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AGENDA ITEM 4: AIR NAVIGATION

CULTIVATING AIRSPACE EFFICIENCY AND RESILIENCE MANAGEMENT SYSTEM AS A STRATEGIC ENABLER OF SMART SKIES IN APAC

Presented by the International Air Transport Association (IATA)

INFORMATION PAPER

SUMMARY

Effectively managing airspace efficiency and future resilience is a key and strategic enabler for high-quality and sustainable aviation ecosystem. In 2025-2026, to address the operational challenges at Europe-Asia interface affected by airspace disruptions and traffic shift, a comprehensive data-driven study on airspace efficiency and the potential solutions has been completed by IATA and joined by industry stakeholders.

The paper presents the challenges and opportunities in improving airspace efficiency and resilience, along with the outcome from the study and its white paper. Moreover, the establishment of an advanced industry framework is recommended as the strategic enabler for Smart Skies, to effectively manage the airspace efficiency, sustainability and resilience in Asia and Pacific (APAC) region.

CULTIVATING AIRSPACE EFFICIENCY AND RESILIENCE MANAGEMENT SYSTEM AS A STRATEGIC ENABLER OF SMART SKIES IN APAC

1. INTRODUCTION

1.1 Airspace disruptions, operational uncertainty and rising fuel costs have posed significant challenges to the airlines and industry. More airspace is becoming entangled in conflicts which the industry manages safely, but with sub-optimal or inefficient route systems.

1.2 At the beginning of 2026, forecasts indicated airlines would make record profit[1]. With geopolitical conflicts, surging fuel prices, indirect economic impacts are expected to affect airlines even after the recovery to normal operations in the Middle East. At the same time, there is increasing pressure to achieve industry objectives and environmental long-term goals. Meanwhile airspace disruptions and GNSS interference are impacting airline operational decisions at strategic and tactical levels.

1.3 In response, IATA continues to support enhanced airspace management through improved coordination mechanisms, strengthened civil-military cooperation, and ongoing contributions to ICAO contingency frameworks. At the same time, the rapid growth of commercial Unmanned Aircraft (UA) introduces additional challenges for airspace management, requiring a coordinated approach to ensure that their integration does not negatively impact airspace efficiency and resilience.

1.4 Data shows that even a very modest 5% efficiency improvement of the airspace could save airlines $12.5 billion annually and cut millions of tons of carbon[2], while current and emerging technologies provide opportunities to support the achievement of such gains. Some of the technical solutions are already in the cockpit of modern avionics, and the aircraft are ready for more efficient and less polluting operations, but the airspace systems cannot take advantage of the precision and flexibility of modern performance.

1.5 The existing operational improvements were greatly recognized for their immediate potential to increase efficiency and reduce emissions; however, the current approach and measures taken are reactive, fragmented and program based. The industry will need a more structured framework to manage the airspace efficiency, enabled by flexible and data-driven solutions, harmonized international standards, and smarter regulations under multilateralism and innovative thinking.

1.6 The paper provides a briefing on current global/regional status, the project of *Data-driven Airspace Efficiency Study* and its white paper completed by IATA, along with the recommendations on industry framework for airspace efficiency management that supports the States in the region in identifying airspace issues or inefficiencies and addressing them proactively and effectively with key metrics on flight efficiency and environmental impact.

2. DISCUSSION

Current Status of Airspace Efficiency and Resilience

2.1 Often a disruption in one airspace has a spill-over effect on traffic across other FIRs and regions. The current military conflict in the Middle East is impacting flights from and to the region, not just within the region. When a disruption occurs in an airspace, inefficiencies across traffic flows are amplified. Therefore, a holistic approach towards implementing airspace optimization initiatives can help address airspace disruptions. Operational improvements such as air traffic flow

[1] https://www.iata.org/en/publications/economics/reports/global-outlook-for-air-transport-december-2025/
[2] https://www.iata.org/en/pressroom/2026-speeches/willie-walsh-speech-iata-82nd-agm-report-state-global-air-transport-industry/

management, flexible use of airspace and civil-military cooperation, can support more efficient airline operations across axes where there was a shift in traffic flow due to airspace disruption. IATA has been working with ICAO, ANSPs, and other stakeholders to progress the implementation of operational improvements. In some regions there is slow progress due to various challenges, namely availability of funds to support investment in associated infrastructure and lack of political will to introduce change.

2.2 States are required to develop contingency plans under ICAO Annex 11. However, these plans are often not maintained up to date, nor do they include relevant contingency scenarios. At the tactical level, IATA continues working with ICAO, regulators, airlines and stakeholders to ensure effective response to airspace disruptions using Contingency Coordination Teams (CCTs).

2.3 Additionally, exchange of information, amongst States, for known and anticipated disruptions, can help ANSPs and airlines better prepare and agree on contingency scenarios. Strengthening civil-military coordination to ensure effective and timely communication with airspace users, without compromising national security, would enable operators to conduct more robust risk assessments to make better informed operational decisions. IATA has been working with ICAO at global and regional levels to strengthen civil-military cooperation.

