



International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group

Ninth Meeting (CNS SG/9)
(Cairo, Egypt, 19 – 21 March 2019)

Agenda Item 4: CNS Planning and Implementation in the MID Region

OUTCOME OF THE SURVEILLANCE/MICA WORKSHOP

(Presented by the Secretariat)

SUMMARY

This paper presents the outcome of the Surveillance/MICA Workshop, and present the Draft MID Region Surveillance plan for further review and improvement.

Action by the meeting is at paragraph 3.

REFERENCES

- MSG/6 Report

1. INTRODUCTION

1.1 The introduction of Mode S Interrogators in the MID Region has identified the need for a coordinated approach to the allocation and implementation of the limited number of Interrogators Codes. In 2011, the ICAO MID regional office requested EUROCONTROL to formally provide support for MICA in the ICAO MID Region. It has been agreed that the MICA Cell will support the ICAO MID Region with the same process used within the EUR Region.

2. DISCUSSION

2.1 The meeting may recall that the Mode S Interrogator Code Allocation (MICA) process in the MID Region is managed by the EUROCONTROL MICA web application since 2011.

2.2 It was identified that some MICA users are not familiar with the MICA procedures and process. Therefore, the MSG/6 meeting through Conclusion 6/32 agreed that a Surveillance/MICA Workshop be organised in 2019, and that the Draft MID Region Surveillance plan be reviewed and updated.

MSG CONCLUSION 6/32: MID REGION SURVEILLANCE PLAN AND WORKSHOP

That, with a view to provide MICA Operator with necessary knowledge to implement MICA processes efficiently, and in order to develop a comprehensive Surveillance Plan in the MID Region:

- a) a Surveillance/MICA Workshop with support of EUROCONTROL be organised in February 2019;*
- b) States be invited to participate actively in the Workshop; and*
- c) the Draft MID Region Surveillance Plan be reviewed/updated during the Surveillance/MICA Workshop and presented to the CNS SG/9 meeting for further review, before presentation to the MIDANPIRG/17 meeting for endorsement.*

2.3 The meeting may wish to note that the Surveillance/MICA Workshop was convened from 26-28 February 2019. The Summary of the Discussions is at **Appendix A**.

2.4 The meeting may recall that MIDANPIRG 15 through Conclusion 15/32 agreed that, the Eurocontrol Document “Requirements process for the coordinated allocation and use of Mode S Interrogator Codes in the ICAO Middle East Region” (Edition 1.02 dated August 2014), be used for the allocation of the Mode S IC Codes.

CONCLUSION 15/32: MID REGION PROCESS FOR MODE S IC CODES ALLOCATION

That, the Eurocontrol Document “Requirements process for the coordinated allocation and use of Mode S Interrogator Codes in the ICAO Middle East Region” (Edition 1.02 dated August 2014), be used for the allocation of the Mode S IC Codes.

2.5 The meeting may wish to note that new procedure has been develop for users in the MID Region, Therefore, the Eurocontrol Document “Requirements process for the coordinated allocation and use of Mode S Interrogator Codes in the ICAO Middle East Region” has been updated as at **Appendix B**.

2.6 The Workshop reviewed and updated the Draft MID Region Surveillance Plan as at **Appendix C**.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) review the outcome of the Surveillance/MICA Workshop and take actions as appropriate;
- b) review and update the Draft MID Region Surveillance Plan; and

c) endorse the following Draft Conclusion:

***DRAFT CONCLUSION 9/X: MID REGION PROCESS FOR MODE S IC CODES
ALLOCATION***

That, the Eurocontrol Document “Requirements process for the coordinated allocation and use of Mode S Interrogator Codes in the ICAO Middle East Region” (Edition 1.0 dated March 2019), be used for the allocation of the Mode S IC Codes.

APPENDIX A

SURVEILLANCE/MICA WORKSHOP

Summary of Discussions

(Cairo, Egypt, 26-28 February 2019)

PARTICIPATION

25 participants from 6 States (Egypt, Iran, Iraq, Qatar and Sudan) and 2 Organizations.
The workshop supported by EUROCONTROL.
Aireon participated via Webex

WORKSHOP OBJECTIVES

The objectives of the Workshop were to:

- 1) provide an overview of the Mode S principle and operation, the SSR Radio frequency, Avionic Monitoring, and the new Surveillance Standards;
- 2) provide the MICA Operators in the MID Region with necessary information to implement MICA processes efficiently; and
- 3) review and update the Draft MID Region Surveillance Plan.

DISCUSSIONS

The Workshop:

- was apprised of the Mode S principles; lockout, Radar coverage, clusters, IC codes, Elementary and enhanced Surveillance.
- noted MICA process and cycle, EUROCONTROL MICA website was presented.
- reviewed and updated MICA focal points in the MID Region.
- was apprised of the II and SI codes use, operation and allocation.
- noted IC Conflict causes and Management process.
- was apprised of Mode S Radar programming to reduce their contribution to 1030/1090MHz RF band usage.
- was apprised of the radar systems use the shared RF band 1030/1090, examples in Europe and simulation of future use.
- highlighted the impact of the Small Unmanned Aircraft System (sUAS) equipped ADS-B operation on Aircraft detection.
- was apprised of the space based ADS-B technology; constellation, coverage and validation algorithm.
- noted that EU mandates ADS-B carriage version 2 for IFR flight and aircraft more than 5700kg from 2020.

CONCLUSIONS

- No IC allocation needed for mobile Mode S radars and WAM/MLAT (II Code 0).
- In the ICAO MID Region, II codes and matching SI codes are still not allocated to Mode S radar with overlapping coverage.
- EMS Coverage maps allocated by the MICA Cell when supported by Mode S radar and reported in the IC application. Otherwise, range per sector is provided.
- When IC conflict is detected, the Focal Point has to provide the necessary assistance and advice to achieve an early resolution of the IC conflict.

- Radar detection of outbound traffic and not inbound, would be a symptom of IC Code conflict (delayed acquisition of incoming aircraft by Mode S radar).
- Target disappearance could be resulted from transponder over interrogations, so it will be unable to reply to other interrogations. As too many interrogations may prevent the transponder to reply to some of them, and has an impact on surveillance systems.
- The output power and density of sUAS equipped ADS-B could impact the detection range of Aircraft.
- The detection range of aircraft decreases when the ADS-B squitter rate and/or number of aircrafts in sky increase.
- The importance to verify that transponders are not subject to excessive rate of interrogations (below ICAO minimum reply rate capability (50 reply/s)) was highlighted.
- ADS-B version 2 provides good position indicators.
- Space-based ADS-B provides more than a single source ADS-B (ground based ADS-B). With the redundancy of the satellite coverage the same message is received by more than 1 satellite, that means that space based ADS-B is not only providing to the ANSP the ADS-B message, but it is able also to validate the position of that message, independently from GPS or transponder quality. To do the same with ground stations, a complete WAM system will be required, with at least 3 sensors looking at the same target.
- single source ADS-B means that an ADS-B coverage coming from a single ground sensor. In this case, if a transponder has a bad quality, the ANSP has no way to validate the position.
- Space based ADS-B does not require any modification on board of an ADS-B equipped aircraft. it is capable to receive ADS-B messages from all ADS-B transponder, so v.0, v.1, v.2.
- The Hardware needed by ANSP is the Service Delivery Point, a simple redundant router and server. As for data distribution, dual MPLS line can be used to connect SDP to the Space based ADS-B domain. If MPLS will not be available, a dedicated solution has to be investigated

RECOMMENDATIONS

- States shall request coordinated IC code(s) and coverage map(s) (Surveillance and lockout) before start of operation, preferably one year in advance.
- States to plan carefully using active MLAT in order not to generate excess 1030/1090MHz FRUIT; and not to over occupy the Transponder (due to selective interrogations).
- States to monitor, if possible, the transmission on 1030/1090MHz to make sure that Aircraft are not over-interrogated (ICAO annex 10, Vol VI, section 3.1.2.10.3.7.3 & section 3.1.1.7.9.1)
- States to program radar to extract needed BDS register Data and not to extract unused ones.
- For the safety of the air traffic surveillance system, the coverage of two Mode S radars using the same IC shall not overlap.
- Target disappearance is a safety related issue, fall-back procedure should be in place including lockout override.
- ICAO MID to coordinate with IATA to get statistics on the percentage of SI equipped aircraft in the MID Region.
- Regulators and Radar Operators are encouraged to register to MICA website.
- ICAO MID to consider addressing the impact of vehicles equipped ADS-B (ex. sUAS, gladder, airports vehicles, etc.) on 1090MHz RF environment in future relevant Workshops.
- CNS SG/9 to consider requiring that Mode S Radars support the use of II/SI code operation.
- MID Region to consider allocating II code and matching SI for Military.

**EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION**



**Requirements process for the
coordinated allocation and
use of Mode S Interrogator
Codes in the ICAO Middle
East Region**

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EXECUTIVE SUMMARY

The introduction of SSR Mode S interrogators requires a coordinated approach to the allocation and implementation of the Interrogator Codes.

Provisions regarding the implementation and monitoring of Mode S IC allocations have been defined by ICAO.

In the ICAO European region, the management of the plan is exercised by EUROCONTROL on behalf of the European regional office of ICAO. EUROCONTROL has put in place a cell (the MICA Cell) to provide the centralised service of Interrogator Code (IC) allocation to Mode S Operators through their competent Focal Point. To support the coordinated allocation and implementation of the IC to Mode S interrogators in the ICAO European region, the Mode S IC allocation process has been formalized in the “EUROCONTROL Specification for the Mode S IC Allocation Coordination and IC Conflict Management” document.

Mode S interrogators are also installed in the ICAO Middle East region. The operational coverage of some of these interrogators is overlapping coverage of Mode S interrogators installed in the ICAO European region. In order to avoid any Mode S IC conflict with operational Mode S interrogator, it is therefore critical to coordinate the Mode S IC allocation in the ICAO Middle East region in close cooperation with the ICAO Middle East regional office. The Mode S IC allocation process applied in the ICAO European region will also be applied for IC allocation to Mode S interrogators in the ICAO Middle East region. This process is based on 168 days (approximately 6 months) cycles, aligned on AIRAC effective dates. The IC allocation to Mode S interrogators in the ICAO Middle East region and the ICAO European region will be processed together during the same MICA cycles.

This document defines processes applicable to the use of the centralised Mode S interrogator code allocation service in charge of coordinating interrogator code allocations within the ICAO Middle-East region. It specifies the detailed procedures for Mode S Operators to obtain a coordinated Mode S interrogator code and particularly the interfaces between the Mode S Operators, the ICAO Middle-East Regional Officer CNS acting as Focal Point for all competent States of ICAO Middle-East region, and the EUROCONTROL centralised Mode S interrogator code allocation service. State Focal Points can also be nominated in competent States of ICAO Middle-East region in order to support the ICAO Middle-East Regional Officer CNS in the coordination of all matters concerning the allocation of ICs with the Mode S Operators in the State.

This document also specifies the procedures in place to manage interrogator code conflicts and the resolution of issues with respect to the interrogator code allocation plan.

In addition, the IC allocation in the ICAO European region relies on required Mode S interrogator performances and airborne carriage. The last part of this document introduces recommended functionalities for Mode S interrogators and transponders which could compromise future IC allocations if not implemented in that region.

1. Introduction

1.1 Purpose of the document

The purpose of this document is to lay down recommendations and requirements for an efficient support of the EUROCONTROL MICA Cell to the allocation of Mode S Interrogator Code by the ICAO Middle East regional office.

It describes the process and procedures in order to coordinate the Mode S Interrogator Code (IC) allocation for Mode S interrogators with a fixed position within the International Civil Aviation Organisation (ICAO) Middle-East (MID) region.

This document defines the procedures and the role of the following parties involved in the process:

- Mode S Operators
- ICAO MID regional office
- International Organisations
- MID Focal Point(s)
- State Focal Points
- EUROCONTROL Mode S IC Allocation Cell (hereinafter MICA Cell)

The document also describes the management and resolution of IC allocation and IC conflict issues.

1.2 Context

Whilst traditional Mode A/C Secondary Surveillance Radar (SSR) stations continuously interrogate all aircraft within their range, Mode S interrogators perform selective interrogations.

In order to avoid ambiguity in the operation of the system it is essential that each eligible Mode S interrogator is allocated an eligible Interrogator Code (IC) and is protected from interference by other Mode S interrogators operating in overlapping or contiguous airspace. The coverage areas of two Mode S interrogators using the same IC must not overlap, except if they are grouped in a cluster or if other appropriate operational mitigations are in place.

The introduction of Mode S interrogators has identified the need for a coordinated approach to the allocation and implementation of the ICs used by ground-based, airborne and shipborne platforms.

Note: systems such as ACAS or current Multilateration systems do not require the co-ordinated allocation of an IC. Even if they use Mode S interrogations and replies, they do not rely on “All Call” for acquisition or perform lockout.

Interrogator Codes can be either Interrogator Identifiers (II) or Surveillance Identifiers (SI). The design of the Mode S system limits the number of Interrogator Codes available (excluding II zero) to 15 II codes and 63 SI codes. For more information, please refer to [ANNEX A](#).

