Decision Support (as shown in Figure 3)	New decision-support modules added to EFS system; dynamically prompts optimal timing for runway-related instructions based on airport traffic; proactively alerts on error-risk instructions	Technically mitigate human error risks for controllers and reduce workload during high-density operations
AeroMACS Digital airport Surface Communication(as shown in Figure 4)	Trail deployment at Hongqiao Airport: digital communication link between tower and airfield vehicles; triple protection via electronic geofencing, vehicle terminal display, and digital inspection application	Realizes digital vehicle workflows, visual surface situation, and automatic conflict alerts, effectively reducing risks of unauthorized vehicle incursions
Runway Status Lights (RWSL) and Stop Bars	RWSL system deployed with independent logic to determine runway occupancy status in real time and activate lights accordingly; stop bars linked to EFS operations	Directly conveys runway status to flight crew; compensates for human communication delays and errors; enhances crew autonomous situational awareness

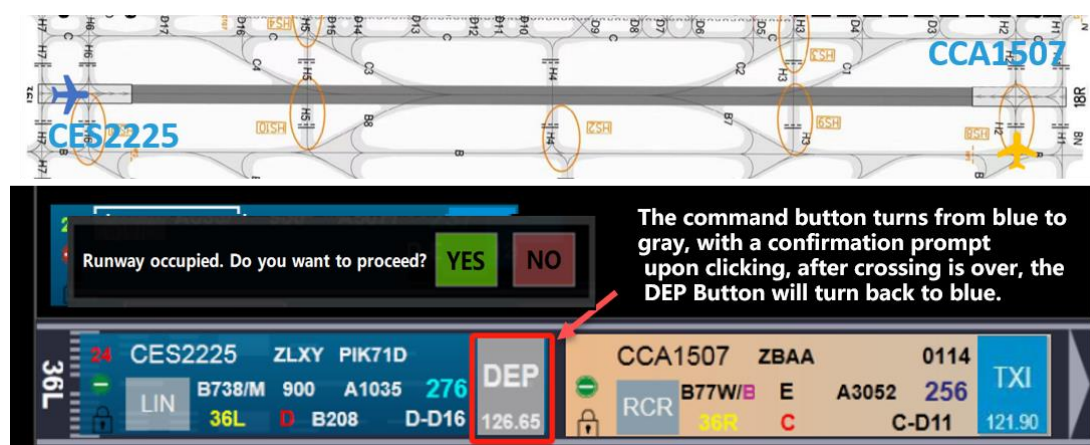


Figure 3: Example of ATC Instruction Decision Support



Figure 4: Example of AeroMACS Application

2.7 In 2025, only 2 runway incursions occurred at the 12 airports under East China Regional ATMB, a 50% reduction compared with 2024. Both events were Category D and below caused by pilot factors, and were promptly detected and properly handled by controllers with decisive measures. This fully demonstrates the phased achievements of East China ATMB's efforts to prevent runway incursions in recent years.

2.8 Asia-Pacific Regional Aviation Safety Plan (AP-RASP 2026-2028) lists runway incursions as a regional high-risk category, and calls on Member States to reduce risks through technical means and regional cooperation. China ATMB's experience in lightweight video surveillance, AeroMACS surface applications, and system decision support can meet the development needs of airports at different stages in the Asia-Pacific region: lightweight solutions are suitable for small and medium-sized airports with relatively limited infrastructure, while the intelligent upgrade roadmap provides a clear path for large hub airports, showing high value for promotion and standardization.

2.9 Looking forward, China ATMB will continue to promote the intelligent evolution from "passive warning" to "active defense" in phases along the established technical roadmap, exploring the introduction of artificial intelligence and voice recognition technologies to optimize alert algorithms, and extending digital guidance capabilities from vehicle operations to aircraft taxiing scenarios. These frontier exploration directions also have value for joint research and collaboration within the Asia-Pacific region.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information presented on China's runway incursion prevention practices, and encourage interested States/Administrations to consider these experienced, as appropriate;
- b) encourage the exchange of information and experience on the application of emerging technologies for runway incursion prevention, taking into account different operational environments and levels of airport infrastructure; and
- c) discuss any relevant matters as appropriate.

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