

# Paving the Space Silk Road

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A Comparison of China's Partnerships with Developing Nations on Space  
Infrastructure Projects

*Taylor Crockett • Cari Reinert • Sona Shaik • Solomon T. Watson*  
The University of Texas at Dallas

## Abstract

In recent years, China has made international news with its rapidly accelerating achievements in outer space, including the construction of its BeiDou satellite system. These advancements have prompted widespread discussion about the growing technological competition between China and the United States in low Earth orbit and beyond. While the United States and China lead the world in space capabilities, many less-developed countries are accelerating their own space programs. The alliances and partnerships that these countries make to achieve their own goals in space will have long-lasting effects on international relations and economic systems in the future. In our study, we sought to investigate China's role in collaborating with four developing space powers: Argentina, Brazil, Egypt, and

Nigeria. We chose to conduct a case study in order to compare several factors across the board, including the incentives for each mission, geopolitical context, and China's rationale for involvement. Our study demonstrates that China's partnerships in space closely mirror and align with its overall Belt and Road initiative. The programs analyzed benefit both China and its partner countries economically, politically, and environmentally. China's cooperation in space with developing space powers illustrates the country's broader attempts to connect economically and politically with the Global South, leading to a future with more worldwide technological development and a dynamic international balance of power.

## I. Literature Review

### *Introduction*

The Belt and Road Initiative (BRI) is China's latest step forward on the global stage. Envisioned initially as an economic belt stemming from the legacy of the Silk Road within China's sphere of influence in Central Asia and the ASEAN, the BRI has grown to encompass global ambitions, including nations in Europe, Africa, and Latin America. By spinning a web of international ties ranging from infrastructure to diplomacy, President Xi Jinping has created a framework that will allow China to compete with other world powers. The BRI promotes Chinese-funded infrastructure development in other countries such that China may benefit from these emerging markets. Participants in the BRI ultimately hope that it is a "win-win cooperation that promotes common development and prosperity" (Fang & Nolan, 2019, p. 99).

Much of the emphasis of the BRI has been placed on innovation, which Xi termed as an "important force powering development" (Fang & Nolan, 2019, p. 24). This will allow China to promote infrastructure that rivals that of other countries and establish a greater foothold. That aside, innovation-driven development creates a foundation for new technologies that advance Chinese ambitions.

Space technology initially appears to fall outside of the scope of the BRI, but adequate remote sensing satellite networks in relevant regions are vital tools for the integration of partner states (Klinger, 2020). Satellites are crucial for collaboration on economic initiatives including agricultural production, climate monitoring, and interoceanic trade, among others. China's partnerships with states seeking to expand their domestic space industries, especially in the near-earth orbit zone, may therefore be partnerships that contribute to the overarching BRI. This paper will investigate four developing space powers (DSPs) and the connection between the BRI and their space programs.

While a great deal of past and ongoing academic research involves the BRI, research on

the connections between the initiative and China's overseas space technology investments remains scarce. Julie Klinger's working paper is one of the first to explore the relationship, but it remains focused on Chinese outer-space infrastructure developments in Africa, only briefly touching on infrastructure developments in Latin America and the Middle East. The paper concludes with suggestions that future research should be conducted on "domestic determinants of national space policies, and the impact of growing space capacity on major domestic and international governance questions" (Klinger, 2020).

This paper seeks to investigate Klinger's assertions on the relationship between China's recent space-related partnerships across the globe and their relationships to the BRI. Several regional or state-specific studies have been done which examine China's contributions to the space industries of foreign states, but to this date, no study has been done which compares such contributions across regions. This paper seeks to employ a globally comparative perspective to examine China's international space partnerships with developing states as a whole under the context of the BRI. We will begin the literature review with a brief summary of the history of the Chinese National Space Agency and the China Great Wall Industry Corporation, as these are the two main actors in China's space-related partnerships. We will then examine existing literature on space infrastructure partnerships by focusing on two regions with emerging space industries. Subsequently, we will identify prominent states from each region through which to conduct our case study comparisons. We will conclude the literature review by identifying the gaps in existing research and outlining the guiding questions and structure of this paper.

### *Brief History of China's Space Development*

The Chinese space program began as a simple rocketry program in response to nuclear threats from the United States and the Soviet Union in the 1950s, but by the turn of the century, China had

laid the groundwork for what is now becoming a formidable entity in space. This is largely due to a recent belief by the Chinese government “that space contributes significantly to China’s national power by serving its political, economic, and military interests” (Pollpeter, 2020, p. 12). By mid-century, China aims to have equaled or surpassed the influence of the American space program.

To promote rocketry and satellite construction, the Chinese government designated all aerospace endeavours to the China Great Wall Industry Corporation (CGWIC), a state-owned company. China ranks second in the number of satellites in orbit by country, only behind the United States. Furthermore, CGWIC has had a growing role in facilitating Chinese space technology to foreign partners; the extent to which this is military-related is disputed and a cause for tension between China and other world powers (NTI, 2001). In the future, China will look to “use its influence to shape international efforts on arms control, sustainability, the commercial uses of space, and natural resource extraction,” topics that may be increasingly weighty when Earth-bound resources become more scarce (Pollpeter, 2020, p. 18). Furthermore, China is using its space program to increase standing with foreign partners, positioning itself as a “benevolent hegemon” worthy of standing next to the United States. Within the Chinese sphere, certain countries have been designated “comprehensive strategic cooperative partners” that receive special attention when it comes to foreign projects, space industry included (Li & Ye, 2019). China’s space program will increasingly go hand in hand with its diplomatic goals in the future.

