



International Civil Aviation Organization

**MIDANPIRG CNS/ATM/IC Sub-Group
(CNS/ATM/IC SG)**

**Sixth Meeting
(Cairo, Egypt, 31 January – 02 February 2012)**

Agenda Item 5: Regional Air Navigation Planning and Implementation Issues

ADS-B MODE S AND OTHER SURVEILLANCE RELATED MATTERS

(Presented by Secretariat)

SUMMARY

This paper presents the Surveillance related matters in the MID Region, including the assignment of IC codes for Mode S radar, ADS-B implementation and Status.

Action by the meeting is at paragraph 3.

REFERENCES

- CNS SG/4 Report
- MIDANPIRG/12 Report
- Summary of the outcome of the MID Surveillance Workshop

1. INTRODUCTION

1.1 MIDANPIRG/12 meeting was held in Amman, Jordan 17-21 October, recalled that SSR Mode S interrogator Identifier Codes are used to reduce garble and to improve performance in the overlapping coverage of SSRs, each Mode S sensor or cluster of Mode S sensors requires a unique Interrogator Identifier (II) code and/or a Surveillance Identifier (SI) code, collectively referred to as Interrogator Codes (IC). Since there are only 15 II and 63 SI codes that can be operationally assigned (special use of II Code zero and SI Code zero is not used), IC assignment needs to be carefully organized to ensure that identical codes are not used in overlapping Mode S coverage areas.

1.2 MID Surveillance Workshop was successfully hosted by the General Authority of Civil Aviation (GACA) in Jeddah, Saudi Arabia, from 08 to 10 May 2011. The workshop was attended by a total of 68 participants from 6 States and 2 International Organizations. Airbus, Boeing and EUROCONTROL participated as presenters through WebEx, were live online presentation were conducted followed by questions and answers session.

1.3 The Fourth Meeting of the CNS Sub Group was held at ICAO Middle East Regional Office, Cairo, Egypt, 25 – 27 September 2011. The meeting was attended by a total of twenty-one (21) participants, which included delegates from six (6) States and two (2) Organizations.

2. DISCUSSION

Mode S IC Code Allocation Issues in the MID Region

2.1 MIDANPIRG/12 meeting was apprised on ICAO provisions on the assignment of interrogation codes (IC) being subject to Regional Air Navigation Agreements. Furthermore, ICAO MID Region is an interface with AFI, EUR and APAC Regions. Consequently, the allocation of IC codes requires coordination with these Regions and within the MID Region.

2.2 The meeting may wish to note that the acquisition of Mode S radar installations by Air Navigation Service Providers (ANSPs) and Military Authorities in European Region has focused attention on the need to establish a single European interrogator code allocation mechanism. Consequently European Region through EUROCONTROL has created Mode S IC Co-ordination Group (MICoG) and Civil/Military SSR Environment Liaison Group (CIMSEL) also developed a software (MICA) application for this purpose.

2.3 Furthermore, MIDANPIRG/12 meeting noted that the centralized Mode S IC Allocation mechanism in Europe is handled by MICoG, where the MICoG members act as the contact points between the Mode S IC Allocation Cell and the State Authority applying for interrogator codes. MICoG provide regular reports to EANPG.

2.4 The meeting may wish to note that the European region has a large number of operational mode S radars as a result some MID States experienced IC code conflicts. Accordingly MIDANPIRG/12 was informed that ICAO MID Regional Office carried out coordination processes with European Region through the MICoG and the MICA application for the allocation of the IC codes for MID States.

2.5 Based on the above MIDANPIRG/12 meeting agreed that ICAO MID Regional Office should continue the same process through MICoG, where ICAO MID Regional Office acts as the focal point. MIDANPIRG/12 meeting requested ICAO MID Regional Office to formalize the process of IC code allocation for the ICAO MID region with EUROCONTROL.

2.6 Accordingly, ICAOMID Regional office carried out the several communications for the formalization process with EUROCONTROL and obtained an official agreement that MICA cell provide the ICAO MID Region at the same time as the standard twice-yearly allocation cycle for mode S radars in the EUR Region, the coordinated listing of interrogator codes and radar coverage maps for mode S radars in the MID Region, also agreed that the MICA application extended to ICAO MID Region.

2.7 The CNS SG/4 meeting agreed that in order to improve the efficiency of the interrogator code allocation process. Operators of mode S radar from the MID Region should be given appropriate access to the MICA web application. Accordingly, all MID States operating or planning to operate mode S radar are requested to assign a MID National Focal Point per State. The meeting further agreed on the following process:

- a) MID State to assign MID State focal point and send details to ICAO MID Regional Office;
- b) the assigned MID State focal point to self-register as operators on the EUROCONTROL One Sky Online portal (the link is provided here below):
<https://extranet.eurocontrol.int/http://was.eurocontrol.int/elsh/registerNewUserForApplication.do?eurocontrolresourceid=circa>
- c) ICAO MID Regional office will coordinate with EUROCONTROL so that the MID State focal points be given MICA application access;

- d) the registered MID National focal points will be requested to use the MICA web as required to fill new requests or amendment required for the IC code allocations; and
- e) the registered focal points will also be requested to monitor the allocations assigned in the MICA application and coordinate internally within the State.

2.8 Based on the above the meeting is requested endorse the following Draft Conclusion emanating from CNS SG/4 meeting:

DRAFT CONCLUSION 4/8: MID MODE S IC ALLOCATION PROCESS

That,

- a) *MID States be urged to assign Mode S IC focal points and send to ICAO MID Regional office; and*
- b) *the MID States Mode S IC focal points to:*
 - i) *register in the appropriate EUROCONTROL website;*
 - ii) *fill new requests or amendments required for the IC code allocations; and*
 - iii) *follow-up the allocations assigned in the MICA application and coordinate internally within the State and report back.*

2.9 The meeting may wish to note that the draft version of document at **Appendix A** is laying down recommendations and requirements for an efficient support of the MICA cell to the allocation of IC for MID States and require review and endorsement by meeting to be the official coordination process for the region ; accordingly the meeting may wish to agree to the following draft conclusion:

DRAFT CONCLUSION 6/X: FORMAL PROCESS BETWEEN MID AND EUROCONTROL MODE S IC ALLOCATION PROCESS

*That, the formal process for the allocation of IC codes for Mode S radars in MID Region be adopted as in document at **Appendix A** to this working paper.*

2.10 The CNS SG/4 meeting reviewed the current list of assigned IC for the MID States Mode S radars which is part of the MID FASID Table as at **Appendix B** to this working paper, the listing will be incorporated in the new documents that will be published electronically by ICAO MID Regional Office. The meeting was informed on the two process of IC code allocations; the normal and the adhoc process.

2.11 The CNS SG/4 meeting was apprised on the following developments:

- Bahrain will be commissioning two new modes S radars in January 2012 and there plans for ADS-B and multilateration (MLAT) system;
- Egypt are in the process of installing MLAT system in few months;
- Jordan will have mode S radar and new automation systems ready by end 2011;
- Saudi Arabia have twenty three mode S radars constellation some of which are already operational and others are in the process to be installed and commissioned;
- UAE is planning to install additional mode S radars by end 2012.

MID Surveillance issues

2.12 MIDANPIRG/12 meeting noted that many emerging surveillance technologies had been included in the ICAO provisions and are being implemented worldwide and in the MID Region, some of which are not a straight foreword implementation and require considerable knowledge on systems and procedures for their implementations. Accordingly, MIDANPIRG/12 meeting agreed to *Conclusion 12/45: MID Surveillance Workshop*.

2.13 Based on the above, the MID Surveillance Workshop was successfully hosted by the General Authority of Civil Aviation (GACA) in Jeddah, Saudi Arabia, (08-10 May 2011). The workshop was attended by a total of 68 participants from 6 States and 2 International Organizations. Airbus, Boeing and EUROCONTROL participated as presenters through WebEx, were life online presentation were conducted followed by questions and answers session.

