TRANSPONDER USE

1. Introduction

A transponder (short-for transmitter-responder) is an inboard electronic device that produces a response when it receives a radio-frequency interrogation. It assists ATC (air traffic controllers) in identifying aircrafts on a radar scope and other aircraft's collision avoidance systems.

2. Transponder in real life

2.1.   Technical description

The ATC radar sends an interrogative 1030 MHz radio frequency pulsed signal.
The aircraft answers on the 1090 MHz radio frequency with another pulsed signal.
After decoding and measuring the delay of answer, the transmitted signal is used on ATC radar to identify the aircraft (code and/or call sign) and display relevant information (azimuth, altitude, speed, flight path).

2.2.   Transponder type

Several different RF communication protocols have been standardized for civilian aviation transponders. Depending on the interrogation mode, transponders can provide identification code, aircraft position, pressure altitude, call sign and other information.

Transponder types are coded using one letter and are present in the ICAO flight plan.

Description of some transponder modes:
- **Mode A** equipment transmits an identifying code only,
- **Mode C** provides identifying code and aircraft pressure altitude,
- **Mode S** (for selective) provides multiple information formats to a selective interrogation (data exchange), including the call sign - it is designed to help avoiding over interrogation and to allow automatic collision avoidance.

The transponder mode S is the most widely used mode.

2.3. Transponder settings

A transponder switch usually has several positions:
- OFF
- STBY: this position will power the transponder and make it ready for operation (warming up)
- ON : this position (MODE A) will only send primary information to the radar that is code and position.
- ALT : this position (MODE C or S) will additionally transmit altitude information.
- TA : this position will provide traffic advisory.
- TA/RA : this position will provide traffic advisory resolution.

2.4. Transponder IDENT

All mode A, C, and S transponders include an IDENT button, which activates a special function known as IDENT (short for identify) in order to help air traffic controllers locate an aircraft.

Squawk IDENT button on a real instrument:

2.5.   Transponder codes

Transponder transmission usually uses a discrete code in order to identify the flight.

For certain type of flights and/or situations, specific transponder codes are used.

Squawk codes are four-digit octal numbers. The dials on a transponder read from **0** to **7**, inclusive.

Thus the lowest possible squawk is **0000** and the highest is **7777**. Four octal digits can represent up to 4096 different codes, which is why such transponders are often called "4096 code transponders".

There is no '8' and no '9' digit in transponder code.

Transponder use	Version 3.1	12 November 2017	Page 3
© IVAO HQ training department	Training Documentation Manager Erwan L'hotellier		

This manual is dedicated only for IVAO_TM_ Network activities. This document must not be used in real aviation or in other networks

3. Code allocation

SSR transponder code is normally allocated by each State with coordination with regional air navigation agreements and taking into account overlapping radar coverage over adjacent airspaces.

In IVAO, SSR transponder code should be allocated by division with coordination with regional air navigation agreements and taking into account the code allocation practiced in adjacent divisions.

Codes 7700, 7600, 7500 shall be reserved internationally for use by pilots encountering a state of emergency, radio communication failure or unlawful interference, respectively:

- 7700 : Emergency code
- 7600 : Radio failure code
- 7500 : Hi-jack code

Here are the description and the usage of some code attribution:

3.1.1. Transponder 7700 : the emergency code

The pilot of an aircraft in a state of emergency shall set the transponder to code 7700 unless ATC has previously directed the pilot to operate the transponder on a specified code.

The pilot shall continue to use the specified code unless otherwise advised by ATC.
If the pilot is facing a simple pan or failure, this code shall not be used.

A pilot shall not use the 7700 code outside a state of emergency.

3.1.2. Transponder 7600 : the radio failure code

The pilot of an aircraft losing two-way communication shall set the transponder to code 7600.

On the IVAO network, if a pilot cannot initiate two-way communication by voice with the air traffic controller, pilot and ATC must try to communicate by text as far as possible and does not use squawk 7600.
This code is mainly used when a pilot is facing serious technical problems with his connection that cannot permit voice and text communication or for training/examination purpose.

This code shall not be used to ignore ATC clearance and contact.

3.1.3. Transponder 7500 : hi-jacking code

In real aviation, if there is unlawful interference with an aircraft in flight, the pilot-in-command shall attempt to set the transponder to code 7500 in order to indicate the situation.

The use of this code is strictly prohibited on the IVAO network. (R&R 6.4.1)
"Special operation including simulation of terrorism and act of wars are prohibited.
Although armed conflicts do exist in the real world, we do not allow the simulation of any form of aggression or violence on the IVAO network."

3.1.4. Non-controlled VFR code

Depending on local regulations, non-controlled VFR codes can change.
The most frequently codes used are:
- **1200** : USA and Canada standard squawk code
- **7000** : Europe VFR standard squawk code
- **2000** : ICAO standard squawk code

Other default codes are dependent on whether local regulations have made them available (ex 1400, 3000).

3.1.5. Non-controlled IFR code

There is one unique worldwide for non-controlled IFR flights code which is 2000

3.1.6. Other codes

This is a list of some other codes available:
- **0000**: this code shall not be used. It is a non-discrete code. It is usually displayed on IvAp in case of some specific technical problems.
- **7777**: Non-discrete code used to test transponders and to check correctness of radar stations
- **74xx**: these codes are sometimes used for NATO special operations