Due to the limited number of ICs, it is necessary to have a centralised IC allocation system to ensure an optimised allocation and a safe operation. In the ICAO EUR region, the centralised IC allocation system is exercised by EUROCONTROL on behalf of the European regional office of ICAO. The MICA Cell has been created to provide the centralised service of IC allocation to Mode S Operators through their competent State Focal Point.

In 2011, the ICAO MID regional office requested EUROCONTROL to formally provide support for Mode S interrogator code allocation in ICAO MID region. It has been agreed that the MICA Cell will also support the ICAO MID regional office, with the same standard bi-annual MICA cycle (see [Section 5](#)) as that for Mode S interrogators within EUR region. This includes a coordinated listing of IC and coverage for Mode S interrogators in MID region. It has also been agreed that a single ICAO MID Regional Officer CNS will coordinate directly with the MICA Cell for all countries in MID region.

1.3 Abbreviations

ANSP	Air Navigation Service Provider
EANPG	European Air Navigation Planning Group
EMS	European Mode S Station
EU	European Union
EUR	Europe (ICAO region)
IC	Interrogator Code
ICAO	International Civil Aviation Organisation
ICD	Interface Control Document
II	Interrogator Identifier
MICA	Mode S Interrogator Code Allocation
MICoG	Mode S Interrogator Code Coordination Group
MID	Middle-East (ICAO region)
SGEG	Surveillance Ground Environment Group
SI	Surveillance Identifier
SSR	Secondary Surveillance Radar
TRD	Test, Research and Development

1.4 Definitions

For the purpose of this EUROCONTROL Specification, the following definitions are applicable.

Cluster: a set of Mode S interrogators connected with each other in the same network and using the same IC to share track information in order to allow aircraft acquisition already acquired by other stations in the same cluster.

Competent State:

- (a) in the case of an ANSP from an EU Member State or States having chosen to transpose the EU regulation, the State that has certified the provider in accordance with Commission Regulation (EC) No 1035/2011 repealing Regulation 2096/2005;
- (b) in other cases for an EU Member State or States having chosen to transpose the EU regulation, the State within the area of responsibility in which the Mode S Operator operates, or intends to operate, an eligible Mode S interrogator.

(c) for States not subject to EU regulation, the State within the area of responsibility in which the Mode S Operator operates, or intends to operate, an eligible Mode S interrogator in accordance with the ICAO EUR FASID and Doc024 (European Principles And Procedures for the Allocation of Secondary Surveillance Radar Mode S Interrogator Codes (IC)).

(d) States from ICAO MID region

Eligible Interrogator Code: any code among the II codes and the SI codes, except:

1. II code 0;
2. the interrogator code(s) reserved for military entities, including intergovernmental organisations in particular North Atlantic Treaty Organisation (NATO) management and allocation;

Eligible Mode S Interrogator: Mode S interrogator for which at least one of the following conditions is satisfied:

1. the interrogator relies, at least partly, on Mode S all call interrogations and replies for Mode S targets acquisition; or
2. the interrogator locks out acquired Mode S targets in reply to Mode S all call interrogations, permanently or intermittently, in part or totality of its coverage; or
3. the interrogator uses multi-site communications protocols for data link applications;

Focal Point (in ICAO EUR region): a person representing one or several competent States or an international organisation applying for interrogator codes, who is responsible for the coordination of all matters concerning the IC allocations between the MICA Cell and the Mode S Operators in his area of oversight.

MID Focal Point: an ICAO Middle East Regional Officer CNS representing the competent States or an international organisation within the ICAO Middle East region applying for interrogator codes, who is responsible for the coordination of all matters concerning the IC allocations between the MICA Cell and the Mode S Operators in the ICAO Middle East region.

State Focal Point: a person representing one or several competent States or an international organisation applying for interrogator codes, who is responsible to support the MID Focal Point(s) in the coordination of all matters concerning the allocation of ICs with the Mode S Operators in his area of responsibility.

Interrogator Code Allocation Plan: the most recently approved complete set of interrogator code allocations.

Interrogator Code Allocation Plan Proposal: a proposal for a complete set of IC allocations, submitted by the interrogator code allocation service for approval by competent States.

Interrogator Code Allocation System: means a system within the European Air Traffic Management Network, and the associated procedures, through which a centralised service of interrogator code allocation (hereinafter interrogator code allocation service), for dealing with the processing of interrogator code applications and the distribution of an interrogator code allocation plan proposal, is provided for Mode S Operators through competent States.

Interrogator Code Application (hereinafter IC application): an application from a Mode S Operator for the allocation of an eligible interrogator code.

Interrogator Code Conflict: uncoordinated coverage overlap of two or more Mode S interrogators operating on the same interrogator code, potentially resulting in aircraft remaining undetected by at least one of the Mode S interrogators.

Lockout: protocol that allows the suppression of Mode S all call replies from already acquired Mode S targets.

Lockout Coverage: Mode S interrogator configuration defining where and how to apply lockout to Mode S targets. The Lockout Coverage can be provided in different formats depending on Mode S interrogator capabilities: European Mode S Coverage Map ICD, lockout range per sector, unique lockout range.

Lockout Coverage in European Mode S Coverage Map ICD format Map (hereinafter Lockout Map): Mode S interrogator configuration file defining where and how to apply lockout to Mode S targets.

MICA Cell: the EUROCONTROL Team operating the interrogator code allocation system in accordance with its associated procedures in order to provide a centralised interrogator code allocation service.

MICA Cycle: a recurrent 6 monthly procedure for Mode S IC allocation.

MICA Cycle Effective Date: the last date of a given MICA cycle.

MICA website: the Mode S IC Allocation web-based application (hereinafter MICA website) is used to coordinate and manage the allocation of eligible IC to eligible Mode S interrogators in ICAO EUR region and ICAO MID region. The access to the web application is managed through the Eurocontrol OneSkyOnline portal. The MICA website is part of the interrogator code allocation system.

Mode S: cooperative surveillance technique for air traffic control which enables the selective interrogation of aircraft and the extraction of air derived data through which new air traffic management functionalities can be developed.

Mode S All Call interrogations: messages that are normally used by Mode S interrogators to acquire Mode S targets entering their area of coverage.

Mode S interrogator: a system composed of antenna and electronics, supporting addressing of individual aircraft through the Mode Select, known as Mode S.

Mode S Operator: a person, organisation or enterprise operating or offering to operate a Mode S interrogator, including:

- (a) Air navigation service providers;
- (b) Mode S interrogators manufacturers;
- (c) Airport operators;
- (d) Military authorities;
- (e) Research establishments;
- (f) Any other entity entitled to operate a Mode S interrogator;

Mode S target: a platform equipped with a Mode S transponder.

Third Country: a country where the Mode S IC allocation is not coordinated by the EUROCONTROL MICA Cell.

1.5 References

*[RD 1] ICAO Annex 10 to the Convention on International Civil Aviation
Aeronautical Telecommunications
Volume IV Surveillance and Collision Avoidance Systems
Amendment 85 or latest*

[RD 2] EUROCONTROL Specification for the Mode S IC Allocation Coordination and IC Conflict Management
EUROCONTROLSPEC153
14th June 2013

1.6 Document structure

[Section 2](#) describes how the IC Allocation coordination is organized in ICAO European region.

[Section 3](#) provides details about the actors and their role in the IC allocation process.

[Section 4](#) details the procedure to submit an IC application in order to request an IC allocation.

[Section 5](#) details the Mode S IC allocation cycle (MICA cycle) which is the default procedure for processing IC applications.

[Section 6](#) details the Ad-Hoc allocation process which is an alternative but more constraining procedure to process IC applications.

[Section 7](#) provides details about the IC conflict reporting procedure.

[Section 8](#) provides details on how to resolve IC allocation and conflict issues.

[Section 9](#) provides some guidance for IC allocation in ICAO Middle East Region. In particular the Mode S interrogator performances are discussed.

2. IC Allocation Coordination in Europe

2.1 Organization

Provisions regarding the implementation and monitoring of Mode S IC allocations have been defined by ICAO.

In the ICAO EUR region, the management of the plan is exercised by EUROCONTROL on behalf of the European regional office of ICAO.

EUROCONTROL has put in place the MICA Cell to perform the allocation of the Interrogator Codes. In addition the Mode S Interrogator Codes Co-ordination Group (MICoG) had been created to oversee the allocation process and provide guidance to the MICA Cell. Presently, the Surveillance Ground Environment Group - Mode S Interrogator Codes Co-ordination Group (hereinafter SGEg-MICoG) performs this task. The SGEg-MICoG members are the Focal Points representing the National Regulatory Authorities of European States and those international organisations applying for IC.

The Focal Points are also responsible for the coordination of all matters concerning the IC allocations between the MICA Cell and the Mode S Operators in their area of oversight.

The Figure 1 here below depicts the co-ordination for IC allocation to Mode S interrogators in ICAO EUR region.

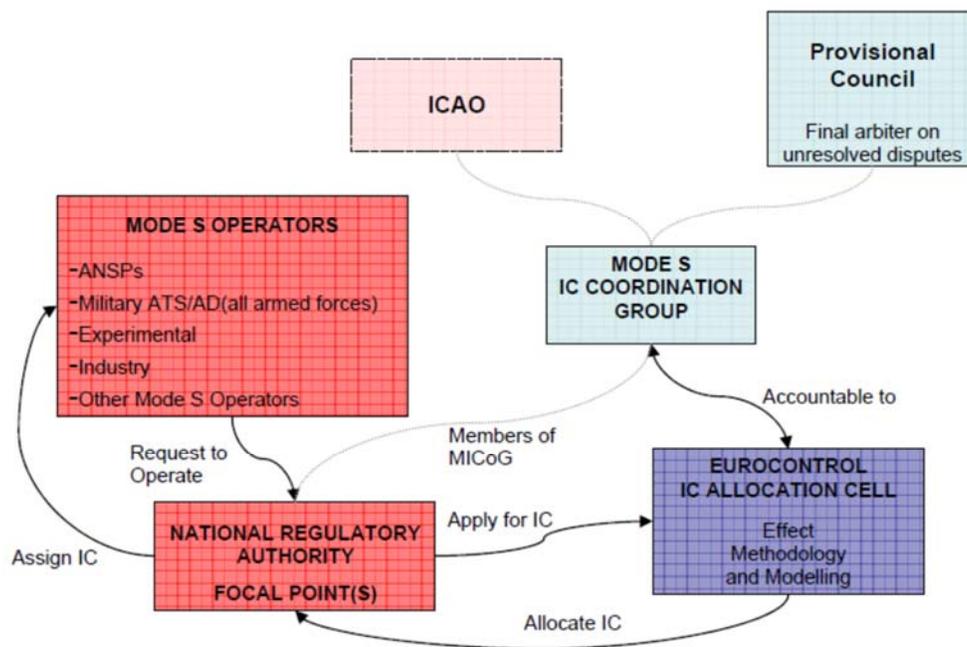


Figure 1: Mode S IC Allocation Coordination in Europe

2.2 IC Allocations Framework

IC allocation started with deployment of the first Mode S interrogators in Europe. The deployment of more Mode S interrogators required a coordinated process which was formalized in 2005:

Mode S Interrogator Codes Allocation Process 1.0

29 September 2005

From that date, the Mode S IC allocation is managed in cycle of 6 months.

To enforce the requirements and responsibilities on each participant, the following European Regulation was issued in 2009:

COMMISSION REGULATION (EC) No 262/2009 of 30 March 2009

laying down requirements for the coordinated allocation and use of Mode S interrogator codes for the single European sky

In 2013, the “EUROCONTROL Specification for the Mode S IC Allocation Coordination and IC Conflict Management” document ([\[RD 2\]](#)) has been issued. This EUROCONTROL specification defines processes applicable to the use of the centralised Mode S interrogator code allocation service (managed by the EUROCONTROL MICA Cell) in charge of coordinating IC allocations within the ICAO EUR region. It superseded the “Mode S Interrogator Codes Allocation Process 1.0” document identified above.

This document specifies the detailed procedures for Mode S Operators to obtain a coordinated Mode S IC and particularly the interfaces between the Mode S Operators, the Focal Points representing competent States in the ICAO EUR region and the EUROCONTROL centralised Mode S interrogator code allocation service.

This document also specifies the procedures in place to manage interrogator code conflicts and the resolution of issues with respect to the interrogator code allocation plan.

EU Member States that comply with this specification comply with a number of regulatory provisions of the European Regulation identified above.

In addition, a web application, called MICA website, has been developed to improve the processing and coordination of IC Allocation to Mode S interrogators in the European region.

3. General Requirements and Responsibilities

3.1 Focal Point Nomination

The ICAO MID regional office **shall** nominate an ICAO Middle East Regional Officer CNS to act as MID Focal Point for all Mode S Operators within the ICAO Middle East region. The MID Focal Point is responsible for the coordination of all matters concerning the allocation of ICs between the MICA Cell and Mode S Operators that operate in a State of the ICAO MID region.

The ICAO MID regional office **should** nominate a backup MID Focal Point to support and to replace the MID Focal Point in order to ensure continuity of service.

Competent States from ICAO MID region **should** nominate a State Focal Point to support the MID Focal Point(s) in the coordination of all matters concerning the allocation of ICs with the Mode S Operators in their area of responsibility.

