ISSN 2624-9081 • DOI 10.26034/roadsides-202000308

Alternatives to GPS: Space Infrastructure in China and Japan

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Control of crucial elements of global infrastructure has long been a sure route to extensive geopolitical influence. Britain's control of the Suez Canal and the USA's of the Panama Canal are both examples of states investing in, and fiercely protecting, key facilitators of the global economy. However, both nations were eventually forced to surrender their grip on these structures. This paper will explore a very similar process underway today: the drift away from the dominance of the US-created Global Positioning Satellite (GPS) system, to a world where multiple similar networks compete for global usage and influence. As we shall see, the consequences of this shift for economics and geostrategy will be profound.

One source of this trend is China. Discussions of Chinese infrastructure usually centre on ground-based infrastructure, such as high-speed railways, ports, and roads built under the Belt and Road Initiative (BRI). However, despite the wide-ranging fixation on this so-called New Silk Road connecting China to Central and South Asia, the Middle East, Europe and Africa, it is pertinent here that a crucial part of this network is in fact being constructed hundreds of kilometres above the surface of Earth—the "Space Silk Road" (Luft 2016). At the heart of this is China's BeiDou Navigation Satellite

System (Ch. 北斗卫星导航系统), sometimes abbreviated as BDS, but commonly known as BeiDou. The system is named after the constellation ancient Chinese used for navigation, the Big Dipper (Ch. 北斗七星). Meanwhile, Japan—China's geopolitical competitor and a close ally of the USA—is busily expanding its own Quasi-Zenith Satellite System (QZSS) into a Japan-centric system capable of providing extensive navigational functions beyond the country's borders. For those doubtful as to the significance of these systems, consider their application in the current Covid-19 viral outbreak. Electronic devices equipped with location-trackers, whether based on GPS or not, are imposed on quarantined travellers and patients to monitor suspected victims in Hong Kong and South Korea (Perrett 2020; Walsh 2020). This is a timely reminder that navigation technology is an integral part of state surveillance systems that can be put in place for control and containment.

Together, BeiDou and QZSS offer alternatives to the dominant global positioning network: the US Navy-controlled GPS, since the 1980s the premier system of its kind in the world. GPS is by far the oldest and best-established network positioning system on Earth; a constellation of twenty-four satellites was fully functional by 1993, five years before the precursors of QZSS, and seven years before BeiDou was initiated. The entire network was primarily conceived of as a military service. However, since around the turn of the millennium, while the younger systems have expanded dramatically, GPS has remained largely stagnant.

Of the two East Asian systems, BeiDou has experienced by far the speediest growth. This is partly because, from the perspective of the Chinese government, there is little doubt that BeiDou is a crucial infrastructural project. Chinese official documents define the system as "space infrastructure of national significance" that offers "all-time, all-weather and high-accuracy positioning, navigation and timing services to global users" (SCIO 2016). Since 2000, China has launched some fifty-three BeiDou satellites, including experimental devices and first-generation platforms that are now defunct (Clark 2019). When completed later in 2020, BeiDou will have a constellation of thirty-five satellites, providing global coverage (Jakhar 2018). Much like GPS, BeiDou's origin was military, and it remains the cornerstone of China's expanding military capabilities. At the same time, though, the network is also being primed for global economic deployment. The cost of BeiDou receiver chips that track and process satellite signals has fallen to the point where for many—particularly countries that have had their communications infrastructure built by Chinese corporations—it is in fact a cheaper option than GPS. BeiDou is already being deployed to cater to the demands of a variety of industries both within and outside of China. Between 2012 and 2017, around 4.8 million commercial vehicles and forty thousand fishing vessels in China were equipped with the system; more than ten thousand fishermen have received assistance or been rescued through utilization of the system, while BeiDou-based automatic driving systems have been in use in more than ten Chinese provinces. In agriculture, herders control their livestock's water use through remote devices operated by sending short messages via satellite. BeiDou has also been widely adopted in the emerging markets of shared bicycles, wearable devices, and as a communication nexus for the Internet of Things (Yu, Wang and Yang 2018)—the integration of communication capabilities into consumer products such as gaming systems and fridges. In 2012, the network extended services across the Asia-Pacific

region and is now an essential part of the benefits package China offers to countries along the BRI. Here, the constellation provides basic satellite navigation services not only to people living in these nations, but also to those utilizing long transport networks that span remote locations (Chen and Jiang 2018).