2.14 The meeting may wish to note that the workshop was conducted with an objective to provide States in the Middle East Region, with a better understanding of evolving aeronautical surveillance and the new technologies to enhance situational awareness. The objective also included the development of MID Region Surveillance strategy and the time lines for the ADS-B implementation.

2.15 The meeting may further wish to note that the presentations and discussions covered mainly the following topics:

- Evolution of aeronautical surveillance
- Surveillance part of the MID REGION ANP FASID
- Radar Performance and Comparison of aeronautical surveillance Systems.
- User Surveillance Requirements
- MID States activities on surveillance
- Mode S coordination issues
- Multilateration and its use and requirement
- Solution and roadmap of FANS and ADS-B on the airbus family fleet
- SESAR and Nextgen requirement and the new advances on the situational awareness in cockpit
- ADS-B Out & ATSAW Deployment in Europe
- Boeing ADS-B Out and Regulatory Mandates in different Region

2.16 The workshop discussed in detail Mode S coordination issues including a live demonstration on the MICA application used by EUROPE and MID, where the participant had good understanding of the different capabilities available in the MICA web tool, the IC allocation cycle along with IC code conflict reporting and resolution screen.

2.17 The workshop was presented with practical examples on the Multilateration, its use and requirement. Presentations also covered the solution and roadmap of FANS and ADS-B and the Mode S Enhanced Surveillance (EHS) mandate in Europe to fulfill the SESAR and Nextgen requirement were highlighted. Furthermore the workshop noted that ADS-B Out, Airborne Traffic Situational Awareness (ATSAW) deployment in Europe is progressing under Surveillance Performance & Interoperability Implementing (SPI IR) mandate.

2.18 The meeting may wish to note that the workshop received presentation from the two major aircraft manufacturers and got better understanding of their plans and the future equipage planning. Especially on ADS, and ADS-B mandates in different parts of the world including Australia, Hong Kong, Singapore, other Asia Pacific Regulatory Agencies, Nav Canada, EURCONTROL/ESA draft rule and the USA.

2.19 The meeting may further wish to note that ICAO is addressing through the ASTAF (Airborne Surveillance Task Force) advanced situational awareness issues, where the mission of the task force is to develop a manual on Airborne Surveillance, covering the implementation of airborne surveillance and the initial applications, implemented by manufacturers over the next 3-5 years along with other related material.

2.20 The CNS SG/4 meeting reviewed and updated the MID Region Surveillance Strategy that was developed by the MID Surveillance workshop as at **Appendix C** to this working paper. Accordingly, CNS SG/4 meeting developed the following Draft Conclusion emanating from CNS SG/4 meeting:

DRAFT CONCLUSION 4/11: MID REGION SURVEILLANCE STRATEGY

*That, the MID Region Surveillance strategy be adopted as at **Appendix C** to this working paper.*

2.21 The CNS SG/4 meeting discussed the action list that was developed by the MID Surveillance workshop and noted that the first two actions are under progress by appropriate ICAO bodies. With regards to aircraft equipage survey, the meeting reviewed the “Surveillance Aircraft Equipage Survey” that was developed by IATA and agreed that IATA will check the possibility to share the survey and its results information with their users and provides an update during CNS/ATM/IC SG/6. It was noted that CANSO is conducting comprehensive survey which will be completed by November 2011. Accordingly, the meeting requested ICAO MID Regional office to check with CANSO the possibility of sharing survey information along with the possibility of storing the data in a common database.

2.22 Based on the above ICAO MID regional office had contacted CANSO and received Middle East ANSPS, Users and Stakeholders Engagement (MEAUSE) annual reports which had high level data on the equipage however the required raw data is still not being consolidated. CANSO also supports the proposal for common data base for ICAO, IATA and CANSO since this will help in facilitating regional programs. Accordingly the meeting may wish to consider ways for establishment of this database.

2.23 The meeting may wish to note the benefits of exchanging surveillance data that will enable greater efficiencies for airlines operating across boundaries by providing increased capacity, reduced workload, and enhance safety. In this regard the meetings recalled that, PANS ATM DOC 4444 para 8.1.5 indicates *States should, to the extent possible, facilitate the sharing of information derived from ATS surveillance systems in order to extend and improve surveillance coverage in adjacent control areas.*

2.24 The meeting may wish to recall MIDANPIRG/12 meeting views for a programme on surveillance data information sharing to be carried out by all MID States in order to significantly reduce surveillance gaps. In this regard MIDANPIRG/12 meeting agreed to the revised Regional PFF for the ATS surveillance data exchange and agreed to *Conclusion 12/46: Exchange of Surveillance data.*

2.25 The meeting may wish to note that as a follow-up to the above conclusion ICAO MID Regional office sent State letter AN 7/5.9–11/025 dated 16 February 2011 and the following States provided replies:

- Bahrain implemented the exchange of surveillance data with Kuwait since 2009, and with Qatar, Bahrain has made request to Saudi Arabia and UAE to implement the exchange of surveillance data, Bahrain has been providing UAE with the surveillance data since 2003;
- Jordan is not exchanging surveillance data, however it will be implemented when the new ATM system is commissioned at the end of the year;
- Oman is presently seeking approvals for the exchange of surveillance data with other states from appropriate authorities; and
- UAE are exchanging surveillance with Qatar

2.26 The CNS SG/4 meeting noted IATA's request on enhancement of the surveillance data exchange especially during the economic crises to enhance safety and efficiency with no huge investments. Accordingly, the meeting agreed to continue encouraging the exchange of the surveillance data.

2.27 The meeting may wish to recall that MIDANPIRG/10 encouraged States, in collaboration with the airspace users to develop and implement an ADS-B trials programme and MIDANPIRG/11 under conclusion 11/69 agreed on a Regional Strategy for the implementation of ADS-B. MIDANPIRG/12 supported the development of a harmonized plan for the ADS-B implementation for the MID Region based on the strategy adopted by MIDANPIRG/11. Accordingly, MID Surveillance workshop developed draft Surveillance strategy including time lines for ADS-B implementation.

2.28 The meeting may wish to note that MIDANPIRG/12 reiterated MIDANPIRG/11 conclusion 11/69 and considered that the MID Region Strategy for the Implementation of ADS-B being valid. However, with the recent developments; the CNS SG/4 meeting reviewed and updated the MID Region Strategy for the Implementation of ADS-B as at **Appendix D** to this working paper and the CNS SG/4 meeting developed the following Draft Conclusion:

DRAFT CONCLUSION 4/12: MID REGION STRATEGY FOR THE IMPLEMENTATION OF ADS-B

*That, the MID Region Strategy for the implementation of ADS-B to be amended as at **Appendix D** to this working paper.*

2.29 The CNS SG/4 meeting was briefed on ICAO initiatives for operational enhancements and noted that Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration using -AIDC-is possible since the required procedures exist and experience from other regions can be a useful reference. Furthermore, technology is available and is implemented in Flight Data Processing and could use the ground network standard AFTN-AMHS or ATN; also there are no specific airborne requirements. In this regard the CNS SG/4 meeting was presented with a draft Interface Control Document for the MID region based on the other regions documents. The CNS SG/4 meeting was in consensus that an educational seminar is required before the mandate in the Region.

2.30 The meeting may wish to recall amendment 85 to annex 10, where MIDANPIRG/12 meeting urged MID States to strictly adhere to the 24-bit aircraft addresses allocated to their States as listed in Annex 10, Volume III, Part I, Chapter 9, Table 9-1 (allocation of aircraft addresses to States). Furthermore, the MIDANPIRG/12 meeting encouraged MID States to allocate the 24 bit address to all aircraft registered in their State with the principle that, at any one time, no address shall be assigned to more than one aircraft.