2.4 Recent activities include the continued activation of CCTs in key regions such as the Middle East to enhance situational awareness for airlines, ongoing contributions to ICAO's global airspace contingency framework, and the use of data analytics tools to quantify the impact of airspace disruptions.

2.5 Furthermore, the increasing use of drones for state/military missions poses a risk to airports and aircraft when such Unmanned Aircraft Systems (UAS) are operated near or within the airspace of an airport. While designating the airspace around airports as "no-fly zones" for unauthorized UA is helpful for commercial and recreational use, but from recent events in the Middle East, this has proved insufficient when there is a military conflict.

2.6 In 2022, IATA led a task force consisting of a number of organizations and civil aviation authorities and developed Guidance Material (Response to Unauthorized UA in the Vicinity of Aerodrome Guidance Material). Yet there seems to be a delay in the implementation of effective risk assessment procedures for unauthorized UA. Since certain counter-UAS technologies can interfere with critical on-board manned aircraft systems, a coordinated, multi-tiered approach is required. This should include risk assessment processes, clear operational procedures for escalating responses, and close collaboration between airport operators, ANSPs, regulators, and law enforcement.

2.7 In parallel to these challenges, the rapid growth of commercial UA, including large-scale drone operations and advanced air mobility concepts, is expected to significantly increase airspace demand. This evolution introduces new challenges related to airspace integration, traffic management, safety, and interoperability with manned aviation.

2.8 ICAO and the industry are progressing UTM guidance to support the scalable integration of UAS. While this provides a useful foundation, further work is required to address the impact on airspace efficiency, capacity, and airline operations. The integration of commercial UA must be considered in the context of overall airspace resilience, ensuring that new operations do not introduce additional challenges or operational disruptions.

Outcome of IATA Data-driven Airspace Efficiency Study

2.9 In response to the airspace disruption and operational challenges along the Europe-Asia air corridor, IATA launched a special project in 2025 titled *Data-driven Airspace Efficiency Study*, in collaboration with the airlines, ANSPs and industry stakeholders. Under this project, a data-driven and performance-based methodology has been developed to analyze and measure the risks, costs and benefits of the potential route optimizations.

2.10 The case study was focused on the Flight Information Regions (FIRs) at Europe-Asia interface (e.g. Urumqi, Lanzhou, Ulaanbaatar and Almaty FIRs), which were significantly affected by traffic shift and airspace constraints. To address the operational challenges in this area, IATA worked with industry stakeholders and came up with a proposal of new efficient ATS routes crossing Urumqi FIR and Ulaanbaatar FIR as an alternate option for the operators (**Figure 1**).

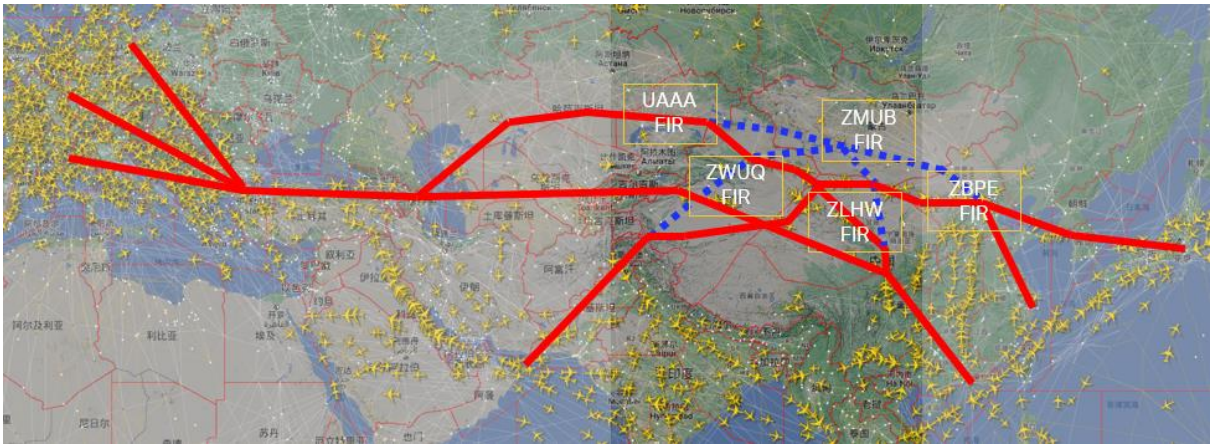

Figure 1: Proposed New ATS Routes as Alternate Option for Operators

2.11 To complete the cost-benefit analysis of the potential solutions, the following approach and steps were implemented by the project team:

a) Real Data Collection and Analysis: The historical flight and NOTAM data collection and analysis covered two flight seasons (from 30 March 2024 to 29 March 2025), during which the real flight plan and schedule data were provided by 22 airlines with the highest frequency of operations.

b) Statistical Modelling: A statistic model was developed in collaboration with industry partners utilizing modelized digital platform (the modernized flight planning system with enhanced tools on airspace capacity, aircraft performance and weather information) to conduct the simulation and evaluation on the existing routes and "What-if" scenarios.

c) Interviews with Key Stakeholders: The interviews were conducted with the key personnel and experts from airspace users, ANSPs, airport operators, CAAs, etc., to validate the pain points and adapt solution concept to actual operational requirements.

