



# ANALYSIS

## BEIDOU: CHINA'S CONSTELLATION OF VASSALAGE

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### Introduction

Satellite navigation systems provide the positioning, navigation, and timing (PNT) services now ubiquitous in modern life. Such systems have three major segments. The satellite segment consists of a network, or constellation, of satellites circling the globe in medium earth orbit (about 22,000 kilometers above the earth).<sup>1</sup> A second segment includes a ground-based network of manned and unmanned control systems that track and monitor the satellites.<sup>2</sup> A third segment consists of user receivers that are built into a wide variety of modern devices from smartwatches to aircraft and are designed to locate and receive signals from at least four satellites.<sup>3</sup> By timing how long it takes for each satellite signal to reach earth and calculating the distance between the satellite and the device, the receiver can calculate its precise position, including latitude, longitude, altitude, and velocity with high accuracy.<sup>4</sup>

The United States was the pioneer of satellite-based PNT capabilities through its development of the Global Positioning System (GPS). GPS was originally developed for military purposes and today still underpins American military power by enabling target location, missile guidance, naval and aircraft navigation, and self-location of land-based troops, all critical capabilities for facilitating joint operations in modern warfare.<sup>5</sup> GPS has since found numerous civilian applications as well. It is crucial to providing safe and coordinated navigation for commercial and civil transportation, including air, maritime, rail,

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<sup>1</sup> Steve Lambakis, *Foreign Space Capabilities: Implications for U.S. National Security*, Fairfax, VA: National Institute for Public Policy, September 2017, 8, available at [https://nipp.org/monographs\\_cpt/in-foreign-space-capabilities-implications-for-u-s-national-security/](https://nipp.org/monographs_cpt/in-foreign-space-capabilities-implications-for-u-s-national-security/).

<sup>2</sup> Irving Lachow, "The GPS Dilemma: Balancing Military Risks and Economic Benefits," *International Security* 20, no. 1 (1995): 126–48, available at <https://www.jstor.org/stable/2539220>, 128; U.S. Space Force, "Control Segment," GPS.gov, January 6, 2021, available at <https://www.gps.gov/systems/gps/control/>.

<sup>3</sup> Lachow, "The GPS Dilemma," 128; U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Alternative to GPS and Its Implications for the United States," staff research report by Jordan Wilson, 115<sup>th</sup> Cong., 1<sup>st</sup> sess., January 5, 2017, available at [https://www.uscc.gov/sites/default/files/Research/Staff%20Report\\_China%27s%20Alternative%20to%20GPS%20and%20Implications%20for%20the%20United%20States.pdf](https://www.uscc.gov/sites/default/files/Research/Staff%20Report_China%27s%20Alternative%20to%20GPS%20and%20Implications%20for%20the%20United%20States.pdf), 3.

<sup>4</sup> Lachow, "The GPS Dilemma," 128; U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Alternative to GPS," 3; Constantine, Roftiel, *GPS and Galileo: Friendly Foes?* Air University Press, 2008, 3–20, available at <http://www.jstor.org/stable/resrep13860.9>, 4.

<sup>5</sup> Lachow, "The GPS Dilemma," 134–5, 137; Constantine, *GPS and Galileo: Friendly Foes?* 4–5.



and road traffic.<sup>6</sup> It greatly facilitates mapping and surveying capabilities and enables efficient emergency management and disaster response, as well as public security functions such as monitoring and surveillance.<sup>7</sup> GPS facilitates precision agriculture, enabling greater crop yields by allowing farmers to monitor and manage site-specific variabilities across vast acreage.<sup>8</sup> GPS also makes possible the tracking and control of other types of satellites.<sup>9</sup> In addition, GPS's timing services are essential to ensuring time synchronization of financial transactions, communications networks, and computer systems globally.<sup>10</sup> GPS technology has also become pervasive in consumer smartphone applications and is playing an increasingly pivotal role in the growing e-commerce market.<sup>11</sup> Today, GPS application to this array of scientific, commercial, government, and consumer needs is now so seamlessly integrated into daily life that most users take such capabilities for granted. PNT use continues to expand: as of 2019, there were over 6 billion PNT receivers in use globally; by 2031, there are expected to be more than 10 billion.<sup>12</sup> Of note, the Asia-Pacific region is currently the largest market for PNT receivers and is expected to remain so through at least 2031.<sup>13</sup>

Through GPS, the United States is currently the global leader in providing satellite-based PNT capabilities.<sup>14</sup> Although the U.S. Government initially conceived, developed, and managed GPS as a military capability, it later offered GPS services free of charge globally to anyone with an appropriate receiver, and U.S. policy evolved accordingly to support the view of GPS as a "global utility."<sup>15</sup> GPS was the first system to achieve global coverage but has since

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<sup>6</sup> U.S. Space Force, "GPS Applications," GPS.gov, November 25, 2014, available at <https://www.gps.gov/applications/>.

<sup>7</sup> U.S. Space Force, "Public Safety and Disaster Relief," June 14, 2019, available at <https://www.gps.gov/applications/safety/>; European Union Agency for the Space Programme, *GNSS Market Report, Issue 6, 2019*, European Global Navigation Satellite Systems Agency, October 6, 2019, available at [https://www.euspa.europa.eu/system/files/reports/market\\_report\\_issue\\_6\\_v2.pdf](https://www.euspa.europa.eu/system/files/reports/market_report_issue_6_v2.pdf), 50.

<sup>8</sup> U.S. Space Force, "Agriculture," GPS.gov, March 6, 2018, available at <https://www.gps.gov/applications/agriculture/>; European Global Navigation Satellite Systems Agency, *Report on Agriculture User Needs and Requirements: Outcome of the European GNSS' User Consultation Platform*, July 1, 2019, available at [https://www.gsc-europa.eu/sites/default/files/sites/all/files/Report\\_on\\_User\\_Needs\\_and\\_Requirements\\_Agriculture.pdf](https://www.gsc-europa.eu/sites/default/files/sites/all/files/Report_on_User_Needs_and_Requirements_Agriculture.pdf), 8.

<sup>9</sup> U.S. Space Force, "Space," January 6, 2021, available at <https://www.gps.gov/applications/space/>.

<sup>10</sup> U.S. Space Force, "Timing," November 5, 2019, available at <https://www.gps.gov/applications/timing/>; Kohn, Ulrich, "Are multi-band GNSS receivers the key to 5G timing?" *Technically Speaking* (blog), ADVA, June 22, 2020, available at <https://www.blog.adva.com/en/are-multi-band-gnss-receivers-the-key-to-5g-timing>.

<sup>11</sup> European Union Agency for the Space Programme, *GNSS Market Report, Issue 6, 2019*, 50; Tracy Cozzens, "China adds to BeiDou as satnav service helps fight coronavirus," *GPS World*, March 10, 2020, available at <https://www.gpsworld.com/china-adds-to-beidou-as-satnav-service-helps-fight-coronavirus/>.

<sup>12</sup> European Union Agency for the Space Programme, *GNSS Market Report, Issue 6, 2019*, 6, 9, 10; European Union Agency for the Space Programme, *EUSPA EO and GNSS Market Report, Issue 1, 2022*, available at [https://www.gsc-europa.eu/sites/default/files/sites/all/files/EUSPA\\_Market\\_report\\_2022.pdf](https://www.gsc-europa.eu/sites/default/files/sites/all/files/EUSPA_Market_report_2022.pdf), 8, 20.

<sup>13</sup> European Union Agency for the Space Programme, *EUSPA EO and GNSS Market Report, Issue 1, 2022*, 20.

<sup>14</sup> Scott W. Beidleman, *GPS versus Galileo: Balancing for Position in Space*, Air University Press, 2006, 51–68, available at <http://www.jstor.org/stable/resrep13861.10>, 65–6; Clayton Cheney, "China's Digital Silk Road: Strategic Technological Competition and Exporting Political Illiberalism," *Issues and Insights Working Paper*, Vol. 19, WP8, Pacific Forum, July 2019, available at [https://pacforum.org/wp-content/uploads/2019/08/issuesinsights\\_Vol19-WP8FINAL.pdf](https://pacforum.org/wp-content/uploads/2019/08/issuesinsights_Vol19-WP8FINAL.pdf), 6.

<sup>15</sup> "U.S. Space-Based Positioning, Navigation, and Timing Policy: Fact Sheet," U.S. Space Force (GPS Major Policy Documents), December 15, 2004, available at <https://www.gps.gov/policy/docs/2004/>; Kasku-Jackson, Jonty, "Prohibiting

been joined by three other global navigation satellite systems (GNSS): the European Union's Galileo, Russia's Global Orbital Navigation Satellite System (GLONASS), and, most recently, China's BeiDou System. The United States at first regarded such systems as competitive with GPS but eventually chose a cooperative approach, seeking interoperability and compatibility between GPS and foreign GNSS.<sup>16</sup> Other GNSS operators have largely followed the U.S. example by making their own civilian signals available globally free of charge and by supporting interoperability and compatibility between systems.<sup>17</sup> Accordingly, receiver devices are now increasingly designed to receive signals not only from GPS but also from other GNSS in integrated fashion, with the aim of improving overall PNT availability and accuracy for users.<sup>18</sup>

However, as China enters the global PNT field with BeiDou, its own independent global system, a foreboding manifestation of geopolitical competition has begun to emerge. China has made BeiDou a key element of a larger, ambitious strategy to cultivate foreign dependencies and to project power throughout the Asia-Pacific region, and progressively around the globe, at the expense of the United States. As China pursues this course, a U.S. policy focused primarily on international cooperation appears increasingly outdated. If the United States seeks to retain the advantages afforded by its global PNT leadership, it must be willing to regard and to leverage GPS as a tool of national power.

### The Evolution of GPS Policy

In the 1960s, the U.S. Department of Defense (DOD) developed the world's first satellite navigation system, a five-satellite constellation called Transit, for the purpose of guiding Polaris submarines and ballistic missiles.<sup>19</sup> The project was so successful that DOD established a joint program office to develop a global positioning system (GPS) that could be used by all military services.<sup>20</sup> DOD launched the first test satellite in 1978 and continued to test and improve the system throughout the 1970s and 1980s.<sup>21</sup> The U.S. Government initially reserved GPS signals primarily for the U.S. military, but a tragedy prompted a change in policy. In August 1983, a Korean Airlines Flight on its way from Anchorage, Alaska, to

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Interference with Space-Based Position, Navigation, and Timing," *Strategic Studies Quarterly* 10, no. 4 (2016): 90–122, available at <http://www.jstor.org/stable/26271531>, 99.