2.31 The meeting may wish to note that the above requirement is already included in the MID FASID Doc 9708. Furthermore, MIDANPIRG/12 meeting urged MID States to maintain databases for all the 24bit aircraft address allocation pertaining to their States and send the assigned allocations to ICAO MID Regional Office and MID RMA for inclusion in their databases as soon possible. Accordingly, the meeting agreed to the following Draft Conclusion noting that MID RMA supports the proposal :

DRAFT CONCLUSION 4/13: ALLOCATION OF 24 BIT AIRCRAFT ADDRESS

That, MID States be urged to:

- a) allocate 24 bit aircraft address according to Annex 10, Volume III, Part I, Chapter 9, Table 9-1 (allocation of aircraft addresses to States);*
- b) send the allocation list to ICAO MID Regional Office and MID RMA by 30 March 2012; and*
- c) provide ICAO MID Regional Office and MID RMA with regular updates to the allocation list.*

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) agree on draft conclusion in para 2.9;
- b) review and comment on strategies in appendices C and D;
- c) recommend ways for the establishment of common databases proposed in para. 2.22; and
- d) agree and support the conduct of AIDC seminar as proposed in para. 2.29.

APPENDIX A
EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION



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

DOCUMENT IDENTIFIER :

Edition Number	:	v 0.8
Edition Date	:	03 November 2011
Status	:	Working Draft
Intended for	:	General Public
Category	:	

DOCUMENT CHARACTERISTICS

TITLE		
Requirements for the coordinated allocation and use of Mode S Interrogator Codes in the ICAO Middle East Region		
		Publications Reference:
		ISBN Number:
Document Identifier	Edition Number:	v 0.8
		Edition Date:
		03 November 2011
Abstract		
Keywords		
Contact Person(s)	Tel	Unit
BODART Jérôme	+32 2 729 4695	DNM/COO/DCO/SCC
POTIER Eric	+32 2 729 3504	DNM/COO/DCO/SCC

STATUS, AUDIENCE AND ACCESSIBILITY					
Status		Intended for		Accessible via	
Working Draft	<input checked="" type="checkbox"/>	General Public	<input checked="" type="checkbox"/>	Intranet	<input type="checkbox"/>
Draft	<input type="checkbox"/>	EUROCONTROL	<input type="checkbox"/>	Extranet	<input type="checkbox"/>
Proposed Issue	<input type="checkbox"/>	Restricted	<input type="checkbox"/>	Internet (www.eurocontrol.int)	<input type="checkbox"/>
Released Issue	<input type="checkbox"/>				

DOCUMENT APPROVAL

The following table identifies all management authorities who have successively approved the present issue of this document.

AUTHORITY	NAME AND SIGNATURE	DATE

DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED

Publications

EUROCONTROL Headquarters
96 Rue de la Fusée
B-1130 BRUSSELS

Tel: +32 (0)2 729 4715

Fax: +32 (0)2 729 5149

E-mail: publications@eurocontrol.int

CONTENTS

DOCUMENT CHARACTERISTICS	2
DOCUMENT APPROVAL	3
DOCUMENT CHANGE RECORD	4
CONTENTS	5
LIST OF FIGURES	7
LIST OF TABLES	8
EXECUTIVE SUMMARY	9
1. Introduction	10
1.1 Purpose of the document	10
1.2 Mode S Interrogator Code.....	10
1.3 Abbreviations	10
1.4 Definitions.....	10
1.5 References.....	11
1.6 Document structure	12
2. IC Allocation Coordination in Europe.....	13
2.1 Organization	13
2.2 IC Allocations Framework.....	13
2.3 IC Allocation Status.....	14
3. Mode S IC Allocation Process.....	16
3.1 IC allocation cycle	16
3.2 Ad-hoc allocation process.....	17
3.3 Applications.....	17
3.4 Allocation Simulations.....	18
3.5 Allocation Proposals.....	18
3.6 Allocation Review.....	18
3.7 Allocation Publication.....	19
3.8 Output of the Allocation Process	19
3.9 Allocation Changes.....	19
3.10 Discrete Code Allocation	20
3.10.1 Il code and mobile radar.....	20
3.10.2 Cluster	20
3.10.3 Test, Research and Development Mode S interrogators	20
3.10.4 Specific code for specific military operations	20

3.11	Dispute Resolution.....	21
3.12	MICoG working arrangement.....	21
4.	Role and Responsibilities for IC allocation in ICAO Middle East Region..	22
4.1	Requirements for Mode S Operators in ICAO Middle East Region.....	22
4.2	Requirements for the ICAO Middle East Regional Office	23
4.3	Requirements related to IC Conflict.....	25
5.	Guidance for IC allocation in ICAO Middle East Region	26
5.1	Mode S Radars Performances.....	26
5.1.1	SI code capability	26
5.1.2	II/SI code operation.....	26
5.1.2.1	II/SI code operation in ICAO Middle East region.....	26
5.1.2.2	II/SI code operation in the European Union	26
5.1.3	Mode S Coverage.....	27
5.2	Requirements for airborne carriage.....	28
ANNEX A	– II/SI code operation.....	29

LIST OF FIGURES

Figure 1: Mode S IC Allocation Coordination in Europe	13
Figure 2: IC Allocation Status in European region at the end of MICA Cycle 13.....	14
Figure 3: IC Allocation Status in Middle East region at the end of MICA Cycle 13.....	15
Figure 4: Mode S IC Allocation Cycle	16

LIST OF TABLES

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 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 (MICA Cell) to perform the allocation of the Interrogator Codes. To support the coordinated allocation and implementation of the Interrogator Code to Mode S interrogators in ICAO European region, a process (Mode S IC Allocation process) has been formalized.

Mode S radars are also installed in ICAO Middle East region. The operational coverage of some of these radars is overlapping coverage of Mode S radars installed in ICAO European Region. In order to avoid any Mode S Interrogator Code conflict with radar already operational in Mode S, it is therefore critical to coordinate the Mode S Interrogator Code Allocation in ICAO Middle East region in close cooperation with the ICAO Middle East regional office.

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.

The Mode S IC Allocation process applied in Europe will also be applied for IC Allocation to Mode S radars in the Middle East ICAO region. This process is based on 168 days (approximately 6 months) cycles, aligned on AIRAC effective dates. The IC allocation to Mode S radars in ICAO Middle East region and ICAO European region will be processed together during the same MICA cycles. This document also details the role and responsibilities of ICAO Middle East regional office and Mode S operators.

In addition, the IC Allocation in Europe relies on required Mode S radar 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.

1.2 Mode S Interrogator Code

Whilst traditional Secondary Surveillance Radar (SSR) station sends interrogations that are replied by all aircraft within its beam, Mode S interrogator transmits addressed interrogations to each aircraft within its coverage.

In Mode S protocol each aircraft and each interrogator must be uniquely identified. Mode S Interrogators are identified by an Interrogator Code.

To secure the safety of the air traffic surveillance system, it is essential that the radar coverage areas of two Mode S interrogators using the same Interrogator Code do not overlap, except if they are grouped in a cluster or if other appropriate operational mitigations are in place.

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. Compared to the number of Mode S interrogators which might be deployed in a region, the number of IC is low.