### ***The Space Silk Road***

Part of these overlying diplomatic goals is a plan that China terms the “Space Silk Road,” intended to parallel and bolster the BRI. The stated purpose of the Space Silk Road is to create “an entire range of space capabilities including satellites, launch services, and ground infrastructure and at supporting related industries and service providers going global” (Seibt, 2020; Ibold, 2018). The development of China’s Global Navigation Satellite Systems (GNSS) BeiDou system (BDS) is

key to the Space Silk Road. BDS offers an alternative to the market-dominant GPS owned by the United States. China wants to become more autonomous and less reliant on the U.S. to avoid compromising its military positions and possess more economic control (Xiaoci, 2020).

In order to make China’s BDS system more reliable, better at tracking objects, and comparable to the GPS network of the U.S., China needs as many eyes in the sky as possible (Seibt, 2020; Ibold, 2018). This gives China an incentive to help develop the space infrastructure of underdeveloped countries that have an interest in space, such that it can use foreign satellites to assist the BDS, create new customers, and obtain more profit than would have come from solely domestic use (Seibt, 2020; Ibold, 2018). The Space Silk Road is not limited to satellites, but China’s main interests certainly stem from an idea of a global satellite network under its vision.

### ***Partnerships by Region: Latin America***

Many Latin American countries and companies view the BRI as an opportunity to access Chinese markets and increase international cooperation and engagement. China has been an important source of foreign direct investment in the region and is considered to be Latin America’s second-largest trading partner. In 2017, the BRI was adapted to include Latin America as an extension region and Panama became the first Latin American country to endorse the BRI. Since 2017, Ecuador, Chile, Uruguay and others have signed agreements with China. In 2019, Argentina, Brazil, Columbia, and Brazil, the four biggest economies in the region, followed the initiative; these four are mentioned in some agreements but have not signed on or have become BRI members (Zhang, 2019). Through partnerships and agreements in the shadow of the greater BRI, Latin American governments and firms are developing construction, energy, and transportation projects (Guzman, Weinman, 2020). Our sources show parallel space development projects in Latin America.

Klinger also wrote a paper in 2018 entitled, “A Brief History of Outer Space Cooperation

between Latin America and China". This study identifies various gaps in research about Latin America-China relations and uses archival research, legal documents, and interviews to present the historical geography of cooperation in relation to outer space research and development (Klinger, 2018). Klinger notes how current research predominantly focuses on trade agreements, migration, and investment without considering space cooperation despite space technology being central in various sectors. For example, satellites are used to monitor crop outputs that South American countries export to China. Thus, she claims that the evolving relationship between Latin America and China "cannot be understood without considering the role of outer space science, technology, and policy" (Klinger, 2018, p. 48). Klinger contextualizes cooperation between Latin America and China by discussing existing literature on this topic, contemporary and historical global space geopolitics, and global governance frameworks. Latin America-China (LAC) space cooperation is essential to the evolution of LAC relations as a component of multilateral outer space cooperation networks (Klinger, 2018, p. 50). LAC space relationships began long before they were acknowledged. Deals and agreements have led to the political geography of Earth orbits from space becoming more diverse with technologies from various countries, ten of which are Latin American. This paper particularly highlights Brazil and Argentina as states that have collaborated on space infrastructure with China, serving as our basis for selecting them as our comparative case studies.

Another source which we used to contextualize China's investments in Latin American space infrastructure was Enrique Londoño's article about Chinese incursions into Argentina. According to Londoño, the United States long served as the economic and political catalyst for the Latin American region, but in the past decade American administrations have begun to withdraw from that role as China is aggressively taking its place, especially reflected by United States policy during the Trump administration. Many Latin American countries made long-term deals that have left them indebted

to China, which has taken advantage of this to leverage its space program, for instance building a satellite-tracking hub in Argentina. These deals have resulted in some Latin American leaders feeling targeted by another wave of imperialism (Londoño, 2018). The article verifies Klinger's emphasis on Argentina as a growing actor in the space industry that has been influenced by China and provides additional political and economic context to China's decisions to invest in Latin America.

### ***Partnerships by Region: Africa***

To contextualize our political and economic understanding of historic China-Africa relations, we included a 2007 study by Carmody and Owusu in our literature review that explores how China and the United States have both been pursuing expanded trade and investment policies in Africa in the 21<sup>st</sup> century. These two world powers often have had conflicting interests regarding their expansion in Africa. The authors theorize that China uses "asymmetric power projection" to funnel aid to Africa in exchange for ludicrous resource deals, therefore encroaching on the dominance of the U.S. aid network and softly increasing its own power. These machinations on both sides look to reorganize the old colonial structure but also strengthen less-than-savory ideals. There are several parallels between China's attempts to obtain resource deals in the early 2000s with Africa and the BRI's focus on establishing China as a major economic power that Africa relies on. One might even consider access to outer space to be a resource deal of its own.

Klinger's twice-mentioned study on China-Africa space infrastructure development serves as our background for understanding China's space partnerships in Africa. The study highlights corporate partnerships between the China Great Wall Industry Corporation and several African states, especially Nigeria and Algeria. A main point of the paper is that China is by no means the sole foreign actor in the space industries of Africa; it competes with the United States, Russia, and many more. By and large, African states control their space industries and

primarily rely on foreign states to contract satellite launches and manufacturing assignments. We chose to include Nigeria and Egypt in our case studies because the two countries provide two diverse perspectives of African nations focused on expanding space infrastructure and both have publicly available data on their collaborations with China on satellite launches and other space-related services.