Competent States from ICAO MID region **should** nominate a backup State Focal Point to support and to replace the State Focal Point in order to ensure continuity of service.

Note: It is expected that the Focal Point availability is ensured during standard business hours. There is no requirement for 24 hours a day, 7 days per week (24/7) availability.

The ICAO MID regional office **should** provide known points of contact for third countries to the MICA Cell through their MID Focal Point(s).

3.2 MID Focal Point Responsibilities

MID Focal Point(s) **shall** be registered on the MICA website. Prior to MICA website registration, MID Focal Point(s) **shall** self-register on the EUROCONTROL OneSkyOnline portal¹. MID Focal Point(s) **shall** inform their State Focal Points, and civil and military Mode S Operators of their responsibilities described in this document.

MID Focal Point(s) **shall** transmit to the MICA Cell the MICA website registration requests they have received and accepted from State Focal Points and Mode S Operators representing either civil or military organisations under their responsibility.

MID Focal Point(s) **shall** inform the MICA Cell within 6 months when a Mode S interrogator ceases operation in order to permit the withdrawal of the corresponding IC allocation.

MID Focal Point(s) **shall** revalidate the IC allocations under their responsibility every 5 years and confirm to the MICA Cell via e-mail whether the issued IC allocations are still in use. This revalidation is to occur every 5 years following the effective date of the issued IC allocation. The IC allocation system automatically identifies which IC allocations need to be revalidated and notifies the MID Focal Point(s) and the States Focal Points if any, for action. An IC allocation that has not been revalidated may be withdrawn from the allocation plan if it is no longer in use (see [Section 3.5](#)).

Note: The effective date of an IC allocation is either the end date of the MICA cycle (see [Section 5](#)) or the end date of the Ad-Hoc allocation process (see [Section 6](#)). The effective date of an IC allocation is indicated on the MICA website and will be part of any exported IC allocation file from the website.

¹ <https://extranet.eurocontrol.int/http://was.eurocontrol.int/elsh/registerNewUserForApplication.do?eurocontrolresourceid=circa>

3.3 State Focal Point Responsibilities

State Focal Point(s) **should** be registered on the MICA website. Prior to this registration, they **shall** self-register on the EUROCONTROL OneSkyOnline portal² and send a request to the responsible MID Focal Point(s) to enable access to the MICA website.

3.4 Mode S Operator Responsibilities

Mode S Operators **should** be registered on the MICA website. Prior to this registration, they **shall** self-register on the EUROCONTROL OneSkyOnline portal² and send a request to their responsible MID Focal Point(s) and State Focal Point(s) if any, to enable access to the MICA website.

Mode S Operators **shall** only operate an eligible Mode S interrogator, using an eligible IC and coverage map if they have received an issued IC allocation, for this purpose, from their responsible MID Focal Point(s).

Mode S Operators **shall** ensure that all Mode S interrogators under their responsibility of operation are programmed with the latest issued IC allocation.

Mode S Operators **shall** report to their responsible MID Focal Point(s) and State Focal Point(s) if any, at least every six months, any update on the installation and operation of eligible Mode S interrogators:

- Any change in the installation planning **shall** be reported.
- Any change in the operational status of the eligible Mode S interrogators **shall** be reported.

Mode S Operators **shall** develop their IC and associated lockout coverage programming procedures, to take into account their own specific arrangements. If Mode S Operators rely on the Mode S interrogator manufacturer to program the Mode S interrogator, they **shall** ensure that the manufacturer has developed programming procedures.

As a minimum, procedures **shall** include the following verification steps, to be completed for each IC allocation programming:

1. Verification of the compliance of programming parameters with the IC allocation data, including:
 - Position of the radar;
 - IC;
 - Lockout range and coverage map.
2. Verification of the validity status of the IC allocation used for programming.
3. Verification of following parameters:
 - Parameters related to II/SI Code Operation;
 - Default parameters to apply when the coverage map is not correctly loaded, if any.
4. When operating in a cluster, verification that the relevant parameters of cluster states are compliant with the IC allocation data.
5. Verification that the programmed data, including following radar chain switch-over and switch-off/switch-on cycles are applied correctly.

² <https://extranet.eurocontrol.int/http://was.eurocontrol.int/elsh/registerNewUserForApplication.do?eurocontrolresourceid=circa>

The procedure results **shall** be recorded, dated, signed and archived for future reference.

3.5 International Organisation Responsibilities

International Organisations **shall** only operate an eligible Mode S interrogator, using an eligible IC and coverage map if they have received an issued IC allocation, for this purpose, from their responsible MID Focal Point(s).

International Organisations intending to operate, or operating, an eligible Mode S interrogator, using an eligible IC and coverage map, **shall** comply with all Mode S Operator responsibilities described in the current document.

3.6 MICA Cell Responsibilities

The MICA Cell **shall** maintain the interrogator code allocation plan.

The MICA Cell **shall** maintain the MICA website.

The MICA Cell **shall** inform the MID Focal Point(s) about IC allocations that need to be revalidated (after the 5-year period).

The MICA Cell **shall** coordinate with the MID Focal Point(s) when an IC allocation has not been revalidated. If it is determined that the IC allocation is no longer in use, it may be withdrawn from the allocation plan.

The MICA Cell **shall** develop and maintain complementary guidance material on the operation of the centralised Mode S interrogator code allocation service.

3.7 IC Allocation Coordinated Area

For the EUR region, the MICA Cell manages the Mode S IC Allocation coordination on behalf of the European regional office of ICAO.

The MICA Cell is also supporting the ICAO Middle East regional office in the coordination and allocation of Mode S ICs in the ICAO Middle East Region.

The list of countries where the Mode S IC Allocation coordination is managed or supported by the MICA Cell can be downloaded from the MICA website (MICA – List of Coordinated Countries.doc). This list provides the status at a given date and may be subject to modification.

Where a potential overlap exists between the coverage of an eligible Mode S interrogator located within the area of responsibility of a competent State whose IC allocation is carried out through the MICA Cell and the coverage of a Mode S interrogator located within the area of responsibility of a third country which is not in the list of coordinated countries, provided that the MID Focal Point(s) has communicated a point of contact for the third country to the MICA Cell, the MICA Cell **shall**:

- a. inform the third country of the safety requirements related to the allocation and use of interrogator codes;
- b. coordinate the use of ICs with that third country

4. IC Application Procedures

4.1 Mode S Operator Responsibilities

Civil or military Mode S Operators intending to operate, or operating, an eligible Mode S interrogator for which no IC has been allocated, **shall** submit an IC application to the MID Focal Point(s) and the responsible State Focal Point(s) if any, including the following key items, as a minimum:

- A unique application reference from the competent State;
- Full details of the Mode S Operator point of contact for Mode S IC allocation matters;
- Mode S interrogator name;
- Mode S interrogator use (operational or test);
- Mode S interrogator position using the World Geodetic System 1984 (WGS 84) reference (Latitude and Longitude in degree, minute, seconds format);
 - If the Mode S interrogator position is sensitive information (e.g. military interrogators), that position may be accurate to the minute.
- Antenna centre height above ground and ground altitude above mean sea level;
- Rotation period;
- Mode S interrogator manufacturer and model;
- Planned date of first Mode S transmission;
- Planned date of end of transmission in case of temporary allocation;
- Ad-Hoc allocation process requested;
 - The Operator **shall** justify why the IC application is to follow the Ad-Hoc allocation process. No justification is required if the IC application is for a TRD Mode S interrogator.
- Requested Mode S coverage;
 - expressed as a range (in NM) per sector
- Specific operational requirements;
- SI code capability;
- “II/SI code operation” capability;
- EMS Map ICD coverage map capability.
- Mode S interrogator operating in cluster or not.
 - second IC requested or not in case of cluster

Note: Fixed operational interrogators are normally allocated a single IC, unless they are operated in a cluster. In that case, a second IC may be allocated to the cluster for fallback modes of operation, and to test and integrate new clustered interrogators.

Mode S Operators **shall** either submit an IC application by using the MICA website or through the responsible MID Focal Point(s).

Note: An IC application form has been developed for this purpose and can be downloaded from the MICA website or from the EUROCONTROL MICA webpage.

When an IC application is submitted using the MICA website, an automatic notification e-mail is sent to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

Mode S Operators **shall** inform their MID Focal Point(s) and responsible State Focal Point(s) if any, of any changes in the installation or planning of eligible Mode S interrogators as soon as possible and at least every six months. IC applications which have not yet been processed **shall** also be updated to reflect those changes.

Note: The planned date of first Mode S transmission provided in an IC application determines when the IC application will be processed by the MICA Cell. Therefore, once the planned date of first Mode S transmission changes and the IC application has not been processed, it is important to update this date information in the IC application.

4.2 MID Focal Point Responsibilities

MID Focal Point(s) **shall** check the validity of IC applications received from Mode S Operators, before they are submitted to the Mode S IC allocation system. The validity check shall include the key items listed in [Section 4.1](#). That validity check depends on the way the IC application has been submitted by the Mode S Operator:

- If the IC application has been directly submitted on the MICA website, the MID Focal Point is informed by a notification e-mail sent by the MICA website. The MID Focal Point **shall** then use the MICA website to review and acknowledge this IC application.

Upon acknowledgement, an automatic notification e-mail is sent by the MICA website to inform the IC application creator, the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

- If the MID Focal Point has received from a Mode S Operator an IC application which has not been submitted on the MICA website, the MID Focal Point **shall** review and submit this IC application on the MICA website.

Upon submission, an automatic notification e-mail is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

- In the event of MICA website service unavailability for MID Focal Point IC Allocation submission:
 1. The MID Focal Point **may** submit the IC application by e-mail to the MICA Cell accompanied by the appropriate form which has been developed for that purpose (the IC application form can be downloaded from the MICA website or from the EUROCONTROL MICA webpage). In this case the MID Focal Point **shall** add full details about the MID Focal Point who is responsible for the coordination of the Mode S IC Allocation.
 2. Once the MICA Cell has submitted the IC application on the MICA website, the MID Focal Point **shall** review and acknowledge this IC application using the MICA website when service availability is resumed.

Upon acknowledgement, an automatic notification e-mail is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

MID Focal Point(s) **shall** submit and acknowledge IC applications on the MICA website before the requirement freeze date of the MICA cycle preceding the Mode S interrogator planned date of first Mode S transmission.

Note: Key MICA cycle dates are available on the MICA website.

IC applications requesting the Ad-Hoc allocation process (see [Section 6](#)) **shall** be submitted and acknowledged on the MICA website by the responsible MID Focal Point before being processed. IC applications may be processed in Ad-Hoc once issued IC allocations of the current cycle are published.

MID Focal Point(s) **shall** report to the MICA Cell any change in the installation planning of eligible Mode S interrogators received from Mode S Operators. IC applications which have not yet been processed **shall** be updated to reflect those changes.

4.3 State Focal Point Responsibilities

The State Focal Point(s), if any, **shall** support the MID Focal Point(s) in reviewing the IC applications provided by Mode S operators in their area of responsibility.

4.4 MICA Cell Responsibilities

The MICA Cell **shall** validate IC applications on the MICA website in terms of their compliance with the format and data conventions, and for completeness, accuracy and timeliness.

- If the IC application cannot be validated (e.g. errors), the MICA Cell shall contact the MID Focal Point(s) for corrective actions.
- Validated IC applications **shall** be integrated into the system by the MICA Cell.

Upon integration, an automatic notification e-mail is sent by the MICA website to inform the IC application creator, the Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

If an IC application is provided by the MID Focal Point to the MICA Cell by e-mail:

1. The MICA Cell **shall** submit this IC application on the MICA website.

Upon submission, an automatic notification e-mail is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell that a new IC application has been created.

2. Once the MID Focal Point has acknowledged the IC application on the MICA website, the MICA Cell **shall** integrate this IC application. The IC application is then ready to be processed.

Upon integration, an automatic notification e-mail is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

The MICA Cell **shall** process submitted IC applications within the adequate MICA cycle on the basis of their planned date of first Mode S transmission (except for IC applications that follow the Ad-Hoc process).

5. Mode S IC Allocation Cycle

The Mode S IC allocation (MICA) cycle is the standard procedure for processing IC applications and to issue corresponding IC allocations. An IC application is submitted to request an allocation for a new eligible Mode S interrogator or to request an update of an existing IC allocation.

There are only two Mode S IC allocation process cycles per year (at 168 days intervals). Each cycle is composed of 4 periods and foresees a contingency of 14 days.

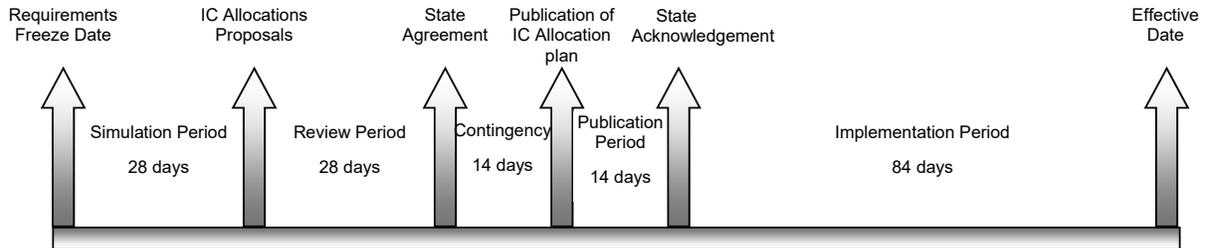


Figure 2: Mode S IC Allocation cycle (MICA cycle)

A flowchart describing the MICA cycle is provided in [ANNEX C](#).