<sup>16</sup> In historical GPS policy, compatibility refers to the ability of PNT signals and services "to be used separately or together without interfering with each individual service or signal, and without adversely affecting navigation warfare," whereas interoperability refers to the ability of PNT signals and services "to be used together to provide better capabilities at the user level than would be achieved by relying solely on one service or signal" (U.S. Space-Based Positioning, Navigation, and Timing Policy: Fact Sheet," available at <https://www.gps.gov/policy/docs/2004/>).

<sup>17</sup> Lambakis, *Foreign Space Capabilities*, 15.

<sup>18</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Alternative to GPS," 4.

<sup>19</sup> Constantine, *GPS and Galileo: Friendly Foes?* 3–4.

<sup>20</sup> Lachow, "The GPS Dilemma," 127.

<sup>21</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Alternative to GPS," 3.

Seoul, South Korea, unknowingly strayed off course into Soviet airspace.<sup>22</sup> The Soviets mistook the plane for an enemy spy plane and shot it down, killing all 269 people onboard.<sup>23</sup> To help ensure that such a calamity would never again occur, President Ronald Reagan announced that GPS signals would be made available for international civilian use once the system was fully operational in 1988.<sup>24</sup> President Reagan's decision set a precedent of treating GPS as a "global utility," a policy that the U.S. Government continues to observe to the current day and which has helped create an expectation that satellite navigation capabilities will be consistently available at little to no cost to all interested users.<sup>25</sup>

True to President Reagan's promise, DOD opened a GPS signal for global civilian use, and by 1995 GPS had achieved global coverage and was available free of charge to anyone with a receiver.<sup>26</sup> This led to a worldwide surge in demand for GPS-compatible receivers, and the commercial satellite navigation industry grew rapidly to meet the new demands of civil and recreational users.<sup>27</sup> However, fearing that foreign adversaries and terrorists might exploit the newly opened signal for nefarious purposes, DOD intentionally degraded the signal precision from about 20 meters to 100 meters.<sup>28</sup> This intentional degradation feature, called Selective Availability (SA), was an enduring feature of GPS for several years and proved to be a source of continual frustration to the growing civilian and commercial GPS user community.<sup>29</sup>

The United States demonstrated the revolutionary "war winner" advantages of PNT during Operation Desert Storm in 1991.<sup>30</sup> Soon thereafter, the U.S. military pioneered Navigation Warfare (NAVWAR), leveraging GPS for its own and its allies' military operations while denying enemy use of GPS during conflicts.<sup>31</sup> All the while, the United States'

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<sup>22</sup> Asaf Degani, "The Crash of Korean Air Lines Flight 007," in *Taming HAL*, New York: Palgrave Macmillan, 2004, available at <https://ti.arc.nasa.gov/m/profile/adegani/Crash%20of%20Korean%20Air%20Lines%20Flight%20007.pdf>, 50, 52.

<sup>23</sup> Sarah Laskow, "The Plane Crash That Gave Americans GPS," *The Atlantic*, November 3, 2014, available at <https://www.theatlantic.com/technology/archive/2014/11/the-plane-crash-that-gave-americans-gps/382204/>.

<sup>24</sup> Lachow, "The GPS Dilemma," 127; Larry M. Speakes, "Statement by Deputy Press Secretary Speakes on the Soviet Attack on a Korean Civilian Airliner," Ronald Reagan Presidential Library and Museum Archives, September 16, 1983, available at <https://www.reaganlibrary.gov/archives/speech/statement-deputy-press-secretary-speakes-soviet-attack-korean-civilian-airliner-1>.

<sup>25</sup> "U.S. Space-Based Positioning, Navigation, and Timing Policy: Fact Sheet," December 15, 2004; Kasku-Jackson, "Prohibiting Interference with Space-Based Position, Navigation, and Timing," 99.

<sup>26</sup> Constantine, *GPS and Galileo: Friendly Foes?* 4; U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Alternative to GPS," 3; Mariel Borowitz, "An Interoperable Information Umbrella: Sharing Space Information Technology," *Strategic Studies Quarterly* 15, no. 1 (2021): 116–32, available at <https://www.jstor.org/stable/26984770>, 121; Lachow, "The GPS Dilemma," 127, 130.

<sup>27</sup> Scott Pace, Gerald P. Frost, Irving Lachow, David R. Frelinger, Donna Fossum, Don Wasseem, and Monica M. Pinto, *The Global Positioning System: Assessing National Policies*, Santa Monica, CA: RAND Corporation, 1995, available at [https://www.rand.org/pubs/monograph\\_reports/MR614.html](https://www.rand.org/pubs/monograph_reports/MR614.html), 2; Lachow, "The GPS Dilemma," 127, 130.

<sup>28</sup> Lachow, "The GPS Dilemma," 126, 128–9.

<sup>29</sup> Lachow, "The GPS Dilemma," 128; Constantine, *GPS and Galileo: Friendly Foes?* 6–7.

<sup>30</sup> Constantine, *GPS and Galileo: Friendly Foes?* 5–6; Lachow, "The GPS Dilemma," 133.

<sup>31</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 52.

technological leadership enabled it to promote GPS as the global PNT standard.<sup>32</sup> Other countries took note of the military and political advantages as well as the growing economic benefits afforded to the United States through GPS.<sup>33</sup>

Civilian demand for GPS quickly began to surpass military demand, and U.S. policy accordingly grew more oriented to its new civilian “customer” base.<sup>34</sup> With the end of the Cold War in the early 1990s, the Administration of President Bill Clinton was eager to move the U.S. Government beyond its predominating focus on military and defense spending.<sup>35</sup> As he sought to shift federal spending away from defense programs, President Clinton also aimed to reinvigorate the American economy by leveraging the burgeoning “Information Technology Revolution.”<sup>36</sup> He therefore pursued policies promoting broad access to the Internet and other computer-related technology.<sup>37</sup> President Clinton also negotiated a number of global trade agreements supporting the globalization of information technology with the goal of integrating the United States more deeply into the global economy.<sup>38</sup> Within this policy context, the Clinton Administration adopted a distinct view of GPS, like the Internet, as a global commodity in the service of the international community. In 1998, Vice President Al Gore announced the addition of a second worldwide civil signal to GPS, hailing it as “a major step in the evolution of GPS as a *global information utility*.”<sup>39</sup> He explained that “GPS is becoming increasingly indispensable for navigation, positioning, and timing by users around the world. Also like the Internet, GPS has become an engine of economic growth and efficiency as businesses and consumers continue to develop new and creative applications of this technology.”<sup>40</sup> He then reiterated the United States’ commitment to providing GPS globally, “free of charge to consumers, businesses, and scientists around the world. We will continue to do everything we can to protect these GPS signals and to promote GPS applications for commercial, public safety, and national security purposes.”<sup>41</sup>

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<sup>32</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 55; Lachow, “The GPS Dilemma,” 141–2; Office of Science and Technology Policy, National Security Council, “Fact Sheet: U.S. Global Positioning System Policy,” Clinton White House Archives, March 29, 1996, available at <https://clintonwhitehouse2.archives.gov/WH/EOP/OSTP/html/gps-factsheet.html>.

<sup>33</sup> Constantine, *GPS and Galileo: Friendly Foes?* 14; Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 54–5.

<sup>34</sup> Constantine, *GPS and Galileo: Friendly Foes?* 7.

<sup>35</sup> Clinton White House Archives, “The Clinton Presidency: Unleashing the New Economy — Expanding Access to Technology,” *The Clinton-Gore Administration: A Record of Progress*, available at <https://clintonwhitehouse5.archives.gov/WH/Accomplishments/eightyears-09.html>; Clinton White House Archives, “The Clinton Presidency: Historic Economic Growth,” *The Clinton-Gore Administration: A Record of Progress*, available at <https://clintonwhitehouse5.archives.gov/WH/Accomplishments/eightyears-03.html>.

<sup>36</sup> *Ibid.*

<sup>37</sup> *Ibid.*

<sup>38</sup> *Ibid.*

<sup>39</sup> Office of the Vice President, “Vice President Gore Announces Enhancements to the Global Positioning System that Will Benefit Civilian Users Worldwide,” Clinton White House Archives, March 30, 1998, available at <https://clintonwhitehouse6.archives.gov/1998/03/1998-03-30-vp-announces-second-civilian-signal.html>, emphasis added.

<sup>40</sup> *Ibid.*

<sup>41</sup> *Ibid.*

The balance in U.S. policy continued to shift in favor of civilian and global demands throughout the Clinton Administration. The chorus of complaints about the SA degradation feature continued to swell and soon included the U.S. Government's own civilian agencies, such as the Department of Transportation and the Federal Aviation Administration, which demanded increasingly precise GPS capabilities for their operations.<sup>42</sup> In recognition of the growing importance of GPS for civil, commercial, and scientific purposes, President Clinton announced that the SA feature would be discontinued by 2006 in order to "[e]ncourage acceptance and integration of GPS into peaceful civil, commercial and scientific applications worldwide" and to "[p]romote international cooperation in using GPS for peaceful purposes."<sup>43</sup> In keeping with a global utility perspective, President Clinton's announcement also emphasized that the United States would continue to offer GPS services worldwide without charge.<sup>44</sup>

### The Rise of Competing Global Navigation Satellite Systems

Despite the purported global benefits of the U.S. commitment to underwriting satellite navigation for the rest of the world, some countries felt at a strategic disadvantage in depending on GPS for their own military and civil uses.<sup>45</sup> In the 1980s, the Soviet Union pursued the development of an alternative GNSS, called GLONASS, for military use.<sup>46</sup> (GLONASS was made available for civilian use in 2007 and did not include a degradation feature like the GPS SA, making it attractive to some civilian users as an alternative to GPS.<sup>47</sup>) Then in 1999, the European Union (EU) announced plans to develop its own global PNT system, Galileo.<sup>48</sup> The EU's primary objective was to safeguard European sovereignty by avoiding dependence on the "non-civilian" GPS and GLONASS systems.<sup>49</sup> Galileo also promised greater accuracy and better coverage at higher latitudes than GPS and boasted the distinction of being the only satellite navigation system designed specifically for civilian application and controlled by civil authorities.<sup>50</sup>

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<sup>42</sup> Constantine, *GPS and Galileo: Friendly Foes?* 6.