### ***Summary***

Regional studies about China's cooperation on building space infrastructure in developing states have provided valuable insights about our research interests. For one, the variety of states and regions with which China has cooperated on space infrastructure development demonstrates that China has vested political and economic interests in influencing these state's emerging space industries. Secondly, these studies show that China is not the only actor vying for the business in and influence over emerging space powers; it

must compete with a variety of other international and corporations to provide services to many of these regions. These insights help us to narrow our focus for this paper. This paper takes a comparative, case-study approach, drawing from the history of China's cooperation with relevant states from each region. We intend to analyze each state to determine the relative scale of China's influence over and interactions with the domestic space industry, the nature and purpose of these interactions, and whether they relate to China's BRI plans. Then, we will compare all states to determine whether universal similarities exist or whether those factors are heavily influenced by each state's region. Ultimately, our research seeks to answer two questions. What relationships exist between China's space infrastructure partnerships in DSPs and China's BRI goals? If such relationships exist, do they differ according to geographic regions, or are they globally homogeneous in nature?

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## **II. Data and Methods**

### ***Data Methods***

To determine whether global similarities exist with China's various international space partnerships, we take a case study approach. In each case study, we examine the scope, scale, and major objectives of China's space partnerships with DSPs in the hopes of examining their motivations and implications for the future of the BRI and the global space arena. Our qualitative data is taken from an amalgamation of news articles and press releases from various countries, academic studies, think tank publications, industry insider blogs, and publications from non-profit observers.

### ***Hypothesis***

Our hypothesis is that China's partnerships with DSPs will display global similarities. We predict that China's space partnerships will mirror and bolster the BRI by establishing a "Space Silk Road" with a history of collaboration on a variety of projects. We will be comparing the scope, scale, and major objectives of China's space partnerships in four states from different cultural and regional areas of the world: Brazil, Argentina, Nigeria, and Egypt, along with the predicted long-term effects of these partnerships on military and economic development.

### III. Case Studies

#### *Argentina*

In the decade following the 2008 economic recession, Argentina has repeatedly found itself in an economically precarious situation. Its current president, Alberto Fernández, largely ran on a platform advocating for more government involvement in the market, after four years of a neoliberal approach by his predecessor, Mauricio Macri (La Nacion, 2019). Despite these back-and-forths, one thing remains clear: regarding the economy, Argentinians may be getting desperate for some sort of meaningful improvement.

On the other side of the equator, the 2016 election of Donald Trump in the United States foreshadowed a tightening of these straits for Argentina. For many decades, the United States had been Argentina's most influential trading partner. The left-leaning President Kirchner began to shift gears by strengthening ties with a new economic partner: China. Her successor, Macri, though on the opposite end of the economic ideological spectrum, found this to be one of his sole points of agreement with her. Now, given the new administration of Fernández, Argentina faces new tariffs from the United States imposed by the Trump administration and continued by the Biden administration, suggesting a continuation of Argentina's drift towards China's support (Hsiang, 2019).

Argentina is one of the few global beneficiaries of a Chinese "comprehensive strategic partnership," a special relationship committing China and its counterpart to increased trade, cooperation and mutual investment. Under Kirchner, "more than 20 treaties and investment projects were agreed" (Hsiang, 2019). Macri attended the 2017 Belt and Road Forum in Beijing at the behest of President Xi. The current state of the China-Argentina relationship under the vision of the BRI is evident. Though Argentina is still debating whether to join many of its neighbors in formally endorsing the BRI, the economic ties between China and Argentina are strengthening (Dalto, 2020). Renewable energy projects funded by Chinese investors span the country, and a

currency exchange program is helping Argentina slowly escape a decade-long financial crisis. Meanwhile, under the vision of BRI, some space industry projects have taken hold.

In 2012, China and Argentina came to an agreement—500 acres of land would be signed over to the Chinese government for the purpose of building a satellite tracking center in a remote region near the Andes. After years of Chinese assistance after the 2008 financial crisis, it's possible the Chinese government felt that a favor was owed. Though the discussions were secret, the initial reaction from the public was overt: citizens were wary of making concessions to a foreign power, especially of a military nature.

Though China promised that the satellite tracker would be civilian in nature, the operations are run by its military (Wiñazki, 2019). Furthermore, an analysis of the documentation regarding the base's development indicates that China does intend to use it strategically if necessary. Several defense experts have warned that satellite espionage is a real possibility. Nonetheless, the project remains an officially scientific collaboration between the China Satellite Launch and Tracking Control General (CTLG) and the Argentinian National Space Activities Commission (CONAE) seeking to expand current astronomical data and otherwise (Wiñazki, 2019).

CONAE worked with NASA and a handful of European space agencies in the 1990s to facilitate its first observational satellites. The most recent satellite mission, SAOCOM 1A, was launched by SpaceX. However, Argentina is certainly posturing towards an in-house operation; like the United States, the private space industry is becoming increasingly relevant. One of Argentina's largest and most promising entrants into the space industry is a young satellite company named Satellogic.

Sponsored by the Argentinian Ministry of Science, Technology and Innovation, Satellogic has rapidly transformed from a startup company creating concept satellites into a regional

powerhouse. A \$50 million USD funding round in 2019 led Satellogic to begin its next project which will put at least 50 hyperspectral observational satellites in Earth orbit. A prior funding round in 2017 had already netted the company \$27 million USD (of note: Chinese company Tencent was the primary fundraiser). In a matter of national pride for Argentina, “Satellogic builds its satellites in house,” though the Argentinian space industry is not the point of rocketry to meet its new launch demands (Foust, 2019). Thus, Satellogic looked abroad.

In what may have been a shock to many foreign observers, Satellogic contracted China Great Wall Industry Corporation (CGWIC), to carry out the launch. CGWIC is not a private firm, but a nationally-owned company given the sole authority in China to construct rocketry. In essence, Satellogic formed an agreement directly with the Chinese government. The deal is worth over \$77 million USD and will likely only expand as Satellogic continues to take on more satellite contracts.