5.1 Simulation Period

The simulation period of the MICA cycle lasts 28 days. During this period, the MICA Cell performs interrogator code allocation plan update simulations and prepares a proposed update of the interrogator code allocation plan. This proposed update is to be approved during the subsequent review period.

5.1.1 Mode S Operator Responsibilities

This period does not apply to Mode S Operators.

5.1.2 MID and State Focal Point Responsibilities

This period does not apply to MID and State Focal Points if any.

5.1.3 MICA Cell Responsibilities

During the simulation period of a Mode S IC Allocation Cycle, the MICA Cell **shall**:

- perform interrogator code allocation plan update simulations on the basis of the pending IC applications
- prepare a proposed update of the interrogator code allocation plan for approval by the Focal Points representing the competent States that are affected by it

At the end of the 28-day simulation period, the MICA Cell **shall** create IC allocation proposals covering:

- pending IC applications for new Mode S interrogators,
- pending IC applications to modify the IC allocation of existing Mode S interrogators,

- changes to existing IC allocations impacted by the proposed interrogator code allocation plan update³.

Upon creation of the IC allocation proposals, an automatic e-mail notification is sent by the MICA website to inform all Focal Points and the MICA Cell. This notification contains the list of all IC allocation proposals that constitute the proposed interrogator code allocation plan update.

The proposed update of the interrogator code allocation plan **shall** be free of IC conflict.

The IC allocations proposed by MICA Cell **shall** to the greatest extent meet the following operational requirements of the IC applications:

- Mode S interrogator planned date of first Mode S transmission
- Requested Mode S coverage
- Any specific operational requirements

IC allocation proposals **shall** be available online on the MICA website where they can be accessed by the MID Focal Point(s) and the responsible State Focal Point(s) if any, for review.

5.2 Review Period

The review period of the MICA cycle lasts 28 days. During this period, the MID Focal Point(s) and the responsible State Focal Point(s) if any, review the IC allocation proposals that constitute the proposed interrogator code allocation plan update. An acceptance (or refusal) is required from the MID Focal Points representing ICAO MID Member States that are affected by the proposed interrogator code allocation plan.

5.2.1 Mode S Operator Responsibilities

Mode S operator may access the MICA website to consult the status of the IC allocations proposed for the Mode S interrogators that they operate or plan to operate.

Mode S operators shall not program IC allocation proposals in Mode S interrogators.

5.2.2 MID Focal Point Responsibilities

The proposed updated interrogator code allocation plan **shall** be subject to the approval, through their MID Focal Point(s), by all competent States that are affected by the update of the plan.

MID Focal Point(s) **should** check the suitability of the proposed IC allocations with the responsible Mode S Operators and the responsible State Focal Point(s) if any, for the Mode S interrogators installed or planned to be installed in a member State of the ICAO MID region.

MID Focal Point(s) **shall** use the MICA website to accept or reject IC allocation proposals for planned or existing Mode S interrogators in a member State of the ICAO MID region before the end of the review period. Once an IC allocation proposal is accepted or rejected, its status is updated on the MICA website and an automatic e-mail notification is sent by the MICA website to inform the responsible MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

In the event of MICA website service unavailability, the MID Focal Point **shall** contact the MICA Cell by e-mail to indicate acceptance or rejection of the proposed IC allocations.

If an IC allocation proposal is rejected by a MID Focal Point, this **shall** be duly justified.

³ It may be necessary to change existing IC allocations in order to accommodate the IC applications.

5.2.3 State Focal Point Responsibilities

The State Focal Point(s) if any, **shall** support the MID Focal Point(s) in reviewing the IC allocation proposals for Mode S radar installed or planned to be in their area of responsibility during the MICA cycle review period.

5.2.4 MICA Cell Responsibilities

If any of the proposed IC allocations are rejected within the first 14 days of the review period, the MICA Cell **shall** prepare a new proposed IC allocation plan update.

Note: If any IC allocation proposal is rejected after the initial 14 days of the review period, the MICA Cell will attempt to provide a new IC allocation proposal which is acceptable. As a measure of last resort, the MICA Cell will cancel an unacceptable IC allocation proposal and the corresponding IC application will be re-processed in the next MICA cycle.

If the MID Focal Point contacts the MICA Cell by e-mail to accept or reject the IC allocation proposals, the MICA Cell **shall** use the MICA website on behalf of the MID Focal Point to submit the acceptance or rejection of these IC allocation proposals. Once an IC allocation proposal is accepted or rejected, its status is updated on the MICA website and an automatic e-mail notification is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

5.3 Publication Period

The publication period of the MICA cycle lasts 14 days. On the first day of the publication period, the MICA Cell updates the interrogator code allocation plan and communicates it to the MID Focal Points. All IC allocation proposals which have not been rejected are issued on the MICA website.

An automatic e-mail notification containing the list of all issued IC allocations is sent by the MICA website to inform the MID Focal Point(s), the State Focal Point(s) if any, and the MICA Cell. An automatic e-mail notification is also sent by the MICA website to the Mode S Operators if IC allocations are issued for the Mode S interrogators they operate.

5.3.1 Mode S Operator Responsibilities

Mode S operator may access the MICA website to consult or export the IC allocations issued for the Mode S interrogators that they operate or plan to operate.

Mode S operators shall not program issued IC allocations in Mode S interrogators during the publication period.

5.3.2 MID Focal Point Responsibilities

Within the 14 days of reception of the updated interrogator code allocation plan, MID Focal Point(s) **shall**:

- Communicate issued IC allocations covering pending IC applications as well as changes to existing IC allocations impacted by the update of the interrogator code allocation plan to the relevant Mode S Operators and State Focal Point(s) if any, under their responsibility;
- Provide the implementation sequence to all impacted Mode S Operators and State Focal Point(s) if any;

Note: IC allocation programming may need to be carefully sequenced in order to avoid temporary IC conflicts.

- Acknowledge issued IC allocations under their responsibility by using the MICA website;

Upon acknowledgement, an automatic e-mail notification is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

In the event of MICA website service unavailability, the MID Focal Point **shall** contact the MICA Cell by e-mail to submit the acknowledgement.

5.3.3 State Focal Point Responsibilities

The State Focal Point(s) if any, **shall** support the MID Focal Point(s) during the publication period.

5.3.4 MICA Cell Responsibilities

On the first day of the publication period, the MICA Cell **shall**:

- Update and communicate to the MID Focal Point(s) the interrogator code allocation plan which has been approved, without prejudice to national procedures for the communication of information on Mode S interrogators operated by military
- Provide the implementation sequence to the MID Focal Point(s)

If the MID Focal Point contacts the MICA Cell by e-mail to acknowledge issued IC allocations, the MICA Cell **shall** acknowledge these issued IC allocations on behalf on the MICA website. Upon acknowledgement, an automatic notification e-mail is sent by the MICA website to inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

5.4 Implementation Period

The implementation period of the MICA cycle lasts 84 days. The end date of this period is also the end date of the MICA cycle and the MICA cycle effective date.

All changes to existing IC allocations issued during the Mode S IC allocation cycle must be programmed in Mode S interrogators before the end of the implementation period.

IC allocations issued for new Mode S interrogators should be programmed conforming as much as possible to the planned date of first Mode S transmission provided in the IC application.

The programming of IC allocations which are covered by the implementation sequence must be coordinated as described in the implementation sequence. An example of the implementation sequence diagram is provided in [ANNEX D](#).

5.4.1 Mode S Operator Responsibilities

When programming a Mode S interrogator, Mode S Operators **shall** comply with:

- The allocated IC provided in the issued IC allocation;
- The surveillance and lockout coverage provided in the issued IC allocation;
- The implementation sequence document and coordinate IC Allocation programming with other Mode S Operators if necessary;

Prior to programming an issued IC allocation in a Mode S interrogator, the Mode S Operator **shall** perform the following verification steps:

1. verify if the issued IC allocation is identified in the implementation sequence document

- a. If the IC allocation is not identified in the implementation sequence, then no coordination with other Mode S Operators is required.

The Mode S Operator may proceed to program the IC allocation in the Mode S interrogator and skip the below steps 2 and 3.

- b. If the IC allocation is identified in the implementation sequence, then coordination with other Mode S Operators may be required.

Step 2 **shall** be performed.

2. verify the position of the issued IC allocation in the implementation sequence

- a. If the IC allocation is at the beginning of the implementation sequence, the programming of this IC allocation does not depend on any other IC allocation programming.

The Mode S Operator **should** proceed to program the IC allocation in the Mode S interrogator as soon as possible.

- b. If the IC allocation is not at the beginning of the implementation sequence, there is a dependency on the programming of other Mode S interrogators which precede it in the implementation sequence.

Step 3 **shall** be performed.

3. verify on the MICA website if all preceding IC allocations in the implementation sequence for other Modes S interrogators have been programmed

- a. If all preceding IC allocations in the implementation sequence are confirmed on the MICA website as being implemented, the Mode S Operator **should** program the IC allocation in the Mode S interrogator as soon as possible in case of changes to existing IC allocations.

- b. If any of the preceding IC allocations in the implementation sequence are not confirmed on the MICA website as being implemented, the Mode S Operator **shall** wait before programming the IC allocation.

Mode S Operators **shall** implement all changes to existing IC allocations before the end of the implementation period.

Once an issued IC allocation has been programmed, the responsible Mode S Operator **shall** inform the MID Focal Point(s), the responsible State Focal Point(s) if any, and, if he's registered on the MICA website, **shall** confirm its implementation on the MICA website.

When the implementation of an IC allocation is confirmed on the MICA website, the status of the issued IC allocation is updated on the MICA website and an automatic notification e-mail is sent by the MICA website to inform the responsible Mode S Operator(s), the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell that issued IC allocation has been programmed into the respective Mode S interrogator.

This IC allocation implementation confirmation mechanism enables the IC allocation system to provide to all registered users on the MICA website the up-to-date status of the implementation of the interrogator code allocation plan in Mode S interrogators.

Mode S Operators **shall** contact the MID Focal Point(s) and the responsible State Focal Point(s) if any, if they encounter problems or difficulties when implementing IC allocations.

5.4.2 MID Focal Point Responsibilities

MID Focal Point(s) **shall** ensure that all changes to existing IC allocations are programmed before the end of the implementation period.

When a MID Focal Point is informed that an IC allocation is programmed, he **shall** verify that the implementation status of that IC allocation is confirmed on the MICA website. If not, the MID Focal Point **shall** confirm the implementation. Upon confirmation of implementation, the status of the issued IC allocation is updated on the MICA website and an automatic e-mail notification is sent by the MICA website to inform the responsible Mode S Operator(s), the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

In the event of MICA website service unavailability to confirm the implementation of an issued IC allocation, the MID Focal Point **shall** contact the MICA Cell by e-mail to confirm the implementation of the issued IC allocation.

5.4.3 State Focal Point Responsibilities

The State Focal Point(s) if any, **shall** support the MID Focal Point(s) during the implementation period.

5.4.4 MICA Cell Responsibilities

If the MID Focal Point contacts the MICA Cell by e-mail to confirm the implementation of an issued IC allocation, the MICA Cell **shall** confirm the implementation of the issued IC allocation on behalf of him on the MICA website.

Upon confirmation of implementation, the status of the issued IC allocation is updated on the MICA website and an automatic e-mail notification is sent by the MICA website to inform the responsible Mode S Operator(s), the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell.

6. Ad-hoc Allocation Process

IC applications may be processed on an Ad-Hoc basis, but this process must not impact any existing Mode S IC allocations issued to other Mode S interrogators.

The Ad-Hoc process is suited for IC applications for TRD Mode S interrogators as there is no need to allocate a de-conflicted interrogator code. It is not recommended to apply this process for operational Mode S interrogator IC applications. Indeed, as no change will be made to existing issued IC allocations, the provided allocation may be far more constraining than one provided within a standard MICA cycle (see [Section 5](#)).

To avoid any impact on the proposed IC allocation plan update, Ad-Hoc IC applications are only processed after the publication of the issued IC allocations of the current MICA cycle.

The time frame of the Ad-Hoc allocation process in the MICA cycle is provided in the figure below.

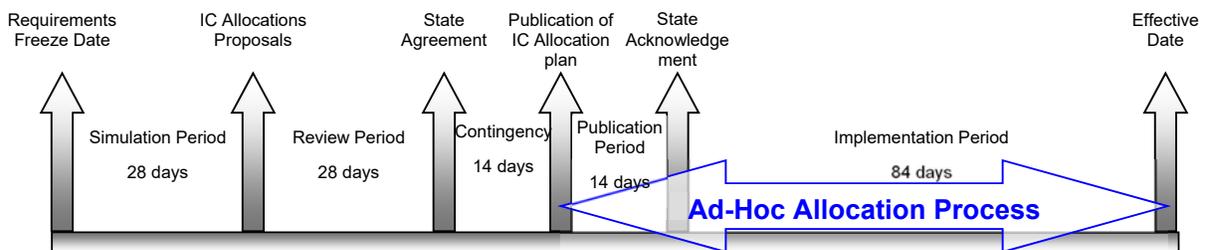


Figure 3: Ad-Hoc Allocation Process Time Frame in MICA Cycle

In general, the Ad-Hoc process is a short process lasting 15 days.

