

# GPS Vulnerabilities

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Tonight's training will cover two topics, which I believe is a first for our LeeCares weekly network. The primary discussion will be about GPS, or the Global Positioning System, followed by a brief mention of the importance of today's date in United States history.

Global Navigation Satellite Systems are absolutely essential for proper functioning of business transportation, military defense, aircraft safety, electrical grid operation, mobile telephone service, shipping and, more recently, self driving automobiles and trucks. This is because GNSS provides both precise location identification (down to a few centimeters in some cases) and ultra precise time data.

There are four distinct GNSS systems worldwide: Galileo in Europe, GLONASS in Russia, BeiDou in China, and the most familiar to us, GPS in America. Our GPS consists of a constellation of satellites orbiting approximately 20,000 kilometers above the earth. They continuously broadcast their precise location and exactly what time it is. By comparing radio signals from several satellites, receivers on or near the earth's surface can know with amazing accuracy where they are actually located.

The most pressing issue affecting all GNSS, and our GPS in particular, is its vulnerability to jamming or spoofing. GPS satellite signals are transmitted with about the same wattage as a refrigerator light bulb. This extremely weak signal can be easily interfered with both accidentally and intentionally. Solar flares can affect it, as can weather conditions featuring severe electrical discharges. More frighteningly, the very weak GPS signals can easily be tampered with by bad actors of all stripes.

You may recall that in 2016 two small American naval vessels with 10 sailors aboard were captured by the Iranian navy and their crews paraded around as prisoners of war by the Iranian government. It is believed that the GPS system of these small ships were spoofed into believing that their course kept them in international waters when in fact they had traveled into Iran controlled waters which led to their capture. Thankfully, the crews were released in a very short time. But, the fact that their more robust GPS systems could be misled by radio signals mimicking and substituting for real GPS signals is a real warning about the vulnerability of the GPS system.

More recently a Swedish transport ship was lured into Iranian waters using what is thought to be the very same spoofing. While Iranian officials denied the activity, dozens of other commercial vessels in the vicinity reported GPS anomalies in the days leading up to the capture of the Swedish ship. Imagine the chaos and potential loss of life such an activity could create if used against commercial air traffic.

The other side of GPS vulnerability involves jamming of the low powered signal. Small hand held devices that do precisely this are available for purchase in some parts of the world. The Federal Communications Commission has expressly forbidden the sale, possession or even advertising of such systems. As we all know, however, criminals by definition do not obey laws and it is possible to purchase and take delivery of a GPS jammer by using a Virtual Private Network which makes it look like the purchase was made outside the US. Penalties for violating the FCC prohibition are huge, with

buyers and sellers of these devices being fined tens or even hundreds of thousands of dollars in recent years. Still, this problem is growing. An estimated 85% of all car thefts in Mexico feature the use of GPS jamming techniques to stymie the location signals generated by the stolen vehicle, making them invisible to supposedly secure tracking systems like Lojack or the dozens of small tracking devices you can easily purchase at WalMart or Amazon.

In a future training I will address the various methods being devised to beef up GPS security against the known vulnerabilities of the Global Positioning System.

Lastly, today is an important date in the history of the United States of America. In 1916 President Woodrow Wilson proclaimed June 14 as Flag Day, a day to display and celebrate the banner symbolizing our great nation. That same year he also proclaimed the Star Spangled Banner as the National Anthem of our country. However, Congress did not officially recognize the Star Spangled Banner as our National Anthem until 1931 and it was not until 1949 that President Harry Truman signed legislation marking June 14 as the date for annual celebration of our flag.

Please join me in standing, facing any visible US flag or to the northeast if no flag is visible, removing any head wear you may have on, placing your right hand over your heart and reciting our Pledge of Allegiance to the Flag of the United States of America:

**"I pledge allegiance to the Flag of the United States of America, and to the Republic for which it stands, one Nation, under God, indivisible, with liberty and justice for all."**

This is KI5HHI, back to net control.

\*Attribution given to *The Economist* and the US Department of Homeland Security for information cited in this training.