At this point, both the public and private space industry sectors in Argentina are partnering with China rather than Western partners who had secured their support for over a century to fulfill their goals. These investments from China are not quixotic; they further China’s goal to establish a greater economic and technological foothold in Latin America.

Many Latin American countries have long wanted to escape the shadow of the United States, which for more than a century has dictated the direction of the economy of the Americas. Argentina wants this no less than any other, and China has given them an opportunity to greater exercise global influence under the BRI. The joint Chinese-Argentinian space industry projects posture Argentina to expand its position from a raw-material exporter in the American sphere to an economic influencer in its own right. Were Argentina to formally endorse the BRI, it would be in a comfortable situation, and likewise, China will surely be glad to have established a greater foothold in the region through space-industry ambitions and otherwise.

### ***Brazil***

Brazil is one of China’s most important economic and political partners in Latin America. They are binded by their like-minded critique of the international system as stacked against the developing world (Trinkunas, 2020). Although Brazil is not formally incorporated in the BRI, “Brazil’s global interests and export markets are clearly affected by China’s overseas investment program” (Trinkunas, 2020).

More specifically, China and Brazil have been cooperating on Space related projects since the 1980s with the China-Brazil Earth Resource Satellite (CBERS). CBERS was China’s first international cooperative space technology venture with another developing country (Zhao, 2005). In 1987, the National Institute for Space Research and the China Academy of Space Technology signed an agreement that defined the nature and scope of technological cooperation between them. There was mutual interest in development, satellite technology, digital image analysis, and remote sensing data applications (Jesus, Itami, Segantine, Chagas, 2020). In 1988, the protocol on Research and Production of the Earth Resource Satellite was signed and resulted in the launch of CBERS-1 in 1999 from a Chinese base in Taiyuan, which was delivered for service in 2002 with satellite data images. This agreement also covered the development of CBERS-2 and cost 100 million USD for development and 50 million USD to launch; China would bear 70% of the total costs and Brazil would cover the rest (China Space Report).

There were two more cooperative protocols in 1994 and 2000 that dealt with furthering cooperation in space technology, specifically the development of Earth resource satellites. Another protocol agreed to in 2002 provided a more concrete framework of cooperation in space projects, outlined the development of a second generation of CBERS satellites, and contained nineteen articles that elaborate on the commercialization of outer space. Overall, this agreement has resulted in six satellite launches: CBERS-1 (1999), CBERS-2 (2003), CBERS-



2B (2007), CBERS-3 (2013), CBERS-4 (2014), CBERS-4A (2019).

The primary outcomes of the CBERS launches relate to the agriculture sector and the environment. The information gathered and collected from the satellite launches have been useful for monitoring biomes (especially the Amazon), cartographic analysis, monitoring of vegetation and agriculture (Jesus et al., 2020), investigation of natural hazards, imaging of disaster and emergency areas (Qiao, Zhao, Liu, Jia, 2009) etc. Specifically, the information collected from the CBERS-1 launch has been extensively utilized in crop classification and monitoring the growing condition. CBERS-1 has helped improve geological hazards monitoring in China and the data has been applied to forestry, water conservancy, environment protection, marine resources etc. (Qiao et al., 2009). For example, in Nanjing, crop yield estimates are based on this data and in Xinjiang, a remote sensing monitoring system has been established for cotton cultivation (Qiao et al., 2009). The data collected from these launches and their applications have provided a scientific basis for government decision making and have created great economic and social benefits in Chinese national economy construction (Qiao et al., 2009).

Brazil is not formally recognized as a target for China's Belt and Road initiative; however, Brazil's global interests and export markets are clearly affected by China's overseas investment programs (Trinkunas, 2020). It has also been argued that despite the "geographic distance separating Brazil from the BRI, the initiative has concrete repercussions for Brazil's bilateral and multilateral dealings with China" (Abdenur, 2019, p.153). Even though Brazil is involved in some agreements related to the BRI, the space cooperation and partnership occurring between the two countries does not seem to have a clear connection to the initiative.

### ***Egypt***

Historically, Egypt has built and maintained strong economic and political ties with China. The first Arab and African nation to publicly sign on to the Belt and Road Initiative, Egypt also holds a

"comprehensive strategic partnership" with China. Trade between the two countries has skyrocketed, reaching above \$13.8 billion USD in 2018, and China has made significant investments in Egyptian infrastructure and business: "the transfer of Chinese expertise in the management of economic zones to Egypt is one of the important factors that will help Egypt to succeed in the development of other economic zones" (Metwally, 2019). As Egypt's economy develops with the help of China, Russia, and other sources of foreign investment, the state has turned its sights to the stars, looking to establish more infrastructure in the marketplace of space.

In comparison to long-standing space agencies like NASA and the Chinese Space Agency, Egypt's space agency is still in its infancy. Created in 2017 by the Egyptian House of Representatives, the Egyptian Space Agency seeks to give Egypt a seat at the table in the global space arena (Shay, 2019) by increasing its capability to manufacture, assemble, and launch satellites. Egypt already owns two communication satellites, NileSat1 and NileSat2, that successfully operate from near-earth orbit. However, its third satellite EgyptSat 2, created with a grant from Russia for defense purposes, was lost in 2015 due to human error (Al-Youm, 2015). After the loss of EgyptSat 2 and the official establishment of the Egyptian Space Agency, Egypt began looking for more opportunities in global space collaboration to foster technological innovation and development. One important project on the horizon is the MISR-SAT2, a joint project between Egypt and China funded by a \$100 million USD grant from the latter.

