International Civil Aviation Organization

The Thirteenth Meeting of the South China Sea Traffic Flow Review Group (SCSTFRG/13)

Beijing China, 16 – 18 July 2025

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

REVIEW OF THE EXISTING FLAS/FLOS IN SOUTH CHINA SEA AIRSPACE

(Presented by the Secretariat)

SUMMARY

This paper presents the considerations when reviewing the existing FLAS/FLOS operation and No-PDC FL in various FIRs of the South China Sea area. All Member States are invited to review the data and provide feedback on their current FLAS/FLOS operations to the ICAO Secretariat to improve the capacity, efficiency and safety.

1. INTRODUCTION

1.1 Since the inception of the South China Sea FLAS/FLOS operation in 2002 by the Asia-Pacific RVSM Implementation Task Force and amendment in 2007 by the South China Sea RVSM Scrutiny Group, circumstances have changed a lot over the last 20 years.

1.2 Whilst the traffic flow demand has evolved, particularly the traffic increase on the secondary crossing routes, and the improvement of communication and surveillance coverage within the area; aircraft navigation capabilities; and Air Traffic Management systems, higher capacity and efficiency are expected from the airspace users to maximize the benefits from investment in ANS systems.

1.3 At the SCSTFRG/10 meeting, to facilitate the discussion on the existing FLAS/FLOS to promote the long-term consideration of post-pandemic scenarios, the group agreed to the ***Decision SCSTFRG/10-1: Review of the existing South China Sea Flight Level Allocation Scheme (FLAS) and Flight Level Orientation Scheme (FLOS)***

2. DISCUSSION

Observation of FLAS/FLOS among the ATS Routes

2.1 Through the updated data submitted by South China Sea States prior to the meeting, the ICAO APAC Regional Sub-Office has corrected the data from the previous version of the Chart to provide an overview of the FLAS currently operating in the South China Sea airspace among the major routes, as illustrated in **Chart 1**.