<sup>43</sup> Office of Science and Technology Policy, "Fact Sheet: U.S. Global Positioning System Policy."

<sup>44</sup> Office of Science and Technology Policy, "Fact Sheet: U.S. Global Positioning System Policy"; Constantine, *GPS and Galileo: Friendly Foes?* 6.

<sup>45</sup> Lachow, "The GPS Dilemma," 141–2.

<sup>46</sup> European Space Agency, "GLONASS General Introduction," 2011, available at [https://gssc.esa.int/navipedia/index.php/GLONASS\\_General\\_Introduction](https://gssc.esa.int/navipedia/index.php/GLONASS_General_Introduction).

<sup>47</sup> Lachow, "The GPS Dilemma," 139; European Union Agency for the Space Programme, "What is Galileo?" YouTube video, 1:36, December 11, 2017, available at <https://www.euspa.europa.eu/european-space/galileo/faq#GAL>; European Space Agency, "GLONASS General Introduction."

<sup>48</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 60.

<sup>49</sup> European Union Agency for the Space Programme, "What is Galileo?"

<sup>50</sup> European Union Agency for the Space Programme, "Is Galileo the Same as GPS?" YouTube video, 0:39, June 18, 2019, available at <https://www.youtube.com/watch?v=4mrV-aEurY8&list=PLoW55g8cihhJH9Gu-CSBMZSKYl4sSD7Ly&index=7>; European Union Agency for the Space Programme, "What is the added value of Galileo

The United States was initially skeptical that Galileo would survive EU bureaucratic hurdles, but once the program secured authorization and funding in 2002, U.S. policymakers quickly realized that Galileo was poised to become a peer competitor of GPS.<sup>51</sup> Galileo planned to use the same frequency range as GPS, complicating U.S. options for controlling and jamming GPS signals in potential conflicts.<sup>52</sup> U.S. leaders also fretted that the European Union would establish standards that were incompatible with GPS and successfully draw away GPS customers, threatening to end the U.S. monopoly over both the satellite navigation market and international PNT standards.<sup>53</sup> The EU's program quickly attracted investment interest from several countries, including China, India, South Korea, Israel, and Canada, portending a huge user market for Galileo beyond the EU and threatening to undermine the multi-billion dollar investment the United States had already made in GPS.<sup>54</sup> U.S. policymakers also worried that the European Union would one day require, by law, the use of Galileo in certain regions.<sup>55</sup>

Reacting to this development, the Clinton Administration turned off the GPS SA degradation feature in 2000, six years ahead of schedule, to demonstrate responsiveness to GPS's non-military users and to diminish the incentives driving the EU and Russian GNSS projects.<sup>56</sup> DOD also accelerated its GPS modernization schedule in order to improve accuracy.<sup>57</sup> On the diplomatic front, American officials openly resisted the development of Galileo. Once President George W. Bush entered office, Bush Administration officials complained to European leaders about the potential interference Galileo posed to GPS signals.<sup>58</sup> But European officials, wary of the potential "vassal status" (in the words of French President Jacques Chirac) of depending on the U.S. military for satellite navigation, continued to pursue the program.<sup>59</sup>

Once it was clear that Galileo would proceed despite objections from Washington, U.S. policymakers determined that the best course of action was to focus not on competing with Galileo but rather on making GPS compatible and interoperable with Galileo and other foreign PNT systems.<sup>60</sup> The head of the U.S. delegation charged with negotiating the future relationship between GPS and Galileo compared satellite navigation, as Vice President Gore

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with respect to other GNSS?" updated May 21, 2021, available at <https://www.euspa.europa.eu/european-space/galileo/faq#value>.

<sup>51</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 59, 60.

<sup>52</sup> *Ibid.*, 54.

<sup>53</sup> *Ibid.*, 55–56.

<sup>54</sup> *Ibid.*, 54–55, 58–59.

<sup>55</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 56; Erwin, Sandra I., "Europe's Galileo Plans to Challenge U.S. GPS Dominance," *National Defense*, June 1, 2000, available at <https://www.nationaldefensemagazine.org/articles/2000/6/1/2000june-europes-galileo-plans-to-challenge-us-gps-dominance>.

<sup>56</sup> Constantine, *GPS and Galileo: Friendly Foes?* 7.

<sup>57</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 59.

<sup>58</sup> Borowitz, "An Interoperable Information Umbrella," 122.

<sup>59</sup> *Ibid.*

<sup>60</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 60.

had done in 1998, to the Internet, arguing that it “would make no more sense to have two disconnected, non-interoperable and exclusionary global navigation systems ... than it would to have two Internets.”<sup>61</sup>

Therefore, the United States and EU signed a “historic agreement” in June 2004 to establish a “framework of cooperation ... in the promotion, provision and use of civil GPS and GALILEO navigation and timing signals and services, value-added services, augmentations, and global navigation and timing goods,” and “to work together, both bilaterally and in multilateral fora ... to promote and facilitate the use of these signals, services, and equipment for peaceful civil, commercial, and scientific uses, consistent with and in furtherance of mutual security interests.”<sup>62</sup> In December of the same year, the United States and Russia formally committed to cooperate in PNT matters and announced their intent to establish joint working groups for this purpose.<sup>63</sup> Only a few days later, President Bush issued a new policy specifically to provide guidance to the U.S. Government in navigating the new multi-GNSS environment. This 2004 policy re-emphasized the view of GPS as a “global utility” and a critical element of the globalized economy, and affirmed the intent to keep it so.<sup>64</sup> It acknowledged the advent of new foreign PNT systems and acknowledged that U.S. policy would need to adapt to this reality.<sup>65</sup> Therefore, it stated as an explicit goal to “encourage foreign development of positioning, navigation, and timing services and systems based on the Global Positioning System,” and to seek interoperability and compatibility between GPS and foreign systems.<sup>66</sup> Thus, President Bush fully enshrined in GPS policy the principle of international cooperation and the primacy of cooperation over competition, further establishing the U.S. view of satellite navigation as a global utility.

### **China’s BeiDou System**

The U.S. emphasis on foreign PNT cooperation created a friendly and timely international GNSS environment for China, which had initiated its own PNT program, called Compass, in 1994.<sup>67</sup> The Compass program became a higher priority for Beijing after the Taiwan Strait Crisis of 1995–1996, when China’s GPS-dependent missile guidance system temporarily lost

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<sup>61</sup> *Ibid.*, 61.

<sup>62</sup> “Agreement on the Promotion, Provision and Use of Galileo and GPS Satellite-Based Navigation Systems and Related Applications,” conclusion date: June 26, 2004, GPS.gov, available at <https://www.gps.gov/policy/cooperation/europe/2004/gps-galileo-agreement.pdf>, 6; U.S. Space-Based Positioning, Navigation, and Timing National Executive Committee, “GPS and Galileo...Progress Through Partnership,” fact sheet, 2007, available at <https://www.gps.gov/policy/cooperation/europe/2007/gps-galileo-fact-sheet.pdf>.

<sup>63</sup> “Joint Statement on the U.S. Global Positioning System (GPS) and the Russian Global Navigation Satellite System (GLONASS),” GPS.gov, December 10, 2004, available at <https://www.gps.gov/policy/cooperation/russia/2004-joint-statement/>.

<sup>64</sup> “U.S. Space-Based Positioning, Navigation, and Timing Policy: Fact Sheet,” December 15, 2004.

<sup>65</sup> *Ibid.*

<sup>66</sup> *Ibid.*

<sup>67</sup> U.S. Congress, House of Representatives, Foreign Affairs Committee, Republicans, “China Regional Snapshot: Space,” 117<sup>th</sup> Cong., 1<sup>st</sup> sess., last updated March 16, 2021, available at <https://gop-foreignaffairs.house.gov/china-regional-snapshot-space/>.



the ability to track and direct its own missiles.<sup>68</sup> This “unforgettable humiliation,” purportedly caused by a U.S. NAVWAR operation, strengthened Beijing’s resolve to develop its own satellite navigation system so that it would never have to depend again on a foreign system.<sup>69</sup> China went on to launch its first experimental navigation satellites in 2000.<sup>70</sup> Foreign observers initially assumed that China was developing Compass only to enhance military capabilities, but in 2006 China announced that it would make Compass available for commercial use starting in 2008.<sup>71</sup> In 2012, after several additional satellite launches, China completed the regional version of what it renamed the BeiDou (Big Dipper) Navigation Satellite System (BDS), providing PNT coverage to all of China and much of the Asia-Pacific region.<sup>72</sup> China quickly proceeded to next-generation development of the system and in August 2020 placed its final satellite into orbit to complete its global coverage.<sup>73</sup> BDS’s current constellation of more than 40 satellites is larger than GPS’s 31, and offers greater accuracy than GPS in many regions of the world.<sup>74</sup> As of the launching of the final satellite in 2020, BDS already claimed 400 million users across 120 countries.<sup>75</sup>

In 2006, soon after President Bush chose to emphasize foreign cooperation in GPS policy, the United States entered into discussions with China on potential cooperation between GPS and BDS.<sup>76</sup> This was followed in 2014 by a joint statement between Washington and Beijing

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<sup>68</sup> Lambakis, *Foreign Space Capabilities*,” 20; Anthony H. Cordesman and Joseph Kendall, *Chinese Strategy and Military Modernization in 2016: A Comparative Analysis*, Center for Strategic and International Studies, 2016, available at [https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/161208\\_Chinese\\_Strategy\\_Military\\_Modernization\\_2016.pdf](https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/161208_Chinese_Strategy_Military_Modernization_2016.pdf), 502–3.

<sup>69</sup> Lambakis, *Foreign Space Capabilities*,” 20; Cordesman and Kendall, *Chinese Strategy and Military Modernization in 2016*, 502–3.

<sup>70</sup> Andrew Jones, “China Launches Beidou, Its Own Version of GPS,” *IEEE Spectrum*, August 12, 2020, available at <https://spectrum.ieee.org/tech-talk/aerospace/satellites/final-piece-of-chinas-beidou-navigation-satellite-system-comes-online>; United Nations Office for Outer Space Affairs, “International Committee on Global Navigation Satellite Systems: The Way Forward: 10 Years of Achievement, 2005–2015,” New York: United Nations, 2016, available at [http://www.unoosa.org/res/oosadoc/data/documents/2016/stspace/stspace67\\_0\\_html/st\\_space\\_67E.pdf](http://www.unoosa.org/res/oosadoc/data/documents/2016/stspace/stspace67_0_html/st_space_67E.pdf), 39.

