MPSCS RADIOS IN AIRCRAFT

By David Hayhurst, NCC Manager

Many MPSCS members have installed MPSCS radios in their aircraft and experienced mixed results while in flight. So why can't an aircraft talk on the MPSCS while in flight when the aircraft will consistently talk with the control tower and other aircraft service stations?

Aircraft use assigned frequencies in the 108 to 135 MHz frequency range which is assigned by the FCC to aviation services. The radios use amplitude modulation (AM) for transmissions. AM has the ability to hear multiple transmissions at the same time just as a person can hear multiple conversations within the same room. Frequency Modulation (FM) commonly used by older public safety two-way radio systems cannot decode multiple transmissions without garbled or lost transmissions. Digital communications are also limited to a single radio signal at a time or garbled or lost transmissions result.

During the early days of radios in Police cars, AM stations in the 700 KHz (.7 MHz) to 1.5 MHz band were used to talk to the cars. As technology developed, the Ultra High Frequencies (UHF) in the 30 to 50 MHz range was assigned to two-way radio service along with the developing FM transmissions. The UHF antennas were smaller than the old AM stations and FM provided clarity along with squelch to silence the radio between transmissions.

It was quickly learned that a base station with a tall antenna in the UHF band resulted in greater coverage areas between a Dispatcher and car. However, with a tall antenna came the nuisance of hearing your neighbor in the next county or sometimes next state. At times their signal would cover up your own radios!

In the quest for more distance between car to car, the repeater was created using a receiver on one frequency and a transmitter on a different frequency connected to the tall antenna. The audio from the receiver was connected to the transmitter and using the newly designed squelch, they were able to create the repeater. With the repeater connected to the tall antenna, cars were able to talk up to 50 miles apart instead of the typical 2 to 8 miles car to car.

As technology progressed, systems were built in the 150 to 162 MHz band, 450 to 470 MHz band and 800 MHz bands to allow for more conversations. As the demand for radio systems grew, reuse of a frequency became a hotly contested issue. The FCC enacted rules governing the assignment of a frequency to minimize interference. Our 800 MHz frequencies are reassigned by the FCC at intervals of 70 miles or greater.

As aircraft became part of the fleet for public safety agencies, radios were installed to permit communications with the dispatcher and field units. When the aircraft is sitting on the ground, it operates like a typical mobile radio. Once in flight it becomes the "antenna on a *very* tall tower". In flight the radio will hear the local base station and stations counties or states away as the altitude increases. When the pilot transmits in flight, he or she will be heard counties and states away.

The FCC allows operation of private land mobile radios in aircraft regularly flown at altitudes below 1 mile above the earth's surface and at a power level not to exceed 10 watts. Even so, the operation of the radio in an aircraft is secondary to land-based systems.

So when does the interference start? Let's start by assuming a typical 450' MPSCS tower over fairly flat land. An aircraft at 1000' will hear all towers on the same frequency up to 75 miles away. Climbing to 1500' and they will hear towers 93 miles away. Flying at 3000' allows you to hear stations 107 miles away. During flight, the radio may not properly detect the digital control channel signal and therefore miss the call or message.

When the aircraft transmits, it can cause interference to a field unit on the ground and possibly block a message. If the radio detects a loss of communications with a trunking tower, it will repeatedly send out short transmissions as it attempts to affiliate to the last tower it was able to decode.

Consider using the 800 MHz direct I-TAC or I-CALL channel to contact an aircraft in flight. The FCC has also identified several VHF frequencies for communications with ground units. There is no guarantee the aircraft will only hear the desired units on VHF, but instead the FCC limits the use of the VHF frequency to air to ground traffic, not ground to ground transmissions.

As a side note, the typical FAA ground to air traffic control stations use an antenna mounted at 30' to 40'. The aircraft provides the "tall tower" at 5,000' to 30,000' and thereby talks hundreds of miles while in flight.

More information is available on the FCC website within CFR Title 47, Part 90.423.

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