



ESWATINI CIVIL AVIATION AUTHORITY

# Advisory Circular

CAA-AC-AWS030

April 2021

---

## 1.0 PURPOSE

1. As part of modernization of air traffic control facilities, Secondary Surveillance Radars are being provided to cover the major air routes in the country and also to provide the Minimum Safe Altitude Warning (MSAW) System. To derive full benefit of these facilities it is necessary that the aeroplanes operating in Eswatini airspace are fitted with the altitude reporting transponders.
2. ICAO Annex 6 Part II relating to operation of general aviation aeroplanes also requires that:  

“All aeroplanes shall be equipped with a pressure-altitude reporting transponder, which operates in accordance with the relevant provision of Annex10, Vol.IV.”
3. Mode ‘A’ / ‘C’ transponder provides traffic advisory in an aircraft fitted with ACAS-I/ TCAS-I and both traffic advisory and resolution advisory in an aircraft fitted with ACAS-II/ TCAS-II. Mode ‘S’ Transponder is a source of reliable air space surveillance. It enhances the operation of Air Traffic Control Radar Beacon System (ATCRBS) by adding a Data Link feature and interrogation capability over and above Mode ‘A’ / ‘C’ transponder operation which only determines the aircraft altitude. Mode ‘S’ transponder also provides traffic advisory in an aircraft fitted with ACAS-I/ TCAS-I and both traffic advisory and resolution advisory in an aircraft fitted with ACAS-II/ TCAS-II.
4. The Data Link facility allows Mode ‘S’ transponder to perform additional Air Traffic Control and Air Separation Assurance (ASA) functions. Due to discrete addressing feature of Mode ‘S’ transponder, the capability of interrogators is enhanced to handle more number of aircraft. Installation of Mode “A’ / ‘C’ and Mode ‘S’ transponders enhances the safety of aircraft operations and gives relief to pilots and ATCOs by reducing voice communication.
5. Regulation 6 of Eswatini Civil Aviation Authority (Operation of Aircraft) Regulations, Regulation 6(1) (k) and 8(1) (l) of Eswatini Civil Aviation (Instrument & Equipment) Regulation, stipulate that every aircraft shall be fitted and equipped with instruments and equipment including radio apparatus and special equipment as may be specified according to the use and

circumstances under which the flight is to be conducted. These parts of the SWACARs lay down the requirements for installation of Mode 'A' / 'C' and Mode 'S' transponders and describes the procedure for allotment of Mode 'S' address.

## 2.0 REFERENCES

- a) ICAO Annex 6 Part II
- b) Eswatini Civil Aviation (Instrument and Equipment) Regulations
- c) Regulation 6 of Eswatini Civil Aviation (Operation of Aircraft) Regulations

## 3.0 DEFINITIONS

- d) **Primary Radar** : Primary Radar transmits a beam of radio frequency energy and subsequently receives the minute proportion of this energy which has been echoed back to it by the target. This reflected signal is picked up and processed to provide a display which shows the location of the target.
- e) **Secondary Radar** : This radar transmits a characteristic group of pulses recognizable to the transponder in the target aircraft which then responds after a pre-determined precise interval with a coded train of pulses which identifies and/or provides information about the aircraft.
- f) **Secondary Surveillance Radar (SSR)** : The SSR as per ICAO is required to provide an identification capability within the world's air traffic control systems. It was derived from Identification of Friend or Foe (IFF) system with which it co-exists and inter-operates the system comprising of interrogative radar on the ground and transponder beacons carried on aircraft.
- g) **All SSR systems operate on the same frequencies, interrogation being at 1030 MHZ and transponder replies being at 1090 MHZ.**
- h) **Traffic Alert & Collision Avoidance System (TCAS)** : It is an independent aircraft equipment designed to detect potential conflicting aircraft that are equipped with Secondary Surveillance Radar (SSR) Transponders.
- i) **Airborne Collision Avoidance System (ACAS)**: An aeroplane system based on Secondary Surveillance Radar (SSR) transponder signals, which operates independently of ground based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR Transponders.
- j) **Mode 'A' / 'C' transponder** –Airborne equipment that generates specified responses to Mode 'A', Mode 'C' and intermode interrogations but does not reply to Mode 'S' interrogations.
- k) **Mode 'A'** – An interrogation that elicits reply from transponder for identity and surveillance. l)  
**Mode 'C'** – An interrogation that elicits reply from transponder for automatic pressure altitude transmission and surveillance.

The above modes are used during interrogation for air traffic services.

- m) **Mode `S`:** It is a mode select - A transponder format to allow discrete interrogation and data link capability. The Mode `S` ground equipment operates on the same frequency as SSR and comprises an interrogator and a receiver. Monopulse techniques are invariably used. In addition to Mode `S` function, the ground station will also radiate standard SSR mode and will therefore be capable of operating in conjunction with aircraft carrying standard SSR equipment. In the same way, Mode `S` transponder will be compatible with SSR ground stations.
- n) **Mode `S` transponder:** It provides the communication capabilities (data link) required for ACAS/ TCAS as well as for Air Traffic Control Radar Beacon System (ATCRBS) transponder function (Mode `A` and Mode `C` operation).
- o) **Commercial Air Transport Operation.** An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.
- p) **General Aviation Operation.** An aircraft operation other than a commercial air transport operation or an aerial work operation.

