A Brief History of Outer Space Cooperation Between Latin America and China

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ABSTRACT

Scholarship on Latin America-China relations has focused predominantly on trade agreements, commodity exports, investment, migration, and, to a lesser extent, geopolitical implications for the post-Cold War world order. Entirely absent from research on Latin America-China relations is the question of outer space cooperation, despite the centrality of outer space-based technologies to the very sectors and relations that have proven so generative for Latin America-China scholarship and policy engagement since the turn of the millennium. Bilateral outer space cooperation between China and Latin American countries dates back to 1984, while multilateral engagements by all parties shaped the dawn of the space age in the 1960s. As such, this collaboration is an important antecedent to what is generally considered the "new" or "contemporary" geography of Latin America-China relations. Drawing on archival research, legal documents, and interviews, this article presents a brief historical geography of Latin America-China cooperation in outer space research, development, and policy.

KEY WORDS: *Latin America, China, outer space, satellites*

RESUMO

Estudos sobre as relações entre a China e a América Latina se concentraram principalmente em temas como acordos comerciais, exportação de commodities, investimentos, migração e implicações geopolíticas para a ordem mundial pós-Guerra Fria. A questão da cooperação espacial ficou completamente ausente nas pesquisas sobre as relações sino-latino-americanas, apesar da centralidade das tecnologias do espaço para esses setores e suas configurações que estimularam pesquisas acadêmicas e envolvimento político desde a virada do milênio. A cooperação bilateral na área do espaço exterior entre a China e os países latino-americanos começou em 1984, enquanto as relações multilaterais entre esses países já havia definido o início da era espacial na década de 1960. Assim, essa colaboração é um antecedente importante para aquilo que se geralmente considera como geografia "nova" ou "contemporânea" das relações sino-latino-americanas. Com base em pesquisas de acervo, documentos legais e entrevistas, este artigo apresenta uma breve ge-

ografia histórica da cooperação entre China e a América Latina na pesquisa, desenvolvimento e política do espaço exterior.

PALAVRAS CHAVE: *Latina, China, espaço, satélites*

中国与拉丁美洲国家关系的学术研究主要关注于贸易协定、大宗商品出口、投资、移民，以及较小程度上冷战后世界秩序的地缘政治影响。尽管外太空技术在各个领域和关系中处于中心地位，而这些领域和关系已被证明能够有效促进拉美国家和中国自2000年以来的学术和政策参与，但中拉关系的研究却完全未涉及外太空合作的问题。中国与拉美国家之间的双边太空合作可追溯至1984年，而双方各党派的多边合作在20世纪60年代就已形成了太空时代的黎明。因此，双边太空合作是一个重要的先行者，是拉丁美洲与中国关系"新地理"或者"当代地理"的重要前提。本文基于文献研究法，法律文件和选择性访谈，简要展示了中国和拉丁美洲国家在太空合作研究、发展和政策方面的历史地理学背景。

关键词：拉丁美洲国家，中国，太空，卫星

INTRODUCTION

China's satellite tracking and control center opened in the Quintuco region of Neuquén Province in southern Argentina in April 2017. News coverage in the Americas, in any language, was minor (Goñi, 2015). Constructed and controlled entirely by a Chinese military detachment, it was leased tax-free to China for fifty years with the approval of the Argentine Parliament in 2015. Although it is designed to track China's robotic missions to the Moon and Mars, some speculated that it was placed in Patagonia because it sits directly south of Washington, D.C., and can therefore spy on the geostationary satellites that serve the U.S. East Coast (Rotberg, 2017). Others alleged that the base could be used to interfere with communications and electronic networks. Still others worried that the potential dual use "could implicate [Argentina] in a future military conflict between the United States and China" (Dinatale, 2014). While the nature of the limited coverage of this development is a typical discursive response to reports of developments in China-Latin America space relations, the Neuquén base is but one manifestation of the evolving physical and political geographies of outer space, which involve both terrestrial and extraterrestrial spatial transformations and is driven in part by cooperation among Latin American countries and China.

