*International Civil Aviation Organization*

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**Agenda Item 4: Discussion on PBN Routes Development and FLAS/FLOS Optimization**

# PROPOSAL FOR IMPROVING A1 ROUTE SAFETY MARGIN THROUGH PARALLEL ROUTE IMPLEMENTATION

(Presented by CHINA)

**SUMMARY**

This paper presents the emerging operational challenges along ATS Route A1 and presents a proposal to improving its safety margin through establishing parallel RNAV2 routes. It highlights increasing demand in 2025, the limitations of current tactical measures including lateral offset procedures, and recent progress made through ad-hoc coordination. The proposal underscores the necessity of strategic planning to address long-term airspace efficiency and safety concerns.

## 1. INTRODUCTION

1.1 ATS Route A1 has long served as a critical corridor linking Southeast Asia and Northeast Asia, traversing some of the most operationally intensive portions of the South China Sea airspace. Historically recognized as the highest-priority trunk route in the region, A1 has played a vital role in supporting regional connectivity and facilitating efficient in north–south traffic flows. Following the rapid traffic demand recovery in 2025, traffic volume has returned to pre-2019 levels and are forecast to exceed them in this year, with peak periods again approaching or surpassing 600 daily movements. This resurgence has reaffirmed the segment's status as one of the most congested and strategically sensitive portions of the APAC ATS route network, placing immense pressure on air traffic control workload, airspace capacity and flight level allocation .

1.2 In 2025, a new and notable trend has emerged in the Asia-Pacific region: the accelerated growth of international medium- and long-haul operations between key cities in Southeast Asia—such as Ha Noi, Da Nang, and Bangkok—and major Northeast Asian hubs including Shanghai, Seoul, and Tokyo. These city-pair markets have seen rapid expansion due to rising economic exchanges, restored tourism flows, and competitive airline scheduling strategies. As a result, demand on A1 has become increasingly concentrated not only in terms of capacity, but also in terms of time—especially during nighttime peak hours. This intensification of bidirectional flows has significantly increased route complexity and conflict potential. The situation underscores the urgent need for a fundamental redesign of A1 to preserve regional operational stability and accommodate future demand growth.

1.3 The proposal for parallel route implementation along A1 aligns with the broader strategic objectives of South China Sea airspace modernization. As traffic demand continues to rise and complexity grows due to mixed traffic flows and regional airport developments, the need for more structured and resilient route systems becomes increasingly critical. Parallel route implementation is

not merely a reducing controller workload measure—it represents a fundamental shift toward future-ready airspace architecture that is capable of accommodating sustained growth and minimizing conflict points. By enabling predictable, noninflected traffic flows in both directions, the proposal enhances regional connectivity, facilitates optimized flight level allocation, and contributes to a safer and more efficient South China Sea airspace environment. Furthermore, it complements other regional initiatives, such as PBN route expansion and FLAS/FLOS harmonization, making it a keystone project for long-term operational resilience and seamless cross-FIR coordination.

## 2. DISCUSSION

Current Challenges

2.1 *High Traffic Density and Demand Surges.* In 2019, the A1 route accommodated up to 610 daily flight movements within the Sanya FIR. With rapid demand recovery fully underway, traffic volumes in 2025 are projected to exceed those historical peaks. Demand is especially concentrated during the nighttime period between 1600 and 2200 UTC, when both northbound and southbound flows intensify concurrently. This bidirectional surge during peak windows amplifies sector complexity, increases controller workload, and raises the risk of level change conflicts. Without structural reforms, continued growth will further strain the already saturated route environment.

2.2 *Preferred Flight Level Congestion.* Data analysis indicates that most air crafts on A1 strongly prefer cruising at FL290, FL330, and FL370, due to fuel efficiency and airline performance envelopes. This leads to over-concentration at these flight levels, limiting vertical maneuvering options and forcing a significant number of flights to operate at suboptimal levels. In peak periods, the frequency of level changes and tactical re-clearances substantially increases controller task load, while negatively affecting flight efficiency, fuel burn, and emissions. The limited availability of usable flight levels has become a critical constraint under the current FLAS arrangements.

2.3 *Lateral Offset Procedures with Benefits and Limitations.* To mitigate potential safety hazard, strategic lateral offset procedures have been applied in specific FIRs, allowing aircraft to operate slightly off the center line of A1. While these measures simulate some benefits of parallel routing—such as increased lateral spacing and enhanced deconfliction, but they remain a tactical workaround rather than a sustainable solution. Offsets depend heavily on procedural compliance and pilot/controller awareness, and introduce additional risks such as lateral deviation misinterpretation, navigation system variation, and coordination ambiguity at FIR boundaries. Offset procedures also complicate coordination of emergency diversions, and handover sequencing.

