International Civil Aviation Organization

The Combined Tenth Meeting of the South Asia/Indian Ocean ATM Coordination Group (SAIOACG/10) and Twenty—Seventh Meeting of the South-East Asia ATS Coordination Group (SEACG/27)

Video Teleconference, 29 March – 02 April 2021

Agenda Item 3: Review of Current Operations and Problem Areas

FREE-ROUTE OPERATIONS (FRTO) TRIALS FOR OPTIMUM CAPACITY AND FLEXIBLE FLIGHTS

(Presented by Singapore)

SUMMARY

This paper presents the effort by Singapore to carry out Flexi Airspace trials to validate elements within the Free-RouTe Operations (FRTO) thread of Block 0 of the Aviation System Block Upgrade (ASBU). Taking advantage of the current lower traffic volumes, States/Administrations should collaborate to explore cross-border free-route operations to maximise benefits.

1. INTRODUCTION

1.1 Free-Route Operations (FRTO) is one of the threads in the ASBU that will bring about optimum capacity and flexible flights. Within the FRTO thread, there are 4 elements, namely,

- Direct Routing [FRTO-B0/1],
- Flexible Use of Airspace (FUA) [FRTO-B0/2],
- Pre-validated and coordinated routes to support flight and flow such as User Preferred Routes (UPR)[FRTO-B0/3], and
- Basic conflict detection and conformance monitoring such as Medium-Term Conflict Detection (MTCD) [FRTO-B0/4].

1.2 These elements will form the base to develop capabilities and enable concepts such as Free-Route Airspace (FRA) to pave the way for Trajectory Based Operation (TBO).

1.3 FRA concepts had been trialed and implemented in other parts of the world such as Europe and North America. In Europe for instance, FRA is a specified airspace within which aircraft operators may plan a route between a defined entry point and a defined exit point efficaciously, with the possibility to route via intermediate, whether published or unpublished way points. Within this airspace, flights would still be subject to air traffic control.

1.4 The implementation of FRA has also expanded to be a cross-boundary initiative in the European environment. Such implementation on a larger scale would reap exponential benefits such as more direct routings beyond Transfer of Control (TOC) points for more efficient trajectories and mutual development of cross boundary conflict detection tools, which will also increase flight safety. The

requirements for such cross-boundary collaboration would hinge on harmonized procedures and processes for flight planning and ATC coordination to increase flight efficiency.

2. DISCUSSION

1.5 Since 1 September 2020, Singapore initiated the "Flexi Airspace Trials" where Singapore based carriers such as the Singapore Airlines (SIA) flights planning to utilize ATS routes L642 and N892 for arrival into Singapore Changi Airport were provided the option to flight plan via waypoint ESPOB to ELALO and for ATS route N892 to flight plan via ATS waypoint MELAS to MABAL. The trial levels are from FL290 to FL400. This allowed for direct routings to be facilitated for participating flights where possible. The Flexi Airspace Trials are currently on-going and interim trial results between September 2020 and January 2021, more than 2,000 flights have participated. The flights that participated in the trial saved a total of about 140 tonnes of fuel.

2.1 The Flexi Airspace Trials employs several elements in the FRTO thread of the ASBU. Direct routings [FRTO-B0/1] are established with the aim of providing airspace users with additional flight planning route options with published conditions of use. While the existing ATS routes within the Singapore FIR have been established to be as direct as possible, Singapore saw an opportunity to experiment direct routings. The aim was also to verify the adequacy of existing flight planning processes to support such planning service, in a bid to provide more efficient and flexible route options for airlines and as the first step towards exploration of FRA implementation.

2.2 One of the considerations to enable direct routings is the airspace classification that flights would have to transit across. Existing ATS routes have controlled airspace on either side of the centerline of the ATS routes (typically 25NM for RNAV10). Beyond these lateral limits, it would be uncontrolled airspace (Class G). In order to facilitate such direct routings, segments of class G airspace had to be temporarily re-designated as Class A to facilitate the trials. This process would be similar to the concept of FUA [FRTO-B0/2] where coordination for the use of airspace that are typically not used for civil aviation will be released for use by civil traffic. This could form the foundation to automate data exchange between stakeholders for a more efficient use of airspace.

2.3 In planning for the trials, emphasis was placed on identifying the adequacy of safety-nets to alert air traffic controllers to potential conflicts when facilitating the new direct route. It was determined that the Mid-Term Conflict Detection (MTCD) [FRTO-B0/4] function in the ATM system would suffice in providing the advance alerts. The ability for advance conflict detection is important in a flexible routing environment where flights have more options of trajectories and predictability of conflict points become dynamic.

