

Transponders - Ground Lesson

Attention

Air Traffic control says "N123AB squawk 4321...radar contact..."

Objective

To understand terminology in relation to transponders. To know when they are required.

Schedule

Ground instruction – 15 minutes

Reference Material

AOPA.org

What

I transponder tell ATC where we are located in 3 dimensions – latitude, longitude, and altitude.

Why

ATC needs to know where we are at to keep separation from other traffic.

Material

Modes and Codes

Mode A. Sometimes referred to as mode 3/A. Civil Mode A is identical to military Mode 3. Mode A responds to an ATC interrogation signal with the transponder code set by the pilot.

Mode C. Refers to aircraft equipped with an altitude encoder and altimeter. With Mode C, ATC will actually see the flight level altitude on their radar screen if the transponder is operating in the Mode C or "ALT" (altitude) Mode.

Mode S. Mode S is a possible platform for a variety of other applications, such as Traffic Information Service (TIS), Graphic Weather Service, and Automatic Dependent Surveillance-Broadcast (ADS-B). Under ADS-B, each aircraft periodically broadcasts its identification, position, and altitude. Overall, Mode S provides improved surveillance quality, discrete aircraft addressing function, and digital capability. Mode S is not required for general aviation aircraft.

Squawk Codes

- 1200 Visual Flight Rules (VFR)
- 1202 Gliders
- 7500 Hijack
- 7600 Communications failure
- 7700 Emergency

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- 7777 military intercept code

75 - My passenger wants to drive

76 - The radio needs a fix

77 - We're all going to heaven

Transponder Equipment Suffixes

/U Transponder with Mode C DME

/P Transponder with Mode C AREA NAVIGATION (RNAV)

/E Flight Management System (FMS) with DME/DME and IRU position updating

/F FMS with DME/DME position updating

/G Global Navigation Satellite System (GNSS), including GPS or Wide Area Augmentation System (WAAS), with en route and terminal capability.

/R Required Navigational Performance (RNP). The aircraft meets the RNP type prescribed for the route segment(s), route(s) and/or area concerned.

Rules

According to the AIM, Section 4-1-19: In all cases, while in controlled airspace, each pilot operating an aircraft equipped with an operable ATC transponder maintained in accordance with 14 CFR section 91.413 shall operate the transponder, including Mode C if installed, on the appropriate code or as assigned by ATC.

The following areas require the operation of a Mode C transponder:

- Operations within Class A, Class B, and Class C airspace.
- Operations within 30 nautical miles of the primary airport within Class B airspace from the surface to 10,000 feet MSL.
- Operations above the ceiling and within the lateral boundaries of Class B and C airspace.
- Operations above 10,000 feet MSL in the contiguous 48 states, excluding the airspace at and below 2,500 feet AGL.
- The AIM states in Section 4-1-19(a)(3) that for airborne operations in Class G airspace, the transponder should be operating unless otherwise requested by ATC.

All aircraft are required to be equipped with a Mode C transponder when flying at or above 10,000 feet MSL, over the 48 contiguous states or the District of Columbia, excluding that airspace below 2,500 feet AGL.

According to 14 CFR 99.13, no person may operate an aircraft into or out of the United States, or into, within, or across an ADIZ designated unless operating a transponder with Mode C.

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Flying into a Mode C Veil without a Transponder

For flying into a Mode C veil without an operable transponder, the pilot needs to telephone the appropriate radar facility for the Class B airspace and ask for permission to make the flight. Upon agreeing to conditions (including direction of flight and altitude), the pilot will be given a code number that he will mention to the controller upon initial radio contact. This is the same procedure that a pilot with an inoperative transponder/encoder would use to fly in or out of the Mode C-veil airports for avionics repair.

The situation may be slightly different if the pilot is landing at a satellite Class D (towered controlled) airport within the veil but outside of Class B airspace. The approval is still given by the controlling radar facility via telephone. The radar facility may still issue the code number but may only require the pilot to contact the tower in the Class D airspace.

NOTE: You should not expect approvals at the busiest of Class B airports during their peak times or under difficult weather conditions, but if this telephone procedure can expand the utilization of your aircraft occasionally, then by all means, phone to find if you can "fit into" the system.

Transponder Tests and Inspections

According to 14 CFR 91.413, a transponder may not be used for the above purposes unless, within the preceding 24 calendar months, the ATC transponder has been tested and inspected and found to comply with appendix F of FAR Part 43.

If a transponder is installed or the maintenance of a transponder may introduce errors, the transponder must be inspected and found to comply with paragraph (c), appendix E, of FAR Part 43. The tests and inspections must be conducted by a properly equipped repair station certified in accordance with 91.415(c)(1), the holder of a continuous airworthiness maintenance program under Part 121 or 135, or the manufacturer of the aircraft on which the transponder to be tested is installed, if the transponder was installed by the manufacturer.

ATC Transponder Phraseology

- Squawk. Operate transponder on designated code in Mode A.
- Ident. Engage the "IDENT" feature on the transponder.
- Squawk and Ident. Operate transponder on designated code in Mode A and engage the "IDENT" feature.
- Squawk Standby. Switch transponder to "STANDBY" or "SBY" position.
- Squawk Altitude. Active Mode C with automatic altitude reporting. Typically this is the "ALT" option.
- Stop Altitude Squawk. Turn off altitude reporting switch and continue transmitting Mode C framing pulses. If your equipment does not have this capability, turn off Mode C.
- Stop Squawk. Switch off transponder.
- Squawk Mayday. Operate transponder in the emergency position (7700).
- Squawk VFR. Operate transponder on code 1200.