

EATM
Mode S Programme

Mode S Elementary
& Enhanced Surveillance

Information Notice



European Organisation for the Safety of Air Navigation



This notice is for Information only





Purpose

The purpose of this Information Notice is to brief our Stakeholders about regulation changes related to the mandatory carriage and operation of Secondary Surveillance Radar (SSR) Mode S airborne equipment.

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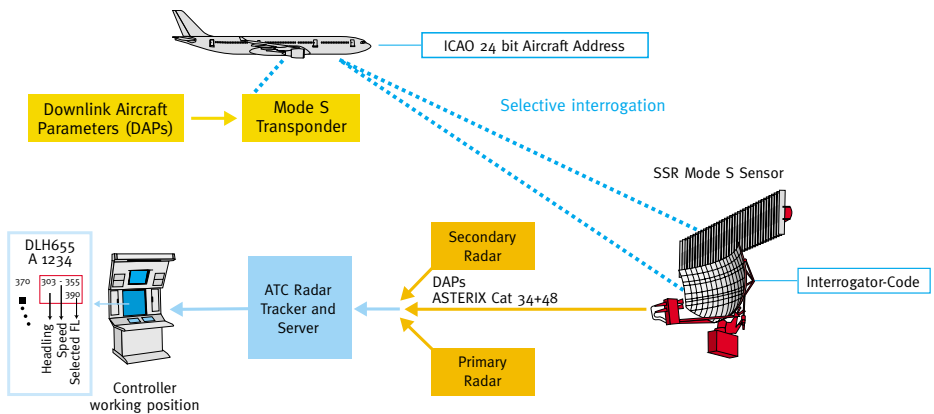
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The Mode S Concepts

Whilst traditional Secondary Surveillance Radar (SSR) stations interrogate all aircraft within their range, Mode S establishes selective and addressed interrogations with aircraft within its coverage. Such selective interrogation improves the quality and integrity of the detection, identification and altitude reporting. These improvements translate into benefits in terms of safety, capacity and efficiency - benefits which are key to supporting the future of the high-traffic density airspace of Europe. This first step of selective interrogation is known as **Mode S Elementary Surveillance**.

Mode S Enhanced Surveillance builds upon the concept of Elementary Surveillance and consists of the extraction of further aircraft parameters known as Downlink Airborne Parameters (DAPs). This facilitates an increase in the safety and efficiency of the ATM operations

Secondary Surveillance Radar (SSR) Mode S Surveillance



Implementation Decisions

Elementary Surveillance

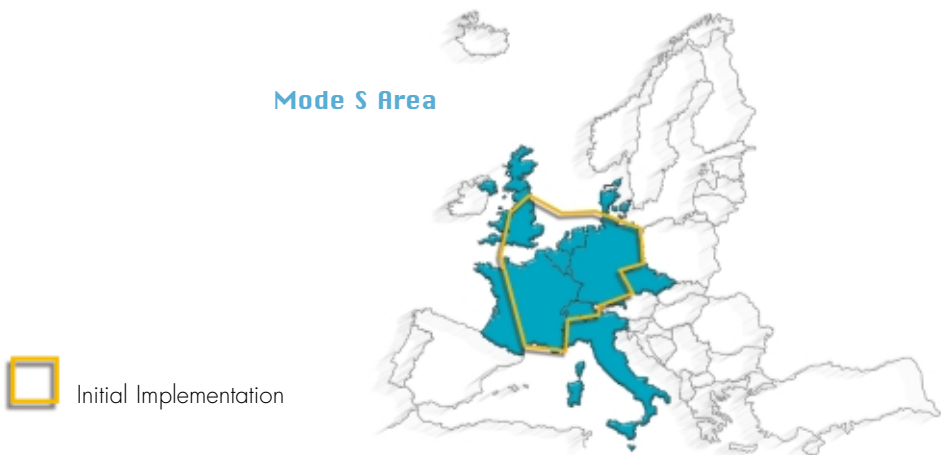
On 7th April 2000, the Provisional Council of EUROCONTROL agreed to implement Mode S Elementary Surveillance within the core area of Europe subject to high air traffic density. Initially, this will apply in the airspace of **Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland.**

Following the agreement between EUROCONTROL and the participating States, Aircraft Operators are required to equip their aircraft with Mode S airborne equipment that supports Mode S Elementary Surveillance functionality. This includes Mode S transponders with Surveillance Identifier (SI) code capability and the automatic reporting of aircraft identification in accordance with ICAO Standards and Recommended Practices (SARPS).