<sup>71</sup> Constantine, *GPS and Galileo: Friendly Foes?* 18.

<sup>72</sup> United Nations Office for Outer Space Affairs, “International Committee on Global Navigation Satellite Systems,” 39; Jones, “China Launches Beidou, Its Own Version of GPS.”

<sup>73</sup> Jones, “China Launches Beidou, Its Own Version of GPS”; Ghiasy, Richard and Rajeshwari Krishnamurthy, *China’s Digital Silk Road: Strategic Implications for the EU and India*, Institute of Peace and Conflict Studies and Leiden Asia Centre, August 2020, available at [http://ipcs.org/issue\\_briefs/issue\\_brief\\_pdf/sr208\\_august2020\\_china’s%20digital%20silk%20road-strategic%20implications%20for%20the%20eu%20and%20india\\_final.pdf](http://ipcs.org/issue_briefs/issue_brief_pdf/sr208_august2020_china’s%20digital%20silk%20road-strategic%20implications%20for%20the%20eu%20and%20india_final.pdf), 6.

<sup>74</sup> Ryan Woo, “China set to complete Beidou network rivalling GPS in global navigation,” *Reuters*, June 11, 2020, available at <https://www.reuters.com/article/us-space-exploration-china-satellite-idUSKBN23J0I9>; U.S. Space Force, “Space Segment,” GPS.gov, March 16, 2021, available at <https://www.gps.gov/systems/gps/space/>; Sabena Siddiqui, “BRI, BeiDou and the Digital Silk Road,” *Asia Times*, April 10, 2019, available at <https://asiatimes.com/2019/04/bri-beidou-and-the-digital-silk-road/>; C. Raja Mohan, “Raja Mandala: A Silk Road for the Heavens,” *Carnegie India*, April 23, 2019, available at <https://carnegieindia.org/2019/04/23/raja-mandala-silk-road-for-heavens-pub-78966>.

<sup>75</sup> Jonathan E. Hillman, “China and Russia: Economic Unequals,” Center for Strategic and International Studies, July 15, 2020, available at <https://www.csis.org/analysis/china-and-russia-economic-unequals>.

<sup>76</sup> “Joint Statement: U.S.-China Civil Global Navigation Satellite Systems (GNSS) Cooperation,” GPS.gov, May 19, 2014, available at <https://www.gps.gov/policy/cooperation/china/2014-joint-statement/>.

committing to cooperation in PNT.<sup>77</sup> For its part, since opening BDS to civilian use, China has adopted a public posture of foreign cooperation, highlighting its bilateral and multilateral engagements on satellite navigation and espousing the principles of interoperability and compatibility.<sup>78</sup> Following the U.S. example, China has also sought to publicly depict satellite navigation as a global utility, describing BDS as “developed by China, dedicated to the world.”<sup>79</sup> In late 2019, the chief BDS architect portrayed BDS as a special Chinese gift to other nations, saying, “China’s BDS will contribute Chinese solutions to the world, and give full play of its role, with a renewed attitude, stronger capabilities and better services, to serve the world and benefit humankind.”<sup>80</sup>

### BeiDou and Beijing’s Quest for Global Influence

While China appears to be following the same globally minded path that the United States blazed, the underlying political philosophies of the Chinese Communist Party drive a very different approach to foreign policy than America’s.<sup>81</sup> Michael Mazarr and Ali Wyne describe such distinctive foreign policy approaches as “theories of influence” and capably highlight the contrast between the respective theories of influence that animate U.S. Government and Chinese Communist Party behavior.<sup>82</sup> On the one hand, the United States generally seeks to exercise power in foreign affairs in a way that also allows other nations to advance their own interests, thereby incentivizing support for the United States’ leadership.<sup>83</sup> This approach helped give rise to the U.S.-led liberal international order characterized by free market practices and multilateral governing institutions, an order that has permitted participating states to more or less pursue their own interests.<sup>84</sup> On the other hand, China’s Communist

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<sup>77</sup> Ibid.

<sup>78</sup> People’s Republic of China, BeiDou Navigation Satellite System, “System,” available at <http://en.beidou.gov.cn/SYSTEMS/System/>; U.S. Congress, U.S.-China Economic and Security Review Commission, “China’s Alternative to GPS,” 4–5; Jana Robinson, Patrik Martínek, Jakub Prazák, and Kristína Sikoraiová, “China Deploys BeiDou to Project Power and Influence,” *PSSI Perspectives—8, Space Security Program*, Prague Security Studies Institute, March 2021, available at [https://www.pssi.cz/download/docs/8505\\_08-pssi-perspectives-china-deploys-beidou-to-project-power-and-influence-3.pdf](https://www.pssi.cz/download/docs/8505_08-pssi-perspectives-china-deploys-beidou-to-project-power-and-influence-3.pdf), 2; Lu, Xiaochun, “Update on BeiDou Navigation Satellite System and PNT System,” lecture, Stanford 2019 PNT Symposium, National Time Service Center, Chinese Academy of Sciences, October 30, 2019, available at [http://web.stanford.edu/group/scpnt/pnt/PNT19/presentation\\_files/I10-Lu-Beidou\\_PNT\\_Update.pdf](http://web.stanford.edu/group/scpnt/pnt/PNT19/presentation_files/I10-Lu-Beidou_PNT_Update.pdf), 36–7.

<sup>79</sup> Changfeng Yang, “Directions 2020: BeiDou in the new era of globalization,” *GPS World*, December 13, 2019, available at <https://www.gpsworld.com/directions-2020-beidou-in-the-new-era-of-globalization/>; People’s Republic of China, BeiDou Navigation Satellite System, “System.”

<sup>80</sup> Yang, “Directions 2020: BeiDou in the new era of globalization.”

<sup>81</sup> Ibid.

<sup>82</sup> Michael J. Mazarr and Ali Wyne, “The Real U.S.-China Competition: Theories of Influence,” *The RAND Blog*, Santa Monica, CA: Rand Corporation, January 29, 2020, available at <https://www.rand.org/blog/2020/01/the-real-us-china-competition-theories-of-influence.html>.

<sup>83</sup> Mazarr and Wyne, “The Real U.S.-China Competition: Theories of Influence”; U.S. Congress, U.S.-China Economic and Security Review Commission, “The Chinese Communist Party’s Economic Challenge to the Free World,” testimony by Miles Yu, 117<sup>th</sup> Cong., 1<sup>st</sup> sess., April 15, 2021, available at [https://www.uscc.gov/sites/default/files/2021-04/Miles\\_Yu\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2021-04/Miles_Yu_Testimony.pdf), 3.

<sup>84</sup> Mazarr and Wyne, “The Real U.S.-China Competition: Theories of Influence.”

government follows a strongly authoritarian agenda that ultimately seeks deeply hierarchical and transactional relationships with the aim of constraining the choices of other countries for its own advantage.<sup>85</sup> At one time, the United States had high hopes that China would adopt a more liberal political model as it integrated into the global economy. Since the 1970s when Deng Xiaoping pursued economic reforms and greater Chinese participation in the international community, China has become one of the world's top economic and technological powers; yet, contrary to U.S. optimism, China's integration into the global economy has not been accompanied by domestic political liberalization.<sup>86</sup> Rather, China kept its authoritarian system and, as its power grew, developed its own global ambitions.<sup>87</sup> The 2008 global financial crisis, which China survived comparatively unscathed, accelerated its rise as a great power relative to the United States and other Western countries.<sup>88</sup> China's current leader, Xi Jinping, is now pursuing a heavily nationalist policy aimed at securing China's global preeminence by 2049.<sup>89</sup> Ultimately, this policy seeks the "Chinese Dream" of recovering the historical territories and national prestige that China lost to foreign powers during the period from the mid-19<sup>th</sup> to mid-20<sup>th</sup> centuries, which the Chinese refer to as the "Century of Humiliation."<sup>90</sup> As China pursues its vision for global preeminence, its distinct model of foreign influence has led it to pursue a strategy of "offensive decoupling" in which China aggressively eschews any type of foreign dependency for itself while cultivating relationships with other countries in a way that ensures susceptibility to Chinese tools of power.<sup>91</sup> Hence, as explained by Dr. Miles Yu, an expert in Chinese diplomatic and military

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<sup>85</sup> Ibid.

<sup>86</sup> Henry Kissinger, *World Order*, New York: Penguin Books, 2014, 225; Malik, Mohan, "Xi's Reforms and the U.S.-China Relationship," Ilan Berman and Rich Harrison, eds., *Defense Dossier, Issue 17*, American Foreign Policy Council, August 2016, available at <https://www.afpc.org/publications/e-journals/understanding-implications-of-xis-new-policies>, 20; U.S. Congress, U.S.-China Economic and Security Review Commission, "The Chinese Communist Party's Economic Challenge to the Free World," testimony by Miles Yu, 3; Michael Mandelbaum, *The Rise and Fall of Peace on Earth*, New York: Oxford University Press, 2019, 55.

<sup>87</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, "The Chinese Communist Party's Economic Challenge to the Free World," testimony by Miles Yu, 3.

<sup>88</sup> Mandelbaum, *The Rise and Fall of Peace on Earth*, 70; U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on "The Chinese View of Strategic Competition with the United States," testimony by John Pomfret, 116<sup>th</sup> Cong., 2<sup>nd</sup> sess., June 24, 2020, available at [https://www.uscc.gov/sites/default/files/2020-06/Pomfret\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2020-06/Pomfret_Testimony.pdf), 2.

<sup>89</sup> Patricia Kim, "Understanding China's Military Expansion," Pacific Council on International Policy, September 19, 2019, available at <https://www.pacificcouncil.org/newsroom/understanding-china's-military-expansion>; Mandelbaum, *The Rise and Fall of Peace on Earth*, 71.

<sup>90</sup> Jeff M. Smith, "The Region Seeks Balance," Ilan Berman and Rich Harrison, eds., *Defense Dossier, Issue 17*, American Foreign Policy Council, August 2016, available at <https://www.afpc.org/publications/e-journals/understanding-implications-of-xis-new-policies>, 15; Mandelbaum, *The Rise and Fall of Peace on Earth*, 56, 62, 71.