#### 4.0 REQUIREMENTS

1. Unless otherwise authorized by Director General, no person shall operate in the Eswatini airspace, an aeroplane having maximum certified take off mass of 5700 Kilograms and above and having maximum certified passenger seating configuration (excluding any pilot seats) of more than 30 seats or maximum payload capacity of more than 3 tones, if such aeroplane is not equipped with Mode 'S' transponder.
2. Unless otherwise authorized by Director General, no person shall operate for commercial air transport operation in the Eswatini airspace,
  - (a) an aeroplane having a maximum certified passenger seating configuration of 20 to 30 or a maximum certificated take off mass in excess of 5700kg, if such aeroplane is not equipped with Mode 'S' transponder.
  - (b) an aeroplane having a maximum certified passenger seating configuration of 10 to 19 and a maximum certificated take off mass less than 5700kg, if such aeroplane is not equipped with Mode `A` / `C` transponder.
  - (c) a twin jet engine aeroplane having a maximum certified passenger seating configuration of less than 10 and a maximum certificated take off mass less than 5700kg, if such aeroplane is not equipped with Mode `A` / `C` transponder
  - (d) a helicopter if it is not equipped with Mode `A` / `C` transponder.
3. Unless otherwise authorized by Director General, no person shall acquire for the purpose of commercial air transport operation in the Eswatini airspace;

- (a) an aeroplane having a maximum certified passenger seating configuration of 20 to 30 or a maximum certificated take off mass in excess of 5700kg, if such aeroplane is not equipped with Mode 'S' transponder .
  - (b) an aeroplane having a maximum certified passenger seating configuration of 10 to 19 and a maximum certificated take off mass less than 5700kg, if such aeroplane is not equipped with Mode 'A' / 'C' transponder .
  - (c) a twin jet engine aeroplane having a maximum certified passenger seating configuration of less than 10 and a maximum certificated take off mass less than 5700kg, if such aeroplane is not equipped with Mode 'A' / 'C' transponder.
  - (d) a helicopter if it is not equipped with Mode 'A' / 'C' transponder.
4. Unless otherwise authorized by Director General, no person shall operate for general aviation operation in the Eswatini controlled airspace or on promulgated ATS routes, an aeroplane or helicopter, if it is not equipped with Mode 'A' / 'C' transponder.

**5.0 GUIDANCE AND PROCEDURES FOR ALLOTMENT OF MODE 'S' ADDRESS**

1. Aircraft fitted with Mode 'S' transponder will be provided with Mode 'S' address by Director General following the aircraft address procedure based on sequential assignment which consists of a total of 24 bits. The first twelve bits indicate the country code and the remaining twelve bits give the Mode 'S' address. The code allotment shall be as given below;

Country code for Eswatini (14 bits)												Mode 'S' Address (10 bits)											
0	0	0	0	0	1	1	1	1	0	1	0	0	0	-	-	-	-	-	-	-	-	-	-

2. Whenever an aircraft is equipped with Mode 'S' transponder, the aircraft operator/ owner shall apply to Director General of Civil Aviation, (Attn.: Chief Airworthiness Inspector) Box D361, The Gables H126, Eswatini on form ESWACAA-Form-AIW033, for allotment of specific Mode 'S' address giving the following information:
- (i) Aircraft Type and Registration Number.
  - (ii) Serial Number of the aircraft.
  - (iii) Name and address of the Operator.

After the above information is received, the specific code shall be allotted by Director General of Civil Aviation.

3. Register of aircraft allotted with Mode 'S' address.  
 The Director General of Civil Aviation will maintain a register of all aircraft allotted with Mode 'S' address. This register will be open to inspection by any person desirous of doing so.

4. All Eswatini registered aircraft fitted with Mode 'S' transponder shall be issued with Mode 'S' address by Director General. Mode 'S' address issued by any other foreign regulatory authority shall stand cancelled after issue of Eswatini registration.

#### **6.0 OPERATIONAL REQUIREMENTS:**

1. Prior to commencing operation of the aircraft fitted with Mode 'A' / 'C' or Mode 'S' transponder as required by Para 3 above, the aeroplane flight manual shall be amended to include:
  - (i) Appropriate procedure for the use of transponders;
  - (ii) Necessary amendment to the checklist.
2. The operator shall lay down its procedure to ensure that the transponder is kept 'ON' throughout the operations.
3. The transponder should be operated in accordance with the relevant provision of Annex 10 Volume IV.

#### **7.0 MAINTENANCE AND CERTIFICATION OF TRANSPONDERS**

1. The transponder shall be of approved type and meet the specifications given in the FAA TSO-C74 C for Mode 'A' / 'C' transponder and TSO - C112 for Mode 'S' transponder or any other specifications acceptable to Director General.
2. The transponder shall be installed in an approved manner by an approved organization /Manufacturer.
3. The transponder shall be maintained in serviceable condition. For release of aircraft under MEL due to defect in the transponder system, an entry shall be made in the maintenance record, which includes the date and time of invoking the MEL and proper placarding in the cockpit.
4. Engineers inspecting/certifying the transponders should hold appropriate type rated license in category "R" and should be adequately trained on this equipment.

**Approved by Director General  
Civil Aviation Authority**