



Prevention of Collision at Sea – Gee, How Does GPS Do It?!

■ by VINCENT T. PICA, II

Division Captain, Division 18 (1SR) - United States Coast Guard Auxiliary



In 1951, a Raytheon Ph.D., Dr. Ivan Getting, born in 1912, suggested to the U.S. Government that satellites could be used for navigation and positioning. The concept was developed only from a laboratory standpoint for many years, until October 4, 1957. "Sputnik" sent shock waves through the defense establishment when it became immediately apparent that Sputnik's radio signal was a lighthouse in outer space. By 1960, the U.S. Navy had a working model and it went live with "Transit" in 1965 for the Polaris fleet. By 1973, the Navy wanted a reliable, global system for all vessels and what we now know as GPS was born in a brain-storming session at the Pentagon over the Labor Day weekend. By 1978, the skeleton of GPS was aloft and reached operational status with 24 satellites in 1993. (There are now 31 such satellites aloft.) Around that time, the U.S. Government turned over GPS technology, that we paid the estimated \$12 billion it took to build, to the private sector and said, "Have at it!" We did and companies and divisions of even bigger companies were created. Along with the jobs and the benefits to so many that were derived from that act, there came one little wrinkle, "Selective Availability." The designers of GPS noted to President Clinton that such technology could eventually be used by our enemies to target us. "For \$500, some Russian spy drives up alongside a missile base, or the White House, and now has the exact position of where it is." This was deemed, "Not such a good idea..." So, the government intentionally degraded the quality of the system to the degree that "POGPS" (Plain Ol' GPS) was accurate to within roughly a football field. In one of his final acts as president, Mr. Clinton turned off Selective Availability, correctly reasoning that with nuclear weapons as powerful as they were, you didn't exactly have to hit the White House on the roof for the bomb to be effective in its mission. The only people being disbenefited by Selective Availability were the people who had paid for it—us.

How Actually Does It Work?

The easiest and most reliable measurement we can make with current technology is time itself. Everyone has heard of "atomic clocks" where we can measure time to within billionths of seconds by counting the vibrations of the atoms themselves. So, if we put enough atomic clocks in orbit and measure the time it takes, at the speed of light, for the signal of three of those clocks/satellites to reach our \$300 GPS unit in the cockpit of our boat, we must know where we are. It is coastal piloting to the nth degree. Akin to using a handheld compass to find the angle from our boat to three landmarks and drawing the lines back to the boat to find the boat's location relative to those objects, the GPS uses time differences to do the same thing. It can even tell your elevation should you be using a handheld GPS while hiking or hunting. But there are a couple of wrinkles in this simple model and it demonstrates the genius of the designers.

Forgetting about the "Doppler effect" (why a car's horn sounds differently as it approaches and then moves away from you) which is easily compensated for, the first wrinkle was thrown in by Albert Einstein. Under the Theory of Relativity, objects traveling at high speeds actually distort time itself. So, with the satellite traveling around the Earth at a distance of 11,000nm twice a day, "relativistic effects" have to be accounted for or the system would be absolutely useless. In fact, if it wasn't for Einstein's work in 1905, there would be no GPS. The second wrinkle was cost, to us. To make the system work, all the clocks have to be accurate to a couple of billionths of a second of each other. Such clocks cost about \$100,000. Such an expense hardly stops a government project, but all the clocks have to be that accurate. That means the one in your GPS too...and the clock in your GPS is no more accurate (nor expensive) than your quartz wristwatch. So, how does it work?

When my children confront me with some fantastic fact, I answer with this bit of logic: "If that were

true, what else would have to be true to make it so?" This usually shortens the debate about martians populating early Earth. But the designers of the GPS system used essentially the same logic to replace a \$100,000 atomic clock with a cheap quartz wristwatch. They take the signal from a 4th satellite. If our GPS clock was as accurate as the ones in the satellites, the redundant signal from the 4th satellite should give the same position as was calculated by the other three satellites. Once the GPS knows the difference in the calculated positions, it knows the error factor built in by the cheap quartz watch and it then compensates for it, giving you atomic clock accuracy on your boat!

How Accurate?

In the days of Selective Availability, commercial GPS accuracy was good to within the length of a football field. Now, it is accurate to within 30+/- feet. How come, with all this fantastic technology, it can't be more accurate? The answer is time again.