<sup>91</sup> Mazarr and Wyne, "The Real U.S.-China Competition: Theories of Influence"; U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on "An Assessment of the CCP's Economic Ambitions, Plans, and Metrics of Success," testimony by Matt Pottinger, 117<sup>th</sup> Cong., 1<sup>st</sup> sess., April 15, 2021, available at [https://www.uscc.gov/sites/default/files/2021-04/Matt\\_Pottinger\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2021-04/Matt_Pottinger_Testimony.pdf), 1; U.S. Congress, U.S.-China Economic and Security Review Commission, "The Chinese Communist Party's Economic Challenge to the Free World," testimony by Miles Yu, 1.

history and strategic culture, the guiding principle of Chinese Communist leaders in foreign affairs remains that of a zero-sum game: “You die, I live.”<sup>92</sup>

This abiding principle is especially true of China’s relationship with the United States. China’s imitating of the cooperative model and message that the United States pioneered belies Beijing’s view that China is in fierce competition with the United States.<sup>93</sup> One way Beijing competes with Washington is by pursuing an “opportunistic” foreign policy, “finding and filling in voids where other countries have failed to step forward.”<sup>94</sup> Hence, Beijing seeks to expand its foreign influence at the expense of the United States by offering needed financing, technology, and expertise to vulnerable countries throughout Asia, Africa, the Middle East, and Latin America—countries where resources are limited but populations are growing and economic demand is great.<sup>95</sup>

This approach to foreign policy makes the rise of BDS a cause for concern rather than a reason for celebration. Beijing views space-based assets and other advanced technologies as key tools of competition in the modern technological age and, accordingly, has given tools such as the newly global BDS a central place in its strategy to decouple itself from U.S. technologies and influence.<sup>96</sup> Furthermore, China is leveraging BDS and other digital tools to create distance between other countries and the United States and, in doing so, to position

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<sup>92</sup> Translation of oft-repeated Chinese principle *nisiwohuo*, translated by Dr. Miles Yu in U.S. Congress, U.S.-China Economic and Security Review Commission, “The Chinese Communist Party’s Economic Challenge to the Free World,” testimony by Miles Yu, 4; Hudson Institute, “Miles Yu, Senior Fellow,” available at <https://www.hudson.org/experts/1356-miles-yu>.

<sup>93</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “The Chinese View of Strategic Competition with the United States,” testimony by Alison A. Kaufman, 116<sup>th</sup> Cong., 2<sup>nd</sup> sess., June 24, 2020, available at [https://www.uscc.gov/sites/default/files/2020-06/Kaufman\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2020-06/Kaufman_Testimony.pdf), 7.

<sup>94</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “The Chinese View of Strategic Competition with the United States,” testimony by Alison A. Kaufman, 7–8.

<sup>95</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “The Chinese View of Strategic Competition with the United States,” testimony by Alison A. Kaufman, 7–8; U.S. Congress, U.S.-China Economic and Security Review Commission, “China’s Smart Cities Development,” research report by Katherine Atha, Jason Callahan, John Chen, Jessica Drun, Ed Francis, Kieran Green, Dr. Brian Lafferty, Joe McReynolds, Dr. James Mulvenon, Benjamin Rosen, and Emily Walz, 116<sup>th</sup> Cong., 2<sup>nd</sup> sess., January 2020, available at [https://www.uscc.gov/sites/default/files/China\\_Smart\\_Cities\\_Development.pdf](https://www.uscc.gov/sites/default/files/China_Smart_Cities_Development.pdf), 3; Hillman, Jonathan E., “Competing with China’s Digital Silk Road,” February 9, 2021, available at <https://www.csis.org/analysis/competing-chinas-digital-silk-road>; Goswami, Namrata, “The Economic and Military Impact of China’s BeiDou Navigation System,” *The Diplomat*, July 1, 2020, available at <https://thediplomat.com/2020/07/the-economic-and-military-impact-of-chinas-beidou-navigation-system/>.

<sup>96</sup> Elsa B. Kania, “China Has a ‘Space Force.’ What Are Its Lessons for the Pentagon?” *Defense One*, September 29, 2018, available at <https://www.defenseone.com/ideas/2018/09/china-has-space-force-what-are-its-lessons-pentagon/151665/>; Robinson et al., “China Deploys Beidou to Project Power and Influence,” 2; U.S. Congress, U.S.-China Economic and Security Review Commission, “China’s Pursuit of Space Power Status and Implications for the United States,” staff research report by Alexander Bowe, 116<sup>th</sup> Cong., 1<sup>st</sup> sess., April 11, 2019, available at [https://www.uscc.gov/sites/default/files/Research/USCC\\_China's%20Space%20Power%20Goals.pdf](https://www.uscc.gov/sites/default/files/Research/USCC_China's%20Space%20Power%20Goals.pdf), 3; U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “A Net Assessment of CCP’s Economic Ambitions, Plans and Metrics of Success,” Panel I: “The Chinese Communist Party’s Economic Ambitions: Is the Past Prologue?” statement by Loren Brandt, 117<sup>th</sup> Cong., 1<sup>st</sup> sess., April 15, 2021, available at [https://www.uscc.gov/sites/default/files/2021-04/Loren\\_Brandt\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2021-04/Loren_Brandt_Testimony.pdf), 1–2; Cheney, “China’s Digital Silk Road: Strategic Technological Competition and Exporting Political Illiberalism,” 6.

them for “recoupling” to Beijing on its own terms.<sup>97</sup> BDS, therefore, is poised to be a key tool in China’s quest to displace U.S. influence and to cultivate a network of digital vassal states through which the Chinese Communist Party can more freely advance its authoritarian agenda.

### BeiDou’s Place in the Belt and Road Initiative

One of the key strategies for achieving Xi’s “Chinese Dream” is China’s ambitious “Belt and Road Initiative” (BRI), an expansive, technology-powered version of China’s ancient “Silk Road.”<sup>98</sup> The BRI aims to create economic and political connections and partnerships around the world through Chinese investment in massive infrastructure projects such as ports, roads, and railways.<sup>99</sup> Since the BRI’s launch in 2013, China has attracted interest in the BRI from over 140 countries, representing over 60% of the world’s population and 40% of global gross domestic product, securing strategic footholds in Asia, Africa, and South America.<sup>100</sup> The BRI has exhibited a troubling pattern of cultivating foreign dependency on China. China tends to offer enormous loans to developing countries to finance BRI construction projects, but the projects are not always completed, and those that are completed do not always produce the revenue needed to pay the debt.<sup>101</sup> Several BRI countries across Asia, Africa, and the Middle East are therefore now at risk of debt distress.<sup>102</sup> In some cases, China uses its position as creditor to acquire greater direct control over strategic infrastructure, as it did in Sri Lanka by securing a 99-year lease to Hambantota Port in exchange for debt relief.<sup>103</sup> Some analysts now suspect that the BRI is really a wide-reaching attempt by Beijing to cultivate coercive leverage over much of the developing world, to secure access to strategic

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<sup>97</sup> Robinson et al., “China Deploys Beidou to Project Power and Influence,” 2; Ghiasy and Krishnamurthy, *China’s Digital Silk Road: Strategic Implications*, 5; U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “A Net Assessment of CCP’s Economic Ambitions, Plans and Metrics of Success,” statement by Loren Brandt, 1–2.

<sup>98</sup> U.S. Library of Congress, Congressional Research Service, “China’s ‘One Belt, One Road’ Initiative: Economic Issues,” by Karen Sutter, Andres B. Schwarzenberg, and Michael D. Sutherland, January 22, 2021, available at <https://crsreports.congress.gov/product/pdf/IF/IF11735>, 1.

<sup>99</sup> Ibid.

<sup>100</sup> James McBride, Noah Berman, and Andrew Chatzky, “China’s Massive Belt and Road Initiative,” Council on Foreign Relations, last updated February 2, 2023, available at <https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative>.

<sup>101</sup> Jeff M. Smith, “China’s Belt and Road Initiative: Strategic Implications and International Opposition,” *Backgrounder No. 3331*, Heritage Foundation, August 9, 2018, available at [https://www.heritage.org/sites/default/files/2018-08/BG3331\\_2.pdf](https://www.heritage.org/sites/default/files/2018-08/BG3331_2.pdf), 13–15; Patrick Mendis and Joey Wang, “Unveiling China’s Grand Plan,” *Harvard International Review*, Vol. 40, No. 3, *Mind the Gap: The Interplay of Transportation and Inequality* (Summer 2019), pp. 36–39, available at <https://www.jstor.org/stable/10.2307/26917253>, 38.

<sup>102</sup> Smith, “China’s Belt and Road Initiative,” 13–15; John Hurley, Scott Morris, and Gailyn Portelance, “Examining the Debt Implications of the Belt and Road Initiative from a Policy Perspective,” Center for Global Development, March 2018, available at <https://www.cgdev.org/sites/default/files/examining-debt-implications-belt-and-road-initiative-policy-perspective.pdf>, 1–2, 8.

<sup>103</sup> Smith, “China’s Belt and Road Initiative,” 13–15; Mendis and Wang, “Unveiling China’s Grand Plan,” 38. Note: Sri Lanka defaulted on its debt in May 2022. See Hoskins, Peter, “Sri Lanka defaults on debt for first time in its history,” May 20, 2022, *BBC*, available at <https://www.bbc.com/news/business-61505842>.

locations for its own economic and military interests, and to compromise the sovereignty of the host countries and their political institutions.<sup>104</sup>

Although much of the early public attention on BRI was on terrestrial infrastructure, the BRI is increasingly focused on digital infrastructure as a means of fostering interconnectedness between air, land, and maritime transportation routes, energy infrastructure, and international communications infrastructure.<sup>105</sup> More broadly, digital infrastructure advances the BRI vision to strengthen links between BRI member countries, to, in Beijing's words, "promote the connectivity of Asian, European and African continents and their adjacent seas, ... set up all-dimensional, multi-tiered and composite connectivity networks," and, ultimately, "enable them to understand, trust and respect each other and live in harmony, peace and prosperity."<sup>106</sup> Accordingly, the BRI construct encapsulates a number of ancillary information technology-oriented efforts, known by various "silk road" monikers including the Space Silk Road and the Digital Silk Road.<sup>107</sup> While these nebulous efforts have not been neatly defined by Chinese officials, they appear to represent expansive and overlapping initiatives aimed at encompassing BRI countries under a vast network of Chinese digital infrastructure, underpinned not only by satellite navigation infrastructure but also by 5G cellular networks, terrestrial and submarine data cables, and data storage centers.<sup>108</sup>

In the Space Silk Road element of the BRI, China promotes expanded coverage and use of BeiDou by emplacing BDS-related infrastructure, technology, and expertise in foreign countries.<sup>109</sup> Thailand signed on as the first BDS "client" in 2013 and now hosts a BDS ground station, several reference stations, and an industrial park for producing BDS receivers.<sup>110</sup> China subsequently constructed BDS ground stations and reference stations in several other

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<sup>104</sup> U.S. Library of Congress, Congressional Research Service, "China's 'One Belt, One Road' Initiative: Economic Issues," 2; David O. Shullman, "Protect the Party: China's growing influence in the developing world," Brookings, January 22, 2019, available at <https://www.brookings.edu/articles/protect-the-party-chinas-growing-influence-in-the-developing-world/>.

