GOVERNMENT OF INDIA

OFFICE OF DIRECTOR GENERAL OF CIVIL AVIATION

TECHNICAL CENTRE, OPP SAFDARJANG AIRPORT, NEW DELHI

CIVIL AVIATION REQUIREMENTS
SECTION 2 - AIRWORTHINESS
SERIES 'R', PART IV
DATED 8TH FEB, 1994 **EFFECTIVE: FORTHWITH**

F. No. 11/690/CAR/ Section 2/ Series R/IV

Subject: **INSTALLATION OF MODE 'A' / 'C' AND MODE 'S' TRANSPONDERS.**

1. INTRODUCTION :

1.1 As part of modernisation 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 Indian airspace are fitted with the altitude reporting transponders.

1.2 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."

Further, the Asia Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG), have also recommended in their report of eighth meeting held from 23rd to 29th September, 1997 that:

"from 1st January, 1999 all aeroplanes shall be equipped with a pressure altitude reporting transponder".

1.3 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.

1.4 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.

1.5 Sub Rule 3 of Rule 9 and Rule 57 of the Aircraft Rules, 1937, 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. This part of the CAR lays down the requirements for installation of Mode 'A' / 'C' and Mode 'S' transponders and describes the procedure for allotment of Mode 'S' address. This CAR is issued under the provisions of Rule 57 and Rule 133A of the Aircraft Rules, 1937.

2. DEFINITIONS:

2.1 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.

2.2 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.

2.3 Surveillance radar. Radar equipment used to determine the position of an aircraft in range and azimuth.

2.4 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.

All SSR systems operate on the same frequencies, interrogation being at 1030 MHZ and transponder replies being at 1090 MHZ.

2.5 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.

2.6 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.

2.7 Aircraft address. A unique combination of twenty-four bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance.

2.8 Human Factors principles. Principles which apply to design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

2.9 Mode 'A' – An interrogation that elicits reply from transponder for identity and surveillance.

2.10 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.

2.11 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.

2.12 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.

2.13 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).

2.14 Commercial Air Transport Operation: An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

2.15 General Aviation Operation: An aircraft operation other than a commercial air transport operation or an aerial work operation.

3. REQUIREMENT

3.1 Unless otherwise authorised by DGCA, no person shall operate in the Indian airspace, an aeroplane having maximum certified take off mass of 5700 kg 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.

3.2 Unless otherwise authorised by DGCA, no person shall operate for commercial air transport operation in the Indian airspace, from 1st January, 2001,

(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 engined 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.

3.3 Unless otherwise authorised by DGCA, no person shall acquire for the purpose of commercial air transport operation in the Indian airspace, from 1st January, 2000,

(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 engined 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.

3.4 Unless otherwise authorised by DGCA, no person shall operate for general aviation operation in the Indian controlled airspace or on promulgated ATS routes, from 1st January, 2003, an aeroplane or helicopter, if it is not equipped with Mode 'A' / 'C' transponder.

4. ASSIGNMENT OF AIRCRAFT ADDRESSES

4.1 An individual aircraft address shall be assigned by DGCA to all suitably equipped aircraft entered on Indian Aircraft register, using its allocated block of address.

***Note**:- For an aircraft delivery, the aircraft operator is expected to inform the airframe manufacturer of an address assignment. The airframe manufacturer or other organization responsible for a delivery flight is expected to ensure installation of a correctly assigned address supplied by DGCA.*

4.2 Aircraft addresses shall be assigned to aircraft in accordance with the following principles:

a) At any one time, no address shall be assigned to more than one aircraft.

b) Only one address shall be assigned to an aircraft, irrespective of the composition of equipment on board.

c) The address shall not be changed except under exceptional circumstances and shall not be changed during flight;

d) When an aircraft is deregistered, the owner shall return the old aircraft address to DGCA;

e) The address shall serve only a technical role for addressing and identification of aircraft and shall not be used to convey any specific information; and

f) The addresses composed of 24 ZEROS or 24 ONES shall not be assigned to aircraft.

5. APPLICATION OF AIRCRAFT ADDRESSES

5.1 The aircraft addresses shall be used in applications which require the routing of information to or from individual suitably equipped aircraft.

5.2 An address consisting of 24 ZEROs shall not be used for any application.

6. PROCEDURE FOR ALLOTMENT OF MODE 'S' ADDRESS

6.1 Aircraft fitted with Mode 'S' transponder will be provided with Mode 'S' address by DGCA which consists of a total of 24 bits. The first six bits indicate the country code and the remaining 18 bits give the Mode 'S' address. The code allotment shall be as given below:

1 0 0 0 0 0 -
<-- (6 bits) ----> <----- (18 bits) ---------→
Country Code Mode S Address for India

6.2 Whenever an aircraft is equipped with Mode 'S' transponder, the aircraft operator/owner shall apply to Director General of Civil Aviation, (Attn.: Director of Airworthiness) Technical Center, Opp. Safdarjung Airport, New Delhi - 110003, 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

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

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.

6.4 All Indian registered aircraft fitted with Mode 'S' transponder shall be issued with Mode 'S' address by DGCA. Mode 'S' address issued by any other foreign regulatory authority shall stand cancelled after issue of Indian registration.

7 OPERATIONAL REQUIREMENTS:

7.1 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.

7.2 The operator shall lay down its procedure to ensure that the transponder is kept 'ON' throughout the operations.

7.3 The transponder should be operated in accordance with the relevant provision of CAR Section 9 Series D Part V.

8 MAINTENANCE AND CERTIFICATION OF TRANSPONDERS

8.1 The transponder shall be of approved type and meet the specifications given in TSO–C74 C for Mode 'A'/'C' transponder and TSO-C112 for Mode 'S' transponder or any other specifications acceptable to DGCA.

8.2 The transponder shall be installed in an approved manner by an approved organisation / manufacturer.

8.3 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 that includes the date and time of invoking the MEL and proper placarding in the cockpit.

8.4 Engineers inspecting/certifying the transponders should hold appropriate CAR 66 type rated licence in category "B2" and should be "adequately trained on the maintenance/functions/operation of transponder".

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