Enhanced Surveillance

In February 2002, three States, **France, Germany** and the **United Kingdom** announced their common decision to implement Mode S Enhanced Surveillance in major Terminal Manoeuvring Areas and enroute airspace. Furthermore Switzerland and the EUROCONTROL Maastricht UAC will also implement Enhanced Surveillance in a similar timescale.

Where will Mode S be deployed?



Implementation Timescales

Elementary Surveillance

IFR Airborne Implementation

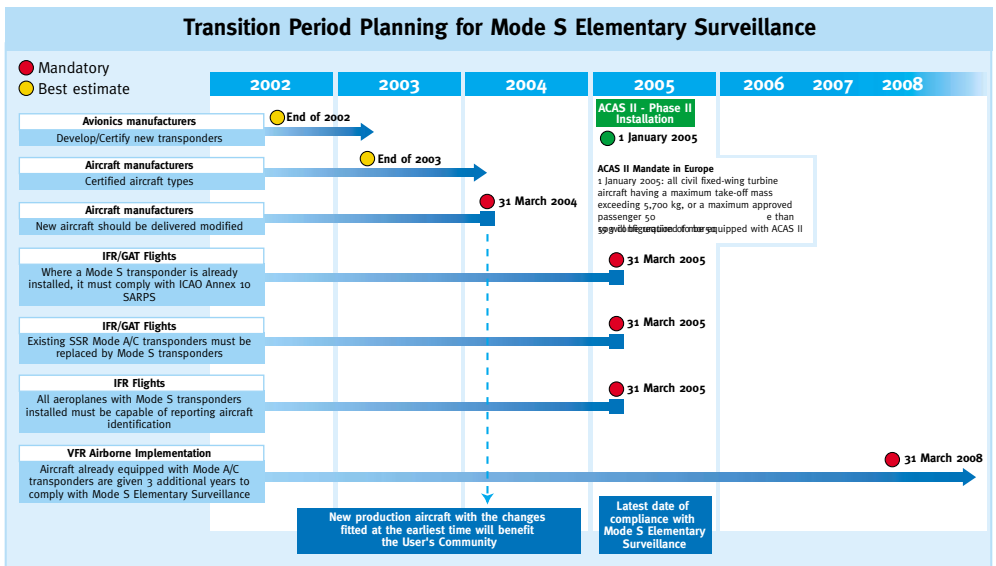
For aircraft flying IFR as GAT, latest dates for the carriage and operation of Mode S Elementary Surveillance airborne equipment in designated airspace are as follows:

- New production aircraft to be compliant by 31 March 2004
- Completion* of aircraft retrofits by 31 March 2005

VFR Airborne Implementation

All aircraft flying VFR in designated airspace are required to carry and operate Mode S Elementary Surveillance airborne equipment by 31 March 2005 with the following Transition Period:

- New production aircraft to be compliant by 31 March 2005
- Completion of retrofits by 31 March 2008, subject to individual State agreements.

