

PNT and Great Power Competition¹

Once upon a time there was a race between a tortoise and a hare. A competition between one who was swift and agile but complacent, and one who was slower but focused and determined. We all know who won.

We live in a world where great powers are in constant competition. One in which GPS and positioning, navigation, and timing, or PNT, has evolved from a peacetime “silent utility” into both a shield and weapon. An under-the-radar tool in the competition between powerful nations. For decades the United States sprinted ahead and dominated global satellite navigation and PNT. This increased our hard and soft power tremendously. We regularly reaped the benefits, often without knowing it. But as of today we have fallen behind. Unless we catch up, our failure could decide the fate of our nation, and change the course of history.

Come with me to 1996, the year of The Unforgettable Humiliation. Outraged at Taiwanese moves for international recognition of its independence, China mobilized 150,000 troops to Fujian Province on the shores of the Taiwan Strait. It conducted live fire exercises, a mock amphibious landing, and aggressive naval maneuvers. The United States immediately became involved and sent two aircraft carrier battle groups to the area in what became known as the Third Taiwan Strait Crisis.

¹ Presentation by Mr. Dana A. Goward to Rhode & Schwartz seminar at Assoc. of Old Crows Space Symposium, MITRE, Bedford, MA 21 June 2023

As part of its show of power, China fired three missiles into the Strait. The first landed as intended about 18 kilometers from Taiwan's Keelung military base. The other two missiles were lost.

China said this was because the United States altered or denied the GPS signals the missiles used for guidance.

For the People's Liberation Army (PLA) this became known as "The Unforgettable Humiliation." But China plays the long game.

The Unforgettable Humiliation birthed a 24-year effort that resulted in BeiDou, a satellite navigation system superior in many ways to all others. Along the way it created a Chinese space industry worth tens of billions of dollars a year building everything from personal user equipment to advanced launch and delivery systems. It begat unmanned trips to the far side of the moon, the PLA Strategic Support Force and Rocket Force, and a whole inventory of new cruise, ballistic, and hypersonic missiles.

And their efforts were not just in space. Having once been stung by the fragility of space systems, China also reinforced and built terrestrial GPS-like systems to provide essential PNT services. Precisely measured fiber runs enabled easy transmission of hyper-accurate time for future 5G networks and autonomy corridors. A high power, low frequency Loran system that reached across the country and 1,000 miles offshore was upgraded. In the words of one research paper, 'we must have this in the event signals from space are no longer available.'

The creation of BeiDou and these other systems were China's declaration of technological independence. No longer would the PLA or the rest of China be

reliant on the west, or on space, for these crucial services. The PNT needed to underpin virtually every technology, and every aspect of life in the First World.

China became a truly great power.

America's use of GPS and PNT for soft power really began in 1983 after a navigation error caused Korea Air flight 007 to wander into Soviet airspace. In the wake of its shoot down President Reagan made GPS available for use by global aviation. What had been a military system, was officially dual use – both civil and military.

And for four decades it has been US government policy to encourage adoption and use of GPS, worldwide. As you know that effort has been incredibly successful. Perhaps in no small part because GPS had at least a ten-year head start on the world's second global satnav system, Russia's GLONASS. And even then the Russian system didn't turn out to be all that reliable.

The Soviets recognized the hard and soft power potential of PNT and began development of GLONASS in 1976. Though, with the fall of the Soviet government and other challenges it didn't become operational until 1993.

Despite GLONASS's challenges, Vladimir Putin and his cronies know all about the power of PNT in great power competition. As a homeland defense measure, they have retained their terrestrial Chyaka-Loran system serving most of the country.

And in November 2021, while massing troops along the border with Ukraine, Russia destroyed a dead satellite with a ground-based missile. Less a week later state-sponsored media boasted Russia could shoot down all 32 GPS satellites and "blind NATO." Shortly thereafter a member of the US President's National

Security Council confessed that GPS was “still a single point of failure” for America.

Who knows what strategic role Russia’s threat to GPS has played in the US response to the invasion and subsequent support for Ukraine?

On the ground in Ukraine GPS jamming has been wide-spread and has had a huge tactical impact. Open statements by officials have said it is hampering the effectiveness of U.S. provided weapons and Ukrainian forces must constantly scramble to find ways to navigate drones.

Ukraine is a case study in miniature of the strategic and tactical importance of PNT in great power competition. And it shows us how difficult it is to operate with degraded GPS, and how dependent we all are on space for our very survival.

Europe also understands the essentiality of PNT to its standing in the world. In September 2003, ten years after Russia’s GLONASS became operational, the European Union decided to build its own satnav, Galileo. This despite pleas from the U.S. that GPS was theirs to use at will. No need to go to all that trouble.

But European leaders understood that, as long as they relied on another for essential PNT services, services they needed to defend themselves and fuel their economy, they would not be a great power. Having their own satnav constellation would reinforce their space-based economy, and create jobs. And it would give them services to offer others. Services that, unlike GPS, are non-military, and specifically designed for civil and commercial applications.

How about other nations? Do they recognize the importance of PNT in global competition?

The United Kingdom has been frantically examining its PNT alternatives since Brexit removed it from full participation in Galileo.