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

1.3 Abbreviations

IC	Interrogator Code
II	Interrogator Identifier
MICA	Mode S Interrogator Code Allocation
MICoG	Mode S Interrogator Code Coordination Group
MID	Middle East
SI	Surveillance Identifier
SSR	Secondary Surveillance Radar

1.4 Definitions

1. **Cluster:** A set of Mode S interrogators connected all together in the same network and using the same Interrogator Code to share track information in order to allow aircraft acquisition already acquired by other stations in the same cluster.
2. **Eligible Mode S interrogator:** fixed Mode S interrogator for which at least one of the following conditions is satisfied:
 - a. the interrogator relies, at least partly, on Mode S all call interrogations and replies for Mode S targets acquisition; or

- b. 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
 - c. the interrogator uses multisite communications protocols for data link applications.
3. **Eligible Interrogator Code:** any code among the II codes and the SI codes, except
- a. II code 0
 - b. the Interrogator Code(s) reserved for military entities including intergovernmental organisations in particular North Atlantic Treaty Organisation (II code 15 is currently reserved in Europe for NATO management)
4. **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.
5. **Lockout:** protocol that allows the suppression of Mode S all call replies to Mode S all call interrogations transmitted on a specific IC.
6. **Lockout Map:** Mode S interrogator configuration file defining where and how to apply lockout to Mode S targets.
7. **MICA web:** the Mode S Interrogator Code Allocation (MICA) web application is used to coordinate and manage IC Allocation to Mode S radars in the ICAO European region and in the ICAO Middle East region. The access to the web application is managed through the Eurocontrol OneSkyOnline portal.
8. **Mode S All Call interrogations:** messages that are normally used by Mode S interrogators to acquire Mode S targets entering their coverage area.
9. **Mode S interrogator:** system composed of antenna and electronics, supporting detection and tracking of individual aircraft through the Mode S protocol.
10. **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 units operating Mode S interrogators on any other interrogator code than II code 0
 - e. research establishments
 - f. any other entity entitled to operate a Mode S interrogator
11. **Mode S target:** a platform equipped with a Mode S transponder.

1.5 References

ICAO Annex 10 to the Convention on International Civil Aviation
Aeronautical Telecommunications
Volume IV Surveillance and Collision Avoidance Systems

1.6 Document structure

Chapter 2 describes how the IC Allocation coordination is organized in ICAO European region. The IC Allocation status in the ICAO European region and ICAO Middle East region is also provided in this chapter.

Chapter 3 presents the IC Allocation process that is applied in the ICAO European region to process Interrogator Code requests for new Mode S radars. This process will also be applied to the ICAO Middle East region.

Chapter 4 summarizes the role and responsibilities of ICAO Middle East regional office and Mode S operators in the IC Allocation process applied in the ICAO European region.

Chapter 5 provides some guidance for IC allocation in ICAO Middle East Region. In particular the Mode S radar 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 European ICAO 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 (MICA Cell) to perform the allocation of the Interrogator Codes. In addition a working arrangement (MICoG) has been created to oversee the allocation process and provide guidance to the MICA Cell. MICoG members are the Focal Points representing the National Regulatory Authorities of European States and those international organisations applying for Interrogator Codes.

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 radars in ICAO European region.

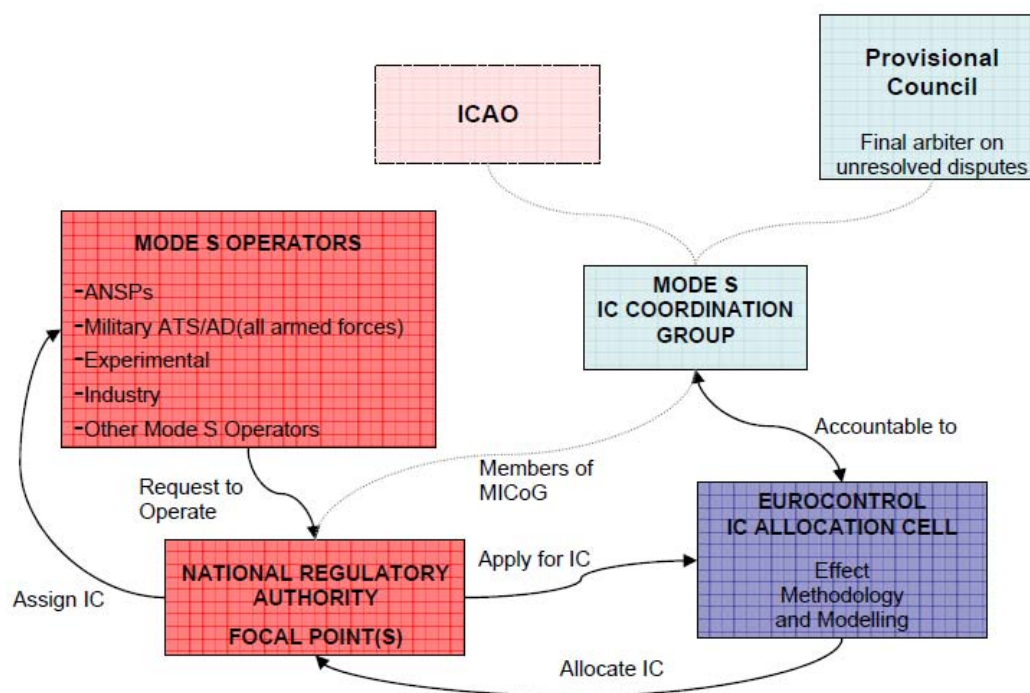


Figure 1: Mode S IC Allocation Coordination in Europe

2.2 IC Allocations Framework

IC allocation started with deployment of the first Mode S stations in Europe. The deployment of more Mode S stations 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

For countries belonging to the European Union, the European Regulation supersedes the Eurocontrol document depicting the Mode S Interrogator Codes Allocation Process.

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

2.3 IC Allocation Status

At the end of MICA Cycle 13 (September 2011), 247 Mode S radars were allocated an Interrogator Code, either an II code or an SI code, in the European region.

The Figure 2 here below depicts the IC Allocation Status in the European region at the end of MICA Cycle 13.

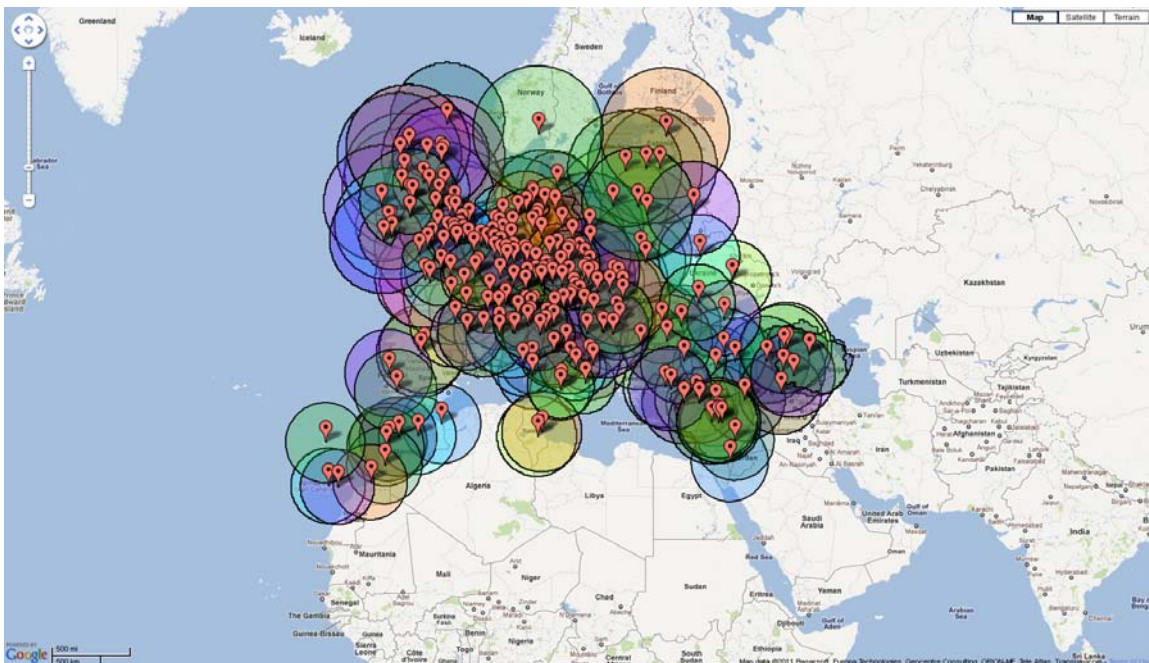


Figure 2: IC Allocation Status in European region at the end of MICA Cycle 13

Mode S radars are also installed in ICAO Middle East region. The operational coverage of some of these radars is overlapping coverages of Mode S radars installed in ICAO European Region. In order to avoid any Mode S Interrogator Code conflict with radar already operational in Mode S, it is therefore critical to coordinate the Mode S Interrogator Code Allocation in ICAO Middle East region in close cooperation with the ICAO Middle East regional office.

