International Civil Aviation Organization

Eighth Meeting of the Surveillance Implementation Coordination Group (SURICG/8)

Bangkok, Thailand, 6 – 9 June 2023

Agenda Item 8: Update on surveillance activities and explore potential cooperation opportunity

UPDATE THE ACTION PLAN FOR SURVEILLANCE IN CHINA

(Presented by China)

SUMMARY

This paper represents the current status of the civil ATC surveillance business in China and the latest development.

1. INTRODUCTION

1.1 At present, CAAC has widely deployed primary surveillance radars (PSR), secondary surveillance radars (SSR) and ADS-B equipment for air surveillance. These surveillance facilities are applied to identify and track targets in the En-route area and approach area.

1.2 For airport surface surveillance, Surface Movement Radars (SMR) and Multilateration (MLAT) systems have been used in major airports.

1.3 With the wide implementation of various surveillance technologies, CAAC has accumulated practical experiences in this regard. CAAC is now conducting research and putting into practice ADS-B based ATC operations, Mode S DAPs applications and radar clustering, etc.

2. SURVEILLANCE STATUS

2.1 Currently, the number of the surveillance detection systems from CAAC, such as PSR, SSR, ADS-B, SMR and MLAT, which are under operation and construction has not changed compared to 2022. And more detailed information can be found in the *IP13_CHN AI.8a Update the Action Plan for Surveillance in China* at SURICG/7.

3. SURVEILLANCE IMPLEMENTATION

ADS-B Application for ATC Operation

3.1 The initial operation of ADS-B based ATC Operation Implementation has been carried out since October 2019 in a step-by-step approach.

3.2 Currently, CAAC has completed the Phase 2 of ADS-B ATC Operation, which is to implement ADS-B control operation in the APP and ACC area without radar control ability; to

implement Radar/ADS-B mixed control operation in the APP and ACC areas with Radar control ability.

3.3 The integration and application of ADS-B data in China's ATM Automation System has increased from 65% at the end of 2019 to 92% at present.

3.4 ADS-B has successfully solved the problem of visibility in areas without radar coverage; In radar coverage areas with high air traffic flow and flight density, ADS-B has demonstrated its ability of the radar's redundant back-up. In recent years, ADS-B has provided continuous and stable alternative service several times when radar equipment quits service

3.5 After the implementation of ADS-B control operation in the Chengdu-Lhasa route and multiple control areas, such as Urumqi, Aksu, Harbin, Yantai, and Lijiang, the route procedure control interval decreased from 10 minutes to 10 kilometers gradually. The airspace capacity and flight efficiency have been greatly improved .

3.6 Stable, continuous, and reliable ADS-B data is the foundation for implementing ADS-B control operation. In the initial stage of ADS-B control operation, CAAC has launched data quality analysis and identified some issues:

- The ground stations mainly focus on the issues of data output differences, data item retention mechanisms, and data quality;
- The data processing station/center mainly focuses on the issues of processing capacity and functional completeness;
- The ATM Automation System mainly involves the issues of access and application, correlation weights and fusion algorithms, preprocessing and parameter settings.

3.7 Therefore, in response to the issues above, CAAC has launched research on the application of ADS-B technology and optimization. For detailed information, see the *IP11_CHN AI.7 Study on Optimization and Improvement of ADS-B Application in China* at SURICG 7, and also see the updated information IP18 in this meeting.

Mode S DAPs Implementation

3.8 The wide deployment of Modes S Radars and ADS-B ground stations has greatly facilitated the research work initiated by CAAC on Mode S DAPs applications.

3.9 CAAC takes an active part in the compilation and revision of 《ICAO APAC Mode S DAPs IGD》together with Hong Kong China and other APAC member states. Edition 1.0 has been a great success since it was first released on the CNS SG/23(2019), gaining wide recognition and positive appreciation. As the Mode S technology develops, several versions of the IGD have been released accordingly so far.

3.10 In Mode S DAPs WG/6 held in March 2023, CAAC presented the revised draft (Edition 5.0) of the Mode S DAPs IGD, together with Singapore. This version mainly supplements the content of Mode S downlink format, the relevant error detection and correction mechanism , the application of SELECTED ALTITUDE and GPS interference recognition techniques using ADS-B ADD. This is the fifth time that has accomplished the revision task.

3.11 DAPs WG/6 is the last conference of the ICAO APAC Mode S working group. Afterward, the relevant issues and action plans in this field will be incorporated into the responsibilities of the Surveillance Implementation Coordination Group(SURICG).

3.12 Since being established in 2018, Chinese technicians have been actively engaged in Mode S research and, as a result, have submitted nearly 60 papers to DAPs WG over the past 6 years, including BDS SWAP Recognition(SURICG/6 -IP/19), DAPs-Based Upper Air Wind Speed Estimation(DAPs WG/5-IP/09), DAPs Application in Safety Net of ATMAS(ATMAS TF/2-IP/06), DAPs Extraction Strategy Research(DAPs WG/3- IP/06), Experience Sharing of GPS Interference

Troubleshooting Based on ADS-B Data（DAPs WG/5-IP/10、DAPs WG/6-IP/09, The Issues of Low Efficiency of Altitude Intention Marker Bits in Airborne Downlink Data（DAPs WG/6-IP/12), and Abnormal Decoding of ADS-B CPR Caused by Incorrect Ground to Air State of Aircraft(DAPs WG/5-IP/06), etc.