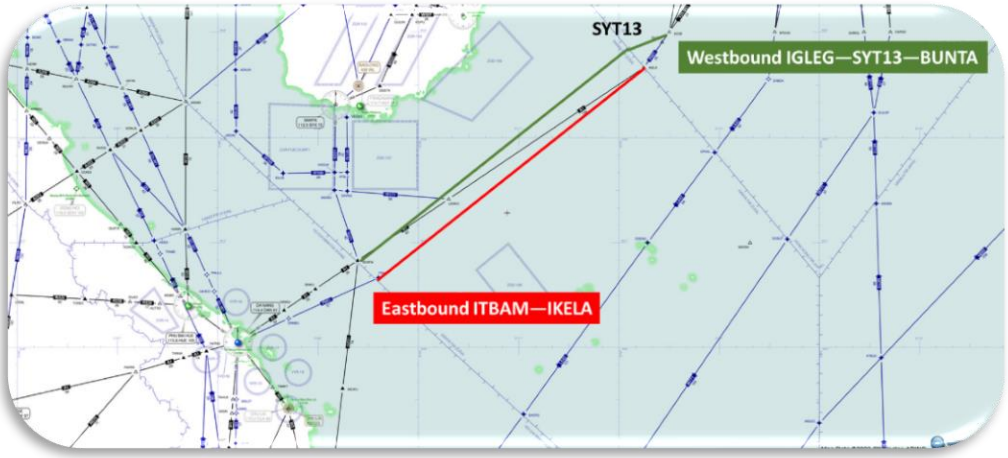
2.4 *Complexities Due to Operational Environment.* The A1 route operates in a complex and dynamic airspace environment, shaped by multiple interacting factors. Frequent convective weather in the South China Sea often necessitates route deviations, while traffic convergence near Sanya, Da Nang, and adjacent FIR entry/exit points exacerbates sector density. Additionally, turbulence reports and temporary altitude restrictions—both internally imposed and due to inter-FIR arrangements—further constrain operational flexibility. FLAS and FLOS discrepancies between FIRs result in abrupt flight level transitions. Analysis shows that approximately 25% of flights within Sanya FIR require tactical mid-route flight level adjustments, introducing further complexity and increasing the risk of errors or loss of separation.

Progress in Planning

2.5 *Bilateral Coordination Achievements.* ATMB and VATM have maintained close coordination over the past two years, demonstrating mutual commitment to addressing shared airspace challenges. Regular bilateral discussions and technical consultations have resulted in preliminary consensus on the necessity and general framework for establishing parallel routes along the A1. Both States recognize the strategic benefits of such restructuring—not only for national ATM efficiency but

also for broader regional traffic flow improvement. The bilateral cooperation sets a positive example for other States involved in South China Sea route governance and lays the groundwork for eventual multilateral alignment.

2.6 *Route Design and Technical Readiness.* The proposed dual-route structure envisions a southwest-bound unidirectional route (SYT13–BUNTA) and a northeast-bound unidirectional route (ITBAM–IKELA) in Sanya FIR, effectively replacing the current bidirectional route A1. Technical assessments conducted by Sanya FIR indicate that both radar surveillance and VHF coverage are sufficiently robust above 4,500 meters to support this transition. From navigation specification, over 98% of aircraft operating on A1 are already with RNAV2-compliant, which minimizes implementation friction and reduces the need for fleet adaptation. This high level of technical readiness provides a strong foundation for a timely and low-disruption deployment of the new parallel routes.




Proposed parallel uni-directional routes (Within Sanya FIR)

2.7 *Technical Evaluation Underway.* Detailed evaluations are ongoing to determine the optimal lateral spacing between the proposed parallel routes. The objective is to ensure safe separation while enabling flexible use of identical flight levels on both tracks—an approach that could dramatically increase available capacity and reduce the need for altitude deconfliction. The evaluation considers factors such as wake turbulence separation minima, airspace volume optimization, CNS infrastructure limitations, and inter-FIR transition alignment. Results from this technical analysis will guide final route alignment decisions and feed into upcoming safety assessments and operational trials, forming a key milestone on the path to implementation.

Way Forward

2.8 *Development of a Phased Roadmap under ICAO Facilitation.* To ensure a coordinated and efficient transition from a single bidirectional route to a pair of structured parallel unidirectional routes, it is proposed that the relevant States/Administrations take the lead in facilitating the development of a comprehensive, phased implementation roadmap. This roadmap should reflect the collective input of all States/Administrations along the A1 and include clearly defined milestones and responsibilities. Specifically, stakeholders should strive to reach consensus on the preferred route configurations by the end of 2025. This would involve finalizing the alignment of entry and exit points, confirming the lateral spacing, and formally agreeing on traffic directionality. Based on this foundation, safety assessments—including hazard identification, risk mitigation strategies, and operational scenario testing—can be undertaken in 2026. These assessments should be paired with limited-scope trial operations to validate the practicality of the new route structure. Provided that safety and efficiency benchmarks are met, full-scale implementation could then be targeted for 2027. This three-year timeline balances urgency with the need for methodical planning and risk management.

2.9 *Resolution of Key Technical and Operational Issues*. Several operational and technical issues should be resolved to ensure successful deployment of the parallel routes. One of the first priorities is the precise definition of entry and exit points for both the northeast-bound and southwest-bound routes. These points should be strategically selected to integrate seamlessly with upstream and downstream route segments in adjacent FIRs, minimizing lateral and vertical transition complexity. Equally important is the determination of appropriate lateral separation between the two routes. The separation distance must be sufficient to allow for independent traffic flows while enabling the possibility of using identical flight levels when applicable. This would greatly enhance route capacity without increasing vertical complexity.

2.10 Stakeholder Communication and Airline Engagement. As implementation advances, regular engagement with airlines and other stakeholders will be essential. Timely dissemination of planning updates, navigation requirements (e.g., RNAV2 compliance), procedural changes, and trial schedules will promote early readiness and minimize resistance. Feedback from airline operations centers, flight dispatchers, and pilots should be systematically gathered and analyzed to refine route design and operational assumptions. Clear communication of expected benefits—such as reduced delays, more predictable flight levels, and lower fuel burn—will help secure operator buy-in and support a smoother transition during the trial and full implementation phases.

## 3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) recognize the increasing urgency for structural upgrades to the A1 route due to 2025 traffic developments;

c) support the continued bilateral and multilateral coordination toward A1 parallel route implementation;

d) discuss the development of a regionally supported implementation roadmap;

e) discuss any relevant matters as appropriate.

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