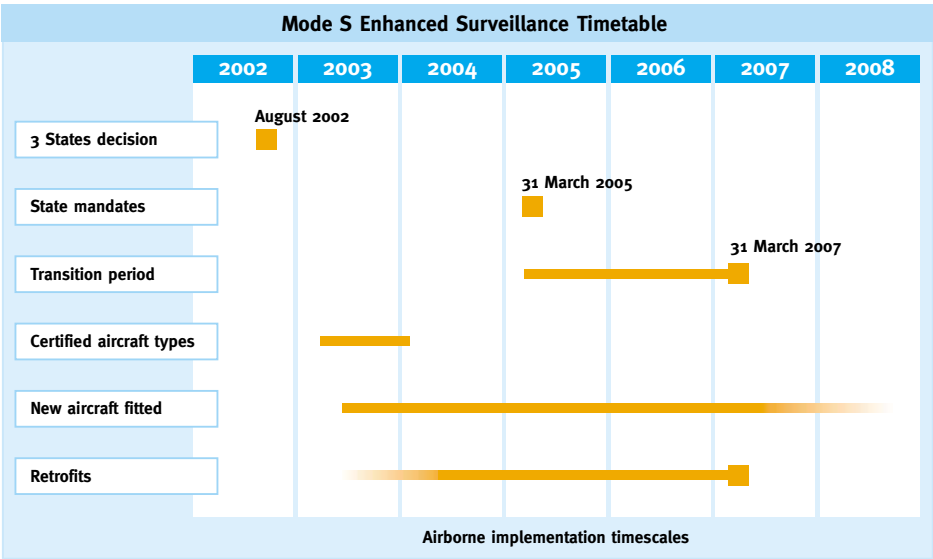


* *note: For aircraft subject to Enhanced Surveillance implementation, operators may also apply for a partial alleviation from the Mode S Elementary Surveillance requirements in order to install the wiring for Aircraft Identification reporting at the same time as the wiring for Enhanced Surveillance*



Enhanced Surveillance

France, Germany and the United Kingdom are mandating the carriage and operation of Mode S Enhanced Surveillance airborne equipment. This mandate will be applicable for all aircraft flying as IFR/GAT with effect from 31 March 2005. A transition period of 2 years will be applied until 30 March 2007, during which a coordinated exemption policy will be applied through the EUROCONTROL Mode S Exemption Coordination Cell.



Benefits of Mode S

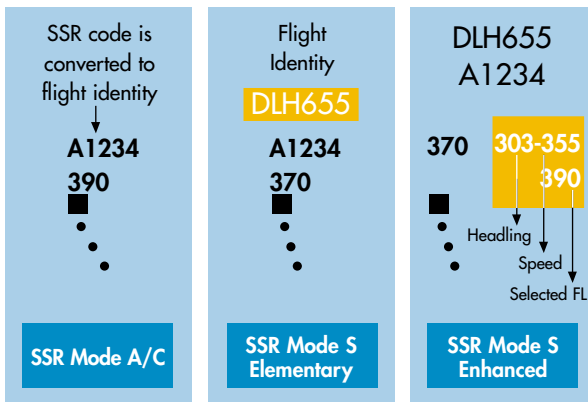
Air Traffic Controllers

For many years, Controllers have been provided with radar identity (Mode A) and altitude (Mode C) information downlinked via an SSR transponder, supported by data processing and display functions.

Mode S Surveillance provides the controller with:

- Elementary Surveillance: Position + Altitude + downlinked Aircraft Identification
- Enhanced Surveillance: Heading + Speed + Selected vertical intention

Indicates new item



Unambiguous aircraft identification

The availability of more than 16 million unique ICAO 24-bit aircraft addresses, in conjunction with the automatic reporting of aircraft identification (flight identity), permits the unambiguous identification of aircraft independently of any SSR Mode 3/A code assignment.



Improved integrity of surveillance data

Selective interrogation and the superior resolution ability of Mode S over existing SSR installations will

- Eliminate synchronous radar replies
- Resolve the effects of over interrogation
- Simplify aircraft identification in the case of radar reflections

Improved air picture and tracking

The radar controller can be presented with a better current air picture including system acquisition of aircraft identification (flight identity). Greater data integrity and precision will improve tracking and the use of 25' altitude increment will provide enhanced vertical tracking.

Alleviation of Mode 3/A code shortage

The situation concerning code shortage in the EUR Region is reaching a critical stage. The reporting of aircraft identification (flight identity) will ease the pressure on Mode 3/A codes in the short to medium term and will eventually solve the predicament of European SSR code shortage permanently.

Improvement to the Safety Nets

The improvements will reduce the number of conflict nuisance alerts and enhance the integrity of separation assurance.

