



ICAO

International Civil Aviation Organization

**THE FOURTH MEETING OF MODE S
DOWNLINKED AIRCRAFT PARAMETERS
WORKING GROUP
(MODE S DAPs WG/4)**

Web-conference, 29 – 31 March 2021

Agenda Item 6: Revision on the Draft Roadmap on Mode S DAPs for APAC Region

REVISED ROADMAP FOR MODE S DAPs

(Presented by China and Singapore)

SUMMARY

This working paper revised the Mode S roadmap that was previously proposed during Mode S DAPs WG/3.

1. INTRODUCTION

1.1 The Terms of Reference for the Mode S DAPs Working Group includes the formulation of a roadmap for DAPS Application.

1.2 An initial version of the roadmap was generated at Mode S DAPS WG/3 for consideration by SURICG/5.

1.3 The topics considered in the roadmap were:

- a) Mode S mandate;
- b) Use of SI Codes;
- c) Radar Clustering;
- d) Use of conspicuity codes;
- e) Weather reporting capability; and
- f) Datalink Map.

1.4 However, due to the evolving and complex nature of Mode S related technology, only the roadmap of *Mode S mandate* was adopted after some amendment.

1.5 This paper proposes a revised roadmap. Considering the evolving and complex nature of Mode S related technology, roadmap will only be recommended for some of the topics that were previously discussed.

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2. DISCUSSIONMode S mandate

2.1 Europe currently mandate that all IFR aircraft to minimally be Elementary Mode S equipped by 7 Dec 2020. For aircraft with a mass >5700kg or a speed >250kt, aircraft shall be equipped with Enhanced Mode S and ADS-B (version 2) effectively on 7 Dec 2020.

2.2 As more and more aircraft are equipped with ADS-B, it's almost certain that they are also minimally Elementary Mode S capable, especially for passenger aircraft. There could still be some which are non-Mode S and would need time to be equipped.

2.3 In view of the above, it was originally proposed that for a forward fit of Enhanced Mode S by 1 Jan 2022 and retrofit of Elementary Mode S by 1 Jan 2022. Minimally for aircraft with a mass >5700kg or a speed >250kt.

2.4 Considering the difficulty faced by airlines, the proposal was later amended by SURICG/5 to just a forward fit of Enhanced Mode S by 1 Jan 2022. Minimally for aircraft with a mass >5700kg or a speed >250kt. This proposal was subsequently adopted by APANPIRG/31.

Use of SI code

2.5 Asia Pacific region currently uses II code for mode S radars. In view of high radar density in parts of Asia Pacific, ICAO APAC is currently reviewing whether there is a need to use SI codes.

2.6 It is noted that for SI code to be used, the Mode S transponders has to be support SI code. However, despite ICAO Annex 10 Vol 4 stating that all Mode S transponders have to support SI code by 1 January 2005, there are still aircraft not supporting the SI code.

2.7 In consideration that there will be no IC interference between two radars having "matching II and SI codes" for transponders that supports SI code and that there are aircraft using transponders not supporting SI codes, two strategies were proposed (refer to another related paper):

- a) Option 1: All States in Asia Pacific to switch from II to SI code (using II/SI mode) on a fixed date.
- b) Option 2: States to transit from II to SI (using II/SI mode) individually (preferred).

2.8 It is noted that, in the transiting from II to SI (using II/SI mode), the airspace users, in particular the aircraft that does not support SI code will not be affected.

Radar Clustering

2.9 Radar clustering is a technique whereby a group of radar with overlapping coverage using the same IC code. The radars are networked together such that information on aircraft acquisition is shared between the radars. This will reduce the need for all-call replies.

2.10 The potential advantages of clustering is the use of a single IC (thus reducing the pressure on demands for ICs) and also for the potential reduction in all-call FRUIT. The main limitation of clustering is that it adds complexity (& hence cost) to the overall system design and requires additional management functionality for control and co-ordination.

2.11 Thus far, only Germany and the Netherlands practices radar clustering.

2.12 Due to the complexity, no roadmap is proposed for this topic. However, States with capability may adopt radar clustering and share the experience with other States.

Use of conspicuity codes

2.13 In most ATM systems, Mode A is the primary means for flight plan coupling. Due to limited number of Mode A addresses, there may not be sufficient unique Mode A addresses to be allocated to the flights.

2.14 In the case of Europe, due to their European Mode S mandate, Mode S address can be used for flight plan coupling for some flights, thus reduce the usage of the Mode A codes. The Mode A code 1000 is assigned as the conspicuity code.

2.15 USA is still using Mode A codes for coupling.

2.16 APAC currently still assigns Mode A codes. In anticipation that Mode S codes would be used in future, it was agreed that the Mode A code of 1000 be reserved as the conspicuity code for APAC so as to match EUR.

2.17 For the conspicuity code to be used, the ATM systems must support the conspicuity code feature. There will be cost involved and such spending may be optimised through coordination within the region. It is proposed that the roadmap for the ATM systems to be decided by the ATMTF.

Mandating weather reporting capability

2.18 It is widely recognised that weather information downlinked from aircraft is very useful for ATM operations. However, only less than 1% of aircraft provide the data via BDS 4,4 (Wind Speed, Wind Direction, Temperature) and BDS 4,5 (Temperature, Turbulence).