d) Technical Visits to Key Facilities: Technical visits were organized to the ACCs and airports concerned and joined by industry advisors, to validate the infrastructure and direct/in-direct costs needed to fulfil future operational needs.

e) Performance Assessment and Desk Research: A multi-dimensional KPI framework was developed to evaluate airspace efficiency improvements from the simulated data, and a multi-faceted assessment approach was implemented for all the stakeholders involved.

f) Industry Review and Validation: An industry review workshop was hosted on 25-27 November 2025 in Xi'an, China in collaboration with Air Traffic Management Bureau of Civil Aviation Administration of China (CAAC/ATMB), attended by 103 participants from nine States/ANSPs, 20 airlines and seven international organizations and institutes. The methodologies were discussed and endorsed by the participants and further improvements were made based on industry feedback.

2.12 Overall results of the performance assessment:

a) the simulations were conducted for a total of 68,256 flights over the one-year period from March 2024 to March 2025. For each flight, operations on the originally planned route and diversion to the proposed alternative route were simulated.

b) qnalysis of original route operations revealed that 6,664 flights (14.4%) were affected by NOTAM-induced airspace restrictions, resulting in an average delay of 140.3 minutes per affected flight, with a median of 114.3 minutes. To assess the overall potential of the new routes, different assumptions based on the change in route distance following diversion were applied.

c) assuming full diversion for flights with shorter alternative distances, annual total flight time could be reduced by 4,968 hours, fuel consumption by 33,530 tonnes, and CO2 emissions by 105,623 tonnes. Route charges would decrease by approximately USD 2.04 million, while delay time attributable to NOTAM restrictions would be reduced by 13,084 hours. The total controller service time would be reduced by 4,968 sector hours.

2.13 In summary, the proposed new ATS routes through Urumqi FIR and Ulaanbaatar FIR offer significant strategic value in alleviating operational pressure on the Europe-Asia interface and enhancing regional airspace resilience. Meanwhile, recommendations for future research and proposed short-, medium- and long-term actions for the industry stakeholders are provided. Further details of the case study can be found in the following White Paper: Data-driven Airspace Efficiency Study.

Recommended Industry Framework for Airspace Efficiency Management

2.14 According to the above case study and industry feedback, it is identified that airspace efficiency is a core enabler of operational excellence, cost discipline and environmental sustainability. As industry navigates evolving pressures on service quality, cost management and decarbonization responsibilities, the ability to manage airspace efficiency as a strategic asset has never been more essential. The most effective programs make leadership commitment visible, governance clear and performance continuously monitored while empowering personnel to innovate in their daily work.

2.15 The Smart Skies concept for the region perfectly aligns with the current industry requirements and path to the future of APAC, one of the strategic enablers would be a robust and mature framework to be developed and established by the stakeholders. For instance, it is suggested to foster and build an Airspace Efficiency Management System (AEMS), which adopts the structured and organization-wide framework inspired by the Safety Management System (SMS), moving airspace efficiency from the reactive, fragmented and program-based efforts to a proactive discipline grounded in governance, data-driven approach, and continuous improvement (**Figure 2**).

Figure 2: Recommended Industry Framework for Airspace Efficiency, Sustainability and Resilience Management

2.16 Industry guidance materials will need to be developed to provide fundamental AEMS framework, recommended methodologies and tools, as well as implementation guidelines to address specific and key scenarios (e.g. airspace/airport disruptions, drones and new entrants in congested airspaces, space vehicle activities, large weather events or route changes, etc.). This approach is intentionally practical and scalable so that the CAAs and ANSPs in the region with different sizes of airspace and airports, infrastructure compositions, and operational profiles, etc. can adapt it to their own context. By applying the principles, States can turn their airspace systems into a controlled, optimized and continuously improving asset, delivering immediate and long-term efficiency, sustainability and resilience.

2.17 To facilitate adoption and implementation, data platforms and digital tools also need to be developed to support robust airspace efficiency framework, e.g. data/AI-driven technologies for airspace efficiency gap analysis, performance monitoring and benchmarking tools with recommended KPIs, digitalized intelligent platform with greater level of collaboration between airspace efficiency and operators' fuel/emission programs, etc.

2.18 It is recognized that the establishment of airspace efficiency management framework will serve as a blueprint for building a disciplined, organization-wide system and an enabler of Smart Skies of APAC in the long run.

Key Takeaways and Recommendations

2.19 Short-term: Immediate mitigating actions including strengthened civil-military, cross-region and cross-border cooperation are required in response to the challenges in airspace contingency and efficiency, especially during the era of uncertainty with increasing conflict risks and emerging impact from new entrants to the civil aviation and current airspace systems.

2.20 Medium-term: Industry guidelines along with data-driven and performance-based technical solutions need to be developed to support the airspace planning and operational optimization initiatives, also to enhance the interoperability of UAS among civil and State systems.

2.21 Long-term: The recommended industry framework and modernized digital tools for effectively managing airspace efficiency and resilience will need to be developed and equipped to enable safer, smarter, greener and multi-layered operations with integration of various airspace users.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to note the information contained in this Paper.

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