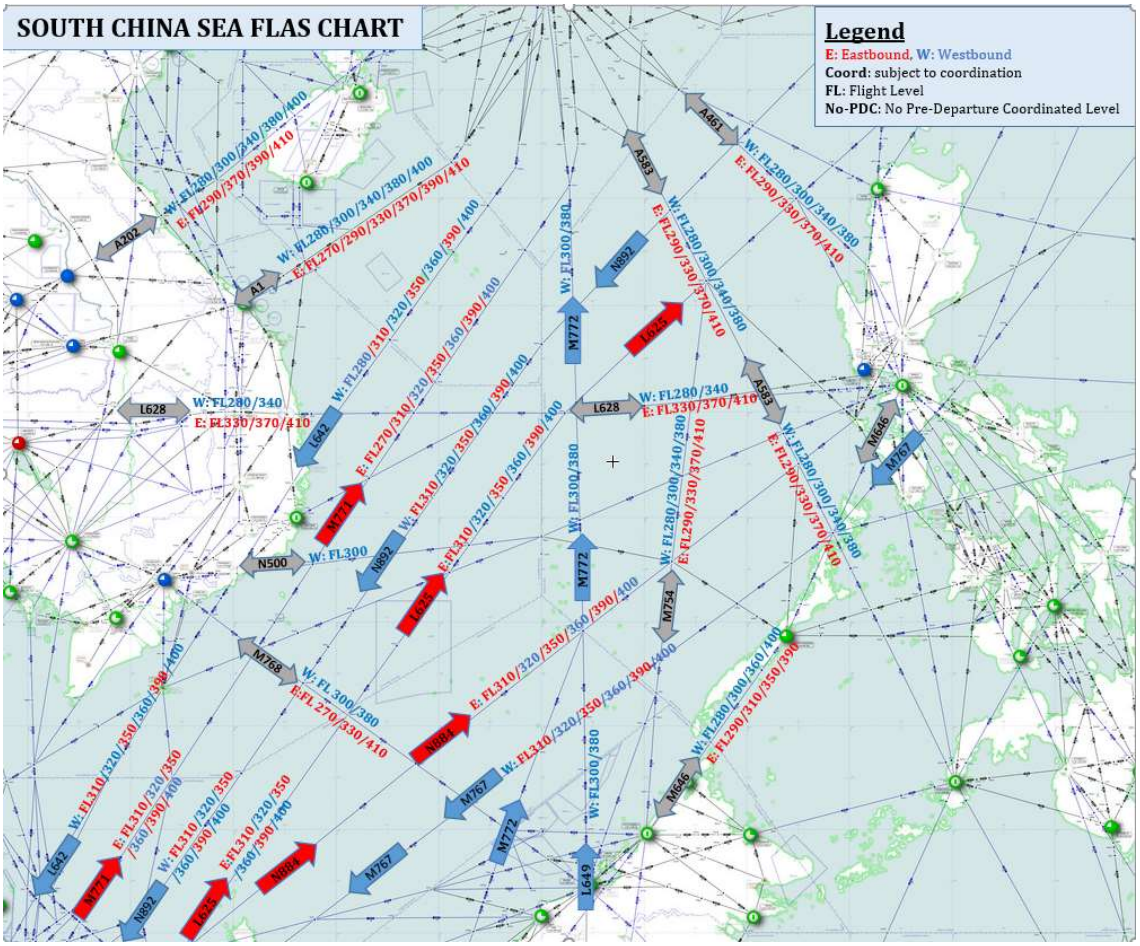

Chart 1: FLAS/FLOS among the ATS Routes

2.2 The SCS airspace structure used a non-standard Flight Level Orientation System (FLOS) and a complex Flight Level Allocation System (FLAS) providing vertical separation between the major routes and the less-busy crossing routes to overcome lengthy pre-departure coordination procedures.

2.3 As shown in the chart, non-standard FLOS is being used on the pairs of the unidirectional parallel routes system under the multilateral agreements of the relevant ACCs to fully utilize the limited usable flight levels ever since the SCS FLAS system was designed.

FLAS/FLOS Expectations in the APAC Seamless ANS Plan

2.4 All States should use the ICAO Table of Cruising Levels (FLOS) based on feet as contained **in Annex 2 Appendix 3a.** as specified in paragraph 7.15 as Regional Seamless ANS Elements with Priority 2.

2.5 According to **the clause 7.38 in the APAC Seamless ANS Plan version 4.0**, priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilised for safety and efficiency reasons within:

a) Category R airspace with the agreement of all ANSPs that provide services:

- within the airspace concerned; and

- within adjacent airspace which is affected by the FLAS; or

b) Category S airspace with the agreement of all ANSPs that provide services:

- **where crossing track conflictions** occur within 50 NM of the FIR boundary; and
- ATS surveillance coverage does not overlap the FIRs concerned, or ATS surveillance data is not exchanged between the ATC units concerned.

South China Sea ATS Surveillance and Communication coverage

2.6 According to the current *APAC Seamless ANS Plan version 4.0*, paragraph 6.18 identified the South China Sea lacking ATS surveillance and DCPC VHF coverage which need to be addressed with the highest priority which is on SCS airspace and the northwestern portion of the Manila FIR. Recent developments in the CNS area since CNS SG/26 meeting might be of interest to SCSTFRG.

2.7 As of mid-August 2022, 16 states and administrations provided updated coverages, and all plottable data provided has been applied to update coverage maps. Based on the inputs from States/administrations, the South China Sea pictures of ATS surveillance and DCPC VHF coverage are given in Figures 1 and 2, respectively.