According to Haitham Medhat, the Head of Team for the project's development, China and Egypt began work on MISR-SAT2 in 2019, and the satellite is planned to launch in 2022 for a 5 year orbit (Egypt Today Staff, 2020). The satellite will be assembled in Egypt and launched in China, and the project will guide the young Egyptian Space Agency along the steps of satellite construction. Chinese Ambassador to Egypt Liao Liqiang confirmed in September 2019 that this cooperation takes place directly under the Belt and Road Initiative and that the project is intended to

leave Egypt as “the first African country to have complete satellite assembly integration testing capabilities” (Shafiq, 2019). Along with providing instrumental training to Egyptian scientists, engineers, and leaders in the space industry, the satellite will give Egypt advanced remote sensing capabilities for use imaging soil for agricultural purposes and monitoring other environmental factors.

The MISR-SAT2 project exemplifies the extent of Egyptian and Chinese cooperation, not just in regard to space capabilities, but in regard to Egypt’s economic future as a potential center for commerce in North Africa and the Middle East. It is clearly China’s goal to establish itself as a long-term ally to Egypt, aiding it along in its development on many fronts. This project will likely allow Egypt to build a more self-sufficient future for itself in an increasingly competitive arena—near-Earth orbit and cislunar space—with an ally determined to expand its global space partnerships.

### ***Nigeria***

In various forums, China has officially expressed that Africa plays an important role in the establishment of its Space Silk Road initiative (Maida, 2020). Nigeria officially joined the BRI in 2018 along with a number of other African nations and through the signature of a Memorandum of Understanding with China (Ibrahim and Bibi-Farouk, 2020). Another diplomatic engagement worth noting is the participation of Nigeria within the Forum on China-Africa Cooperation, which itself includes a variety of divergent and sub forums, sites of dialogue, and disparate issues that concern the member parties (Ibrahim and Bibi-Farouk, 2020).

The main area of cooperation between Nigeria and China is infrastructure development. The first expression of BRI cooperation to materialize was The Abuja-Kaduna Railway, though work began prior to Nigeria’s formal entry into the BRI, which connected the capital Abuja to a major industrial city in Kaduna (Ibrahim and Bibi-Farouk, 2020). Subsequently, a series of other projects were completed, such as the Abuja Rail Mass Transit Project, the Lagos-Calabar coastal

railway project, New Abuja International Airport Terminal, Port Harcourt International Airport, Kano International Airport, the Lekki Deep Sea Port Project, and the Abuja Township Road Project (Ibrahim and Bibi-Farouk, 2020; Maida, 2020). Some future projects slated for completion include funding for the Nigeria National Petroleum Corporation, Ajaokuta-kaduna-Kano, \$400 million USD of investment in heavy industries across Nigeria, and the completion of the National Information and Communication Technology Infrastructure backbone phase 11 (Ibrahim and Bibi-Farouk, 2020). As a result of these projects, “trade volume between Nigeria and China has soared to \$15.3 billion USD in 2018; 10.8% higher than in 2017” (Maida, 2020).

Nigeria’s space program began in 1999 under President Olusegun Obasanjo during Nigeria’s democratic transition from authoritarianism (Way, 2020). The formation of the National Space Research and Development Agency (NASRDA) was ultimately more symbolic than anything else; it was part of an effort to signal an interest and commitment to intellectual curiosity in contrast to the brutal anti-intellectual regime prior (Way, 2020). The current goals of NASRDA were outlined in 2005 (manufacture a Nigerian satellite; have a Nigerian astronaut; and create a Nigerian launch vehicle to launch Nigerian-made satellites from a spaceport located in Nigeria) and little ground has been made in achieving these goals (Way, 2020). In the end, the Nigerian government approaches these goals as symbolic, ensuring that they are simply funded and worked towards, rather than prioritizing timelines and completions (Way, 2020). However, the program still has made some strides: in 2003, Nigeria launched NigeriaSat-1 and has produced and launched five more home-developed satellites. (Way, 2020).

Outside of the symbolic gains from the program, Nigeria wants to use its space program for gaining access to new technologies, especially to assist the mitigation of climate change (Way, 2020). The investment of STEM education and provision of jobs will provide socio-economic gains for impoverished communities (Way, 2020).

There are also security goals, specifically the use of satellite monitoring for assisting the combat of Boko Haram and piracy (Way, 2020). However, the majority of funding for space goes to the civilian agency (Way, 2020). Finally, the use of space technologies and systems to assist in the fulfillment of the United Nations' Sustainable Development Goals (SDGs) (Way, 2020).

Despite the lofty goals and commitments by the state, there are some challenges that make fulfilling them difficult, and the space program isn't politically popular (Way, 2020). The current political terrain of Nigeria is defined largely by a fear and concern of corruption, and a program that takes in large sums of money but does not benefit the population directly or in a visible way is not only ripe for corruption but a great deal of criticism (Way, 2020). The breakout of COVID-19 and the subsequent economic slowdown has hurt the availability of funds for space (Way, 2020). There is a more systemic economic problem that if not addressed could hamper the Nigeria's space development for the long term: Nigeria's overreliance on oil and lack of economic diversity has made Nigeria's economy very susceptible to major economic harm as result of a global economy transitioning to more renewable energy systems (Way, 2020). Apathy within the populace about government effectiveness, poverty, and a weak technological base that all have to be overcome (Way, 2020). Finally, Nigeria is reliant on Russian and Chinese rockets to launch their satellites, with little technical know-how within the country to develop their launch system (Way, 2020).

