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NAVIGATION & RESILIENCE

Beyond GPS: what happens when navigation meets the real world?

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Positioning, navigation and timing now underpin far more than the bridge. Image: iStock.

There's a reason behind Australia's biennial conference devoted to positioning, navigation and timing (PNT). Modern navigation has become more than simply knowing where you are, and I think a recent amalgamation of two professional bodies closely tied to PNT reflects that realisation.

Until recently, Australia's navigation ecosystem was split between the Australian Institute of Navigation (AIN), grounded in operational navigation practice, and iGNSS, the country's specialist GNSS and PNT community.

Their coming together is, I think, more than administrative, in that it signals a broader shift in navigational thinking. It is no longer charts or satellites; it is a system-of-systems built on trusted positioning, navigation, and timing.

It really is all in the timing

In fact, of the three elements in that acronym, timing is the most critical. Just as the development of the marine chronometer in the late 18th century finally solved the problem of longitude, today's positioning systems rely on extraordinarily precise measurements of time to determine location.

But that precision has also become the backbone of modern society itself, underpinning everything from telecommunications and transport to financial systems and energy networks.

Most of that timing accuracy comes from global navigation satellite systems (GNSS), with GPS still the most relied on system in much of the Western world. The problem is that when those signals degrade or disappear, it's not just navigation that suffers.

The flow-on effects can ripple through systems most of us rarely associate with satellites at all.

A sailor in a room of rocket scientists

That context explains why, when I was invited to speak at this year's PNT 2026 conference, I was initially unsure of exactly what a sailor could contribute to a room full of scientists, including, in some cases, actual rocket scientists.

As it turns out, what many attendees wanted was an end-user's perspective. Real-world stories about the way PNT-enabled technology is used, and relied on, in sometimes high-consequence environments.

From that perspective, the conference was genuinely eye-opening. The depth of work underway spans everything from magnetic and gravitational navigation, to sophisticated anti-spoofing and interference detection, to sensor fusion and integrity monitoring.

One of the more striking discussions was the exploration of signals of opportunity, and the use of communication satellites, never designed for navigation, as alternative sources of position and timing. Not because it's clever (although it very much is), but because resilience demands options.

Resilience is layers, diversity and trust

That focus on alternatives reflects a sobering reality: loss or degradation of GNSS is no longer a theoretical risk. In some parts of the world, it is now a near-daily occurrence. While much deliberate jamming and spoofing is concentrated around conflict zones, the underlying vulnerabilities are global. GNSS disruption can just as easily arise from environmental effects, system design limitations, power loss, interference, or simple geography and infrastructure masking.

What came through clearly across the conference was that resilience isn't about replacing one satellite system with another. It is about layers, diversity, and trust. Manufacturers are

responding accordingly, developing solutions that can be scaled and combined depending on operational need.

As one Australian technology CEO put it during their presentation, resilience doesn't require a single perfect answer, it requires proportionate answers, chosen deliberately. And as another researcher mentioned, it's also not necessarily the primary system that might be immediately affected. Operations and systems are so intertwined it could be a secondary or tertiary back-up system that fails due to a loss of GNSS, that cascades into other systems. It is the whisper leading to an avalanche.

Why this matters at sea

For maritime operations, this conversation is, I think, particularly pressing. A generation of navigators has grown up in a world where satellite positioning has always been there. They're highly capable users of advanced systems, but that familiarity brings a recognised risk of automation bias in which they trust the display over other cues, even when something doesn't feel right. International regulators and professional bodies are increasingly acknowledging this over-reliance as a real-world safety concern.

At sea, some GNSS disruptions can be managed with alternative techniques and a return to fundamentals. But in constrained environments, where margins are tight and visibility limited, those fallbacks aren't always viable. In many modern ports and transport hubs, GNSS-derived position and timing are moving beyond being an aid, and becoming an enabler of everyday operations.

Beyond the berth

And that reliance extends well beyond vessel movements. Stevedoring operations increasingly depend on GNSS synchronised systems for crane positioning, container tracking, scheduling, and automation. Port security, customs clearance, and border control systems rely on trusted time stamps and location data to manage access, monitor cargo, and maintain chain of custody. When positioning or timing degrades, the impact isn't necessarily confined to a single ship or berth. It can affect the flow of trade itself.

A reality that was never far from the surface at this year's conference. The key message wasn't alarmism. It was recognition. Recognition that PNT underpins far more than many of us tend to acknowledge, and that resilience needs to be incorporated technically, operationally, and culturally.

If nothing else, the conference reinforced for me a simple truth: when technology becomes invisible, its failure becomes dangerous. For maritime and transport, sectors where precision, scale, and consequence intersect every day, connecting the people building resilient PNT systems with those who rely on them in real-world operations has never mattered more.

The opportunity now is to move beyond discussion and deliberately build resilience into an infrastructure and human interface that underpins trade, safety, and our national wellbeing.

And yes, I’m going to say it… sometimes it really is all in the timing.

And that timing is, I think, now.

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