II conflict Analysis and II/SI Mixed Operation

3.13 The APAC Regional Roadmap for Mode S Implementation, indicates that the States with Mode S radars capable of performing II/SI mode operations are urged to transit from II code to II and SI mixed code, to ease the shortage of II codes.

3.14 With the consideration of the ever-increasing density of Mode S radars deployed in China and its neighboring countries and regions, CAAC has launched surveys on II conflict analysis(DAPs WG/5 - IP/07)and II/SI mix operation capabilities(SURICG/5 -IP/18).

3.15 China has completed the plan formulation work concerning II/SI Code Allocation and has finished the II/SI mode operations trials. For detailed information about CAAC's transition from II code to II and SI mixed code, you can refer to DAPs WG/6-IP/14. As planned, CAAC is considering to change some radars to SI codes and set radars with overlap areas while containing the same IC either not to lock Non-SI transponders or using an intermittent lock strategy for Non-SI transponders.

3.16 Next, CAAC will actively follow the ICAO APAC procedure to coordinate the allocation of II/SI codes with neighboring countries and regions.

Radar Clustering

3.17 The Surveillance Co-ordination Network(SCN) connects a group of sensors with overlapping coverage sharing the same IC, communicating as a cluster. By exchanging track data through SCN, sensors in the cluster can acquire target information and maintain tracking cooperatively. The Surveillance Co-ordination technique should be regarded as an effective solution to reduce asynchronous interference(FRUIT), suppress false targets, and improve detection quality.

3.18 In April 2021, CAAC launched Mode S Clustering trials, aiming to evaluate its feasibility in China and to further promote SCN applications based on corresponding conclusions. (DAPs WG/5-IP/08).

3.19 The Mode S SCN trials in China are planned to be carried out in three stages. In the first stage, CAAC will use radars of the same radar manufacturer to conduct cluster trials. In the second stage, CAAC will use radars of different radar manufacturers to conduct cluster trials. According to the results of the trials, CAAC will formulate a formal technical specification for Mode S SCN implementation in China for the third stage.

3.20 In the Mode S DAPs WG/6 held in March 2023, CAAC presented *IP/15 the Progress of the CAAC Trails on Surveillance Co-ordination Network of the Mode S Secondary Radar,* sharing the phased achievements of the trials based on the solo radar manufacturer. In this paper, the preliminary preparation work of the building transmission network, the upgrade and deployment of software and hardware for radars, functional verification and performance evaluation, and other contents and results of the trials are described and summarized in detail.

A-SMGCS

3.21 Up to now,24 airports in China have installed A-SMGCS Level-II systems. In order to further optimize A-SMGCS for facilitating the safety of aircraft and vehicles at airports and enhancing airport operation efficiency, CAAC issued "The Suggestions on Promoting Deployment and Application of A-SMGCS" on April 24, 2019. In this circular, considering the importance and effectiveness of the Stop Bar light, all airports with A-SMGCS are suggested to install the Stop Bar. Further, for large busy airports with multi-runways, when newly built or reconstructed & expanded,

this circular suggested to install the Taxiing Guidance, Stop Bar and Runway Status lights, meeting A-SMGCS Level-IV requirements in these large airports.

3.22 Following the above suggestions, the first Level-IV A-SMGCS has been put into operation at Beijing Daxing Airport.

4. SURVEILLANCE ACTION PLAN

4.1 "The development plan for CNS" approved by CAAC in 2021 was presented as a relatively detailed guidance for all usable/available surveillance technology applications in various ATC operation scenarios.

4.2 The detailed contents are presented in Appendix.

5. ACTION BY THE MEETING

5.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matter as appropriate.

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	Near–Term (2025)	Long–Term (2030)
Radar	● Continues to install and upgrade Mode S SSR in radar control area to guarantee the timely, continuous, accurate and reliable service according to the ATC requirements; ● Further implementation of Mode S SSR data link applications and start to conduct Mode S SSR networking research.	● Maintain a certain scale and number of SSR according to the short-term plan and SSR work with other surveillance methods like ADS-B; ● Adjust the deployment of Mode S SSR or build new ones with the change of air route and/or approach areas to satisfy the ATC demands; ● Realize a fully comprehensive surveillance system integrated with SSR and ADS-B equipment; ● Promote the clustering implementation of Mode S SSR.
ADS-B	● Push forward the research on ADS-B related technology and support the application of these new findings, making ADS-B ATC operations fully available in all ATC area in China; ● Provide ADS-B data services to airports, airlines, aviation-related enterprises, industrial regulators, research institutions and the ordinary people; ● Promote the construction and operation of ADS-B to make ADS-B control operation covers the whole China airspace according to China's low-altitude airspace management and reform work plan; ● Encourage ADS-B OUT applications based on the BeiDou Navigation Satellite System.	● As the internationalization of BeiDou standard proceed, CAAC will steadily integrate the BeiDou Navigation Satellite System into its comprehensive surveillance system. As a secure and precise GNSS source, the BeiDou Navigation Satellite System will make ADS-B applications more secure, always-available, accurate and reliable; ● Continues to learn from the practical international experience about ADS-B IN and conduct ADS-B IN trials in certain specific airspace; ● Make research on Flight Information Service-Broadcast (FIS-B) as an essential part of ADS-B IN applications and realize Air-Air surveillance based on FIS-B trials and practical surveillance demands.
MLAT & SMR	● Use solid-state SMR with MLAT integration as the means for airport surface surveillance.	● According to daily operation in busy airports, deploy more SMR and MLAT systems and upgrade the existing ones if needed; ● Be open to the introduction of brand-new surveillance technology to safeguard the safe operation of airport surface movement.