Japan has recently announced it is expanding its regional satnav system so that it can cooperate with, but operate independently from, GPS and other GNSS.

India has made a similar announcement and says it plans to eventually expand its regional system to be a global one.

And regular interference with GPS and GNSS by Russia, China, and their proxies is making smaller countries nervous about relying on others and on space.

Particularly those living near the action.

South Korea, nearly surrounded by Russia, China, and North Korea, has invested heavily in a system of systems approach to PNT. In addition to planning its own GNSS augmentation satellite, it has upgraded its cooperative Loran-C system to a standalone eLoran. Now it will be able to continue to work with the neighboring Chinese and Russian systems, but can operate independently if those other systems ever become unavailable or compromised.

In the middle east where interference with GPS is a daily occurrence, Iran has boasted it has had a terrestrial alternative to GPS since 2016. Saudi Arabia has had Loran-C since WWII and recently announced it is upgrading to the more accurate and automated eLoran standard.

But in the United States we are far from the action. I wonder if in our isolation we really appreciate the role GPS and PNT play in great power competition. In maintaining our place in the world.

We massively over-rely on GPS and it is, indeed, our single point of failure.

At the same time China, our biggest adversary and, according to the Department of Defense our “pacing threat,” has three PNT satellite systems at different altitudes, and multiple terrestrial PNT networks. China is PNT resilience personified.

A former chief analyst for the CIA has called this imbalance between US and Chinese capabilities an open invitation for attack. One that could begin on a small scale with some jamming or spoofing, then quickly escalate to an out-of-control armed conflict.

So, what must be done to protect the United States, deter mischief, and reduce the potential for disaster?

We have known the answer for a long time. The US government codified it in a 2008 plan resolving to build a resilient national PNT architecture. One that contained multiple diverse PNT delivery systems so that threat vectors impacting one would be very unlikely to impact the others. A combination of signals from satellites, terrestrial broadcast, and fiber. Relatively inexpensive, yet, if done properly, incredibly resilient.

But, critics say, it will be hard to change. New signals will have to be adopted. New equipment will have to be built. All true.

Will it be worth it?

Our very lives depend upon weak signals from GPS satellites. Signals and satellites that are under constant threat from solar activity – which, incidentally, could be the greatest threat – to debris, and a wide variety of malicious cyber, radio frequency, directed energy, and kinetic attacks.

Yet these are, in the minds of many, all tenuous and theoretical. After all, nothing bad has happened yet. Where is the clear and present danger?

That question brings us back to China. The challenge of our age.

China recognizes the soft power benefits of PNT and has been aggressively marketing BeiDou along with a tech stack of user and other equipment as part of its belt and road initiative to lure nations away from GPS. As one example of their success, the Pakistani military has abandoned GPS in favor of BeiDou.

And China has been exercising the hard power aspects of PNT by jamming GPS in the South China Sea and spoofing it to conceal Russian and Iranian oil shipments.

All part of a national agenda China is rapidly executing.

For 5,000 years China was the most advanced and sophisticated society on the planet. Then came 150 years of oppression by the west with Opium Wars, military defeats, and unfair trade.

President Xi is determined to make China great again.

BeiDou and a space program that challenges America's shows his "Great Rejuvenation of the Chinese Nation" is working. Finally, a great leap forward. China regaining its position in the world.

Chinese efforts have been so successful that President Xi has recently moved up the goal for finishing "The Great Rejuvenation" from 2049, the nation's 100 birthday, to insisting it be complete before 2027.

And so here we are in 2023 with a 70-year-old President Xi who, like his 70-year-old friend Vladimir Putin, is keenly aware that leaders don't establish legacies in

their 80's. And like Putin, Xi has a highly prosperous breakaway province that has been a long-time thorn in his side and that needs to be brought back into the fold.

China is no longer emergent. It is back. And it still has scores to settle with the west. Lots of them.

China has the world's most resilient PNT architecture, a combination of space and terrestrial systems, while the U.S. and the west mostly rely on fragile GNSS signals. Again, such a huge strategic imbalance is dangerous. It is an open invitation to take advantage.

2024 is the Year of the Dragon, a symbol of power, honor, luck, and success. President Xi very much wants to be China's modern-day dragon.

October of 2024 also marks the 75th anniversary of the founding of the People's Republic of China. 75 years of struggle and success. And 75 years of failure to reunify Taiwan with the mother country.

2024 could be a propitious year for China to give its perpetual critics and adversaries their own Unforgettable Humiliation.

We must have a sense of urgency. America needs to level the playing field by establishing a resilient PNT architecture at home, and export the idea and equipment to others. It is the only way to protect ourselves and increase global stability.

PNT once was the peaceful table around which the world sat and cooperated. It has become a tool for conflict. Imbalances in PNT capability among the great powers are now hair triggers for major armed conflict.

In 1996 the Peoples' Liberation Army may have been humiliated, but they learned two important lessons. Don't depend on others for critical national needs, and don't depend solely on space.

We must benefit from their experience and that of Aesop's complacent hare. Failing to do so will not only lose us the race but could end in something much worse than an unforgettable humiliation.

The Resilient Navigation and Timing Foundation is a public benefit, scientific educational charity, 501(c)3, registered in Virginia.

Visit us at RNTFnd.org