International Civil Aviation Organization

MIDANPIRG Air Traffic Management Sub-Group

Tenth Meeting (ATM SG/10)
(Jeddah, Saudi Arabia, 20 – 23 October 2024)

Agenda Item 3: Planning and Implementation issues related to ATM/SAR

USE OF MODE S CONSPICUITY CODE FOR TRANSIT FLIGHTS

(Presented by the United Arab Emirates & Sultanate of Oman)

SUMMARY

The flow in air traffic has led to challenges in allocating Secondary Surveillance Radar (SSR) codes for flights, as maintaining the necessary retention time before code reuse has become increasingly difficult. This paper proposes adopting a unique and shared conspicuity code in conjunction with Mode S technology to identify aircraft and link radar tracks with flight plans. This solution is viable and proven but relies on consistent Mode S support across neighboring states to be effective over extensive flight segments. The paper explores the application of Mode S for radar track and flight plan coupling and recommends a coordinated implementation strategy for Mode S usage in the MID region.

Action by the meeting is at paragraph 3.

REFERENCES

- ICAO Doc 7030: Regional Supplementary Procedures
- Middle East Secondary Surveillance Radar Code Management Plan (SSR CMP)
- ICAO Annex X Volume IV: Surveillance and Collision Avoidance Systems

1. INTRODUCTION

1.1 The aviation industry has experienced significant recovery following the COVID-19 pandemic, with air traffic levels rebounding and surpassing pre-pandemic figures. This recovery has been particularly noticeable in the international sector, where the demand for cross-border travel has led to a substantial increase in the number of flights.

1.2 A consequence of this traffic flow has been the increasing difficulty in allocating Secondary Surveillance Radar (SSR) codes. The growing number of flights has strained the available code groups, making it challenging to assign unique SSR codes while adhering to the agreed-upon two-hour retention time. This situation has led to heightened concerns about potential code conflicts and the need for efficient methods of code allocation to maintain the integrity and safety of air traffic management.

1.3 To mitigate these challenges, the use of a unique Mode S conspicuity code and flight identification based on unambiguous Mode S identification offers a viable solution to optimize code utilization and maintain operational efficiency.

1.4 The ICAO Middle East SSR Code Management Plan (SSR CMP) designates SSR code A1000 as the Mode S conspicuity code. This standardization optimizes SSR code usage by leveraging Mode S Elementary Surveillance (ELS), ensuring all aircraft identified through downlinked Aircraft Identification (ACID) share the same SSR code.

2. DISCUSSION

2.1 The increasing complexity of air traffic management, driven by the flow in international flights in the MID region, necessitates a more robust approach to SSR code allocation. The established SSR code allocation methods, while effective and safe, are reaching their operational limits.

2.2 The allocation of SSR (Mode 3/A) codes is governed by the Middle East Secondary Surveillance Radar Code Management Plan (SSR CMP), which designates specific code ranges to each Flight Information Region (FIR) for both international and domestic use. The primary objective of this plan is to minimize the risk of multiple flights being assigned the same SSR code, thereby enhancing the safety and efficiency of air traffic management.

2.3 However, it is well known that the availability of SSR codes is constrained by transponder technology, offering a total of 4,096 technically available codes. The available codes are organized into series and allocated to the FIRs within the region for their exclusive use.

2.4 As the number of flights continues to rise, the limited pool of discrete SSR codes increases the risk of the same code being assigned to multiple aircraft within the airspace. This overlap heightens the likelihood of flight misidentification and incorrect coupling of flight plans, posing a significant challenge to air traffic management.

2.5 Mode S technology and advanced ATM automation systems, provide an opportunity to move away from using discrete SSR codes for aircraft identification. Mode S interrogation provides the necessary aircraft identification for coupling radar tracks with flight plans, ensuring accurate and efficient tracking.

2.6 **Mode S transponders,** with their unique 24-bit aircraft address, ensure that each aircraft is distinctly identified without the risk of code duplication. Additionally, Mode S enhances situational awareness by providing detailed aircraft information to ATC systems. This capability is particularly beneficial in high-density traffic areas, where the potential for SSR code conflicts is elevated. The use of a unique conspicuity code in conjunction with Mode S identification further enhances the efficiency of air traffic management by simplifying the process of code allocation for transit flights.

2.7 **Conspicuity Codes** are standard and non-discrete SSR codes telling the ATM systems NOT to make use of SSR code to identify the aircraft and couple the radar tracks with flight plan. Instead, the ATM systems should make of the Mode S interrogated information, such as the downlinked aircraft identification or ICAO 24-bit aircraft address, to identify the aircraft and couple the flight plans. In line with the EUR and APAC region, MID SSR CMP reserves the code A1000 as conspicuity code.