6.1 Simulation Period

During the simulation period of the Ad-Hoc allocation process, the MICA Cell performs interrogator code allocation plan update simulations on the basis of the pending IC applications and prepares a proposed update of the interrogator code allocation plan for approval by the competent States that are affected by it.

As the number of Ad-Hoc IC applications to be processed is usually low and no change to the existing IC allocations is made, the IC allocation proposals are created within a few days.

6.1.1 Mode S Operator Responsibilities

This period does not apply to Mode S Operators.

6.1.2 MID and States Focal Point Responsibilities

This period does not apply to MID and State Focal Points if any.

6.1.3 MICA Cell Responsibilities

The responsibilities on the MICA Cell are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 4.1.3](#)) with the exception of:

- The MICA Cell **shall** issue IC allocation proposals which only cover Ad-Hoc IC applications. No change will be made to existing IC allocations issued for other Mode S interrogators.

- The IC allocations proposed by MICA Cell may not meet the following operational requirements of the IC applications:
 - Mode S interrogator planned date of first Mode S transmission in case the IC application is received at short notice;
 - Requested Mode S coverage;
 - Specific operational requirements;

6.2 Review Period

Contrary to the standard MICA cycle review period of 28 days, the Ad-Hoc process review period is generally limited to 14 days. An acknowledgement is required from the Focal Points representing the competent States that are affected by the proposed interrogator code allocation plan update.

If an IC allocation proposal is rejected, the MICA Cell may prepare an updated IC allocation proposal. Nevertheless, due to the limitations inherent to the Ad-Hoc process, it may not be possible to fulfil all the requirements requested by the Mode S Operator. In such case, the unsuitable IC allocation proposal is withdrawn and the IC application will be processed in the next MICA cycle (see [Section 5](#)).

6.2.1 Mode S Operator Responsibilities

Mode S operator may access the MICA website to consult the status of the IC allocations proposed for the Mode S interrogators that they operate or plan to operate.

Mode S operators shall not program IC allocation proposals in Mode S interrogators.

6.2.2 MID Focal Point Responsibilities

The responsibilities on the MID Focal Point are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.2.2](#)).

6.2.3 State Focal Point Responsibilities

The responsibilities on the State Focal Points are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.2.3](#)).

6.2.4 MICA Cell Responsibilities

The responsibilities on the MICA Cell are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.2.4](#)) with the exception of:

- If an IC allocation proposal is rejected, the MICA Cell may prepare an updated IC allocation proposal.

6.3 Publication Period

Once the review period of the Ad-Hoc process is finalised, the MICA Cell updates the interrogator code allocation plan and communicates it to the MID Focal Point(s). All IC allocation proposals which have not been rejected are issued on the MICA website. This date of issue becomes the effective date for the IC allocations processed in Ad-Hoc.

Once IC allocations are issued, an automatic e-mail notification is sent by the MICA website to inform the MID Focal Points, the State Focal Point(s) and the MICA Cell. This notification contains the list of all issued IC allocations.

No coordination with other Modes S operators is required as there is no change to the existing Mode S allocations issued for other Mode S interrogators.

6.3.1 Mode S Operator Responsibilities

Mode S operator may access the MICA website to consult or export the IC allocations issued for the Mode S interrogators that they operate or plan to operate.

Mode S operators shall not program issued IC allocations in Mode S interrogators during the publication period.

6.3.2 MID Focal Point Responsibilities

The responsibilities on the MID Focal Point are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.3.2](#)) with the exception of:

- There is no time limit to communicate issued IC allocations to the relevant Mode S Operators and State Focal Point(s) if any;
- There is no implementation sequence to provide;

6.3.3 State Focal Point Responsibilities

The responsibilities on the State Focal Points are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.3.3](#)).

6.3.4 MICA Cell Responsibilities

The responsibilities on the MICA Cell are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.3.3](#)) with the exception of:

- There is no implementation sequence to provide;

6.4 Implementation Period

IC allocations processed Ad-Hoc can be programmed by the Mode S Operators once they are issued by the MICA Cell.

6.4.1 Mode S Operator Responsibilities

When programming a Mode S interrogator, Mode S Operators **shall** comply with:

- The allocated IC provided in the issued IC allocation;
- The surveillance and lockout coverage provided in the issued IC allocation;

Once an issued IC allocation has been programmed, the responsible Mode S Operator **shall** inform the MID Focal Point(s) and the responsible State Focal Point(s) if any. If he is registered on the MICA website, he **shall** confirm its implementation on the MICA website

When the implementation of an IC allocation is confirmed on the MICA website, the status of the issued IC allocation is updated on the MICA website and an automatic e-mail notification is sent by the MICA website to inform the responsible Mode S Operator(s), the MID Focal Point(s), the responsible State Focal Point(s) if any, and the MICA Cell that the issued IC allocation has been programmed into the respective Mode S interrogator.

This IC allocation implementation confirmation mechanism enables the IC allocation system to provide to all registered users on the MICA website the up-to-date status of the implementation of the interrogator code allocation plan in Mode S interrogators.

Mode S Operators **shall** contact the MID Focal Point(s) and the responsible State Focal Point(s) if any, if they encounter problems or difficulties when implementing IC allocations.

6.4.2 MID Focal Point Responsibilities

The responsibilities on the MID Focal Point are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.4.2](#)) apart that there is no impacted IC allocation to be considered.

6.4.3 State Focal Point Responsibilities

The responsibilities on the State Focal Points are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.4.3](#)).

6.4.4 MICA Cell Responsibilities

The responsibilities on the MICA Cell are identical to those detailed within the Mode S IC Allocation Cycle (see [Section 5.4.4](#)).

7. IC Conflict Reporting

7.1 Introduction

Operating Mode S interrogators may be impacted by an IC conflict or may be the source of an IC conflict.

An IC conflict is defined as an uncoordinated overlap of lockout coverage of two or more Mode S interrogators operating on the same IC, potentially resulting in aircraft remaining undetected by at least one of the Mode S interrogators.

The Mode S IC allocation system provides a means to report an IC conflict through a reporting mechanism implemented in the MICA website.

7.2 IC Conflict Reporting Procedure

7.2.1 Mode S Operator Responsibilities

Mode S Operator **should** assess the possible impact on air traffic services of Interrogator Code conflicts, and the corresponding potential loss of Mode S target surveillance data from the impacted Mode S interrogators, taking into account their operational requirements and available redundancy.

Unless the potential loss of Mode S target surveillance data has been assessed to have no safety significance, Mode S operators **should**:

- implement monitoring means to detect interrogator code conflicts caused by other Mode S interrogators impacting eligible Mode S interrogators they operate on any operational interrogator code;
- ensure that the interrogator code conflict detection provided by the implemented monitoring means is achieved in a timely manner and within a coverage that satisfy their safety requirements;
- identify and implement as appropriate, a fallback mode of operation to mitigate the possible interrogator code conflict hazards on any operational code;
- ensure that the implemented fallback mode of operation does not create any interrogator code conflict with other Mode S interrogators referred to by the interrogator code allocation plan.

When a Mode S Operator identifies a potential IC conflict impacting a Mode S interrogator under his responsibility, he **shall**:

1. Report the potential IC conflict to the MID Focal Point(s) and the responsible State Focal Point(s) if any, and make available, through the MICA website (if he's registered), any related information for other Mode S Operators.

Once reported on the MICA website, the system will send an automatic e-mail notification to inform all registered users (MICA Cell, Focal Points and Mode S Operators) that a potential IC conflict has been identified.

2. Report the potential IC conflict accompanied with the related information to the MICA Cell if it has not been possible to report it on the MICA website.

3. Investigate the conflict and coordinate bilaterally with appropriate Mode S Operators to determine the potential cause of conflict. Mode S Operators contact details are provided on the MICA Contact List which is published by the MICA Cell on the MICA website.
4. Advise the MICA Cell, the MID Focal Point(s), the responsible State Focal Point(s) if any, and relevant Mode S Operators once the potential cause of the conflict has been identified.
5. Advise the MICA Cell, the MID Focal Point(s), the responsible State Focal Point(s) if any, and appropriate Mode S Operators once the conflict has been resolved.

7.2.2 MID Focal Point Responsibilities

When the MID Focal Point is notified by a Mode S Operator of an IC conflict within his area of responsibility, the MID Focal Point **shall** provide the necessary assistance and advice to achieve an early resolution of the IC conflict.

If the Mode S Operator has not been able to report the conflict on the MICA website, the MID Focal Point **shall** report the IC conflict on the MICA website with any related information.

The MID Focal Point **shall** ensure that all appropriate parties that might be affected by the IC conflict are informed:

- Mode S Operator(s) who might be the cause of conflict and responsible Focal Point(s)
- Mode S Operator(s) who might be impacted by the conflict and responsible Focal Point(s)
- The responsible State Focal Point(s) if any,
- MICA Cell

When a MID Focal Point is notified that a conflict might originate from within his area of responsibility, he **shall** ensure that the relevant Mode S Operator(s) cooperate to identify the cause of the conflict and take the necessary actions in a timely manner.

7.2.3 State Focal Point Responsibilities

The State Focal Point(s) if any, **shall** support the MID Focal Point(s) in case of IC conflict.

7.2.4 MICA Cell

If a potential IC conflict accompanied with the related information has been reported to the MICA Cell but has not been reported on the MICA website, the MICA Cell **shall** report it on the MICA website accompanied with any related information provided by the Mode S Operator.

The MICA Cell **should** provide whatever assistance and advice it can to facilitate the dissemination of information and early resolution of the conflict.

8. Resolution of IC Allocation and IC Conflict Issues

8.1 IC Allocation Issues

The Mode S IC allocation process is executed in a constrained environment. Notably, to avoid overlapping coverage with other Mode S interrogators using the same IC, an IC allocation proposed by the MICA Cell may not meet the requested operational requirements of the IC application. As a result the MICA Cell allocation proposal for a Mode S interrogator may contain operational restrictions.

These operational restrictions may not be acceptable to the MID Focal Point and the IC allocation proposal for the Mode S interrogator can be rejected.

Other proposals may lead to unacceptable operational restrictions on existing IC allocations for other Mode S interrogators. If no other acceptable IC allocation can be proposed, then no IC allocation will be issued at the end of the IC Allocation process for the Mode S interrogator. As a consequence, the update of the interrogator code allocation plan will not contain an IC allocation covering the IC application submitted for the Mode S interrogator.

If no IC allocation has been issued, the MICA Cell will perform the following actions:

1. Re-process the IC application in the next Mode S IC Allocation cycle.
2. Investigate and propose an interim IC allocation to the MID Focal Point(s), i.e. a temporary IC allocation that would be valid until a satisfactory IC allocation is issued. This temporary IC allocation may be on a test IC or on an operational IC with operational restrictions. This temporary IC allocation should permit to start the Mode S interrogator installation and test.
3. Attempt to determine IC allocation options in close collaboration with the MID Focal Point(s) of competent States that could participate in the identification of an acceptable proposal for all parties.

8.2 IC Conflict Issues

Operation of Mode S interrogators may be impacted by an IC conflict. This may prevent them to reliably detect incoming traffic, potentially compromising the safety of air navigation. Mode S interrogators impacted by such conflicts may need to apply the appropriate fallback mode of operation to mitigate the IC conflict.

The IC conflict resolution depends on the collaboration between Mode S Operators (see [Section 7](#)). In the event of lack of collaboration, the MICA Cell will initiate mediation with the Focal Points of the competent States concerned.

8.3 Resolution of Issues

Dispute may happen during the Mode S IC Allocation process.

The MID Focal Point(s) shall manage disputes inside the ICAO Middle East region.

Final arbiter has to be identified to resolve disputes that could occur between countries of ICAO EUR region and ICAO MID region.

9. Guidance for IC allocation in ICAO MID Region

9.1 Mode S Interrogators Performances

9.1.1 SI code capability

It is recommended for Mode S Interrogators to support SI code capability.

Initially, for technical reasons, only Interrogator Identifier codes (II codes) 1 to 15 were defined and allocated as Interrogator Codes in the ICAO EUR region. Due to the expected number of Mode S interrogators, measures were later taken to allow the use of additional Surveillance Identifier codes (SI codes) 1 to 63.

Only SI code capable Mode S targets will be correctly detected by Mode S interrogators operating on SI code. ICAO annex 10 requires all Mode S transponders to be SI code capable however the experience shows that there are still old versions of Mode S transponders flying without the SI code capability.

9.1.2 II/SI code operation

It is recommended for Mode S Interrogators to support II/SI code operation.

Normally, the use of SI codes requires that all Mode S targets within the coverage of Mode S interrogators are equipped for this purpose. However, specifications were developed by EUROCONTROL for an II/SI code operation which enables the early use of SI codes by Mode S interrogators in an environment where not all Mode S targets are equipped for the use of SI codes.

A Mode S interrogator which operates on an SI code with II/SI code operation enabled will correctly detect both SI capable and II only capable Mode S targets.