Until now, the allocation of Interrogator Codes to Mode S radars in ICAO MID region has been done on an ad-hoc basis.

At the end of MICA Cycle 13 (September 2011), 32 Mode S radars were allocated an II code in the Middle East region.

The Figure 3 here below depicts the IC Allocation Status in the Middle East region at the end of MICA Cycle 13.



Figure 3: IC Allocation Status in Middle East region at the end of MICA Cycle 13

The purpose of this document is then to lay down recommendations and requirements for an efficient support of the MICA cell to the allocation of IC by the ICAO MID office in the ICAO Middle East Region.

3. Mode S IC Allocation Process

The Mode S IC Allocation process applied in Europe and described hereafter will also be used for IC Allocation to Mode S radars in the Middle East ICAO region.

If, for some reasons, the Mode S IC Allocation process cannot directly be applicable to the ICAO Middle East region, then differences will be highlighted.

The MICA web is the main interface of the Mode S IC Allocation process. Register users can submit applications to get an IC for new Mode S radars, they can also retrieve the issued allocations. In addition, there is a conflict report mechanism to help Mode S operators to investigate potential Mode S conflicts. As a consequence, all Focal Points shall be registered on the MICA web. It is highly recommended for Mode S operators to also be registered in order to have direct access to their allocations and to be able to investigate quicker IC conflicts.

3.1 IC allocation cycle

The IC allocation to Mode S radars in Middle East region will be processed together with IC allocation to Mode S radars in European region during the same MICA cycles.

The Mode S IC Allocation cycles are based on AIRAC effective dates. MICA cycles are as follows:

- There are only two allocation effective dates per year (at 168 days intervals).
- Applications to request the allocation of an Interrogator Code must be received at least 168 days before the effective AIRAC date; that is before the requirements freeze date (see Figure 4 her below).
- Applications received after the requirements freeze date will not be processed until the next allocation cycle, unless they can be accommodated through the ad-hoc process.
- Draft allocation or change proposals are published by the MICA Cell, for review by the Focal Points, 140 days in advance of the corresponding effective date.
- The draft proposals publication is followed by a 28 days review period.
- The allocations are then published 98 days in advance of the effective date.
- Focal Points from affected states have 14 days to acknowledge the new allocation plan and to transmit allocation details to Mode S Operators as necessary.
- All changes implemented through the cyclic IC allocation process shall be completed before the cycle effective date. The effective date is the latest implementation date and will correspond with the requirements freeze date for the next allocation cycle.

Note: Other systems such as radar data processing systems may need to be updated concurrently during the implementation period, e.g. to reflect a possible change in radar coverage maps.

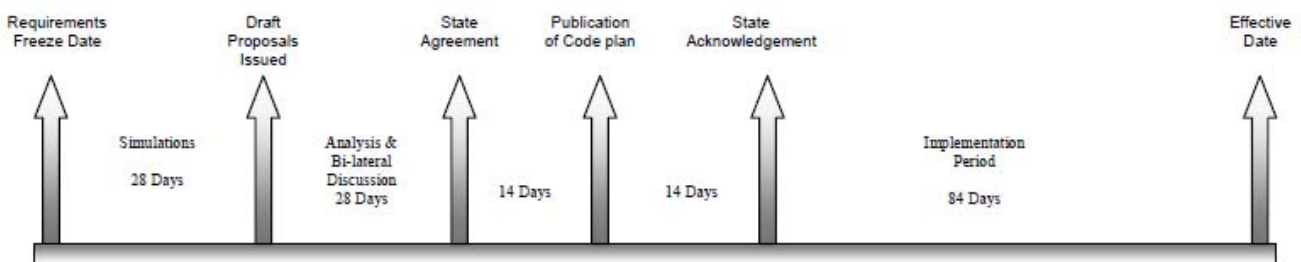


Figure 4: Mode S IC Allocation Cycle

3.2 Ad-hoc allocation process

The MICA Cell will deal with urgent applications on an ad-hoc basis, but will not guarantee an optimal allocation. In particular, no change will be made to the existing Mode S allocations during the ad-hoc process.

As no existing issued Mode S allocation can be impacted by the ad-hoc process, this process is faster than the Mode S IC Allocation cycle.

3.3 Applications

Requests for the allocation of a Mode S Interrogator Code have to be made by the Mode S Operators to the appropriate National Authority of the European Region which is empowered to issue, amend or revoke approvals to operate Mode S interrogators, or by a properly designated authority in the case of international organisations.

The ICAO Middle East Regional Officer will act as the Focal Point for all Mode S Operators within the ICAO Middle East region. As a consequence, he will be responsible to collect applications from all Mode S Operators in ICAO Middle East region.

Applications shall be submitted at least 168 days before the target effective date to give adequate time to be processed by the MICA Cell and any difficulties to be resolved. Focal Points and Mode S Operators are advised to take the allocation period into consideration when developing implementation plans.

Applications for IC allocation should be submitted online on the MICA web by the Focal Point for European region.

Applications can also be submitted by the Mode S Operator on the MICA web. In that case, the applications shall be reviewed and acknowledged online by the responsible Focal Point.

Requests for IC allocation can still be submitted by the Focal Point by e-mail accompanied by the appropriate form which has been developed for that purpose. Nevertheless the online submission on the MICA web is preferred.

The operators must provide the necessary information to perform the IC allocation. An IC application shall include the following key items:

- a. Mode S interrogator name
- b. Mode S interrogator use (operational or test)
- c. Mode S interrogator position in Lat/Long (in degree, minute, seconds format)
- d. Mode S interrogator planned date of first Mode S transmission
- e. requested Mode S coverage
- f. SI code capability
- g. 'II/SI code operation' capability
- h. coverage map capability

In the application, the requested Mode S coverage, provided in range per sector, is defining the required operational coverage. A Mode S Operator can communicate additional specific operational requirements to the MICA Cell, through his Focal Point.

If the Mode S interrogator position is a sensitive information (e.g. military radars), that position can be approximate to the minute.

3.4 Allocation Simulations

During the Allocation Simulation period, the MICA Cell is creating allocation proposals for all applications under process in the current MICA cycle. Existing IC allocations may also be impacted.

The MICA Cell may need guidance from and coordination with Focal Points and/or Mode S Operators to complete its work. Focal Points and Mode S Operators points of contact should be available to provide assistance to the MICA Cell during the Allocation Simulation period, particularly if they submitted applications processed in the corresponding MICA cycle.

Points of contact of Mode S Operators who are not registered on the MICA web shall be explicitly provided by the responsible Focal Point.

3.5 Allocation Proposals

At the end of the simulations period, the MICA Cell issues IC allocation proposals. The proposals cover new allocations as well as existing allocation changes required to provide IC allocations to new Mode S interrogators.

All the allocation proposals are available online on the MICA web and can be accessed by all Focal Points. Allocation proposals for radars of a given organisation can also be accessed by Mode S operators from the same organisation.

3.6 Allocation Review

Focal Points have 28 days to review the allocation proposals. An acknowledgement is required from affected States only.

Each Focal Point has to accept or reject allocations proposed for Mode S radars installed or planned to be in the country under his responsibility. To fulfil that task, the Focal Points are responsible to check the acceptability of the allocation proposals with the corresponding Mode S Operators.

The ICAO Middle East Regional Officer will have to accept or reject all allocation proposals for Mode S radar installed or planned to be in the ICAO Middle East region. To fulfil that task, he will have to check the acceptability of the allocation proposals with the corresponding Mode S Operators.

