

EUROPE AWAKE !
GNSS JAMMERS - THE NEW WMD

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I. PNT AND HISTORY

Hegel wrote that history moves forward in a series of cycles. First, a violent swerving in one direction. Then, a strong movement in the opposite direction. Finally, a return to a point between the two extremes.

Thus it is with PNT. First, we relied on terrestrial radio systems for our positioning, navigation, and timing. These systems, mostly line of sight, worked reasonably well but were expensive and gave us poor coverage. Then along came the satellite GNSS systems. They gave us superb accuracy and coverage. A revolution! We have achieved perfection! All the old stuff to the guillotine.

Now we are saying...not so fast. PNT by GNSS is wonderful but its not perfect. There are serious limitations to GNSS which can and do threaten sovereignty, security, and safety. Now we know that we must retain a back up system that will protect our airplanes, boats, internet, telecommunications, power grids, and...tax collections!

The back up that will keep us going is LORAN.

II. OLD EUROPE

Here is a personal declaration. I am an Atlanticist. My ancestors are from Old Europe. The Atlantic Alliance is critical to the security of my country, America, and is a model of democracy, social responsibility, and culture to the rest of the world. Thank you, France, for your help in our revolution. Thank you, Germany, for being a bulwark against forces to the East. And thank you, Britain, for the enduring special relationship with America.

Sometimes, with all good intentions, we threaten ourselves. Our growing dependence on GPS, soon to be joined by the excellent GALILEO system, is putting us all at risk. We-all of us, the US and the EU must not permit this to happen.

To the barricades! Europe, awake!

III. A SHARP SWORD BECOMES A PLOWSHARE

In our fascination with the wonderful things GNSS can do for the civil economy we overlook a fundamental truth. GPS and Galileo are military targeting systems. In fact, GNSS is the most powerful weapon since the invention of the atomic bomb.

The GNSS civil signal in space is agnostic-it knows no one master. It is a highly accurate targeting system for the Western Alliance and for our enemies and for terrorists. The civil GPS signal can guide a missile into the River

Entrance to the Pentagon, or into the Oval Office of the White House, or into an Ultra Large Crude Carrier in the port of Marseilles.

The Defense Ministries know this perfectly well and are working feverishly and mostly in secret to protect their forces from the threat of GNSS.

This effort produces some surprising results. The same companies that are making civil GNSS navigation and traffic control equipment are, at the same time, making systems to destroy GNSS! The Boeing Company, for example, makes GPS satellites and precision GPS aviation landing systems. Boeing also wants us all to convert our air traffic control (ATC) systems to a satellite based "net centric" system. Boeing also produces a satellite killer (AS) satellite described as a "giant fly swatter". Lockheed Martin makes an array of GPS dependent ATC systems. Very recently LM was awarded a US DOD contract for a satellite which can contact other satellites for "maintenance". DOD also admitted the LM satellites could kill other satellites. And Raytheon, supplier of the WAAS/GPS precision landing systems, is a leader in technology to jam the GNSS/GPS signals. I guarantee you the European defense companies are doing the same thing.

There are no villains of this piece. The Defense Ministries have every right -indeed, every obligation- to protect us from hostile use of GNSS. I support these effort.

Here is the problem: GPS/GNSS began as an exclusively military system for war fighting platforms and ordinance. But GNSS was hijacked by a myriad of civil users. A study by Helios Technologies listed 137 different European Civil enterprises that are now dependent on GNSS PNT. Of these, only 40 would continue if GNSS were disrupted. That is why I said to the Air Traffic Control Association in 1997 that GNSS jammers should be listed as the Fourth Weapon of Mass Destruction (WMD).

As you have heard at this conference, GPS/GNSS is extremely vulnerable to various forces-cosmic, military, and terrorist. So: to protect its people, platforms, and ordinance the US DOD installs a more secure backup guidance system in every aircraft, missile, and in most other ordinance.

Not only are the Defense Ministries protecting their own operations with redundant nav systems: they are also developing-GNSS jamming systems to protect themselves from hostile use of the signal. In the United States the DOD is constantly testing ever more sophisticated GNSS jamming systems, both spoofers and noise jammers, and is also running routine jamming exercises to train its warriors to react to loss of GNSS. This is happening in the EU as well. For example: recently in the North Sea.

IV. WHO NEEDS LORAN?

Now, let me address a question which remains to be answered about the critical issue of GNSS vulnerability.

What services need fail safe redundancy?

It seems to me that two types of service must be protected.

First, safety of life services. This includes all aviation navigation and all marine navigation. Surely this is obvious. However there are some in my country who seem to think that mariners can dust off the sextant and revert to dead reckoning. All praise to the Irish and Brits who are on record supporting maritime LORAN redundancy.

Secondly, GNSS applications where the loss of GNSS would cause great economic harm. Some of these applications seem obvious to me. I would list cell phone systems, the internet, telephone systems, energy production and distribution systems, and all wireless telecom systems. In the latter category the dependency may not be initially evident. Does your radar surveillance transmit data via a wireless or wire line link? Then it is very likely to depend on GPS/GNSS timing.

The wonderful uses of GNSS are now so ubiquitous that we should begin a study to determine which can continue successfully without GNSS. There is a lot of work here for public policy experts.

V. PROTECTING THE CIVIL USERS

The civil world has been very slow to react to the reality of GNSS vulnerability. Some of the reaction has been hostile. Those of us who have warned against this risk-the LORAN Mafia-have been accused of being hostile to GNSS.

Nothing could be farther from the truth. No one believes that LORAN should be used as a stand-alone system of navigation. Instead, LORAN should be teamed with GNSS-GPS plus Galileo, WAAS, and EGNOS- in a single, integrated receiver. This is very simple with today's receiver technology. The first GNSS/LORAN marine receivers have come on the market and are on display here. Aviation receivers, because they must provide vertical navigation, are a bit more complicated and are under development. The prototypes by Rockwell Collins in the US are showing excellent results.

Let me summarize the benefits of backing up GNSS with LORAN redundancy

- Any event likely to disrupt GNSS, whether intentional or unintentional, will not interrupt navigation or timing.
- A redundant, fail safe GNSS/LORAN combination will remove any incentive to use GNSS vulnerability to cause aircraft or vessels to crash, or to bring down timing dependent networks.
- The technical performance of modern LORAN is now fully tested and proven by exhaustive analysis.
- LORAN is an ultra low cost signal to put in service
- Enormous cost savings are possible by establishing and using LORAN with GNSS. Every non-directional beacon (marine and aviation), VOR, and DME can be decommissioned.
- *And Loran provides long range coverage with an accurate signal and Stratum I timing down to the ground or to the ocean.*

_LORAN is the best friend GNSS ever had.