For more information, please refer to [ANNEX B](#).

9.1.2.1 II/SI code operation in ICAO Middle East region

Even if the current number of Mode S interrogators installed in ICAO MID region is not as high as in the ICAO EUR region, there is no guarantee that allocating only II code to Mode S interrogators in the ICAO MID region will remain possible in the future.

Without any regulation to support SI code allocation (on Mode S interrogators to support SI code and II/SI code operation), it may not be possible to keep on allocating Interrogator Code to Mode S interrogators in the future, preventing them to operate in Mode S.

9.1.2.2 II/SI code operation in the European Union

In order to facilitate and support the use of SI code in European Union, requirements on SI code and II/SI code support capabilities have been lay down in article 3 of COMMISSION REGULATION (EC) No 262/2009:

*Article 3****Interoperability and performance requirements:***

Mode S operators shall ensure that the radar head electronics constituent of their Mode S interrogators using an operational interrogator code:

1. support the use of SI codes and II codes in compliance with the International Civil Aviation Organisation provisions⁴
2. support the use of II/SI code operation in compliance with the requirements specified in Annex B

9.1.3 Mode S Coverage

Several formats exist to define the Mode S coverage:

- Mode S responsibility map (in European Mode S Coverage Map ICD format⁵).
 - This map format has been developed by EUROCONTROL in the frame of the POEMS contract⁶. System Maps are geodesic maps (latitude/longitude) sub-divided into horizontal cells of approx. 5NM by 5NM (latitude of Paris) and an associated vertical extent.
 - When supported by the Mode S interrogator, the coverage allocated during the Mode S IC Allocation Cycle is provided in this format.
- Sectorized Range
 - The circular coverage is divided into sectors (by default 32 sectors). Surveillance and Lockout ranges are provided per sector.
 - When coverage map in EMS Map ICD format is not supported by the interrogator, then surveillance and lockout coverage allocated to the radar are provided in this format.
- Global Range for the circular coverage.
 - One unique surveillance range and one unique lockout range are provided for the circular coverage.
 - When none of the both formats above are supported, then this format is used.

Mode S Operators are encouraged to support the use of European Mode S coverage maps.

As these coverage maps are all aligned on the same common origin and have the same cell size, coverage maps can be joint without overlapping which is optimal in terms of allocation volume and RF band usage (as there may be no gap between coverage of neighbouring Mode S interrogators on the same Interrogator Code, aircraft lockout is optimized).

The second solution is less optimal as there will be gaps between allocated coverage. Nevertheless to use range per sector is better than to apply the same range to the circular coverage (Third solution).

Concerning the third solution, the maximum range without overlap of neighbouring Mode S interrogators on the same IC will be used as the circular range.

⁴ Chapter 3 'Surveillance radar systems', Section 3.1.2.5.2.1.2 'IC: Interrogator code' of ICAO Annex 10 'Aeronautical Telecommunications', Volume IV 'Surveillance Radar and Collision Avoidance Systems' (Third Edition, July 2002, incorporating Amendment 77).

⁵ European Mode S Station Coverage Map Interface Control Document, Edition 1.16

⁶ European Mode S Station Functional Specification, Edition 3.11

9.2 Requirements for airborne carriage

It is required for Mode S targets to support SI code capability.

In ICAO Annex 10 Vol. IV - §2.1.5.1.7.1: "SI code capability shall be provided in accordance with the provisions of 2.1.5.1.7 for all Mode S transponders installed on or after 1 January 2003 and by all Mode S transponders by 1 January 2005."

Airspace regulation should enforce the carriage of Mode S transponder capable to support SI capability as defined in ICAO Annex 10 Vol. IV.

Middle East ICAO office should verify and ensure the correct transponder capability in order to allow the use of SI codes in the ICAO MID region.

It is already possible to start using SI code without having 100% of the fleet SI capable. However in this case Mode S ground stations shall have the II/SI code operation capability in order to acquire aircraft which are not SI capable.

When using II/SI code operation aircrafts which are not SI cable must not be locked-out. Depending on the number of aircrafts which are not SI capable, the II/SI code operation may increase the RF pollution.

9.3 MICoG working arrangement

SGEG-MICoG working arrangement has been created to oversee the allocation process and provide guidance to the MICA Cell. SGEG-MICoG members are the Focal Points representing the National Regulatory Authorities of European States and those international organisations applying for Interrogator Codes.

As Focal Point for all countries in ICAO MID region, the ICAO MID regional officer is invited to be a SGEG-MICoG member and to attend SGEG-MICoG meetings (twice a year).

ICAO MID regional office should determine the necessity to meet Middle East Mode S Operators at regular interval to discuss about technical problems and other topics related to Mode S interrogators installation in ICAO MID region. The MICA cell would not participate to Middle East Mode S Operators meetings.

The ICAO MID regional officer could submit problems encountered in ICAO MID region during the SGEG-MICoG meeting.

ANNEX A – Discrete Code Allocation

A.1 II code and mobile interrogators

II code 0 has been reserved by ICAO for Mode S interrogators that have not been assigned with a unique discrete Interrogator Code and are authorized to transmit (please refer to §3.1.2.5.2.1.4.2 of [\[RD 1\]](#) for more information).

Mode S interrogators using II code 0 in accordance with the ICAO Standards and Recommended Practices do not need to be subject to the coordinated IC allocation process.

Discrete code allocations are not issued for mobile installations for which special modes of acquisition on II code 0 are used.

SI codes matching II code 0 (SI 16, SI 32, SI 48) are not allocated.

Note: as not all Mode S aircraft are SI capable, II/SI code operation has to be programmed on stations operating both on II code and matching SI codes in order to acquire both SI capable and non SI capable aircraft. As there is no requirement to support II/SI code operation for mobile stations interrogating on II code 0, matching SI codes (SI 16, SI 32, SI 48) are currently not allocated by MICA Cell.

A.2 Test, Research and Development Mode S interrogators on II code 14

In order to save interrogator codes for operational ATC (and Air Defence...) Mode S interrogators, SGEN-MICoG decided that, when transmitting for non-essential Test, Research or Development (TRD) activities, interrogators should operate on a reserved, shared interrogator code: II 14.

Due to the mode of operation of TRD stations on II code 14 (no constraint on II/SI Code Operation programming (see [ANNEX B](#) for more information on II/SI Code Operation)), SI codes matching II 14 (SI 14, SI 30, SI 46, SI 62) are currently not allocated to operational Mode S interrogators. As a consequence, SI codes matching II 14 may currently be allocated to TRD stations.

In order to avoid unnecessary RF pollution in the 1090 MHz band, SGEN-MICoG decided that TRD sites with allocated II code 14 would need to use permanent lockout in their entire coverage, and would not be allowed to use All Call lockout override.

SGEN-MICoG is aware that this is a very restrictive mode of operation which does not guarantee detection performances when two or more TRD stations with overlap transmit concurrently. Therefore SGEN-MICoG agreed on the following:

- Should a TRD operator require guaranteed detection performances for limited trials, he can initiate a co-ordination with overlapping TRD operators to make sure that they do not transmit at the same time (informing the MICA Cell and regulators as well). The TRD operator is responsible for initiating this co-ordination. When TRD operators do not need guaranteed detection performances, they can transmit without coordinating with other TRD operators, as long as they do not conflict with critical operations announced by others through the above mechanism.
- Should a TRD operator need to operate for extended periods with guaranteed performance (for transponder monitoring for instance), then he should apply for a distinct code allocation, using the normal IC allocation request procedure. This request will be processed by the MICA Cell, with due regard to the operational requirements, as for any other IC application.

- Should a TRD operator need to test and evaluate modes of operation that are normally not allowed on code 14 (e.g. lockout override...), then he should apply for an exemption, using the normal IC allocation request procedure. This request will be processed by the MICA Cell, with due regard to the operational requirements, as for any other IC application.

An IC application has to be submitted to get an IC allocation to test systems. However, as there is no need to prevent conflict situation on II 14, applications for TRD stations are most of the time processed in Ad-Hoc.

A.3 Specific Interrogator Codes for specific military operations

II code 15 is currently reserved in ICAO EUR region for NATO management. It is not available for allocation as part of the process run by EUROCONTROL.

SI codes matching II code 15 (SI 15, SI 31, SI 47, SI 63) are reserved for military operations in ICAO EUR region (see MICoG Report Meeting #25). They are not available for allocation as part of the process run by EUROCONTROL. The management of these codes is the responsibility of NATO.

This decision only applies to non-fixed, deployable military installations.

Fixed military interrogators are still eligible to get a discrete Interrogator Code following the normal Mode S IC allocation process. In that case, they have to coordinate with the Focal Point responsible of the country where the fixed military interrogators will be installed.

A NATO Focal Point has been nominated and is member of SGEG-MICoG.

ICAO Middle East regional office has to decide how to use II code 15.

ICAO Middle East regional office has to decide how to use SI codes matching II code 15.

A.4 Interrogator Codes allocated to operational Mode S interrogators

All other ICs, i.e. those IC which have not been detailed previously in this Annex, are available for allocation to operational eligible Mode S interrogators:

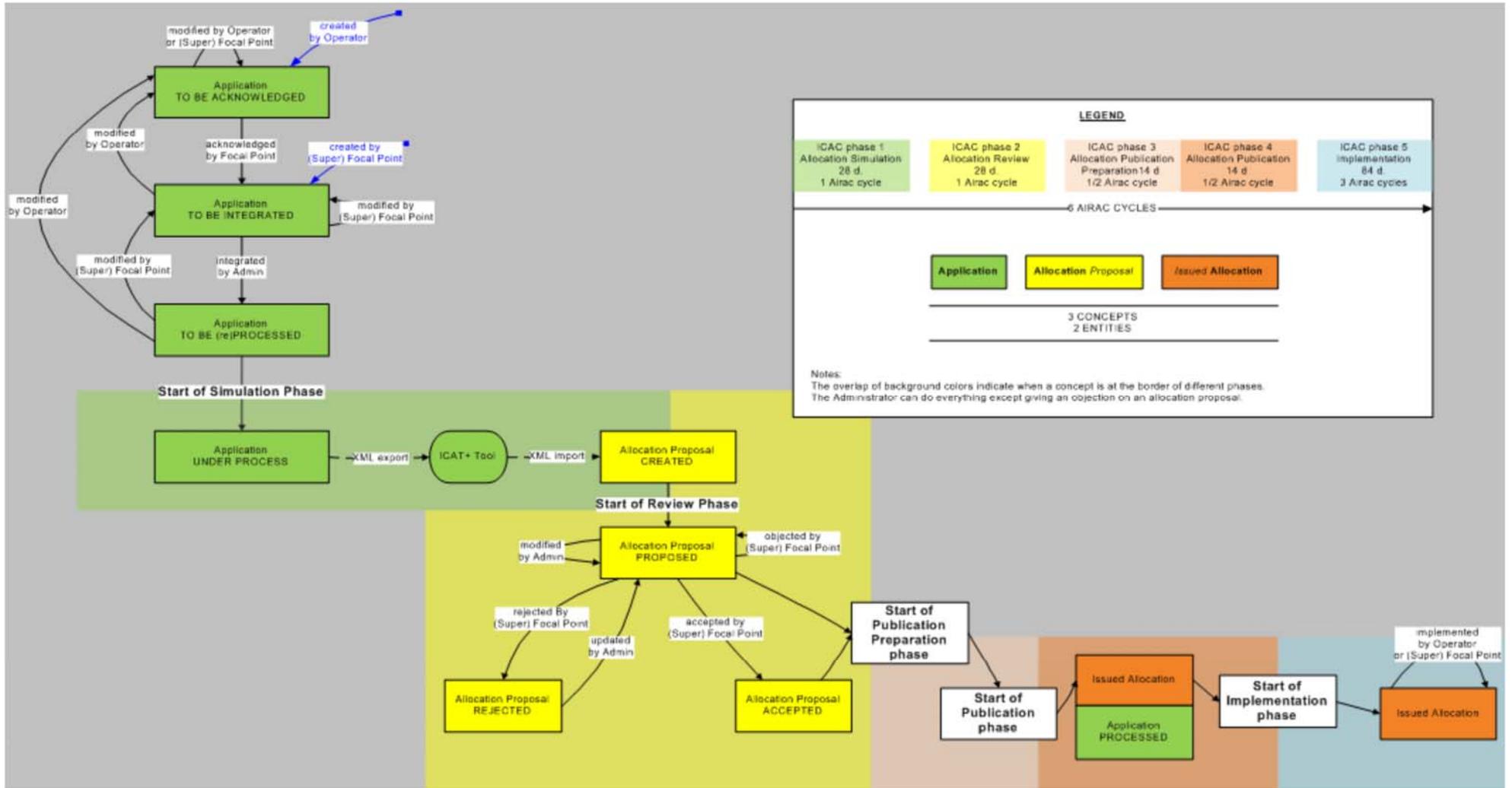
- II code 01 and matching SI codes (SI 01, SI 17, SI 33, SI 49)
- II code 02 and matching SI codes (SI 02, SI 18, SI 34, SI 50)
- II code 03 and matching SI codes (SI 03, SI 19, SI 35, SI 51)
- II code 04 and matching SI codes (SI 04, SI 20, SI 36, SI 52)
- II code 05 and matching SI codes (SI 05, SI 21, SI 37, SI 53)
- II code 06 and matching SI codes (SI 06, SI 22, SI 38, SI 54)
- II code 07 and matching SI codes (SI 07, SI 23, SI 39, SI 55)
- II code 08 and matching SI codes (SI 08, SI 24, SI 40, SI 56)
- II code 09 and matching SI codes (SI 09, SI 25, SI 41, SI 57)
- II code 10 and matching SI codes (SI 10, SI 26, SI 42, SI 58)
- II code 11 and matching SI codes (SI 11, SI 27, SI 43, SI 59)

