

Has your GPS ever gone haywire?

– a discussion on interference with GPS and Chart Plotters

It's one of those beautiful velvet nights with the water hissing down the hull. It's warm, the stars are sparkling and there's phosphorescence in our wake. We are making good time to our next waypoint with not a care in the world.

Time to check our position, so we plot our GPS position on the chart. It seems we have barely moved in the last hour - what's going on? What's more, we need to be careful once we reach the waypoint to manoeuvre past some reefs. So we check the GPS again with the same result. Just a minute, the GPS says we haven't moved at all since we read the latitude and longitude a few minutes ago. This is getting worrying as we should be approaching the waypoint soon, with the reefs beyond.

This is an unlikely scenario but not beyond the bounds of possibility.

GPS Interference

By the time GPS signals reach our receiver they are incredibly weak and only some very clever signal processing drags them out of the background radio noise. It does not take much interference to drown out the signals and make GPS receivers useless.

Almost any electronic device has the potential to cause radio interference to radio, television or any other signal, even GPS. This is why the authorities require suppliers of electronic devices to comply with standards that limit interference and for them to be tolerant of interference. The "tick mark" on DVD players, TV's, phones, sandwich makers, etc, etc shows that they meet the standards. TV and radio transmitters, mobile phones and radios are particularly scrutinized because they are meant to emit radio waves, but only on the permitted frequencies.

What if something goes wrong and a device begins to emit interference? Normally, a complaint to the Spectrum Management Authority (SMA) will bring about an investigation of the interference and rectification of the problem. (That's the theory.)

There's a famous story about interference being caused by a recreational boat in San Diego that obliterated GPS for several kilometres around a marina and caused problems for boats entering the narrow entrance at night. After a lot of detective work, it was found that an amplifier in a TV antenna on a boat was emitting signals on the GPS frequency. After removing the offending antenna, two others were found. It turned out to be a problem during manufacture(1)! Be sure to turn off your TV antenna when you leave the boat. I understand that a TV transmitter in NSW has caused problems also.

Deliberate Interference

Naturally enough, if you are a baddie being bombed with GPS guided bombs, you would want to interfere with the bomb's guidance, so GPS interference transmitters were developed. Not that such devices are likely to be a problem on our boats as they are mainly confined to military test ranges and war zones. However, criminals have access to them to stop their cars being tracked by police and those transmitters are available on the Internet for next to nothing. To learn more about how baddies are interfering with GPS for their own ends, see (2).

So you see that the hypothetical situation at the start of this article may not be ridiculously unlikely after all.

What can we do if our GPS fails for any reason?

Precautions

Most GPS receivers that I have used fail to warn me that they are no longer receiving signals. Indeed, I have asked several manufacturers and the standards body (the National Marine Electronics Association, NMEA) to include an indication of the quality of the position estimate, but to no avail. Those receivers generally leave the last position on screen, leaving you to believe that that is where you are, but in fact that is where you were when the signal was last received.

If you suspect problems with reception, many receivers have a screen that shows you the signal strength of each satellite but there may be nothing to suggest that there is a problem. (As an aside, GPS receivers on aircraft have special systems that provide warnings of failures - thank goodness.)

However, chart plotters incorporating GPS receivers are used to steer the boat and some provide an alarm after half a minute or so of losing GPS signals. I tried a little Navman chart plotter recently and it duly warned me when it lost GPS signals. At the same time it set off an alarm that was barely audible and would be difficult to hear in a seaway. Also, it would no longer guide the autopilot and so you would drift off course.

What To Do?

I suggest the following: In daylight, set your boat up as you would normally sail with autopilot or whatever. Place a piece of foil over the GPS antenna, which might be separate from the receiver or chart plotter, and see what happens. Look for signs that the receiver is no longer receiving signals from the satellites. There is a tiny icon in my Navman that changes from a ship to a star, indicating that the position refers not to the ship's position but to the cursor position.

What happens to your autopilot when GPS is lost? Anything? Is the alarm loud enough for you to hear? (For a few dollars, you can buy an alarm from Jaycar that is guaranteed to wake the dead. Connect it to the alarm output of your chart plotter or receiver.)

Needless to say, good seamanship and not relying only on GPS is strongly advised. Perhaps that's why chart plotter manufacturers ask you to acknowledge their warnings before you can use the charts.

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References

- 1 <http://www.gpsworld.com/gnss-system/signal-processing/the-hunt-rfi-776>
- 2 <http://www.newscientist.com/article/dn20202-gps-chaos-how-a-30-box-can-jam-your-life.html>