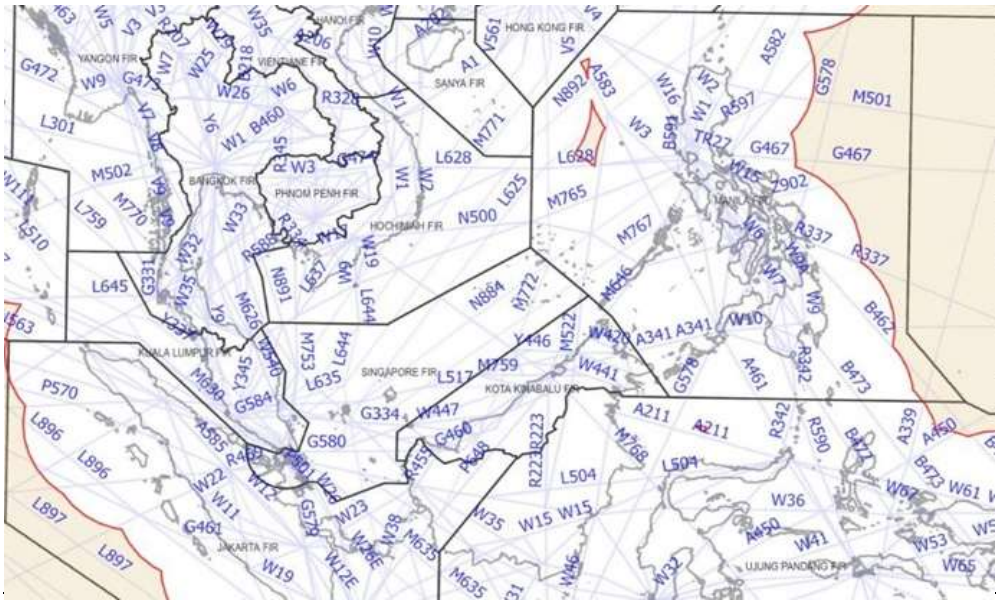

Figure 1: SCS Ground-based ATS Surveillance Gaps (as of 2022)

Note: Figure 1 only considers ground-based surveillance infrastructures and does not include other forms of space-based interrogation.

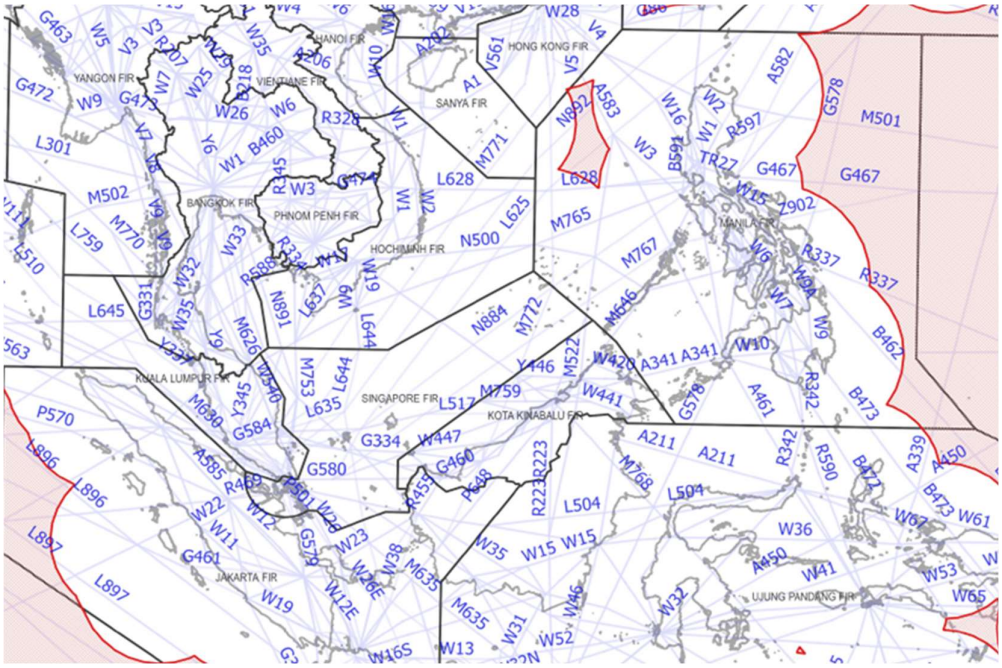

Figure 2: SCS ATS DCPC VHF Gaps (as of 2022)

Note: Figure 2 only considers DCPC VHF communications and does not include other forms of DCPC communications.

2.8 According to the figure, with other surveillance and communication enhancements such as ADS-B, ADS-C and CPDLC, it is believed that most of SCS airspace is almost surveillance and communication covered. ADS-B is used only for surveillance purpose not separation. There are very few States in APAC region which use ADS-B data for separation.

Limitations of the use of FLAS

2.9 This group have noted the interconnectivity of the airspace structure and FLAS/FLOS system. In years of operation, ACCs have become accustomed to this FLAS system, and derived to relatively mature risk response plan, such as the Large Scale Weather Contingency Plan and flexible temporary coordination mechanism. In fact, the current FLAS system has been proven to be reliable, but the following drawbacks should be taken into consideration:

- The reduction of fuel efficiency and increment of carbon emission because of the unavailability of the optimal cruising level, especially on the secondary routes.
- Frequent flight-level changes to accommodate the FLAS requirements among different route segments.
- High demands of extra coordination, causing an increase in the ATCOs' workload, especially in adverse weather conditions.
- Lack of flexibility, some of the secondary crossing routes are now busier than the primary routes compared with the original concept, timely adjustment is necessary.
- Human factors issues. Systemic risks resulting from the switching from normal FLAS to Large-Scale Detour Procedure, lead to the high possibility of coordination errors in the ATC-to-ATC transfer of control responsibility.
- Safety issues caused by the transition from non-standard FLOS levels to standard FLOS levels at the TOC points, especially at the boundary of the SCS area.