<sup>105</sup> People's Republic of China, National Development and Reform Commission, Ministry of Foreign Affairs, and Ministry of Commerce, "Vision and Actions on Jointly Building Silk Road Economic Belt and 21<sup>st</sup>-Century Maritime Silk Road," March 28, 2015, Embassy of the People's Republic of China in the United Kingdom of Great Britain and Northern Ireland, available at <http://www.chinese-embassy.org.uk/eng/zywl/t1251719.htm>.

<sup>106</sup> People's Republic of China, National Development and Reform Commission, Ministry of Foreign Affairs, and Ministry of Commerce, "Vision and Actions"; Smith, "China's Belt and Road Initiative," 3–4.

<sup>107</sup> Preethi Amaresh, "All Weather Friends: China and Pakistan Space Cooperation," *The Diplomat*, January 30, 2020, available at <https://thediplomat.com/2020/01/all-weather-friends-china-and-pakistan-space-cooperation/>.

<sup>108</sup> Smith, "China's Belt and Road Initiative," 1; Hillman, "Competing with China's Digital Silk Road"; Ghiasy, Richard and Rajeshwari Krishnamurthy, "China's Digital Silk Road and the Global Digital Order," *The Diplomat*, April 13, 2021, available at <https://thediplomat.com/2021/04/chinas-digital-silk-road-and-the-global-digital-order/>; Goswami, "The Economic and Military Impact of China's BeiDou Navigation System"; Cozzens, Tracy, "China and Arab states promote BeiDou via Space Silk Road," *GPS World*, April 9, 2019, available at <https://www.gpsworld.com/china-and-arab-states-promote-beidou-via-space-silk-road/>.

<sup>109</sup> Cozzens, "China and Arab states promote BeiDou via Space Silk Road"; Jones, Andrew, "China to complete its answer to GPS with Beidou navigation satellite launches in March, May," *Space News*, February 28, 2020, available at <https://spacenews.com/china-to-complete-its-answer-to-gps-with-beidou-navigation-satellite-launches-in-march-may/>; Mohan, "Raja Mandala: A Silk Road for the Heavens."

<sup>110</sup> Robinson et al., "China Deploys Beidou to Project Power and Influence," 4.

countries, including Pakistan, Australia, Cambodia, Laos, Brunei, and Iran.<sup>111</sup> BDS has been adopted by Pakistan, Thailand, Laos, and Brunei as their primary PNT system and is attracting a growing following in Asia, Eurasia, the Middle East, and Africa.<sup>112</sup> Furthermore, China now claims to have exported BDS-related assets and products of various sorts to 120 countries, expanding the Space Silk Road's global reach.<sup>113</sup> China is also experimenting with space diplomacy to promote foreign use of BDS.<sup>114</sup> For example, in 2017 China launched the China-Arab States BDS Cooperation Forum to facilitate cooperation on promoting and integrating BDS applications in the Middle East and North Africa.<sup>115</sup> In 2018, this initiative established a China-Arab States BDS/GNSS Center in Tunis, Tunisia, intended as a pilot program to promote BDS capabilities and applications throughout the Arab world.<sup>116</sup>

In addition, under the Digital Silk Road rubric, Beijing uses BDS not only to connect BRI nodes horizontally but also to integrate them vertically at the local level.<sup>117</sup> Now that BDS has achieved global coverage, Beijing's goal is to make the system "ubiquitous, integrated and intelligent and comprehensive."<sup>118</sup> While this vision has not been fully elaborated in public, it appears aimed at expanding the use of BDS in multiple sectors of society by integrating BDS with advanced and emerging technological constructs such as 5G, cloud computing, and the Internet of Things.<sup>119</sup> This vision is most clearly evident in China's "smart cities" initiative. Smart cities are "urban ecosystems" characterized by the integrated application of networked technologies to optimize civic management.<sup>120</sup> China has several hundred domestic smart city pilots and is now promoting the smart city concept abroad as

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<sup>111</sup> Siddiqui, "BRI, BeiDou and the Digital Silk Road"; Robinson et al., "China Deploys Beidou to Project Power and Influence," 5; Hunter, Fergus and Peter Hartcher, "Australia 'helping' China develop its rival system to American GPS," *The Sydney Morning Herald*, January 28, 2019, available at <https://www.smh.com.au/politics/federal/australia-helping-china-develop-its-rival-system-to-american-gps-20190128-p50u4m.html>.

<sup>112</sup> Ghiasy and Krishnamurthy, *China's Digital Silk Road: Strategic Implications*, 9; U.S. Congress, House of Representatives, Foreign Affairs Committee, Republicans, "China Regional Snapshot: Space."

<sup>113</sup> *Asia One*, "China Beidou System is Ushering in a Golden Decade," September 24, 2020, available at <https://www.asiaone.com/business/china-beidou-system-ushering-golden-decade>; Dekker, Brigitte, Maaïke Okano-Heijmans, and Eric Siyi Zhang, *Unpacking China's Digital Silk Road*, report, Clingendael Institute, 2020, available at <http://www.jstor.org/stable/resrep25693.3>, 5; Robinson et al., "China Deploys Beidou to Project Power and Influence," 5.

<sup>114</sup> Cozzens, "China and Arab states promote BeiDou via Space Silk Road"; Jones, "China to complete its answer to GPS."

<sup>115</sup> Cozzens, "China and Arab states promote BeiDou via Space Silk Road."

<sup>116</sup> Cozzens, "China and Arab states promote BeiDou via Space Silk Road"; *SpaceWatch.Global*, "China Opens Beidou Satellite Navigation Centre in Tunisia," April 2018, available at <https://spacewatch.global/2018/04/china-opens-beidou-satellite-navigation-centre-tunisia/>.

<sup>117</sup> Ghiasy and Krishnamurthy, "China's Digital Silk Road and the Global Digital Order."

<sup>118</sup> Jones, "China Launches Beidou, Its Own Version of GPS"; China Satellite Navigation Office, "Development of the BeiDou Navigation Satellite System (Version 4.0)," December 2019, available at <http://en.beidou.gov.cn/SYSTEMS/Officialdocument/202001/P020200116329195978690.pdf>, 1.

<sup>119</sup> Meia Nouwens, "China's Digital Silk Road: Integration into National IT Infrastructure and Wider Implications for Western Defence Industries," International Institute for Strategic Studies, February 2021, available at [https://admin.govexec.com/media/china\\_digital\\_silk\\_road\\_-\\_iiss\\_research\\_paper.pdf](https://admin.govexec.com/media/china_digital_silk_road_-_iiss_research_paper.pdf), 8; People's Republic of China, China Satellite Navigation Office, "Development of the BeiDou Navigation Satellite System," 2019, available at <http://en.beidou.gov.cn/SYSTEMS/Officialdocument/202001/P020200116329195978690.pdf>, 18; Lu, "Update on BeiDou Navigation Satellite System and PNT System," 34.

<sup>120</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Smart Cities Development," 1.

a key means of broadening and deepening the reach of the BRI and Digital Silk Road.<sup>121</sup> As of 2020, Chinese tech companies have become involved in smart city projects in over 100 foreign countries in South Asia, Central Asia, Africa, South America, and even in some non-BRI countries such as the United Kingdom and Germany.<sup>122</sup>

BDS is integral to the smart cities concept given PNT's growing importance to numerous municipal and economic sectors, including transportation, logistics, and e-commerce. In China's indigenous smart cities, millions of commercial and mass transit vehicles and aircraft are already dependent on BDS.<sup>123</sup> Now, having begun to connect vast swaths of the developing world under the Digital Silk Road umbrella, Beijing is poised to vertically deepen its digital hold on BRI member countries and economies and also to make digital inroads to non-BRI countries as well.<sup>124</sup> Leveraging BDS through the Space and Digital Silk Road efforts, including the smart city initiative, China is casting its BRI net even further, securing valuable technological footholds around the world, further positioning itself to reorient the locus of economic and geopolitical power in Asia and beyond from the United States to China.<sup>125</sup>

### Implications of BeiDou for the United States

The implications for the United States of these developments are sobering. As BDS encircles the developing world through the BRI, Beijing will be increasingly poised to exert influence over great swaths of the world to the potential detriment of U.S. interests and the interests of current and future BRI countries. BDS will become an increasingly powerful tool as the demands of modern societies make regional and global economies more dependent on digital infrastructure and applications.<sup>126</sup> BDS, under the headings of the Digital and Space Silk Roads, connects the Chinese infrastructure of BRI countries and "smart cities" within a Beijing-managed virtual network. This creates opportunities for China to foster dependencies of countries within this network. Chinese manufacturers of devices with PNT

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<sup>121</sup> Ibid., 3, 16–17, 56, 78.

<sup>122</sup> Alice Ekman, "China's Smart Cities: The New Geopolitical Battleground," Institut français des relations internationales, December 2019, available at

[https://www.ifri.org/sites/default/files/atoms/files/ekman\\_smart\\_cites\\_battleground\\_2019.pdf](https://www.ifri.org/sites/default/files/atoms/files/ekman_smart_cites_battleground_2019.pdf), 22; U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Smart Cities Development," 16–17, 37, 57, 60–62.