The Focal Points should accept or reject allocation proposals directly on the MICA web. There is an Accept button and a Refuse button at the bottom of each Allocation Proposal.

In case an allocation proposal is refused, the following may happen:

- The MICA Cell produces an updated proposal within the initial 14 days of the review period; or
- As a last resort, the controversial proposals are withdrawn, to be processed in the next allocation cycle.

The Focal Points can also raise an objection for any other allocation proposal. In that case, a comment will have to be provided to explain the objection. In that case, the allocation proposal may be updated.

Given that the MICA Cell consults Focal Points and Mode S Operators during the simulations period, objections raised during the review period should be limited.

3.7 Allocation Publication

84 days before the effective date, the MICA Cell publishes official IC allocations.

All the issued IC allocations are available online on the MICA web.

The Focal Point is responsible to ensure that all Mode S Operators under his responsibility and impacted by the Mode S IC Allocation cycle are aware of the new issued allocations. In particular, he is responsible to deliver the IC allocation details to the Mode S Operators. It should be noted that Mode S operators registered on the MICA web have also access to IC allocations issued for their organisation.

The Focal Point has to acknowledge issued IC allocations under his responsibility directly on the MICA web. There is an Acknowledge button at the bottom of each issued IC allocation. By doing this action, the Focal Point confirms that Mode S Operators have been informed.

3.8 Output of the Allocation Process

The allocation activity of the MICA Cell is referred to as being the Interrogator Code allocation. However, an allocation is in fact granting the right to an interrogator to lockout on a given code over a given area. This implies that the output of the allocation process is not only a code, but also a matching coverage.

The coverage associated with the code allocation is defined in the allocation form on the MICA web and can be expressed as:

- A Mode S responsibility map (in the European Mode S Coverage Map ICD format); or
- A sectorised range around the radar position.

The MICA Cell allocates both lockout and surveillance coverage, the former always being inscribed within the latter.

The lockout coverage provided by the MICA Cell is reduced compared to the surveillance coverage. As the lockout timer of an aircraft takes 18 seconds to time-out, the purpose here is to ensure that an aircraft which was locked out by neighbouring radar on the same code is unlocked when entering the surveillance coverage of the next radar.

For a sectorised range around the radar position, the allocated lockout coverage is reduced by 5 NM, compared to the surveillance coverage. For a Mode S responsibility map, the lockout coverage is reduced by 1 cell, compared to the surveillance coverage.

NOTES: Mode S Operators are encouraged to support the use of European Mode S coverage maps. Lacking support for such maps will require the MICA Cell to allocate coverage expressed as sectorised ranges, which may result in less optimal overall coverage.

3.9 Allocation Changes

Existing allocations may be impacted by the MICA Cycle in order to provide IC allocations to new Mode S interrogators.

Interrogator Code and coverage maps changes need to be carefully coordinated in order to avoid potential conflicts.

The MICA Cell identifies all Mode S Operators and ATM systems impacted by a given change and inform their relevant Focal Points. In addition to the issued Allocations, MICA Cell provides an implementation sequence, which is the time-bounded sequence of implementation of Interrogator Code allocations with which Mode S Operators need to comply to avoid temporary interrogator code conflicts

The Focal Points are responsible to provide this implementation sequence to all impacted Mode S Operators. These Mode S Operators are then responsible for the organisation of the necessary coordination. The Mode S Operators are required to advise their Focal Point of the agreed arrangements in advance of implementation. MICA Cell should also be informed.

3.10 Discrete Code Allocation

3.10.1 II code and mobile radar

II Code 0 has been reserved by ICAO for operation without an assigned code. 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 allocation process.

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

3.10.2 Cluster

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

3.10.3 Test, Research and Development Mode S interrogators

Test systems are normally allocated a shared Interrogator Code (currently II 14). This may typically not be a conflict-free situation and Mode S targets acquisition cannot be guaranteed when several test systems operate concurrently. Mode S Operators of Mode S test systems who need to conduct temporary trials requiring a conflict free situation are responsible for the bilateral coordination with other Mode S Operators of Mode S test system.

However, applications for IC Allocation to test systems still need to be done according to the agreed IC Allocation Process.

Operation on any other code without prior coordination and allocation is prohibited as it could severely interfere with other Mode S surveillance systems and consequently impact civil and military ATC and AD operations.

Mode S IC Allocations to test systems on II code 14 and Mode S Operators point of contacts are available on the MICA web.

3.10.4 Specific code for specific military operations

II code 15 is currently reserved in Europe 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 and SI 63) are not reserved for NATO but are currently not used either for allocation.

Discussions are ongoing about the possibility to reserve SI codes matching II code 15 for military use. The management of these codes would be done by NATO.

Mode S interrogators affected by the discussion are exclusively the non-fixed, deployable military installations.

Fixed military radars are still eligible to get a discrete Interrogator Code following the normal Mode S IC Allocation process.

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

Note: there is currently discussion to reserve II code 15 for military application everywhere in the world.

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

3.11 Dispute Resolution

Dispute may happen during the Mode S IC Allocation process. Discussions with the impacted Mode S operator(s) and the responsible Focal Point(s) may be sufficient to find a solution.

If no solution is found, a final arbiter to unresolved dispute is required.

The ICAO Middle East regional officer is responsible to manage disputes inside the ICAO Middle East region.

Final arbiter has to be identified to resolve disputes that could occur between countries of ICAO European region and ICAO Middle East region.

3.12 MICoG working arrangement

MICoG working arrangement has been created to oversee the allocation process and provide guidance to the MICA Cell. 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 Middle East region, the ICAO Middle East regional officer is invited to be a MICoG member and to attend MICoG meetings (twice a year).

ICAO Middle East 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 radar installation in ICAO Middle East region. The MICA cell would not participate to Middle East Mode S operators meetings.

The ICAO Middle East regional officer could submit problems encountered in ICAO Middle East region during the MICoG meeting.

4. Role and Responsibilities for IC allocation in ICAO Middle East Region

4.1 Requirements for Mode S Operators in ICAO Middle East Region

1. 'Mode S Operator' means 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 units operating Mode S interrogators on any other interrogator code than II code 0
 - e. research establishments
 - f. any other entity entitled to operate a Mode S interrogator
2. Mode S Operators should be registered on the MICA web.
3. Mode S Operators shall only operate an eligible Mode S interrogator, using an eligible Interrogator Code, if they have received an Interrogator Code allocation, for this purpose, from the ICAO Middle East regional office.
4. All Mode S Operators intending to operate, or operating, an eligible Mode S interrogator for which no Interrogator Code allocation has been provided shall submit an Interrogator Code application to the ICAO Middle East regional office. **Except if using II=0mobile interrogators**

An IC application shall include the following key items:

- a. Mode S interrogator name
- b. Mode S interrogator use (operational or test)
- c. Mode S interrogator position in Lat/Long (in degree, minute, seconds format); if the radar position is a sensitive information (e.g. military radars), the position can be approximate to the minute
- d. Mode S interrogator planned date of first Mode S transmission;
- e. requested Mode S coverage
- f. SI code capability
- g. 'II/SI code operation' capability
- h. coverage map capability

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

Interrogator Code 0 has been reserved by ICAO for operation without an assigned code. Mode S interrogators using Interrogator Code 0 in accordance with the ICAO Standards and Recommended Practices do not need to be subject to the coordinated allocation process.

The use of II Code 0 can be approved at National Regulatory level.

Mode S applications could be submitted directly on the MICA web by registered Mode S

Operators; or will have to be submitted by e-mail to the ICAO MID Focal Point accompanied by the appropriate application form which has been developed for the purpose.

5. Mode S Operators shall comply with the key items of the Interrogator Code allocations they receive.

Mode S IC allocations could be retrieved directly from the MICA web by registered Mode S Operators; or will have to be provided by the ICAO MID Focal Point to the Mode S Operators by e-mail.