- II code 12 and matching SI codes (SI 12, SI 28, SI 44, SI 60)
- II code 13 and matching SI codes (SI 13, SI 29, SI 45, SI 61)

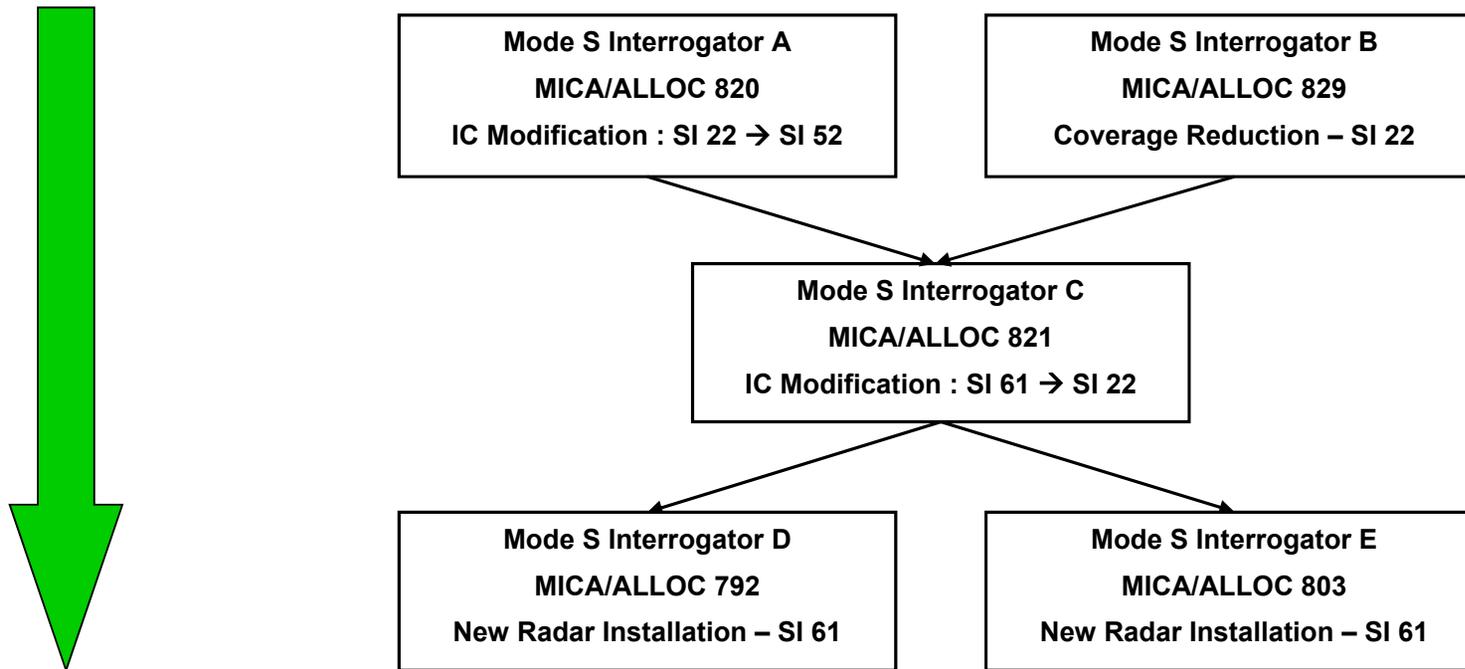
ANNEX B – II/SI code operation

1. Mode S interrogators, when operating with an SI code and if enabled by an appropriate operational parameter, shall also acquire targets through all call replies which are encoded using the matching II code.
2. Mode S interrogators, when operating with an SI code and if enabled by an appropriate operational parameter, shall consider transponders replying with all call replies encoded using the matching II code as non-SI equipped transponders, irrespectively of the SI capability reported in the data link capability report.
3. Mode S interrogators, when operating with an SI code and if enabled by an appropriate operational parameter, shall interrogate transponders lacking SI code capability using the Mode S multisite lockout protocol messages foreseen for II code operation. The II code to be used shall be the matching II code.
4. Mode S interrogators, when operating with an SI code and if enabled by an appropriate operational parameter, shall be configurable by the operator to either:
 - not use lockout on the matching II code for transponders lacking SI code capability, or
 - use intermittent lockout on the matching II code for transponders lacking SI code capability.
5. Mode S interrogators, when operating with an II code and if enabled by an appropriate operational parameter, shall be configurable by the operator to either:
 - not use lockout for transponders which report no SI capability in their data link capability report or cannot report their data link capability, or
 - use intermittent lockout for transponders which report no SI capability in their data link capability report or cannot report their data link capability.
6. When the II/SI code operation is activated, the lockout maps shall not be taken into account for transponders lacking SI code capability.

ANNEX C – Mode S IC Allocation Cycle Flow



ANNEX D – Implementation Sequence Diagram



In the Implementation Sequence Diagram provided above, the sequence of Mode S radar programming is the following:

1. The IC programmed in **Mode S Interrogator A** has to be changed from SI 22 to SI 52 conforming to MICA/ALLOC 820.

The coverage programmed in **Mode S Interrogator B** on SI 22 has to be modified conforming to MICA/ALLOC 829.

As these 2 IC allocations are at the beginning of the implementation sequence diagram, the programming of these IC allocations does not depend on the programming of any IC allocation.

MICA/ALLOC 820 and MICA/ALLOC 829 must be programmed before the end of the Implementation Period of MICA Cycle.

2. As MICA/ALLOC 821 is not at the beginning of the implementation sequence, the programming of this IC allocation depends on the programming of the IC allocations which precede it in the implementation sequence: MICA/ALLOC 820 and MICA/ALLOC 829.

Once step 1 above is done, the IC programmed in **Mode S Interrogator C** has to be changed from SI 61 to SI 22 conforming to MICA/ALLOC 821.

MICA/ALLOC 821 must be programmed before the end of the Implementation Period of MICA Cycle.

3. As MICA/ALLOC 792 and MICA/ALLOC 803 are not at the beginning of the implementation sequence, the programming of these IC allocations depends on the programming of the IC allocation which precedes them in the implementation sequence: MICA/ALLOC 821.

Once step 2 above is done, **Mode S Interrogator D** can be programmed on SI 61 conforming to MICA/ALLOC 792 and **Mode S Interrogator E** can be programmed on SI 61 conforming to MICA/ALLOC 803.

APPENDIX C



MID Region Surveillance Plan

Version 0.3

24/4/2018

Developed by

COMMUNICATION, NAVIGATION AND SURVEILLANCE SUB-GROUP
(CNS SG)

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1- BACKGROUND

Aeronautical surveillance systems are major elements of modern air navigation infrastructure required to safely manage increasing levels and complexity of air traffic. The sixteenth meeting of Air Navigation Planning and Implementation Regional Group in the Middle East (MIDANPIRG/16) tasked the CNS SG through Decision 16/24 to develop the MID Region Surveillance Plan based on the Regional operational requirements, Users' capabilities and specificities of the Region:

DECISION 16/ 23: MID REGION SURVEILLANCE PLAN

That, the MID Region Surveillance Plan be developed by the CNS SG, based on the operational needs identified by the ATM SG.

The global Air Navigation Plan (GANP) through B0-ASUR, defined the possibility of using lower cost ground surveillance supported by new technologies such as ADS-B OUT and Wide Area Multilateration (MLAT) systems.

This document reviews the available surveillance technologies and highlight their strengths and weaknesses. The plan timelines are divided into three stages; short-term until 2020, mid-term from 2021 to 2025, and long-term beyond 2025.

2- INTRODUCTION

The surveillance service delivered to users may be based on a mix of three main types of surveillance:

- a) independent non-cooperative surveillance: the aircraft position is derived from measurement not using the cooperation of the remote aircraft; like Primary Surveillance Radar(PSR);
- b) independent cooperative surveillance: the position is derived from measurements performed by a local surveillance subsystem using aircraft transmissions. Aircraft derived information (e.g., pressure altitude, aircraft identity) can be provided from those transmissions, like Secondary Surveillance Radar (SSR) and Multilateration; and
- c) dependent cooperative surveillance: the position is derived on board the aircraft and is provided to the local surveillance subsystem along with possible additional data (e.g., aircraft identity, pressure altitude). Like Automatic Dependent Surveillance-Broadcast (ADS-B) and Automatic Dependent Surveillance-Contract (ADS-C).

The main applications of ATC Surveillance in civil aviation are:

- 1- Aerodrome Control Service;
- 2- Approach Control Service; and

- 3- Area Control Service.
- 4- Surface/ Ground Management

3- SURVEILLANCE IN GANP

The GANP addressed the emerging Surveillance technologies through the thread Alternative Surveillance in block 0 (B0-ASUR), the technologies laid down in that module are ADS-B Out and MLAT.

The lower costs of dependent surveillance infrastructure (ADS-B and MLAT) in comparison to conventional radars support business decisions to expand radar-equivalent service volumes and the use of radar-like separation procedures into remote or non-radar areas.

The eleventh Air Navigation Conference recommended ADS-B on 1090MHz for international use and this is happening. Equipage rate is growing together with Mode S, airborne collision avoidance system (ACAS) and ADS-B OUT mandates. ADS-B OUT, Version 2 also provides ACAS RA DOWNLINK information.

The GANP Surveillance roadmap is depicted in figure (1).

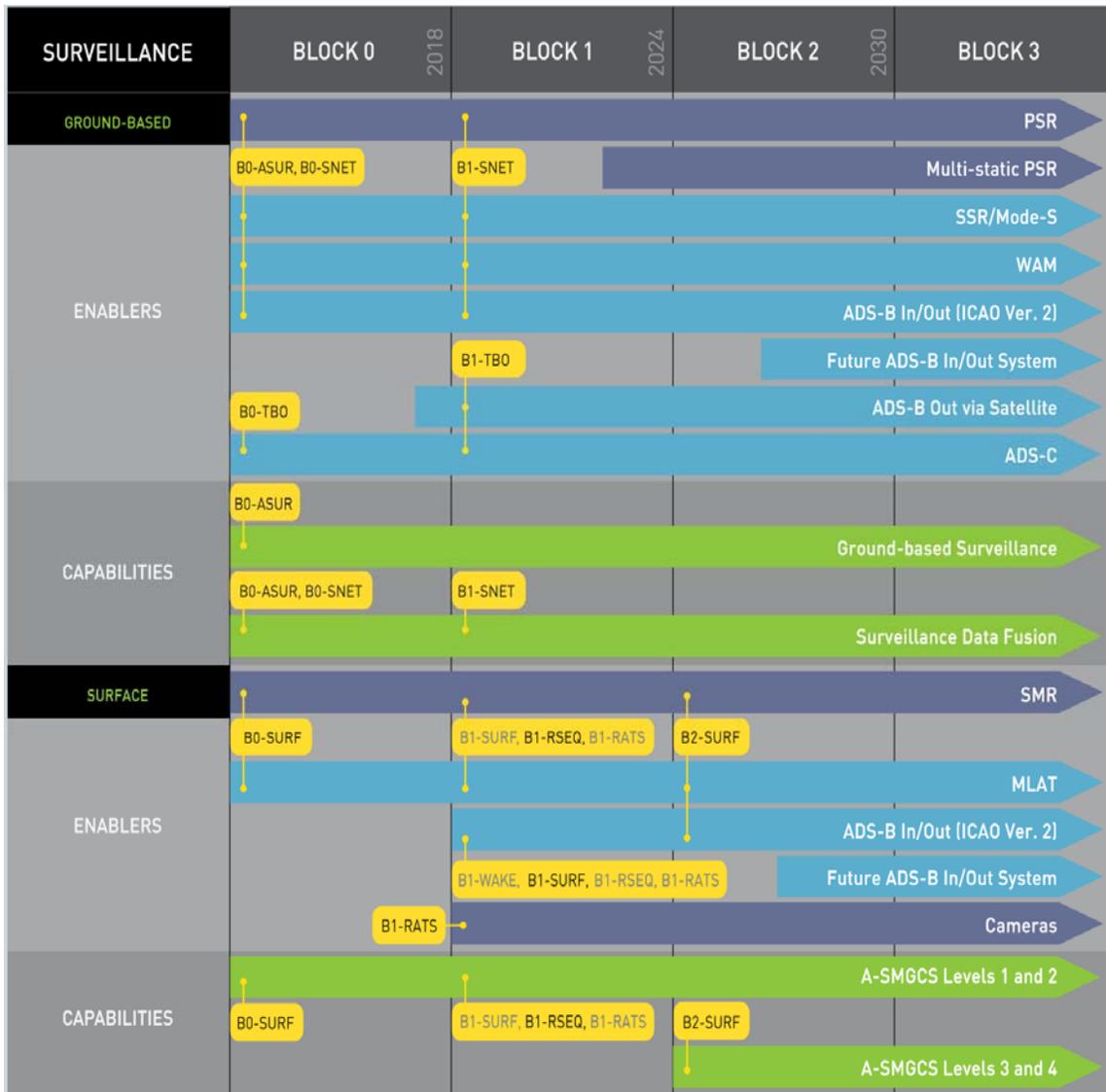


Figure (1)

4- SURVEILLANCE TECHNOLOGIES

4-1 PRIMARY RADAR

Primary Surveillance Radar (PSR) derives aircraft position based on radar echo returns, PSR transmits a high-power signal, some of which is reflected by the aircraft back to the radar. The radar determines the aircraft's position in range from the elapsed time between transmission and reception of the reflection.