2.19 There is currently no service bulletins that will help upgrade aircraft with such capability. There is also currently no plan to develop such upgrades.

2.20 States such as Japan and New Zealand are developing algorithms to derive the weather information from data provide via BDS 5,0 (Track and Turn Report) and BDS 6,0 (Heading and speed report).

2.21 It is envisaged that weather reporting capability will be available in the next generation transponder. Instead of mandating weather reporting capability, it may be more practical to wait for the next generation transponder. Weather information may be derived using algorithms.

Datalink map

2.22 Europe is experiencing very high usage of the 1090MHz frequency. In order to prevent States from over interrogating, Europe has a datalink map which restricts the registers that States can extract from. Europe even have rules stating that Mode S radars should not actively interrogate for Mode A and Flight ID unless there is a change.

2.23 USA does not have such a map as USA do not make use of DAPs.

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2.24 It is understood that the datalink map is difficult to enforce. The coordination efforts may be much higher than the benefits, with no certainty of success. Instead of implementing datalink map, States are urged to adopt the related SARPs and guidance material relating to reduction of frequency congestion.

Monitoring of 1030 and 1090 MHz usage

2.25 It is unclear whether parts of Asia Pacific is facing 1030/1090MHz congestion. It is proposed that States with the capability measure the frequency occupancy. To facilitate such measurement, guidance material is proposed. If the RF occupancy is high, there would be a need for regular monitoring.

3. SUMMARY

3.1 The revised roadmap is summarised as follows:

S/N	Issue	Proposed Roadmap	Reasons
1	Mode S Mandate	<p>Conclusion APANPIRG/31/14 (CNS SG/24/13 (SURICG/5/3(DAPS WG3/1))) - Mode S Forward Fit Equipage in APAC Region</p> <p>That, States/Administrations in APAC Region be strongly encouraged to mandate that registered aircraft with a maximum certified take-off mass exceeding 5 700 kg or having a maximum cruising true airspeed capability greater than 250 knots, with a date of manufacture on or after 1 January 2022 be equipped with Mode S avionics compliant with Enhanced Surveillance (EHS).</p>	<p>Considering that a number of DAPs applications will require EHS and that it's easy for new aircraft to be equipped with EHS. Retrofitting existing airframes with EHS will need further deliberation under challenging pandemic situation.</p>
2	Use of SI Codes	<p>Proposed Draft Conclusion</p> <p>States with Mode S radar capable of performing II/SI mode operations are urged to transit from II code to SI code, so as to ease the shortage of II codes. States planning to perform the transition shall coordinate with ICAO APAC to obtain the SI codes.</p>	<p>Due to higher density of radars, some states are facing a shortage of IC codes, which has to be solved by transiting from II to SI code. It is noted that radars using II and SI codes can co-exist, hence there is no need for a big bang approach. However, States still have to coordinate with ICAO APAC on the allocation of SI codes. Due to some aircraft still not SI code ready, only radars with II/SI mode should be allowed to use SI</p>
3	Radar Clustering	<p>No proposed roadmap at the moment. But States with the competency and operational requirement may consider applying such technique.</p>	<p>Due to complexity and cost, only Germany and the Netherlands have implemented such techniques. It is unclear whether the benefits outweigh the cost.</p>

4	Use of conspicuity codes	<p>Mode A = 1000 has already being assigned as the conspicuity code.</p> <p>Will defer to ATMTF to consider having a roadmap for ATM systems to be ready to support the conspicuity code feature.</p>	<p>It is foreseen that the region will need the automation systems to be able to support the conspicuity code feature before Mode S address can be used in lieu of Mode A address for selected flights.</p> <p>There may be a need to coordinate the efforts within the region.</p>
5	Weather reporting capability	<p>Not practical to mandate weather reporting capability in Mode S, as there are no ready solutions to enable such capability for current transponders (i.e. versions 0,1, and 2). States requiring such capability should consider other means to generate weather information (such as using algorithm to derive weather information).</p>	<p>While weather data is one of the Mode S DAPs, only very few (<1%) aircraft has this capability. The industry does not have software patches to enable this weather feature, hence there is no point having a mandate for weather capability. Instead, some States researched algorithms to derive weather information.</p> <p>It is foreseen that the weather reporting capability will be available in version 3 transponders</p>
6	Datalink Map	<p>No proposed roadmap at the moment. States are instead urged to adopt the various SARPs and guidance material relating to reduction of frequency congestion.</p>	<p>It is difficult to implement and enforce datalink map with no certainty of success.</p> <p>It is more practical to adopt the SARPs and guidance materials relating to the reduction of frequency congestion.</p>
7	Monitoring of 1030 and 1090 MHz usage	<p>States with capability are urged to perform RF measurement on 1030 and 1090 MHz usage. Guidance material is proposed.</p>	<p>It is necessary to ensure that the RF occupancy is kept at healthy levels.</p>

Note: The roadmap may be revisited as and when necessary. It is foreseen that for the items without roadmap, they may be reviewed in 2 to 3 year time.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) note the contents of the paper;
- b) discuss and consider the proposed roadmap.