6. Mode S Operators shall ensure that each of their Mode S interrogators uses exclusively its allocated Interrogator Code, its allocated surveillance coverage and its allocated lockout coverage.
7. Coordination with other Mode S Operators may be required prior to implement the latest issued allocation in Mode S radars in order to avoid potential conflicts. The Mode S Operators shall organize the necessary coordination in collaboration with the ICAO MID Focal Point.
The MICA Cell will identify all Mode S Operators and ATM systems impacted by a given change and will provide to the ICAO MID Focal Point the implementation sequence to follow. The ICAO MID Focal Point will be responsible to provide this implementation sequence to all impacted Mode S Operators. These Mode S Operators will then be responsible for the organisation of the necessary coordination. The Mode S Operators will be required to advise the ICAO MID Focal Point of the agreed arrangements in advance of implementation. MICA Cell should also been informed.
8. Mode S Operators should provide a point of contact in case of conflict.
9. Mode S Operators should restrict transmitter power to the minimum necessary to meet the operational requirement, within the technical constraints of the interrogator.

4.2 Requirements for the ICAO Middle East Regional Office

1. The ICAO Middle East Regional Officer will be the Mode S IC Allocation Focal Point for all countries in ICAO Middle East region.
2. ICAO Middle East regional office shall be responsible to coordinate and manage Mode S IC Allocation both for civil and military in ICAO Middle East region.
3. The ICAO MID Focal Point shall be responsible for the coordination of all matters concerning the IC allocations between the MICA Cell and the Mode S Operators in ICAO Middle East region.
4. The ICAO Middle East regional office shall be responsible to identify which Mode S Operators from ICAO MID Region to register on the MICA web application. Requests coming directly from Mode S Operators won't be accepted if they are not fully supported by the ICAO MID Regional Officer.
5. The ICAO Middle East regional office shall collect the IC applications for all countries in the ICAO Middle East region.

The ICAO MID Focal Point will have to collect application forms received by e-mail.

This point is not relevant if the application has been directly created on the MICA web by the Mode S Operator.

6. The ICAO Middle East regional office shall check the validity of Interrogator Code applications received from Mode S Operators, before making them available to the MICA cell.

The ICAO MID Focal Point will have to review applications received from Mode S Operators and verify that all contained information is correct. In case of mistake, the ICAO MID Focal

Point will have to contact the responsible Mode S Operator to correct them.

Once the application has been verified and is correct:

- *If the application has been created on the MICA web by Mode S operator, then this application has to be acknowledged by the ICAO MID Focal Point*
- *If the application has been provided by e-mail (application form), then the Focal Point can either enter this application on the MICA web or forward this application form to the MICA Cell.*

No applications for Mode S radars in MID region will be processed without approval of the ICAO MID Focal Point.

7. Changes in the interrogator code allocation plan shall be subject to the approval of the ICAO Middle East regional office when countries of ICAO Middle East region are affected by the update of the plan.

Allocation proposals will have to be reviewed by the ICAO MID Focal Point during the review period of the MICA Cycle. In particular, the ICAO MID Focal Point will have to check the acceptability of the allocation proposed for Mode S radars installed or planned to be in ICAO Middle East region with the concerned Mode S Operators. Then he will have to accept or reject these allocation proposals on the MICA web.

8. ICAO Middle East regional office shall ensure that interrogator code allocation changes resulting from an update to the interrogator code allocation plan are communicated to the relevant Mode S Operators under their authority within 14 calendar days of the reception of the updated allocation plan.

In particular, the ICAO MID Focal Point shall deliver the issued allocation details to the concerned Mode S Operators.

The ICAO MID Focal Point can retrieve issued allocations from the MICA web. It should be noted that Mode S operators registered on the MICA web have also access to IC allocations issued for their organisation.

9. Coordination with other Mode S Operators may be required prior to implement the latest issued allocation in the radar in order to avoid potential conflicts. The Focal Point shall inform impacted Mode S Operators and supervise coordination between them.

The MICA Cell will identify all Mode S Operators and ATM systems impacted by a given change and will provide to the ICAO MID Focal Point the implementation sequence to follow. The ICAO MID Focal Point will be responsible to provide this implementation sequence to all impacted Mode S Operators. These Mode S Operators will then be responsible for the organisation of the necessary coordination. The Mode S Operators will be required to advise the ICAO MID Focal Point of the agreed arrangements in advance of implementation. It will also be desirable to inform the MICA Cell.

10. Where an overlap exists between the coverage of a Mode S interrogator located within the area of responsibility of the ICAO Middle East regional office and the coverage of a Mode S interrogator located within the area of responsibility of a third country, the ICAO Middle East regional office shall:

- a. ensure that the third country is informed of the safety requirements related to the allocation and use of interrogator codes;
- b. take the necessary measures to coordinate the use of interrogator codes with the third country.

11. ICAO Middle East regional office shall take the necessary measures to ensure that military units operating eligible Mode S interrogators on any other interrogator code than II code 0 comply with the Requirements for Mode S Operators in ICAO Middle East Region and the Requirements related to IC Conflict.

12. ICAO mid office shall manage dispute which occur inside the ICAO Middle East region.

4.3 Requirements related to IC Conflict

1. Air traffic service providers 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.
2. Mode S Operators and air traffic service providers should take appropriate measures to detect and mitigate the effect of possible interrogator codes conflicts.
3. Mode S Operators shall report any identified Interrogator Code conflict involving an eligible Mode S interrogator they operate on any operational Interrogator Code to the ICAO MID Focal Point and the MICA Cell.
4. Mode S Operators which are registered on the MICA web will have to make available the information related to the conflict to the other Mode S Operators through the conflict report part of the MICA web.
5. For Mode S Operators who are not registered, the ICAO MID Focal Point will be responsible to submit this information and Mode S Operators contact details on the conflict report part of the MICA web.
6. The ICAO MID Focal Point shall be responsible to inform all Mode S Operators from the Middle East region about the interrogator code conflict.

5. Guidance for IC allocation in ICAO Middle East Region

5.1 Mode S Radars Performances

5.1.1 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 European 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 target will be correctly detected by Mode S station operating on SI code. ICAO annex 10 requires all Mode S transponder to be SI code capable however the experience shows that there are still old versions of Mode S transponder flying without the SI code capability.

5.1.2 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 even in an environment where all Mode S targets are not equipped for the use of SI codes.

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

For more information, please refer to Annex A.

5.1.2.1 II/SI code operation in ICAO Middle East region

Even if the current number of Mode S radars installed in ICAO Middle East region is not as important as in the European region, there is no guarantee that allocating II code only to Mode S radar in the ICAO Middle East region will remain possible in the future.

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

5.1.2.2 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 provisions¹
2. support the use of II/SI code operation in compliance with the requirements specified in Annex A

5.1.3 Mode S Coverage

Several formats exist to define the Mode S coverage:

- Mode S responsibility map (in European Mode S Coverage Map ICD format²).
 - This map format has been developed by Eurocontrol in the frame of POEMS contract³. System Maps are geodesic maps (latitude/longitude) sub-divided into horizontal cells from 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 here 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 term of allocation volume and RF band usage (as there may be no gap between coverage of neighboring Mode S interrogators on the same Interrogator Code, aircraft lockout is optimized).

The second solution is less optimal as their will be gap 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 minimum range not to overlap neighboring Mode S interrogators on the same IC will be used as the circular range.

¹ 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).

² European Mode S Station Coverage Map Interface Control Document, Edition 1.16

³ European Mode S Station Functional Specification, Edition 3.11

5.2 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 as described in §5.1.2 in order to acquire aircraft which are not SI capable.

When using II/SI code operation, it is recommended not to lock aircrafts which are not SI cable. Depending on number of aircrafts which are not SI capable, the II/SI code operation may increase the RF pollution. In addition, there could be cases where the aircraft transponder is not working as expected.

ANNEX A – 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 defined in the document referred to in Annex II point 2.
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.