- Excessive longitudinal separation increased the reliance on vertical separation to separate the traffic, leading to insufficient use of limited flight Levels, significantly contributing to the shortage of flight-level resources.
- The capability and efficiency of current FLAS might be insufficient to cope with future traffic growth.

2.10 The group also recalled the Principles and Guidelines of the Optimization of SCS FLAS/FLOS. The following aspects should be taken into account when optimising the existing SCS FLAS/FLOS:

- Normalization of the SCS-modified Single Alternative FLOS to the ICAO Standard Single Alternative FLOS as per Annex 2 Appendix 3a;
- Service performance level commensurate with the CNS/ATM system capabilities in accordance with the expectations of the *Asia/Pacific Seamless ANS Plan*;
- Harmonized and consistent service provision of separation and procedures across the SCS area to reduce human errors;
- Removal of FLAS to allow more opportunities for better flight level allocation according to fleet capability;
- Recognition of the gap between current practice and best practice by ANSPs concerned; and
- Airspace users' expectations and needs for improved capacity, efficiency and safety, including economic and environmental considerations.

2.11 In view of the above-mentioned facts, the goal for the SCSTFRG should be the removal of FLAS in the SCS area to meet the *APAC Seamless ANS Plan*'s expectations. This cannot be achieved without a systematic and holistic roadmap supported by all stakeholders.

2.12 However, the SCSTFRG Priority 4 (Optimisation of FLAS/FLOS operation) cannot be considered an isolated project; it has significant interconnectivity with the SCSTFRG Priority 1, 2 and 3 (reduction of longitudinal separation on primary routes). Horizontal efficiency and vertical efficiency are highly correlated and relevant to one another.

Roadmaps of the SCS FLAS current situation

2.13 In line with the principles outlined in Section 2.11 and building upon IFATCA's original proposal at SCSTFRG/7, the following **six-phase roadmap** is proposed to guide the progressive reform of the Flight Level Allocation Scheme (FLAS) and Flight Level Orientation Scheme (FLOS) in the South China Sea (SCS) area. The roadmap aims to improve flight efficiency, airspace capacity, and operational safety through a phased and harmonized regional approach:

- ***Phase 1****: Targeted Reallocation of Flight Levels*

  To relieve bottlenecks and improve cross-border flows, two of the six currently allocated flight levels on primary ATS routes (M767/N884 and L625/N892)—one in each direction—should be reallocated to high-demand secondary crossing routes (A461, A583, M758, and M761). This adjustment will retain sufficient capacity on the primary routes while significantly easing congestion and delay on the secondary routes.

- ***Phase 2****: Reduction of Longitudinal Separation*

Implement reduced longitudinal separation standards, such as **5–10 NM within FIRs** and **10–20 NM at Transfer of Control (TOC) points**, particularly on primary ATS routes that dominate flight level usage. This aligns with ICAO's global best practices and enhances horizontal efficiency.

- ***Phase 3****: Alignment with ICAO Standard FLOS*

  Update the current SCS-modified single alternate FLOS on primary routes (L625/N892 and M767/N884) to the ICAO Standard Single Alternate FLOS (Annex 2, Appendix 3a). This also enables the release of additional flight levels based on the capacity gains from Phase 2.

- ***Phase 4****: Dynamic and Flexible Use of FLAS*

  Introduce **flexible or time-based FLAS allocation** tailored to daily traffic patterns, seasonal demand, or specific operational contexts, supported by data analytics and predictive modeling.

- ***Phase 5****: Conditional Suspension of FLAS*

  Gradually transition toward **conditional FLAS use**, where the scheme is suspended under normal operating conditions and activated only in specific scenarios such as large-scale weather deviations or contingency operations.

- ***Phase 6****: Structural Modernization and Integration with Future Concepts*

  Undertake a broader restructuring of the SCS route network using RNAV 2/RNP 2 principles, with a long-term goal of implementing **cross-border Free Route Airspace (FRA)** where feasible. This phase includes redesigning route alignments to accommodate near-parallel or unidirectional structures that support higher efficiency and interoperability.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) urge States to review CNS/ATM system capability and match this with service performance, in accordance with the expectations of *the Asia/Pacific Seamless ANS Plan*;

c) review and provide feedback to the South China Sea FLAS/FLOS Chart; and

d) discuss any relevant matters as appropriate.

…….