These technical challenges present an opportunity for China. Nigeria is more interested in an indigenous and autonomous space system than a privatized or outsourced one (Way, 2020). This sets China up as an ideal potential partner because the Space Silk Road operates under the same framework that underpins the rest of the BRI and deals in infrastructure and technical assistance (Way, 2020; Ibrahim and Bibi-Farouk, 2020; Seibt, 2020; Ibold, 2018). The Space Silk Road

sets up possible win-win scenarios for China and Nigeria; in order to make China's BDS system more reliable, better at seeing and tracking objects in Earth's orbit and on Earth itself, and an attractive option compared to the U.S., China needs as many eyes in the sky as possible (Seibt, 2020; Ibold, 2018). This gives China an incentive to help develop the space infrastructure of Nigeria so that they can use Nigerian satellites to assist their BDS, add another customer, and profit off of it more than they would if they had built the satellite for themselves (Seibt, 2020; Ibold, 2018). For Nigeria, this arrangement is attractive because they get access to Chinese technical know-how (Seibt, 2020; Reuters 2018; Way, 2020; Ibold, 2018). A recent example illustrative of this is when a Nigerian limited liability company owned by Nigeria, Nigcomsat, bought two Chinese satellites for \$550 million USD from CGWIC (Reuters 2018). However, CGWIC and the China Exim bank financed the \$550 million in return for 50% equity in Nigcomsat (Reuters 2018). This puts almost all of the risk on China; however, even if Nigcomsat fails, China gains regardless because of the benefits stated above about BDS (Seibt, 2020; Ibold, 2018; Reuters 2018).

There is still intense debate on whether the BRI is exploitative or liberatory. While this article does not speak on the BRI as a whole, it does aim to evaluate the effects and harms of the Space Silk Road on its participants through case studies (Mead, 2018). For Nigeria, given its security interests in space and the types of deals that are being offered, the Space Silk Road is favorable for them; nearly all of the domestic and technical risk is placed on China while granting Nigeria the capacity to develop an indigenous space program at little cost (Way, 2020; Ibold 2018; Seibt, 2020; Reuters 2018). China can pursue its interests while giving Nigeria the opportunity to profit off of it; China already planned to manufacture satellites for the BDS program, but developing other countries into space-faring nations will create a larger customer base and provide competition with the U.S. (Ibold, 2018; Seibt, 2020).

## IV. Figures & Tables

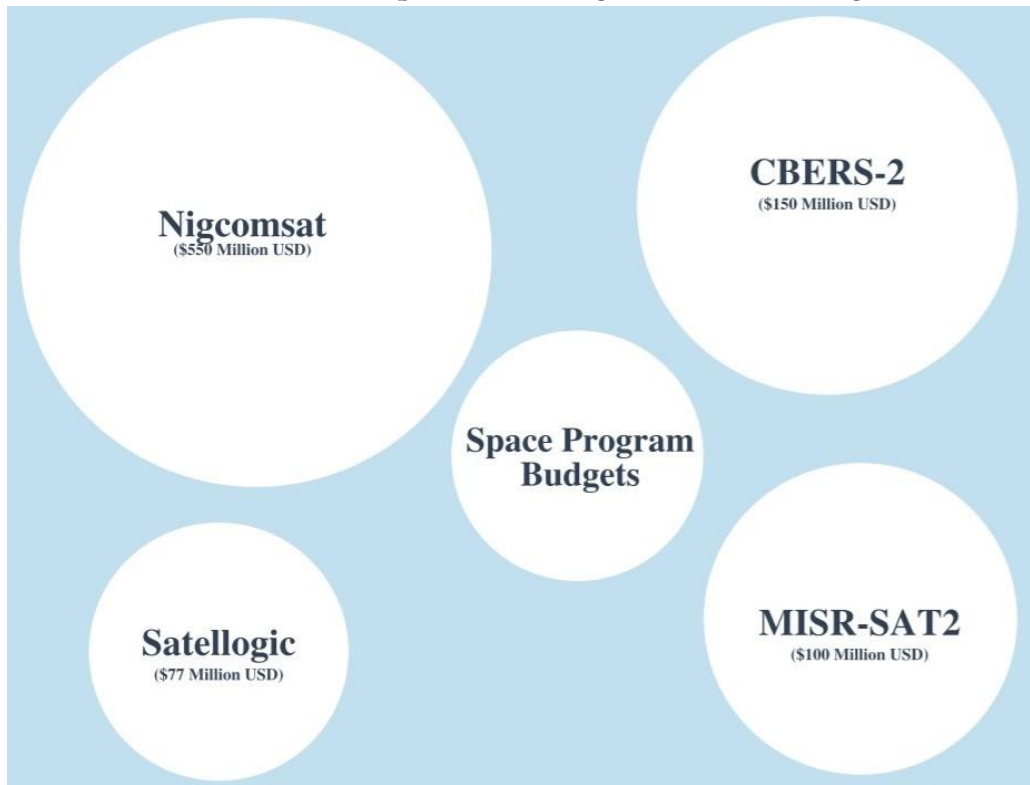
**Table 1** Project Connections to China's Belt-and-Road-Initiative

Project/Program	Connection to BRI
Nigcomsat deal	Chinese satellites are sold to be launched into the Nigerian satellite networks in a form of infrastructure investment. As a result, this helps to advance China's GPS interests and compete with the Western-dominated GPS market.
CBERS	There exists no official BRI relationship; however, CBERS data is being used to bolster both Brazilian and Chinese environmental knowledge. The satellite deals are one facet of a widening trade relationship between the nations.
MISR-SAT2	Egypt was the first Arab and African nation to sign onto the BRI and the MISR-SAT2 is a reflection of its tightening diplomatic ties with China. The \$100 million USD grant will allow the new Chinese ally to lead Africa in satellite integration.
ÑuSat Aleph-1	The rapidly-growing Argentinian space startup Satellogic chose Great Wall Corp to launch its satellites in a lucrative deal that may be the largest of its kind ever in Latin America. The fact that the Chinese national space company was selected over many other potential Western suitors brings to light the advantages Argentina has for selecting Chinese deals while it considers ratifying the BRI.
Estación CLTC-CONAE-NEUQUEN	China asked Argentina to become the home of its first Western-hemisphere satellite tracking base. Though the deal appears to be heavily favoring China, it is likely a courtesy after years of favors granted by China to alleviate Argentina's growing pile of economic problems. These favors have steadily cascaded into a consistent trade relationship that may result in Argentina joining the BRI.

