



Our Wings Carry Your Dreams

Surveillance Radar - Transponders

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Introduction

Transponders are used to identify individual aircraft to Air Traffic Control (ATC) and to other aircraft through use of Secondary Surveillance Radar (SSR). There are two types of Radar.



Primary Surveillance Radar

The rapid wartime development in World War 2 of radar had obvious applications for air traffic control (ATC) as a means of providing continuous surveillance of air traffic.

The limitations for Primary Radar are:

- Smaller aircraft are harder to detect
- No unique aircraft identification is provided

Primary radar is still used by ATC today as a backup/complementary system to secondary radar.

Secondary Surveillance Radar

The need to be able to identify aircraft more easily and reliably led to another wartime radar development, the Identification Friend or Foe (IFF) system, which had been created as a means of positively identifying friendly aircraft from unknown aircraft.

This system, which became known in civil use as **secondary surveillance radar (SSR)** has been widely adopted.

SSR relies on a piece of equipment aboard the aircraft known as a 'Transponder.'

What is a Transponder?

The transponder is a radio receiver and transmitter pair which receives on 1030 MHz and transmits on 1090 MHz.

The target aircraft transponder replies to signals from an interrogator (usually, but not necessarily, a ground station co-located with a primary radar for example Sydney Radar) by transmitting a coded reply signal containing the requested information.

Transponder Modes

3 Transponder Modes are in use in Australia:

Mode A	Transmits Aircraft Identification (no altitude information)
Mode C	Transmits Aircraft Pressure Altitude
Mode S	Transmits information about the aircraft to the SSR system, to TCAS receivers on board aircraft and to the ADS-B SSR system

Transponder Controls

Nowadays, almost all transponders will be capable of Mode A+C or Mode S.

They have a mode switch with four positions labelled: OFF, STBY, ON and ALT.

Some have a fifth position marked TEST.

They also have an IDENT button, a reply light, and code selector switches.



Ident Button – only push if requested to do so by ATC.

VFR Button – only available on more recent Transponders, if pushed it will load Code 1200 as a shortcut instead of having to enter the 4 numbers separately.

ALT Button – Displays aircraft pressure altitude and identification.

ON Button – Displays aircraft identification, no altitude reporting.

STBY Button – Generally for ground use.

ALT and ON Controls

Before you take-off you normally turn your transponder to the ALT position.

This enables it to respond to both Mode A (identification) and Mode C (altitude reporting) interrogations.

If a controller asks you to **'stop altitude squawk'** or similar it means you need to turn off **'ALT'** by pushing the **'ON'** button.

This normally means your transponder is producing misleading altitude reports.

If you are asked to **'recycle'** your transponder you are being asked to turn it off, pause for a few seconds and then turn it back on to ALT mode.

IDENT Use

'Ident' is used to help a controller identify an aircraft's secondary radar (transponder) return.

By asking the pilot to **'squawk ident'** the controller can ensure that the aircraft he/she is talking to matches the radar target he thinks is that aircraft.

To squawk ident, push the **'Ident'** button on the transponder once.

The controller will see on his/her screen your **Ident** and then confirm to you **'LXP identified'**.

Discrete Transponder Codes

A discrete transponder code (usually called a squawk code) is assigned by air traffic controllers to identify an aircraft uniquely in a Flight Information Region (FIR).

This allows easy identification of aircraft on radar. Squawk codes are a four digit octal number.

The dials on a transponder read from zero to seven, inclusive.

Except as indicated below, ***ATC will assign a temporary discrete code for each flight sector for aircraft operating in controlled airspace***, and for aircraft participating in a Surveillance Information Service (SIS).

When operating in Australian airspace, or on reaching the Australian FIR boundary if inbound to Australia, pilots of transponder equipped aircraft must squawk the assigned temporary discrete code for that flight sector.

or

if not assigned a temporary discrete code, the appropriate non-discrete code.

Standard Transponder Codes

Code	Use
	The following codes are the codes you will normally use in training for your RPL
3000	Civil flights in Class A, C and D airspace, or IFR flights in Class E airspace
1200	Civil VFR flights in classes E or G airspace
	You are unlikely to come across the following codes during your RPL training
2000	Civil IFR flights in Class G airspace
5000	Military flights in classes A, C, D or E airspace
6000	Military flights in Class G airspace
4000	Civil flights not involved in special operations or SAR, operating in Class G airspace in excess of 15 nm offshore
7615	Civil flights engaged in littoral surveillance
2100	Ground testing by aircraft maintenance staff
0100	Flights operating at aerodromes when assigned by ATC
7000	RPAS in all classes of airspace and when instructed

Bankstown is a Class D airfield and as per the table above we will use Code 3000 when operating within the boundaries of the airfield and the Tower is active. Once we leave the Bankstown control zone we will set Code 1200.

Emergency Transponder Codes

Code	Use
7700	MAYDAY – Aircraft in distress requiring immediate assistance
7600	Communications failure – your radios are not working
7500	Unlawful interference – normally means a hijack attempt

More detail will be provided on the use of 7600 and 7700 in the briefs on loss of radio communications and forced landings.

Legal Requirements – VFR Aircraft

For a VFR flight at Bankstown airfield (Class D airspace) and the Training Area (Class G airspace) there is no requirement to have a serviceable transponder. However it is always better to have a serviceable transponder and to use it to reduce the risk of a mid-air collision.

Transponder Trouble Shooting

Your transponder is sending and receiving signals if the flashing icon on the screen normally labelled 'Tx' is seen every few seconds.

If ATC request you confirm your altitude, it may be because the altitude displayed on their screens does not match the altitude they expect you to be at. If so you will be asked to **'recycle'** the transponder by turning it off and then on again. If this does not resolve the issue you will normally be requested to revert to the 'ON' mode eg no altitude reporting. You may be restricted from entering controlled airspace as well.

Alternatively, you may have entered the wrong Code; check and confirm Code with ATC.

ADS - B

Automatic dependent surveillance—broadcast (ADS-B) is a new surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked.

The information can be received by air traffic control ground stations as a replacement for secondary surveillance radar, as no interrogation signal is needed from the ground. It can also be received by other aircraft to provide situational awareness and allow self-separation.

ADS-B is "automatic" in that it requires no pilot or external input. It is "dependent" in that it depends on data from the aircraft's navigation system.

In Australia installation of ADS – B is optional for VFR aircraft but mandated for aircraft conducting IFR flights.

Reference Material

<https://www.avweb.com/news/avionics/183231-1.html>

<https://www.youtube.com/watch?v=CHfNwSTghMU>

AIP Reference

Transponder Trivia

The use of the word "squawk" comes from the system's origin in the World War II identification, friend or foe (IFF) system, which was code named 'Parrot'.

If by some chance you overheard on the radio someone saying 'strangle the parrot' he is asking for the Friend or Foe equipment eg Military Transponder to be switched off.