Lost without NavIC: The Strategic Implications of an Atomic Clock Failure

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On 13 March, ISRO confirmed that the third (and last) functional atomic clock, a critical PNT device, aboard the Indian Regional Navigational Satellite System-1F (IRNSS-1F), a first-generation NavIC satellite, had stopped.[1] Without an atomic clock, the decade-old satellite can only continue to transmit one-way messages and is therefore effectively retired from navigation duties.

This development comes a year after NVS-02, a second-generation replacement satellite for NavIC, failed to reach its designated orbit, and several months after ISRO revealed via an RTI request that five out of 11 NavIC satellites were already defunct or retired, with no functional atomic clocks onboard.[2] Notably, NVS-02 was the second NavIC satellite not to reach its orbit, not the first.

To sum up, of the 11 NavIC satellites launched since 2013,

only four were fully operational until last week; that number has now dropped to three.

A satellite navigation system such as NavIC needs a minimum of four orbiters at any given time to accurately determine a position on the ground,[3] and ideally several more dedicated satellites for optimal performance (the US' GPS has over 30, and China's BDS has 45). With IRNSS-1F's retirement, therefore, India's sovereign PNT capabilities is effectively suspended. Worse still, one of the three presently operational NavIC satellites is the twelve-year-old IRNSS-1B, which is already past its design life and could fail at any moment. When that happens, NavIC will become entirely useless.

While NavIC has faced persistent technical challenges since its inception, the current situation is arguably critical. Unless addressed quickly through the launch of replacement satellites, it could carry serious strategic consequences for India.

It's hard to overstate both the civilian utility and the military exigency of a sovereign PNT system.

Economic competitiveness via NavIC

Over the last decade, and in no small part through government mandate, NavIC has emerged as ubiquitous for various critical sectors of the Indian economy. The Indian Railways has integrated it into safety systems for its entire locomotive fleet. Since 2019, every commercial vehicle manufactured in India has a NavIC tracker, as ordered by the Transport Ministry; and hundreds of Indian companies' business models now revolve around the production of these devices alone.

Its applications extend well beyond transportation. Fishermen use NavIC receivers to identify fisheries, and as importantly, the country's maritime boundaries. The system is also widely

deployed for precision agriculture, disaster response, and infrastructure development, including telecommunications network buildout, and so on.

Although many of these economic activities—although not all—can continue using other global navigation systems such as GPS, Russia's GLONASS, or the EU's Galileo, NavIC was designed to offer higher accuracy over India and its surrounding region (approximately a 1,500 km radius) because its satellites are positioned directly overhead, rather than the standard global systems (approx 5-20 mtrs), and foster economic competitiveness.[4] Its signals could reach, for instance, valleys and dense forests where GPS cannot.

Chinese BDS in South Asia

In any case, the strategic need for NavIC extends far beyond market logic.

Over the past decade, China's BeiDou navigation system (BDS) has proliferated across the Asia-Pacific (where its services have surpassed GPS in performance), and every country in South Asia now uses it for a range of civilian applications. As the geospatial market expands, space technologies such as BDS create a considerable advantage for China to position itself as a more attractive tech partner than India. Over time, a dependence on BDS for public services and economic activity in India's neighbourhood could carry strategic costs for India's regional influence.

More immediately, in the absence of NavIC as an alternative, the use of BDS is likely to expand further—exacerbating immediate national security risks for India in its restive border regions and within. For instance, news reports indicate that terrorists may have used BeiDou satellites to coordinate the Pahalgam attack in April 2025, as well as to evade detection from Indian security forces in its aftermath. Experts have also repeatedly flagged BeiDou's

unique SMS function—which facilitates text data transmission via satellites independent of mobile networks—as a serious security challenge since it allows hostile non-state actors to circumvent telecom-network-based surveillance.

The Pakistan-China nexus enabled by satellites

These concerns become more pronounced in the military domain. In 2018, Pakistan became the first foreign nation to acquire access to military-grade BeiDou systems and has since integrated them into its defence architecture. In the aftermath of Operation Sindoor, high-level Indian army and air force officials confirmed the Pakistani military's use of weapons systems—such as J10C fighter jets and PL15 missiles—that are integrated with Beidou, and reports even suggested broader ISR support (beyond specific platforms) enabled by BDS and other space-based assets, by China in the course of the conflict.

Meanwhile, other South Asian militaries have also shown an interest in the use of Chinese BDS for combat navigation and support; most prominently, Bangladesh, which, as per recent reports, has plans to spend over $2.2 billion for the purchase of Chinese J-10Cs, as well as PL-15s.

In this context, NavIC's failures cede strategic ground for greater security cooperation between China and its neighbors, and consequently increase the complexity of India's threat matrix. More immediately, India's growing reliance on foreign PNT systems represents a vulnerability in its defence posture, with potentially serious operational implications.

In fact, NavIC was conceived precisely as a result of the 'GPS-denial' episode during the Kargil War in 1999, which underscored the strategic necessity for sovereign PNS capabilities. That this predicament has returned nearly three decades later is likely to prompt serious introspection—and, potentially, course correction—among Indian defence planners.

In the aftermath of ISRO's announcement, critics have alleged that the space agency's focus on politically high-visibility missions—such as Gaganyaan (India's first human spaceflight) and Bharatiya Antariksh Station (India's first space station)—has seemingly distracted it from core strategic missions. Another line of criticism has focused on the absence of a national space law that can grant statutory powers to IN-SPACe (which CSDR has also flagged in a previous Blindspot), and relieve ISRO of some of its growing regulatory responsibilities. As ISRO juggles sectoral reform, private-sector enablement, deep-space R&D, and operational commitments, this institutional strain has become increasingly apparent.

NavIC's current setbacks may therefore generate fresh momentum for the long-pending Space Activities Bill, as well as prompt a broader reallocation of responsibilities across India's space ecosystem.

At least three second-generation NavIC satellites are scheduled for launch by the end of 2026—missions that will now be critical to restoring the system's operational integrity. Meanwhile, critics may argue that ISRO's obligation to hand-hold space startups has become a liability, but there are many indicators that the government is unlikely to ease the push towards privatization. From a policy standpoint, transferring space technologies—such as launch vehicle production—to industry is expected to strengthen long-term resilience by accelerating the deployment of dual-use space assets.

In fact, the ISRO Chairman last year welcomed the participation of startups in the creation and deployment of complex navigational space tech, and in the aftermath of Operation Sindoor, the GoI accelerated efforts to deploy indigenous satellite constellations that can boost Indian ISR capabilities with significant private sector involvement.

What remains uncertain is the gestation period required for

India’s space startups to absorb, develop, and deploy technologies at scale for national security applications. What is clear, however, is that the transition from an ISRO-centric model to a more distributed ecosystem—comprising both state and private actors—is likely to entail short-term costs.

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[1] Essentially, an atomic clock can measure time to a billionth of a second, and onboard a satellite, it precisely measures how long it takes for a signal to travel from space to a device, which the allows the clock to pinpoint an exact location. It is therefore a critical device in a navigation satellite which offers PNT services provided.

[2] The first generation of NavIC satellites used rubidium atomic clocks, made by Swiss company SpectraTime, that were dogged by failures.

[3] While three satellites provide a rough sense of positionality, a navigation system typically becomes unreliable without a fourth orbiter.

[4]Since other global navigational satellites may not be not directly overhead Inia and the region, their PNT signals are received at an angle with low penetration and can also suffer from latency.