Enhanced Surveillance

Enhanced Surveillance, through the ground acquisition of specific aircraft parameters, will enable the air traffic controllers to increase their efficiency in tactically separating aircraft. The controller's information is improved by providing actual aircraft derived data such as Magnetic Heading, Indicated Air Speed, Vertical Rate and Selected Altitude. This enables controllers to reduce their R/T workload and frees them to concentrate more precisely on ensuring the safe and efficient passage of air traffic.





Pilots

Through the automatic extraction of downlink aircraft' parameters, Enhanced Surveillance will lead to a reduction in Radio Telephony (RT) between the air traffic controllers and the pilots. This reduces the workload on a pilot and removes a potential source of error.

Aircraft Operators

Elementary Surveillance will remove critical Capacity and Safety constraints that would have prevented further traffic increases to take place in the high traffic density airspace of Europe.

Enhanced Surveillance will additionally support Safety and Efficiency improvements to ATM operations. For example, downlinking the Selected Altitude of aircraft will make a significant contribution to the prevention of inadvertent departures from authorised flight levels, known as level busts.

What do you have to do?

If you are an Airspace User

- Install Mode S Transponder Level 2 as a minimum
- Aircraft Operators are required to equip their aircraft with Mode S airborne equipment that supports Mode S Elementary Surveillance functionality.
- The carriage and operation of Mode S Enhanced Surveillance functionality will be mandatory for aircraft with a maximum take-off mass in excess of 5,700 kg or a maximum cruising true airspeed in excess of 250 kts conducting IFR flights as General Air Traffic (GAT), in designated airspace, with effect from 31 March 2005.
- Where a Mode S transponder is already installed, it must comply, as a minimum, with the provisions of ICAO Annex 10, SARPS, Amendment 77 with effect from 31 March 2005.
- Furthermore, the transponders must support **Surveillance Identifier** (SI) codes. This capability is essential for the carriage and operation of Mode S transponders in ECAC airspace from 2005 onwards.
- For Elementary Surveillance, onboard aircraft changes consist of the transponder upgrade/replacement and the necessary modifications required for the downlinking of the Aircraft Identification.
- For Enhanced Surveillance, onboard aircraft changes consist of the transponder upgrade/replacement and the necessary modifications required for the provision of the Downlink Aircraft Parameters*:
 - Air Speed (Indicated AirSpeed and Mach Number)
 - Ground Speed
 - Magnetic Heading
 - Roll Angle
 - Selected Altitude
 - Track Angle Rate
 - True Track Angle
 - Vertical Rate

* *note: the Barometric Pressure Setting parameter is recommended for implementation as part of the Selected Vertical Intention of aircraft*

- The Mode S transponder must be compliant with JAA/EASA Technical Standard Order JTSO/ETSO 2C112b, or an equivalent standard that is compliant with the relevant ICAO SARPS and which is acceptable to the certification authority.

Update the Aircraft Flight Manual

- The Aircraft Flight Manual or the Pilot's Operating Handbook should provide a statement of compliance that the transponder complies with the requirements of Mode S Enhanced Surveillance. The availability of the Enhanced Surveillance downlink parameters should be clearly mentioned.

Inform Flight Crew

- Pilots of aircraft equipped with a Mode S transponder having an aircraft identification feature shall set the aircraft identification in the transponder through the appropriate input, FMS or control panel device. This setting shall correspond to the aircraft identification specified in Item 7 of the ICAO flight plan or if no flight plan has been filed, the registration marking of the aircraft.

Note: Aircraft subject to ACAS II - Phase 2

- *For aircraft that require ACAS II, the Resolution Advisory will need to be reported by the transponder.*
- *ACAS II Phase 2 mandate in Europe is set for 1 January 2005. It means that all civil fixed-wing turbine aircraft having a maximum take-off mass exceeding 5,700 kg, or a maximum approved passenger seating configuration of more than 19 seats will be required to be equipped with ACAS II.*

If you are an Air Navigation Service Provider

Upgrade your Secondary Surveillance Radar to Mode S

To allow Mode S implementation, Air Navigation Service Providers upgrading to a Mode S radar system will find products available on the ATC equipment market.