<sup>123</sup> Ajey Lele and Kritika Roy, "Analysing China's Digital and Space Belt and Road Initiative," *IDSIA Occasional Paper No. 55*, New Delhi: Institute for Defence Studies and Analyses, November 2019, available at

<https://idsa.in/system/files/opaper/china-digital-bri-op55.pdf>, 33; U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Smart Cities Development," 8, 14; Ghiasy and Krishnamurthy, "China's Digital Silk Road and the Global Digital Order."

<sup>124</sup> Siddiqui, "BRI, BeiDou and the Digital Silk Road."

<sup>125</sup> Mendis and Wang, "Unveiling China's Grand Plan," 37; Malik, "Xi's Reforms and the U.S.-China Relationship," 21–2; U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on "A Net Assessment of CCP's Economic Ambitions, Plans and Metrics of Success," statement by Loren Brandt, 1.

<sup>126</sup> Hillman, "Competing with China's Digital Silk Road"; Blanchette, Jude and Jonathan E. Hillman, "China's Digital Silk Road after the Coronavirus," Center for Strategic and International Studies, April 13, 2020, available at <https://www.csis.org/analysis/chinas-digital-silk-road-after-coronavirus>; Goswami, Namrata, "The Economic and Military Impact of China's BeiDou Navigation System."



receivers, including smartphones, cars, ships, and aircraft, are required to make BDS the default PNT provider.<sup>127</sup> China also requires foreign car companies to make their vehicles compatible with BDS in order to sell them in China—a type of regulatory requirement that could be exported easily to foreign smart cities within the BRI.<sup>128</sup> The more China makes key urban areas, developing countries, and regional economies incrementally dependent on BDS and other Chinese integrated technologies, and independent from U.S. systems, the more susceptible such areas will be to the influence of the Chinese Communist Party.<sup>129</sup>

In this way—and given its prominence in the digital aspects of Beijing’s BRI strategy—BDS is poised to be the “digital glue” that connects the disparate BRI countries together under a vast Beijing-sponsored digital umbrella.<sup>130</sup> This in turn creates an environment in which China could eventually “decouple” certain countries or regions of the world from GPS and other U.S. technologies. An overarching technological decoupling trend has already begun, sparked by the United States’ banning of Huawei’s 5G network in 2018.<sup>131</sup> Since that time, China has begun to retaliate in kind, and both China and the United States are now pursuing the development of increasingly incompatible products and systems.<sup>132</sup> While the U.S. Government had important national security reasons for pursuing this path, there is a collateral risk that this technological decoupling trend will intensify to the point at which developing countries seeking advanced technologies will be faced with a mutually exclusive choice between China- or America-aligned technological packages that are incompatible with each other.<sup>133</sup> This, in turn, would foster a global technology economy that is increasingly bifurcated along geopolitical lines and the creation of separate spheres of economic and political influence.<sup>134</sup> Such decoupling would likely benefit China, as a rising power, in that it would create potential vacuums for Beijing to fill, especially in vulnerable developing markets.<sup>135</sup> This decoupling trend will likely be particularly apparent in the smart cities construct, in which the underlying principle of integration and interoperability

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<sup>127</sup> Emmanuel Meneut, “The Chinese Global Positioning Service and the Convergence Between Electronic Warfare and Cyber Attack,” *Asia Focus #141*, Institut de Relations Internationales et Stratégiques, May 2020, available at <https://www.iris-france.org/wp-content/uploads/2020/05/Asia-Focus-141.pdf>, 12.

<sup>128</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “China in Space: A Strategic Competition?” statement by Namrata Goswami, 116<sup>th</sup> Cong., 1<sup>st</sup> sess., April 25, 2019, available at <https://www.uscc.gov/sites/default/files/Namrata%20Goswami%20USCC%2025%20April.pdf>, 22.

<sup>129</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “An Assessment of the CCP’s Economic Ambitions, Plans, and Metrics of Success,” testimony by Matt Pottinger, 2.

<sup>130</sup> Mohan, “Raja Mandala: A Silk Road for the Heavens.”

<sup>131</sup> Ekman, “China’s Smart Cities: The New Geopolitical Battleground,” 21–2; David Goldman, “What is China’s Grand Strategy?” Russell Kirk Memorial Lecture, No. 1312, Heritage Foundation, October 10, 2019, available at [https://www.heritage.org/sites/default/files/2019-10/HL1312\\_1.pdf](https://www.heritage.org/sites/default/files/2019-10/HL1312_1.pdf), 4–5.

<sup>132</sup> Ekman, “China’s Smart Cities: The New Geopolitical Battleground,” 21–22.

<sup>133</sup> Ekman, “China’s Smart Cities: The New Geopolitical Battleground,” 22–23; U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “A Net Assessment of CCP’s Economic Ambitions, Plans and Metrics of Success,” statement by Loren Brandt, 17; Lele and Roy, “Analysing China’s Digital and Space Belt and Road Initiative,” 45.

<sup>134</sup> *Ibid.*

<sup>135</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “The Chinese View of Strategic Competition with the United States,” testimony by Alison A. Kaufman, 7; Ghiasy and Krishnamurthy, “China’s Digital Silk Road and the Global Digital Order”; Hillman, “Competing with China’s Digital Silk Road.”

tends to favor a single technology provider.<sup>136</sup> The digital future hinges partially on successful PNT integration with both existing technologies (e.g., cellular networks) and emerging technologies (e.g., 5G, artificial intelligence, autonomous vehicles). As a result, China's unimpeded ability to cultivate smart cities and technological ecosystems—in some places, such as in Africa, nearly from scratch—will enable Beijing to create stronger and more capable power bases.<sup>137</sup> Backed by its own independent digital PNT backbone, China will likely seek to exploit decoupling trends to accelerate its race against the United States for global technological leadership and influence on its own terms.<sup>138</sup> U.S. policymakers ought therefore to be acutely concerned that China will encourage decoupling and will leverage BDS and its broader Silk Road strategies to shear off countries from the U.S.-favoring bloc and “recouple” them to China as digital vassals.<sup>139</sup>

The possibility of such digital dependence on China is all the more unsettling given the authoritarian agenda promoted by Beijing, especially through the smart cities initiative. The smart cities concept is predicated on the digital collection, monitoring, and aggregation of enormous amounts of data in order to automate and improve city services and operations.<sup>140</sup> However, one of Beijing's top priorities in its domestic smart cities is to enable the collection and synthesis of vast amounts of data on city residents for surveillance and social control purposes. It is logical to expect that China's export of BDS and smart city technology through the BRI will be accompanied by the export of its authoritarian surveillance culture to its host countries.<sup>141</sup> Once integrated with China's 5G network and other advanced technologies, BDS could be a crucial enabler of the surveillance agenda, empowering Chinese authorities to locate, track, and report on the people and activities in its domain.<sup>142</sup> Furthermore, as entire regions become more dependent on BDS and other Chinese systems, Beijing can selectively grant or deny services to influence or mold behavior, providing significant advantages to Chinese authorities seeking to shape political outcomes in strategic locales, including disputed areas such as the South China Sea.<sup>143</sup> This scenario is all the more possible if regions “decouple” from GPS and “recouple” to BDS and China's integrated networks, because Beijing then will be able to threaten BDS-covered areas with technological blackout as a means of political extortion.<sup>144</sup> Once BRI cities and countries are solidly dependent on Beijing's digital

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<sup>136</sup> Ekman, “China's Smart Cities: The New Geopolitical Battleground,” 19; Lele and Roy, “Analysing China's Digital and Space Belt and Road Initiative,” 43–44.

<sup>137</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, “China's Smart Cities Development,” 19; Lele and Roy, “Analysing China's Digital and Space Belt and Road Initiative,” 43–4, 47, 56.

<sup>138</sup> Namrata Goswami, “The Economic and Military Impact of China's BeiDou Navigation System”; Ghiasy and Krishnamurthy, “China's Digital Silk Road and the Global Digital Order”; Mohan, “Raja Mandala: A Silk Road for the Heavens”; U.S. Congress, U.S.-China Economic and Security Review Commission, “China's Smart Cities Development,” 78.

<sup>139</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “A Net Assessment of CCP's Economic Ambitions, Plans and Metrics of Success,” statement by Loren Brandt, 1–2.

<sup>140</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, “China's Smart Cities Development,” 1, 8.

<sup>141</sup> *Ibid.*, 1–3, 15, 44.

<sup>142</sup> Ekman, “China's Smart Cities: The New Geopolitical Battleground,” 13.

<sup>143</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, “China's Alternative to GPS,” 6.

<sup>144</sup> Mazarr and Wyne, “The Real U.S.-China Competition: Theories of Influence.”

infrastructure for the health of their economic and information ecosystems, the Chinese Communist Party will be positioned to pressure the political leaders of such areas to support Beijing's interests and policies on Taiwan, Xinjiang, Hong Kong, Tibet, and the like.<sup>145</sup> As BDS increases its coverage and precision, it will be optimally positioned as a lever of extortion over its feudal-like network of dependent powers. In this way, BDS is poised to become the grand aegis that connects and facilitates control of a constellation of vassal states and their citizens.<sup>146</sup>

Curiously, there is very little available U.S. research that highlights or explores this competitive or coercive potential of BDS within the increasingly controversial BRI. Perhaps the dearth of literature is a consequence of the U.S. tendency to view PNT as a "global commons," an arena of international cooperation and trust exempt from the competitive aspects of foreign affairs. Animated by this belief, the United States has pioneered a cooperative framework for GNSS into which China has readily tapped. Yet, the GPS "global commons" approach was only viable when backed by the United States' hegemonic ability to underwrite the security of the system globally.<sup>147</sup> As this hegemony frays in the face of new challenges in the 21<sup>st</sup> century, and as GPS faces serious competition, the U.S. tendency to view PNT as a "public good" is not only increasingly outmoded but also obscures the nefarious potential of an independent satellite navigation system in the hands of the Chinese Communist Party.<sup>148</sup> Whereas the United States has set a precedent of broadly promoting technological cooperation and interoperability for PNT services, China is less likely to leverage its GNSS in this fashion over the long term, despite its cooperative narratives.<sup>149</sup> Rather, China's authoritarian models and demonstrated efforts to create dependencies in its foreign relationships indicate Beijing will exploit its newly completed BeiDou System not as an opportunity for international cooperation but as a tool of geopolitical competition and control. This emerging scenario is notable given that the United States at one point worried that the EU would require, by law, the use of the Galileo GNSS in certain regions to the exclusion of GPS.<sup>150</sup> Now China actually is pursuing such a strategy, potentially positioning whole regions of the world for such a bifurcated future.