Surface Movement Radar (SMR) is the most widely used non-cooperative surveillance system for aerodrome surveillance. SMR is a primary radar that provides surveillance cover for the manoeuvring area, which is defined as that used for the take-off, landing

and taxiing of aircraft. In A-SMGCS, the non-cooperative surveillance service is typically provided by one or several SMRs.

Millimetre radar is an emerging technology used for aerodrome surveillance which provides higher resolution than traditional SMR. Millimetre Radar and SMR can be used for FOD Detection.

The strengths and weaknesses below are related to the PSR.

4-1-1 Strengths

- ✚ independent Radar, does not require any specific equipment of the aircraft (Transponder).

4-1-2 Weaknesses

- ✚ does not provide the identity or the altitude of the Aircraft
- ✚ cannot be easily sited in oceanic locations, or rough terrain such as in mountainous regions
- ✚ PSR has a heavy reliance on mechanical components with large maintenance requirements
- ✚ high CAPEX
- ✚ can report false target
- ✚ depends on the cross section of the target
- ✚ Silence Cone

4-2 SECONDARY SURVEILLANCE RADAR (SSR/MSSR)

A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

4-2-1 Strengths

- ✚ receive aircraft data for barometric altitude, identification code
- ✚ depends on Reply pulses, which are stronger than echo signals used in Primary Radar.
- ✚ Separate frequency spectrum for transmission and reception, Clutter reduction

4-2-2 Weaknesses

- ✚ high CAPEX
- ✚ cannot be easily sited in oceanic locations, or rough terrain such as in mountainous regions
- ✚ has a heavy reliance on mechanical components with large maintenance requirements
- ✚ Silence Cone

4-3 MODE S RADAR

An enhanced mode of SSR that permits selective interrogation and reply capability.

4-3-1 Strengths

- ✚ improve shortage and constraints in Mode a codes (Aircraft ID)
- ✚ backward compatible with transponder mode A/C
- ✚ ability to download enhance surveillance information
- ✚ increase in data integrity by the use of a parity check mechanism.
- ✚ high parametric altitude accuracy (Coding of altitude data in 25-foot increments).

4-3-2 Weaknesses

- ✚ has a heavy reliance on mechanical components with large maintenance requirements
- ✚ cannot be easily sited in oceanic locations, or rough terrain such as in mountainous regions
- ✚ high CAPEX
- ✚ Silence Cone

4-4 ADS-B

Dependent surveillance is an advanced surveillance technology that allows avionics to broadcast an aircraft's identification, position, altitude, velocity, and other information.

4-4-1 Strengths

- ✚ improve shortage and constraints in Mode a codes (Aircraft ID)
- ✚ Low cost
- ✚ Easy to maintain
- ✚ The non-mechanical nature of the ADS-B ground infrastructure make it easy to relocate and maintain.
- ✚ it to be sited in locations that are difficult for radar installations, like hilly areas, filling the surveillance gap between radar coverage
- ✚ provide radar-like separation procedures into remote or non-radar areas
- ✚ Use of dependent surveillance also improves the search and rescue support provided by the surveillance network, ADS-B's positional accuracy and update rate allows for improved flown trajectory tracking allowing for early determination of loss of contact and enhances the ability for search and rescue teams to pinpoint the related location
- ✚ no Silence Cone

4-4-2 Weaknesses

- ✚ aircraft must be equipped with ADS-B OUT
- ✚ dependent on GNSS, outage of GNSS affect ADS-B

4-5 ADS-C

The aircraft uses on-board navigation systems to determine its position, velocity and other data. A ground ATM system establishes a “contract” with the aircraft to report this information at regular intervals or when defined events occur. This information is transmitted on point-to-point data links.

4-5-1 Strengths

- ✚ can be easily sited in oceanic locations, or rough terrain such as in mountainous regions
- ✚ does not need ground infrastructure
- ✚ minimal cost at ANSP
- ✚ use of dependent surveillance also improves the search and rescue support provided by the surveillance network

4-5-2 Weaknesses

- ✚ high cost per report, as the airline use third party network.
- ✚ long latency when satellite used.

The ADS-C used in Oceanic and remote areas (non-Radar area), therefore, it will be excluded in the next section as it's not applicable in the MID Region.

4-6 MLAT

MLAT is a system that uses currently existing aircraft transponder signals to calculate, usually as a minimum, a three-dimensional position. It requires a minimum of four receiving stations to calculate an aircraft's position. If the aircraft's pressure altitude is known then the position may be resolved using three receiving stations.

MLAT can act in two modes; Passive mode where it uses the existing transmissions made by the aircraft, or active mode, to trigger replies in the manner of Mode S SSR interrogations.

The technique is used to provide surveillance over wide area (wide area MLAT system - WAM).

4-6-1 Strengths

- ✚ can make use of currently existing aircraft transmissions, does not require specific avionics.
- ✚ improve shortage and constraints in Mode A codes (Aircraft ID)
- ✚ provides a transition to an environment where the majority of aircraft will be equipped with ADS-B.
- ✚ no Silence Cone.

4-6-2 Weaknesses

- ✚ requires multiple sensors to calculate aircraft's positions
- ✚ high running cost; including maintenance; telecommunication; multiple secured sites
- ✚ needs a common time reference to determine the relative TOA of the signal at the receiving stations (time-stamped by a common clock or synchronism by a common reference such as GNSS)

4-7 SURVEILLANCE CAMERAS

Surveillance Camera can be used to send High-resolution images at the airport to a workstation in the control tower. Surveillance Camera is an enabler to run remotely aerodrome control as in ASBU module B1-RATS. The air traffic controller can monitor air traffic via screens which provide an image that corresponds to the view through the window in a traditional control tower.

5- COMPARISON BETWEEN SURVEILLANCE TECHNOLOGIES

	PSR	MSSR	Mode S	ADS-B	MLAT
1)Required Avionics	No avionics required	Transponder is required Mode A/C	Transponder is required Mode S transponder	Transponder is required ADS-B or 1090 ES (Mode S + ADS-B)	Transponder is required Can process data from all ADS-B/ES, Mode S, Mode A/C
2)Information Provided	Range and Azimuth	mode A codes, Pressure altitude	mode A codes; Pressure altitude; 24-bit address of the aircraft; aircraft “on-the-ground” status; aircraft ID; aircraft pressure-altitude with 25-ft resolution; and other information	Position, flight level (barometric), position integrity, geometric altitude (GPS altitude), 24 bit unique code, Flight ID, velocity vector, vertical rate, emergency flags, aircraft type category	Position, flight level (barometric), calculated altitude, 4 digit octal identity, calculated velocity vector +mode s data
3)Accuracy & update rate	Moderately high update rate Accuracy depends on target cross-section and range	moderately high update rate and high accuracy	Moderately high update rate and high accuracy (High accuracy ,inherent accuracy of the GPS determined position, and very high update rate	High accuracy at Local Area (LAM), less accurate for Wide Area (WAM) Some MLAT has its own of source of synchronization GNSS is critical for MLAT based on

					GNSS for time provision.
4)Coverage	250 NM	250 NM	250 NM	250 NM Traffic density can affect the coverage	**Depending on the geometry,number of sensors, hilly areas requires more sensors
5)Failure effect		Total loss of coverage	Total loss of coverage	Total loss of coverage	Partial or negligible, (N-1) principle
	6) Cost*				
	6.1 CAPEX				
Sensor Purchase	Very high	high	high	very low	Depending on geometry, for 15 sensors average cost is 5M\$
Site requirement (Civil work, renting/buying land(s), fence,..., etc.)	One site required High cost of the tower	One site required High cost of the tower	One site required High cost of the tower	One site required Cost less	Multiple sites required
	6.2 OPEX				
Maintenance cost (periodic, preventive, emergency)	Heavy maintenance (mechanical parts)	Heavy maintenance (mechanical parts)	Heavy maintenance (mechanical parts)	Low maintenance cost	High maintenance costs to multiple sites
	Dual Telecom. connections	Dual Telecom. connections	Dual Telecom. connections	Dual Telecom. connections	Multiple Dual Telecom.

Telecommunication media	Required from the sensor site. to the ATM centre	Required from the sensor site to the ATM centre	Required from the sensor site to the ATM centre	Required from the sensor site to the ATM centre	connections Required From the sensors sites to the ATM centre
Site physical Security	One secured site	One secured site	One secured site	One secured site	Multiple secured Sites

**The cost does not take into consideration fleet equipage cost*

*** Number of MLAT sensor depends on geometry area and number of clusters, 15 sensors is an estimated number to cover flat 250 NM.*

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6. OPERATIONAL REQUIREMENTS

The need to increase the availability of Surveillance services and to cover the gap areas in the MID Region.

7. BASELINE IN THE MID REGION (24/4/2018)

- All MID State uses SSR/MSSR, some States Uses PSR for Security and Safety purposes.
- Bahrain, Egypt, Oman and UAE implemented MLAT at International Aerodromes
- ADS-B has been implemented at some States as backup and complementary means to the MSSR in Egypt, Jordan, Sudan and UAE.
- Bahrain has implemented ADS-B for Vehicle Tracking purpose.
- Bahrain, Egypt, Jordan, Oman, Qatar, Sudan and UAE have installed SSR Mode S
- UAE issued ADS-B/Out carriage Mandate as of 01 January 2020, ADS-B IN capability shall not be carried unless approved by the GCAA.
- Other ICAO Regions/States mandated carriage of ADS-B; Australia, Europe and United States (FAA) in 2020.
- Several ADS-B mandates worldwide will accelerate the ADS-B equipage. However, Regional Airline, General flights and Military aircraft impeding the ADS-B implementation in the MID Region.

8- SURVEILLANCE PLAN

8.1 Short Term (2018 – 2020)

- Make full use of SSR Mode 'S' capabilities, reduce reliance on 4-digit octal code.
- States to consider emerging dependent Surveillance technologies (ADS-B and MLAT) in their National Surveillance Plans.
- Non-cooperative Surveillance radars be retained for Airports and approach services
- ADS-B/Out Implementation:
 - 1- Prioritize ADS-B/Out implementation in areas where there is no radar coverage surveillance.
 - 2- State should conduct safety assessment for ADS-B/ MLAT implementation as per *Reference [5]*.

- 3- The proportions of equipped aircraft are critical for the ADS-B deployment, therefore, States should early involve Users, communicate the change, the rationale and the impact.
- 4- States are encouraged to use INCENTIVE strategy with stakeholders to accelerate ADS-B equipage; incentive approach might be financial or operational incentive or combined (e.g. Most Capable Best Served principle, waive fees).

- MLAT/SMR to be implemented at Aerodrome to enable A-SGMCS

8.2 Mid Term (2021-2024)

- ADS-B/Out Implementation (*High proportion of ADS-B equipage is anticipated*):

- 1- ADS-B to be implemented for Area and approach Control Services, where implementation would bring capacity and operational efficiencies;
- 2- Relocate, as appropriate, WAM Sensors to work as ADS-B receivers.

- States to share Radar/ADS-B data to improve boundary coverage and enhance the surveillance availability.
- Retain SSR Mode S Radar as backup to ADS-B
- MLAT/SMR/Camera to be implemented at Aerodrome for Ground/Surface Management service.
- Surveillance Camera can be used to operate Remote Control Tower (B1-RTAS).

8.3 Long Term (2025 Onward)

- ADS-B is foreseen to be main Surveillance technology. The existence of Multi-constellation GNSS (GPS, Galileo, GLONASS, ..., etc.) reduces the likelihood of ADS-B outage.
- Implementation of Airborne Collision Avoidance System (ACAS) adapted to trajectory-based operations with improved surveillance function supported by ADS-B aimed at reducing nuisance alerts and deviations.
- Airlines to upgrade ADS-B/Out Avionic to ADS-B in/out.

REFERENCES

- [1] ICAO Annex 10, Aeronautical Telecommunication.
- [2] ICAO Doc 9924, Aeronautical Surveillance Manual
- [3] The Aviation System Block Upgrade Doc, July, 2016.
- [4] ICAO Doc 9871, Technical Provisions for Mode S Services and Extended Squitter.
- [5] ICAO circular 326, Assessment of ADS-B and Multilateration Surveillance to Support Air Traffic Services and Guidelines for Implementation
- [6] EUROCONTROL Standard Document for RADAR Surveillance in EN-Route Airspace and Major Terminal Areas.
- [7] Guidance Material on Comparison of Surveillance Technologies (GMST), APAC Region.

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