**Table 2** Selected Partnerships with China: Budgets and Key Dates

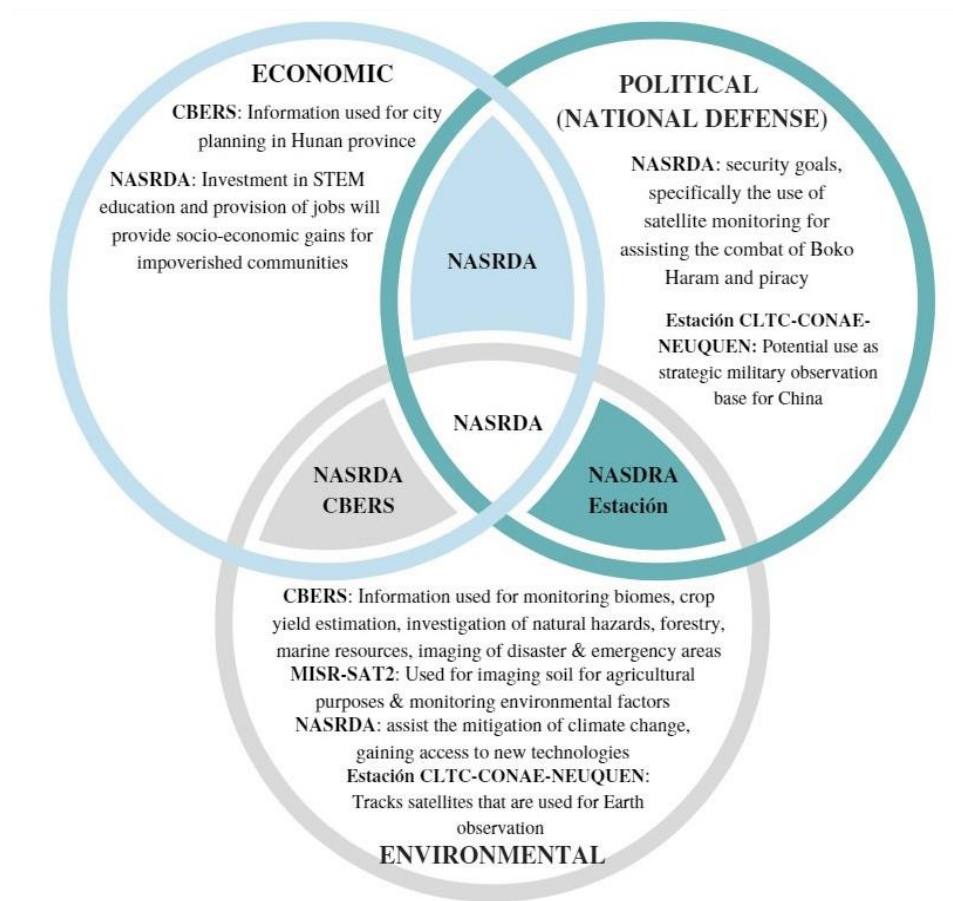
Program Name	Country	Budget	Funding of Partnership	Years Active
Nigcomsat deal	Nigeria	N/A	Equity for satellite	2018-present
CBERS	Brazil	CBERS 1&2: Development - \$100 million USD Launch - \$50 million USD	Investment by China Academy of Space Technology (CAST) & The State Council and the Ministry of Aerospace	1987-present
MISR-SAT2	Egypt	\$100 million USD	Grant from China	Launches in 2022
ÑuSat Aleph-1	Argentina	More than \$77 million USD	Equity for satellites and launch partnership with CGWIC	2016-present
Estación CLTC-CONAE-NEUQUEN	Argentina	N/A	Land-lease, tax exemptions, labor and grants	2014-present

**Figure 1** Bubble Comparison of Magnitude of Funding from China



**Figure 2**

**Venn Comparison of Intersecting Program Areas**



## V. Findings

### *Analysis*

The case studies of space cooperation within the framework of the Space Silk Road are illustrative of a larger dynamic that may provide insights into the BRI and its effects. While space cooperation is a part of a much larger trend of “South-South” collaboration, it cannot be understated that access to space is of immense importance to the modern development of nations (Klinger, 2018; Klinger 2020; Trinkunas, 2020). Many of the instances of cooperation in the case studies regard agricultural management, climate change adaptation and climate management, internet distribution, oceanic trade, disaster preparedness, and the development of domestic industries to become more competitive through the global position of goods (Klinger 2018; Klinger 2020; Foust, 2019; et al., 2020; Qiao et al., 2009; Shafiq, 2019; Way, 2020). While whether the BRI is neocolonial in nature or an instance of a purely mutual benefit is up for debate, as far as space development is concerned, it could be argued that the Space Silk Road is anti-colonial (Durrani, 2019; Mead 2018; Shea, 2020). Leaving developing states to establish space programs on their own without any means of economic, infrastructural or technical support essentially condemns them to lose any gains in space that may come within the next century (Klinger, 2020). Nigeria’s case study encompasses this dynamic: the Space Silk Road provides a pathway for Nigeria to develop a stronghold in space by displacing risk onto China, where a lack of foreign support would spell out an end to any space ambitions due to domestic hesitation and lack of resources (Way, 2020; Seibt, 2020; Reuters, 2018).