Meanwhile, GPS finds its global dominance challenged even by its own long-term users. A good example here is Japan. In 1998, the country took the historic step of launching its own spy satellites to counter North Korea's rocket launches—a move stemming partly from a sense of dissatisfaction at the perceived lack of responsiveness from the USA to Japan's surveillance needs. This in turn led to broader conversations regarding the possibility of a Japanese-run equivalent to GPS. In a fashion typical of Japan's governmental bureaucracy, the idea was knocked around various departments, but when finally approved it proceeded rapidly. The resulting QZSS was born in 2018. The Michibiki satellites that form the core of this new system were specifically designed to exceed their counterparts in GPS, and the European Galileo system, in capacity. Japan's circumstances are somewhat different to China's—military actions running counter to US interests on the part of the Japan Self-Defense Forces are currently unthinkable, and hence Japan's armed forces can continue to rely on GPS without the fear China has of American sabotage. So, though each Michibiki promises to bring key navigational capacity under Japanese government control, it is the hefty economic advantages that are most seductive—companies such as Hitachi and SoftBank estimate that the new system might generate up to forty-four billion yen's worth of new services over the coming years (Shigenori 2018). The potential uses pitched by these companies include providing navigation for self-driving cars and guidance to large-scale farm equipment. Crucially, the ability to offer these new services will stretch as far as Australia, raising the potential of extensive foreign engagement with the QZSS (Shigenori 2018).

These developments are part and parcel of a more widespread challenge in the twenty-first century to the dominance that GPS has held over global navigation for the better part of half a century. The implications are profound. For the USA, this will mean the end of a crucial strategic capability to interfere with the communications of other countries, particularly in times of war (Crichton and Tabatabai 2018). From an American perspective, it is not immediately obvious that there are alternatives to GPS. On ground level, the USA remains the most powerful country in the world, but that view of American hegemony looks increasingly questionable if we look up and take off-Earth infrastructure into consideration.

There are broader concerns too. Analysts have pointed out that the growing global reach of BeiDou could translate into a bifurcated global navigational system, with politics and incentives being deployed by both China and the USA to woo countries to join their respective systems (Jakhar 2018). It also raises troubling possibilities for corporations like Apple, which may be forced to place BeiDou functional chips in its devices, in violation of US security policies. This in turn could mean that Apple's ability to sell its products in China would be limited, or that certain products could only work either in China or America—a challenging state of affairs for such a corporation. Similar concerns surely must give chills to technology and hardware companies that rely on space infrastructure to provide crucial services. Indeed, if

we include other systems such as Russia's GLONASS (Globalnaja nawigazionnaja sputnikowaja sistema/Global Navigation Satellite System), the European Union's Galileo (which continues to grow in size), and India's mooted IRNSS (Indian Regional Navigation Satellite System), it is not hard to imagine a future in which globally functional phone-sets will require several chips, thus increasing prices and requiring the creation of new supply chains.

Nevertheless, the era of GPS's dominance is far from over. Many of its challengers suffer from drawbacks that may, in the long term, discourage switching between networks. BeiDou, for example, relies on a system, which consumes valuable bandwidth and can slow services. Japan's QZSS (similar to a proposed British system) suffers from a lack of scale – they are smaller systems, which means that production prices for their components will not benefit from the cost savings mass production can provide. As a result, their creation and maintenance will be extremely expensive. Many countries continue to be reluctant to engage with GLONASS for strategic and political reasons, while Galileo, though growing, is still small. Thus, for the foreseeable future, GPS will remain the premier satellite constellation in the skies. It is, however, no longer alone out there.

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Cite as: Luk, Christine Y. L. and Subodhana Wijeyeratne. 2020. "Alternatives to GPS: Space Infrastructure in China and Japan." *Roadsides* 3: 57-62. DOI: https://doi.org/10.26034/roadsides-202000308.

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Collection no. 003 was edited by: Christine Bichsel
Managing editor: Agnieszka Joniak-Lüthi
Copyediting: David Hawkins
Layout: Chantal Hinni and Antoni Kwiatkowski

ISSN 2624-9081

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