## The Way Ahead

Beijing's leveraging of BeiDou as a tool of geopolitical competition stands in contrast to the approach of the United States. The United States pioneered satellite navigation and the accompanying model of international cooperation, but China sees space as a competitive

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<sup>145</sup> Namrata Goswami, "The Economic and Military Impact of China's BeiDou Navigation System."

<sup>146</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Smart Cities Development," 16–17.

<sup>147</sup> Meneut, "The Chinese Global Positioning Service and the Convergence Between Electronic Warfare and Cyber Attack," 11, 17.

<sup>148</sup> Mandelbaum, *The Rise and Fall of Peace on Earth*, 136; Meneut, "The Chinese Global Positioning Service and the Convergence Between Electronic Warfare and Cyber Attack," 17.

<sup>149</sup> Beidleman, *GPS versus Galileo: Balancing for Position in Space*, 65.

<sup>150</sup> *Ibid.*, 56.

domain and space assets as tools of competition rather than cooperation. In short, the United States is postured for cooperation while China is poised for competition. China leverages BDS as a tool of national power, and unless U.S. policymakers view GPS in a similar fashion, Washington will not be able to develop a coherent strategy for countering the use of BDS to undermine U.S. interests.<sup>151</sup>

GPS policy has yet to catch up to this burgeoning reality. President Barack Obama, like his predecessors, continued to be guided by a foundational belief that international cooperation in space-based activities would result in positive gains for all. President Obama's 2010 National Space Policy stated up front that "[t]he United States hereby renews its pledge of cooperation in the belief that with strengthened international collaboration and reinvigorated U.S. leadership, all nations and peoples—space-faring and space-benefiting—will find their horizons broadened, their knowledge enhanced, and their lives greatly improved."<sup>152</sup> President Obama further pledged to continue providing GPS for free and to continue pursuing international cooperation as ways to maintain the United States' GNSS leadership.<sup>153</sup> However, a decade later, the Administration of President Donald Trump recognized that the United States faced a changing, increasingly unfriendly geopolitical environment in which an assertive and competitive China featured significantly.<sup>154</sup> Recognizing that broad international cooperation based on a "global utility" construct was an outmoded policy for GPS, President Trump's 2020 U.S. Space Policy pledged to "encourage interoperability with *likeminded* nations."<sup>155</sup>

This was a wise shift, and subsequent administrations would do well to continue updating and sharpening the U.S. GPS posture for the current age and the Chinese challenge in particular. On a policy level, this means discarding the broad, one-size-fits-all international cooperation approach dictated by viewing GPS as a global commons and instead identifying those "likeminded" partners who share an interest in supporting U.S. global leadership. In addition, Washington should reframe U.S. public communication on GPS in a way that accounts for GPS as a tool for advancing U.S. interests. Doing so would communicate to Beijing that Washington recognizes the Chinese tactic of exploiting the openness of U.S.

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<sup>151</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on "The Chinese View of Strategic Competition with the United States," testimony by Alison A. Kaufman, 2, 8.

<sup>152</sup> Executive Office of the President, *National Space Policy of the United States of America*, Obama White House Archives, June 28, 2020, available at [https://obamawhitehouse.archives.gov/sites/default/files/national\\_space\\_policy\\_6-28-10.pdf](https://obamawhitehouse.archives.gov/sites/default/files/national_space_policy_6-28-10.pdf), 2.

<sup>153</sup> Executive Office of the President, *National Space Policy of the United States of America*, Obama White House Archives, 5.

<sup>154</sup> Mandelbaum, *The Rise and Fall of Peace on Earth*, 69–70; U.S. National Security Council, *National Security Strategy of the United States*, 2017, available at <http://nssarchive.us/wp-content/uploads/2020/04/2017.pdf>, 2, 25, 27.

<sup>155</sup> Donald J. Trump, Memorandum, "The National Space Policy, Memorandum of December 9, 2020," *Federal Register* 85, No. 242 (December 16, 2020): 81755, available at <https://www.govinfo.gov/content/pkg/FR-2020-12-16/pdf/2020-27892.pdf>, emphasis added; Donald J. Trump "Memorandum on Space Policy Directive 7: The United States Space-Based Positioning, Navigation, and Timing Policy," January 15, 2021, Trump White House Archives, available at <https://trumpwhitehouse.archives.gov/presidential-actions/memorandum-space-policy-directive-7/>.

values and systems to advance its authoritarian agenda and that the United States does not intend to facilitate this as a matter of its own technology policy.<sup>156</sup>

On a practical level, the United States ought to enhance and expand cooperative efforts with its likeminded allies, such as the EU, Japan, Australia, and India, to provide alternatives to the Space and Digital Silk Roads. As previously highlighted, China is an opportunistic power and is adept at exploiting the aspirations and consumer demands of developing countries, particularly where the United States has not purposefully and energetically engaged.<sup>157</sup> Working with allies and partners to enhance collective influence by offering alternatives to the BRI, especially in the Asia-Pacific region, the United States can help alleviate “decoupling” pressure on regional economies and complicate China’s efforts to create a sphere of digital vassalage.<sup>158</sup> One way to do so—recommended by Matthew Goodman, Daniel Runde, and Jonathan Hillman of the Center for Strategic and International Studies (CSIS)—is by devoting greater priority and resourcing to the Blue Dot Network.<sup>159</sup> Debuted by the United States, Japan, and Australia in 2019, Blue Dot is a multilateral vehicle for supporting and certifying sustainable and transparent infrastructure projects.<sup>160</sup> The Blue Dot Network can serve as a useful alternative to China’s Digital Silk Road for countries interested in investing in digital infrastructure.<sup>161</sup> Furthermore, the United States can use the Blue Dot Network to counter Chinese attempts to entangle vulnerable nations in BDS by promoting integration of GPS in Blue Dot projects. The U.S.-China Economic and Security Review Commission, as well as Jonathan Hillman of CSIS, have suggested that the United States leverage the smart cities construct to support projects that compete with China’s.<sup>162</sup> For example, while the United States has several smart city initiatives domestically, it should also consider teaming with likeminded partners to invest in smart city projects in strategic foreign regions and to promote foreign projects aimed at integrating GPS into networked urban systems.<sup>163</sup> As the smart city concept gains traction abroad, Washington should also seek ways to ensure that U.S. technology companies can remain competitive in foreign

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<sup>156</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, “The Chinese Communist Party’s Economic Challenge to the Free World,” testimony by Miles Yu, 1, 3.

<sup>157</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “The Chinese View of Strategic Competition with the United States,” testimony by Alison A. Kaufman, 7–8; Shullman, “Protect the Party.”

<sup>158</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, hearing on “The Chinese View of Strategic Competition with the United States,” testimony by Michèle A. Flournoy, 116<sup>th</sup> Cong., 2<sup>nd</sup> sess., June 24, 2020, available at [https://www.uscc.gov/sites/default/files/2020-06/Flournoy\\_Testimony.pdf](https://www.uscc.gov/sites/default/files/2020-06/Flournoy_Testimony.pdf), 2.

<sup>159</sup> Matthew P. Goodman, Daniel F. Runde, and Jonathan E. Hillman, “Connecting the Blue Dots,” Center for Strategic and International Studies, February 26, 2020, available at <https://www.csis.org/analysis/connecting-blue-dots>.

<sup>160</sup> U.S. Department of State, “Blue Dot Network,” <https://www.state.gov/blue-dot-network/>; Runde Goodman, and Hillman, “Connecting the Blue Dots”; Mercy A. Kuo, “Blue Dot Network: The Belt and Road Alternative,” *The Diplomat*, April 7, 2020, available at <https://thediplomat.com/2020/04/blue-dot-network-the-belt-and-road-alternative/>; Hillman, “Competing with China’s Digital Silk Road.”

<sup>161</sup> Kuo, “Blue Dot Network: The Belt and Road Alternative”; Hillman, “Competing with China’s Digital Silk Road.”

<sup>162</sup> Jonathan E. Hillman, “Competing with China’s Digital Silk Road.”

<sup>163</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, “China’s Smart Cities Development,” 2, 5; U.S. Department of Transportation, *Smart City Challenge*, last updated December 29, 2016, available at <https://www.transportation.gov/sites/dot.gov/files/docs/Smart%20City%20Challenge%20Lessons%20Learned.pdf>.

markets, such as through targeted tax incentives, easing of certain export control regulations for U.S. companies, and loan guarantees or other financial incentives for foreign customers in the smart city market.<sup>164</sup>

Finally, in anticipation of Beijing's use of BDS coercively in the future, Congress should have the U.S.-China Economic and Security Review Commission conduct a study examining the potential impacts of offensive technological decoupling between the United States and China. Such a study will help U.S. legislators assess the risks of PNT decoupling and develop more thoroughly informed mitigation strategies.

## Conclusion

The GPS policy of the United States has not changed much in the last 20 years, even as the international environment has changed dramatically. China under the Communist Party has exploited the U.S.-led international order to rise as a great power and competitor of the United States while retaining its authoritarian political agenda and coercive model of foreign influence. As Beijing now seeks to leverage its BeiDou satellite navigation system through the Space and Digital Silk Road initiatives to expand its power abroad, the United States can no longer afford a one-size-fits-all posture of international cooperation in its PNT policy. U.S. willingness to regard GPS as a "global utility" may have enhanced American prestige and economic prosperity during the days when the United States was the sole PNT provider. In an age of increasingly fierce geopolitical competition, however, U.S. policymakers need to reevaluate foreign GNSS interoperability and compatibility as the guiding principles of GPS policy. Despite the appealing sound of a "global commons," U.S. policymakers must now recognize that allies and adversaries alike will put their own interests first—as China's drive to establish its own BeiDou-encompassing digital vassal network demonstrates. Once U.S. leaders acknowledge these abiding realities and adjust U.S. GPS policy and public communications accordingly, the United States will be better positioned to wield GPS in a way that serves U.S. interests in the modern age—not as a global public good but as a tool of national power.

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<sup>164</sup> U.S. Congress, U.S.-China Economic and Security Review Commission, "China's Smart Cities Development," 5; Hillman, "Competing with China's Digital Silk Road."