Light travels at the speed of light or about 1 billion feet per second. If light travels at a billion feet per second, this means that it travels 1 foot in one-billionth of a second. While that is largely incomprehensibly fast, think of it this way. If you could drop this newspaper, travel 10 times around the world, you'd be back just before it hit the floor—about 1 second later. Fast, no doubt, but now conceivable. So, every clock in the system has to be accurate to each other by that same one-billionth of a second or there is a built-in 1-foot error. DoD is working to get them all accurate to each other to within a few billionths of a second on a daily basis as they pass overhead...until then, we'll have to be happy getting to within 10 meters of where we are on Earth!

BTW, if you are interested in being part of USCG Forces, email me at USCGAUX2007@aol.com or go direct to MaryJo Cruickshank, who is in charge of new members matters, at FSO-PS@emcg.us and we will help you "get in this thing..."



The Sun of the Beach

People, Places, Things and Satire by RICHARD TUFARIELLO

My New Year's Resolution and Things I've been thinking it over, and after much thought and consideration, I came to this conclusion. My New Year's Resolution is: No More Mr. Nice Guy.

The New Deputy Parks Commissioner? The Rumor Mill—I look into my crystal ball and see Carol Bissonette as Deputy Town Parks Commissioner.

Her first job? There's no need for three parks employees to go to location 49 with three huge trucks to open and close a door. Public Safety did it for \$5 a night. Fifteen minutes to drive there and open the door for the Vietnam Vets, 15 minutes to come back to close it. The Public Safety Officer earned \$10 an hour. A gorilla from Parks threatened a Public Safety Director and his men took over the task with Foley's blessings. Talk about corruption? This is extortion and theft of taxpayer money.

The Parks Department sends out three rocket scientists with three huge trucks at double overtime for four hours. Or, \$867 to open and close the same door. This must stop at once. Carol wants good press from me; she will have to put an end to this legal stealing of taxpayer money with the blessings of Brian Foley. Let's see what the new coalition does about it.

The Great Mickey Mantle Mickey Mantle, number 7, centerfield, New York Yankees. He was my idol as a kid. I remember the year he won the Triple Crown. .353 batting average, 52 home runs, 130 RBIs. That's when New York had the three greatest centerfielders

in the game. The greatest, even greater than the Mick, was number 24 of the New York Giants. The greatest player I ever saw. With his magical basket catches, an arm like a rifle, fielded his position like no one before or since, and his base running and hitting skills. The Say Hey Kid was poetry in motion. But the one with the greatest stats during the five year era from the mid-'50s was the Duke of Flatbush, number 4, Duke Snider of The Brooklyn Dodgers. That's when baseball was not a sport. It was a religion. When the great number 7 Mickey Mantle went on the long journey, the night he died from a failed liver transplant, the daily number was 777. You can't make this stuff up.

Tell Hempstead to Stick it Up Their Ash The Town of Hempstead no longer wants to do business with the Town of Brookhaven. Why not? A company called Covanta took over Hempstead's waste management incinerator and solid waste program. Why cut Brookhaven out? Here's what I think. There's a new technology out there.

It's called the Plasma system, which burns at 10,000 degrees Fahrenheit. This eliminates the need to have a landfill. It leaves no residue. The by-product can be used in many ways. They now use the landfill material as a mining operation by mining the former landfill and turning the material into products. It makes landfills obsolete. So Brookhaven should check into this new technology. Is it safe? Does it release toxins into the air? Is it potentially dangerous? Is it labor intensive? Since the landfill is already lined, it is doable. The

Plasma system can burn up to 3,000 tons per day. Is this in the cards?

John White Convicted of Manslaughter The Miller Place man, 54-year-old John White, was lucky to be charged with manslaughter and not murder. The fact is he waited 20 minutes inside his house loading his illegal weapons because he was "terrified" of the "lynch mob." So terrified he never called 911. So afraid he left the safety of his home to attack it.

He claims the gun went off in a struggle on his driveway. The bullet pierced the ceratoid artery. There was no blood in his driveway but pools of blood in the street. He executed this kid. He was never in danger. If he was unarmed, the kids in the street would have ripped White to pieces after he killed their friend in cold blood. Instead they took their brother to the hospital. After shooting the boy, White did not call the police or an ambulance but did call his liar for hire in true OJ Simpson form. This was a racial murder where again you have a black killing a white claiming he's the victim. 100% garbage.

Any comments sunofthebeach@optonline.net
WWW.SUNOFTHEBEACH.US

Remember Our Fallen And Living Heroes.
Happy New Year!

*Editor's Note:
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