While access to space will be increasingly important in the near and long-term future for the developing world, it is important to note that the Space Silk Road is still going to interact with pre-existing racial, religious, gender, and economic inequalities within those societies (Klinger, 2018; Durrani, 2019). The technological, commercial, and security gains will disproportionately benefit the elite members of society. Great pains need to

be made to make sure that the benefits are dispersed equitably (Klinger, 2018; Durrani, 2019).

The uprooting and disruption of indigenous communities for space bases is a painful component inherent in most Western nations’ space programs. The recent controversy caused by China’s space base in Argentina is indicative of the larger costs that this kind of development can inflict (Durrani, 2019; Wiñazki, 2019). It is also clear that many communities within these countries are aware that there will be negative impacts, or at the very least no immediate benefit, from the expansion of their nations space programs. Many perceive a tradeoff between space programs and other more immediately impactful social programs (Way, 2020). All of this suggests that, to improve the long-term future for developing nations engaging in the Space Silk Road, negotiations and dialogues with China should include the perspective of populations who may have more to lose than to gain (Durrani, 2019). Not only is this a question of making sure the spread of development is more even and less disruptive, but the perception that these deals are beneficial to all parties and communities and providing material examples is important to sell the deals and space programs to more skeptical publics (Way, 2020).

For developing nations, space is becoming a leverage point in negotiations with China to allow self-determination from the American hegemonic bloc (Klinger, 2018; Wiñazki, 2019; Shea, 2020). Cooperation with China can accelerate space programs like those in Nigeria and Egypt. It can also act as a point of leverage in the scope of trade and diplomacy, as demonstrated by Argentina’s Neuquén base (Way, 2020; Wiñazki, 2019; Jesus et al., 2020; Qiao et al., 2009). Despite the favorable terms benefitting case study nations in most agreements we analyzed, space can function as a bargaining chip for developing nations because their space infrastructure development benefits China as well (Seibt, 2020; Ibold, 2018; Reuters 2018). China’s interests in space are mainly security oriented, deterring the

United States' asymmetric advantages elsewhere (Fabian, 2019; Pollpeter, 2020, p. 12; Xiaoci, 2020). Part of this project includes the development of China's own space situational awareness system that is independent of the United States' GPS (Seibt, 2020; Ibold, 2018). In order to advance the system and make it competitive, China needs customers, and the Space Silk Road serves that purpose. These deals create a basis for new partnerships that give China access to important strategic locations for launching co-orbitals (Fabian, 2019). Space deals in the Latin American region often concern security due to proximity to the United States and access to the hemisphere opposite to China (Klinger; 2018; Wiñazki, 2019). However, in Africa, deals are more economically oriented, supporting either infrastructure for resources or China's long-term space situational awareness plan (Seibt, 2020; Ibold, 2018; Klinger 2020; Way, 2020). This slight geographical variation in purpose is depicted in Figure 2.

As far as the U.S. is concerned, recent debates about the BRI and China's movements towards cooperation with DSPs have been viewed as hegemonic competition and requiring a response from the United States (Klinger, 2018; Carmody and Owusu, 2007). This claim is difficult to maintain since there are not many U.S. partnerships or deals with which to displace or compete, and many of the countries in the case lists are still free to, and do pressure deals with other nations including the United States (Klinger, 2020, Klinger, 2018). While Chinese interests in space are mainly security oriented, recent literature suggests that China and the United State are locked in a security dilemma where each acts in response to perceived offensive competition which spirals into arms racing (Fabian, 2019). The kinds of deals and partnerships engendered in the Space Silk Road may be a possible point of cooperation between the United States and China, that may create a win-win-win scenario (Fabian, 2019; Seibt, 2020; Ibold, 2018). If the United States were to act in unison with China to assist in developing space programs through the forum of the Space Silk Road, it would increase the efficacy of deals for the recipient nations due to the financial might of the United States. Cooperation

through the Space Silk Road may also erode the perceptions that drive the security dilemma in space by functioning as a good faith act signalling that the United States' interests are not offensive (Fabian, 2019).

### ***Conclusion***

China's Belt-and-Road-Initiative reaches far, even beyond our planet. Through partnerships on space infrastructure projects with countries in multiple regions of the world, China strengthens economic and political relations with new and old partners and positions itself as an ally to smaller states with ambitions in outer space. What was once an arena dominated by the United States and the Soviet Union is now a marketplace of multitudes, and China is determined to be a key influencer in that marketplace through its Space Silk Road. Our study shows that China has devoted nearly \$1 billion USD towards space infrastructure projects in just 4 countries—most of that support comes in the form of grants and equities. These projects also tend to be versatile, serving a combination of economic, environmental, and political purposes. Although we limited our study to four main countries, we recognize that China has formed partnerships with a variety of other space agencies and corporations worldwide. Future studies could investigate whether the nature of China's partnerships changes in accordance with the relative level of advancement of the other state. Furthermore, although our study chose to focus solely on China as a major partner, future studies could seek to answer several key questions. How are other major space powers reacting to China's Space Silk Road? How do China's investments compare to the United States' and Russia's worldwide? How do independent actors like domestic corporations, multinational corporations, and nongovernmental organizations influence global space developments? Finally, what impact might the Space Silk Road have on future international agreements about the exploration and development of space?

Space cooperation is a singularity in a much broader shift in the developing world's relationship to China. Trends of growing distaste for working solely through the United States'



hegemonic model has led many to seek an alternative, of which China is eager to provide. These desires have engendered a much broader shift in trade, relations, and dealing between these parties. However, this singularity is of immense importance to the future of the developing world

and provides an important means to national self-determination. Understanding the particularities of the singularity of space cooperation—who it affects, who wins, and who loses—is important in predicting and shaping the broader future for all nations involved.

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