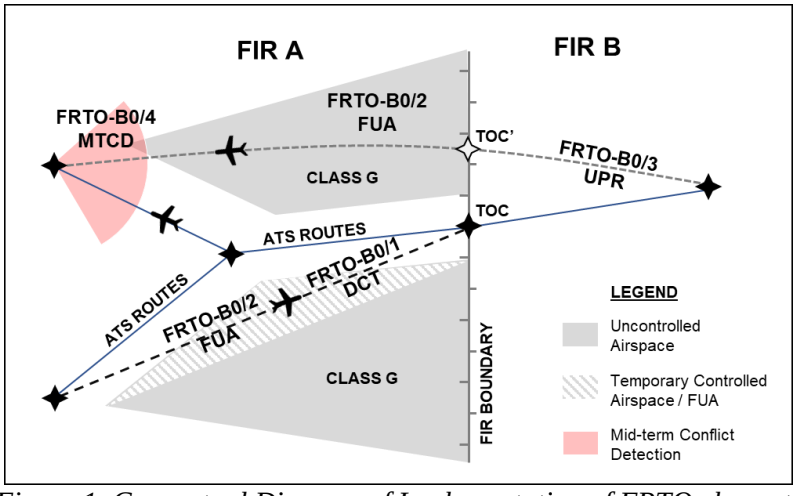

Figure 1. Conceptual Diagram of Implementation of FRTO elements

2.4 A few key lessons were gathered from the trials thus far which would steer expansion of trials and when considering cross border collaborations. Although free route concept had been implemented in other regions, this concept is relatively new in the APAC region. Air Traffic Controller (ATC) familiarity and cognitive preference with the use of ATS route structure, fixed reporting and transfer of control points would need to be addressed. Safety management principles would need to be applied to mitigate risks, which includes briefing to ATC to familiarize with the new procedures and process. Surveys were also conducted to assess ATC acceptance to increase dynamism in flight planning options and to identify possible increase in workload. The survey showed that ATC were confident in their traffic planning and providing safe separation between aircrafts even with the variance in flight planning norms and aircraft trajectory profile. However, there would be a need to further study the scalability of the trials especially when air traffic recovers to pre-COVID level.

2.5 With the fluidity in flight routes, there is also a need to ensure current ATM systems will be able to support the generation and representation of alternative transfer of control point between ATC sectors. This requirement will be amplified when considering cross border collaboration, especially with the norm of employing AIDC to aid with automation for flight coordination between ANSPs. In a more matured environment for FRA airspace, it is envisaged that inter sector and/or cross boundary flight separation requirements would need to be optimized to continue providing benefits to the airspace user. With the probable decrease in aircraft spacing, the need for a reliable and accurate conflict detection and resolution tool would be ideal.

2.6 The above concerns are envisaged to be resolved with the implementation of FF-ICE Release 2 and beyond, where it would be possible for dynamic flight intent and trajectory to be shared between ANSPs and through further R&D to build advance conflict resolution tool. This is also aligned with enablers listed in ASBU to realize the FRTO thread. Nonetheless, it would be possible to plan for flexible route implementation. Where possible, mitigation efforts would be to consider implementing flexible route options during periods of lower and manageable traffic flow (graveyard hours) until the point where the appropriate system support and capabilities are developed. When considering cross border implementation, ANSPs could continue with the use of current TOC point to provide system predictability. However, tactical coordination or arrangement for flight transfers between ATCs could be effected on a requirement basis. Factoring the lesson learnt thus far, Singapore will be exploring to further the flexi route arrangement over other parts of the Singapore FIR through increasing airlines participation and widening trial scope.

2.7 Learning from the experience of FRA implementation in other parts of the world, there is potential for FRA to be implemented between adjacent FIRs to increase the options of routes for aircraft operators. It can be utilized in considerations for weather avoidance and fuel efficiency with benefits that could be amplified when we progress beyond the transfer of control (TOC) points to implement User Preferred Routes (UPR) [FRTO-B0/3]. For instance, AirNav Indonesia had recently initiated UPR trials as part of the effort to provide efficient route options to the airlines and act as a stimulus for traffic growth. The UPR trials are available in Jakarta FIR and Ujung Pandang FIR applicable for international flights overflying Indonesian Airspace. This presents an opportunity to tap on the individual trials to expand on the applicable range whereby flexibility in route options and route efficiency can be provided to the aircraft operators.

2.8 The APAC region could take on a collaborative approach to explore flexible route concepts and take opportunity with the current lower traffic volume to conduct trials. Alignment on the timeline of implementation beyond trials when air traffic volume normalizes could carry forward the benefits on advancement of available technologies such as conflict resolution tools. This would aid in the synchronized progress of advance ATM initiatives in the APAC region giving rise to more efficient flight operations and safer ATM.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note Singapore's effort in explore elements in the FRTO thread of the ASBU as a step towards TBO;

b) discuss on potential collaboration to explore flexible routing concept for the Asia Pacific region to enable optimization for the airspace user and flexibility in ATM; and

c) urge State/administration to capitalize on the lower traffic movement to trial ATM initiatives.

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