2.8 The use of the conspicuity code, along with aircraft identification via Mode S, minimizes the reliance on domestic SSR codes for flights operating entirely within a specific ATC unit's Area of Responsibility (AOR), and under certain conditions, across AOR boundaries.

2.9 The conspicuity code proves even more advantageous when assigned to transit flights that cross AOR boundaries. In such cases, all involved ATC units utilize Mode S downlinked data for flight identification and seamless flight plan coordination.

2.10 The adoption of conspicuity codes aligns with the broader goals of modernizing global air navigation systems, as outlined in ICAO's Global Air Navigation Plan (GANP). These technologies not only address current challenges but also pave the way for future enhancements in surveillance and air traffic control, ensuring that the aviation industry can continue to accommodate growing traffic volumes while maintaining the highest standards of safety and efficiency.

2.11 **Integration and Advantages**: The combined use of conspicuity codes and Mode S transponders in Europe serves as a model for optimizing flight identification processes. Mode S transponders provide detailed and unique identification data, while conspicuity codes support additional situational awareness. This integrated approach enhances the capability of ATC systems to manage dense air traffic, reduce the risk of misidentification, and ensure the safe and efficient operation of airspace.

2.12 This European model highlights the effectiveness of leveraging advanced transponder technology and conspicuity codes to address the challenges associated with high traffic densities, offering valuable insights for other regions aiming to improve their flight identification and air traffic management systems.

2.13 According to the Mode S Interrogator Code Allocation (MICA) data a total of 140 Mode S radars are implemented for another 7 Mode S radars requests for code allocations have been issued. It therefore can be concluded that Mode S air surveillance in the MID region is widely established.

State	Implemented	Issued	Total
Bahrain	3	0	3
Egypt	29	0	29
Iran	0	3	3
Iraq	3	1	4
Jordan	7	0	7
Kuwait	1	0	1
Lebanon	1	0	1
Oman	11	2	13
Qatar	4	0	4
Saudi Arabia	73	0	73
United Arab Emirates	8	1	9

Number of Mode S surveillance sensors in States as of August 2024

2.14 Many states however continue to rely predominantly on Mode A/C information. This reliance is due to the fact that the benefits of conspicuity code are fully realized only when an aircraft operates under Mode S over a significant and continuous portion of its flight. For transit flights, this necessitates those adjacent states support Mode S across their borders, facilitating the coordination of flights with the agreed-upon conspicuity code.

2.15 A meaningful use of a conspicuity code by a state, or coordinated across multiple states, requires a full Mode S radar environment, aircraft being Mode S capable, and compatible ATM system capabilities. The ATM automation system needs to be able to identify the aircraft and couple the radar tracks with flight plan using the Mode S identification. When ground surveillance systems are utilized at airports, the use of conspicuity codes should be extended to include Advanced Surface Movement Guidance

and Control Systems (ASMGCS). Modern surveillance technologies, such as Multilateration and ADS-B, inherently support Mode S, ensuring seamless integration and enhanced situational awareness on the ground.

2.16 If an ATSU is not able to support a continuous control of a flight with the conspicuity code, it is required to revert back to allocate individual SSR codes for the transit flights neglecting the purpose of using Mode S.

2.17 While the use of conspicuity codes and Mode S for aircraft identification can be initiated for domestic flights, their application in international transit flights requires bilateral agreements between states.

2.18 To facilitate the introduction, it is advisable operationally and technically from the states that are interested to implement coordinate closely together to jointly plan for the introduction of using a conspicuity code for international flights.

2.19 The objectives of this cooperation should be to assure that participating states confirm the readiness of the local stakeholders infrastructure (surveillance sensors and data processing), operational procedures. Jointly executed field tests could be organised to validate the readiness and a phased transition be agreed.

Conclusion:

2.20 Under the Abu Dhabi declaration (UAE initiative to support the ANS within the MID Region) UAE supports the implementation of Mode S and Conspicuity Codes for aircraft identification within the transit phase in surveillance environments to optimization of the SSR allocation.

3. ACTION BY THE MEETING

3.1 The meeting is invited to

a) take note of the information contained in this paper, particular the challenges to allocate SSR codes for transit flights with the required retention times to the increasing number of flights;

b) recognize that use of the conspicuity code A1000 for transit flights and Mode S aircraft identification and coupling with flight plans is a viable and proven solution to overcome this challenge;

c) recognize that the use of a conspicuity code for transit flight is best addressed in a coordinated manner of states to have a joined planning to assure operational and technical readiness of all stakeholders; and

d) encourage the States interested to use conspicuity code for transit flights and Mode S aircraft identification and coupling with flight plans to initiate joint discussions to update the bilateral agreements for the implementation.

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