APPENDIX B

Code Allocation Status for Bahrain

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
BAHRAIN					

Code Allocation Status for Egypt

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
EGYPT					
Aswan ERR	02		ad hoc 17/03/2009	NANSC	MICA/ALLOC461
Asyut ERR	03		ad hoc 17/03/2009	NANSC	MICA/ALLOC462
Cairo ERR	11		ICAC 12 7/04/2011	NANSC	MICA/ALLOC630
Hurghada ERR	05		ad hoc 17/03/2009	NANSC	MICA/ALLOC464
Messa Matruh ERR	06		ad hoc 17/03/2009	NANSC	MICA/ALLOC465

Code Allocation Status for Iran

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
IRAN					

Code Allocation Status for Iraq

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
IRAQ					

Code Allocation Status for Jordan

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
JORDAN					

Code Allocation Status for Kuwait

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
KUWAIT					

Code Allocation Status for Lebanon

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
LEBANON					
Baysour	02		23/04/2009	DGCA	MICA/ALLOC467

Code Allocation Status for Oman

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
OMAN					
Muscat	11		Ad-hoc, 29/06/2010	DGMAN	MICA/ALLOC615

Code Allocation Status for Qatar

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
QATAR					

Code Allocation Status for Saudi Arabia

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
SAUDI-ARABIA					
Madinah	04		Ad-hoc, 06/05/2010	GACA	MICA/ALLOC529
Rafha	05		Ad-hoc, 06/05/2010	GACA	MICA/ALLOC530
Turaif	10		Ad-hoc, 17/03/2010	GACA	MICA/ALLOC531
Al-Jouf	08		ICAC 11,21/10/2010	GACA	MICA/ALLOC567
Al-Wejah	01		ICAC 11,21/10/2010	GACA	MICA/ALLOC568
Gassim	03		ICAC 11,21/10/2010	GACA	MICA/ALLOC569
Hail	02		ICAC 11,21/10/2010	GACA	MICA/ALLOC570
KAIA	08		ICAC 11,21/10/2010	GACA	MICA/ALLOC571
TABUK	06		ICAC 11,21/10/2010	GACA	MICA/ALLOC572
ABHA	02		ICAC 12,07/04/2011	GACA	MICA/ALLOC631
BAHA	06		ICAC 12,07/04/2011	GACA	MICA/ALLOC632
KFIA	08		ICAC 12,07/04/2011	GACA	MICA/ALLOC633
KKIA	01		ICAC 12,07/04/2011	GACA	MICA/ALLOC634
QAISUMAH	06		ICAC 12,07/04/2011	GACA	MICA/ALLOC635

SODA		11		ICAC 12,07/04/2011	GACA	MICA/ALLOC636
Training Station		09		Ad-hoc, 02/03/2011	GACA	MICA/ALLOC644
AFIF		10		ICAC 13,22/09/2011	GACA	MICA/ALLOC674
HARAD		11		ICAC 13,22/09/2011	GACA	MICA/ALLOC675
Khayber		07		ICAC 13,22/09/2011	GACA	MICA/ALLOC676
Sharurah		08		ICAC 13,22/09/2011	GACA	MICA/ALLOC677
Shaybah		07		ICAC 13,22/09/2011	GACA	MICA/ALLOC678
Wadi Al-Dawasir		07		ICAC 13,22/09/2011	GACA	MICA/ALLOC679

Code Allocation Status for Syria

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
SYRIA					

Code Allocation Status for UAE

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
EMIRATES					

Code Allocation Status for Yemen

MODE S Interrogator Code Allocations as of 06 May 2010 (Cycle 10)

Mode S Station	ALLOCATED CODE			OPERATOR	REFERENCE/REMARKS
	II	SI	Effective Date		
YEMEN					

APPENDIX C

MID Region Surveillance Strategy

- Share experience and trial results in new surveillance technologies;
- Minimize reliance on position reporting, particularly voice reporting & Primary Radar;
- Maximize contiguous coverage and use of ADS-B on major routes/terminal areas;
- Make full use of SSR Mode 'S' capabilities, reduce reliance on 4 digit octal code;
- Make use of ADS-C when ADS-B, SSR or multilateration not supported;
- Encourage Multilateration for surface, terminal & area surveillance;
- Improve safety through sharing ATS surveillance data across FIR boundaries;
- Broaden scope of cooperation between ANSPs and Stakeholders;
- Acknowledge the development of other Regions and should consider incremental introduction of new surveillance technologies;
- Increase use of Aircraft Derived Data; and
- The MID Region ADS-B implementation times line set for 2017.

APPENDIX D

MID REGION STRATEGY FOR THE IMPLEMENTATION OF AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B)

Considering the:

- a) ICAO strategic objectives;
- b) ICAO Business Plan;
- c) Global Air Traffic Management Operational Concept;
- d) revised Global Air Navigation Plan and associated GPIs;
- e) outcome of the 11th Air Navigation Conference; and

Recognizing that:

- i) the implementation of data-link surveillance technologies is an evolutionary process, but which has significant potential for safety and cost-effectiveness; and
- ii) implementation of ADS-B is in support of various Global Plan Initiatives;

The MID Region strategy for the implementation of ADS-B is detailed below:

- A) the MID Region ADS-B implementation plan should:
 - 1) be evolutionary and consistent with the Global Air Navigation Plan taking into consideration associated MID Region priorities;
 - 2) when cost/benefit models warrant it, prioritize implementation in areas where there is no radar coverage surveillance, followed by areas where implementation would otherwise bring capacity and operational efficiencies;
 - 3) ensure that implementation of ADS-B is harmonized, compatible and interoperable with respect to operational procedures, supporting data link and ATM applications;
 - 4) identify sub-regional areas where the implementation of ADS-B would result in a positive cost/benefit in the near term, while taking into account overall Regional developments and implementation of ADS-B in adjacent homogeneous ATM areas;
 - 5) be implemented following successful trial programmes with regards to safety and operational feasibility, taking into account studies and implementation experiences from other ICAO Regions;
 - 6) be implemented in close collaboration with users;
 - 7) The proportions of equipped aircrafts are also critical for the ADS-B deployment, for which it is required to periodically provide, at least, the following information: number of equipped aircrafts operating in the concern airspace, number and name of the airlines that have equipped aircrafts for ADS-B, type of equipped aircrafts, categorization of the accuracy/integrity data available in the aircrafts;

- 8) The ADS-B deployment should be associated at early stages in coordination with the States/Regional/International Organizations responsible for the control of adjacent areas, and the correspondent ICAO Regional Office, establishing a plan in the potential areas of ADS-B data sharing, aimed at a coordinated, harmonious and interoperable implementation;
 - 9) Each State/Regional/International Organization should investigate and report their own Administration's policy in respect to the ADS-B data sharing with their neighbours and from cooperative goals;
 - 10) The ADS-B data sharing plan should be based selecting centres by pairs and analyzing the benefits and formulating proposals for the ADS-B use for each pair of centre/city with the purpose to improve the surveillance capacity;
 - 11) Likewise, it is necessary to consider implementing surveillance solutions for surface movement control by the implementation of ADS-B; and
 - 12) The implementation would be in conformity with the SARPs, ICAO guidelines and the MIDANPIRG conclusions and according to MID Surveillance Strategy where the time line for implementation is set for 2017.
- B) The implementation would require aircraft equipped with avionics compliant with either:
- i) Version 0 ES as specified in Annex 10, volume IV, Chapter 3, paragraph 3.1.2.8.6 (up to and including amendment 83 to annex 10) and chapter 2 of draft technical Provisions for Mode S services and extended Squitter (ICAO Doc 9871) to be used till at least 2020, or
 - ii) Version 1 ES as specified in chapter 3 draft Technical Provisions for Mode S Services and Extended Squitter (ICAO Doc 9871) Equivalent to DO260A.
- C) Implementation should be monitored to ensure collaborative development and alignment with the MID Region projects and relevant elements of the GPIs.