Modify the Ground ATC Centres

To realise the benefits of Mode S, Air Navigation Service Providers will also have to introduce or modify the following components:

- Surveillance Data Processing Systems (SDPS)
- Flight Data Processing Systems (FDPS)
- Human Machine Interfaces (HMI) of Controller Working Positions (CWP)

The Mode S Exemption Coordination Cell

An Exemption Coordination Cell (ECC) is established within the EUROCONTROL Agency to support the monitoring of the implementation of Mode S Enhanced Surveillance and the coordination of exemptions among the participating States. During the Mode S Enhanced Surveillance transition period, from 31 March 2005 to 30 March 2007, a co-ordinated exemption policy will be applied.

Who should Register with the Mode S Exemption Coordination Cell?

Operators of civil registered fixed-wing aircraft for IFR/GAT flights in airspace where Enhanced Surveillance rules will apply from **31 March 2005** (currently in France, Germany and the United Kingdom) will be required to register when;

- The aircraft has a maximum take-off mass greater than 5,700 kg, or,
- A maximum cruising true airspeed in excess of 250 kt.

Who needs to Apply for an Exemption?

The Mode S implementing States' Regulatory Authorities have delegated the EUROCONTROL Mode S ECC to notify exemptions on their behalf in the following circumstances:

- Where aircraft avionics do not permit the extraction and transmission of the full set of downlink aircraft parameters (DAPs).
- When aircraft operators show a clear intent to equip their aircraft as soon as practicable after 31 March 2005 but before 30 March 2007 and who experience genuine technical issues or supply problems, causing delays that are beyond their control. In these circumstances, operators may also apply for a partial alleviation from the Mode S Elementary Surveillance requirements in order to install the wiring for Aircraft Identification reporting at the same time as the wiring for Enhanced Surveillance DAPs.
- For aircraft that have an out of service date before 31 December 2007.
- For aircraft conducting flights, under existing rules, for the purpose of flight testing, delivery or for transit into and out of maintenance bases.
- For aircraft that intend to conduct only occasional IFR/GAT flights (under 30 hours per annum).

When to Apply?

The Mode S Enhanced Surveillance Exemption Coordination Cell is co-located with the ACAS Support Unit and shares the Database Management System. The Mode S and ACAS Database Management System, or MADaMS for short, is in place and ready for on-line access.

How to Apply?

Manual or on-line registration

Operators who have between 1 and 3 aircraft are encouraged to register and apply for any exemption that might be needed, manually. A Mode S Exemption Request Application Form is available on the Mode S ECC web page (www.eurocontrol.int/mod_s).

Operators of 4 or more aircraft will find it more beneficial to use the on-line facility and should find that much of the details of their aircraft fleets are already stored in the MADaMS database. It will be possible to make a login/password request via this web page where the detailed procedure will also be explained.

Further information on the ECC can be obtained from modes.reg@eurocontrol.int

Documentation

ICAO Documentation

- ICAO Annex 10 Volumes III and IV Amendment 77
- ICAO Regional Supplementary Procedures, DOC 7030/4

JAA Documentation

- JAA TGL n° 13 Elementary Surveillance, Rev. 1
- JAA TGL n° 18 Enhanced Surveillance
- JTSO 2C112b Technical Standard Order, which adopts EUROCAE Transponder MOPS ED-73B

Note: JAA material might be shortly superseded and / or transposed into European Aviation Safety Agency (EASA) material that should become available on the EASA web site www.easa.eu.int

EUROCONTROL

- EUROCONTROL Permanent Commission Recommendation n° 02/04 of 8 August 2002
- Mode S Enhanced Surveillance - 3 States Project - Master Plan - Edition 1.0, 30 August 2002.
- Common Framework for the Regulation of Mode S Enhanced Surveillance - Edition 2.0, July 2003
- Volume 1 and 2 of the ATM Strategy for the years 2000+
- Mode S Elementary Surveillance Transition Plan - Edition 1.0, 27 August 2002
- Guidance for the Operational Introduction of SSR Mode S, Volume I, Elementary Surveillance - Edition 1.0, 17 December 2003

National Documentation

- National Regulatory Documents can be obtained from the National Civil Aviation Authorities

More information on Regulations is available on the Mode S web site:
www.eurocontrol.int/mode_s

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