With 13.5-meter and 30-meter steerable parabolic antennas, Neuquén is the largest ground tracking base outside of China and the second Chinese base in the Americas. It was built to enable China to expand its deep space exploration program. The limited news coverage was overwhelmingly alarmist, deploying the familiar tropes of China's incursion into the United States's backyard (Dinatale, 2015). This alarmist reaction stems from an imagined geography of the Americas as Washington's enduring domain (Blasier, 1985; Cottam, 1994; Grandin, 2006; Livingstone, 2013; McSherry, 2012; Schoultz, 2009). Such reactions convey the impression that these developments are an exception to the rule of U.S. hegemony in the region (Hakim, 2006; Horta, 2008; Nolte, 2013; Paz, 2006). Inaccurate as this may be, it is nevertheless

reinforced by popular notions in the Anglophone world that Latin America has little to no role to play in outer space affairs. But not only is the Neuquén base indicative of the new norm in China and Latin American affairs, outer space cooperation among the two regions goes back several decades (Delgado-López, 2005).

Yet this relationship has been almost entirely ignored in social science scholarship. In this article, I argue that the geography of evolving China-Latin America relations cannot be understood without considering the role of outer space science, technology, and policy.

Nor can global space politics be understood without considering the roles played by Latin America's and China's space programs in national, bilateral, and multilateral engagements. Drawing on archival research, legal documents, and selected interviews, this article presents a brief historical geography of Latin America-China cooperation in outer space research, technological development, and policy, and contextualizes this relationship within broader global and transnational processes of "the production of outer space" (Dickens & Ormrod, 2016) more generally. The first section contextualizes outer space in relation to more familiar domains of research on China and Latin America relations. The following sections briefly review relevant literature and examines the national, bilateral, and international agreements that constitute Latin America-China space cooperation, including new multilateral institutional forms in which Latin America-China outer space cooperation takes place. The concluding section proposes productive areas for further research on outer space cooperation among Latin American countries and China.

LATIN AMERICA, CHINA, AND OUTER SPACE IN CONTEXT

Although there is some controversy over the terms of Argentina's lease to China, the construction of the base in Patagonia is consistent with three key global developments: the planned, published, and treaty-compliant expansion of China's space program (SC, 2016b), which also has monitoring bases in Namibia, Pakistan, Kenya, and aboard five naval vessels (Kenderine, 2017); the plans by the Asia-Pacific Space Cooperation Organization (APSCO) and BRICS member states—Brazil, Russia, India, China, South Africa—to collaboratively expand satellite and remote sensing capabilities across the global South (Declaration, 2017; TBP, 2016); and a much longer history of placing space-related infrastructure in South America by overseas governments and militaries (Blinder, 2017; Messeri, 2016; Redfield, 2001; Frutkin & Griffin, 1968).

Scholarship on Latin America-China relations has focused on trade agreements, commodity exports, investment, and, to a lesser extent, the geopolitical implications of these relationships for the U.S.-dominated post-Cold War world order (Wise & Quiliconi, 2007; Roett & Paz, 2008; Sargent & Matthews, 2009; Gallagher, 2010; Jilberto & Hogenboom, 2010; Jenkins & Barbosa, 2012; Gonzalez-Vicente, 2012; Farooki & Kaplinsky, 2013; Ellis, 2013; Samanamud, 2014; Yue, 2015; Gallagher, 2016).

Entirely absent from these rich bodies of

scholarly and policy literature is the question of outer space cooperation between the two regions. This reflects a broader trend within the social sciences of overlooking the significance of the spaces and technologies of outer space in global—as opposed to US or Russian—political economy. Within the social science literature on outer space, neither Latin America nor China are given more than passing mention, with important exceptions (Blinder, 2017; Frutkin & Griffin, 1968; Harding, 2009; Kulacki, 2014; Kulacki & Lewis, 2009; Mitchell, 2017; Peter, 2006; Solomone, 2006; Z. Wang, 2010). This lack of historical, theoretical, and empirical research into China-Latin America space cooperation ignores the centrality of outer space-based technologies to the very sectors that have proven so generative for China-Latin America scholarship and policy engagement since the turn of the millennium.

For example, satellites are used to monitor the crops that comprise the bulk of South American exports to China (Wu et al., 2015). The navigation of cargo ships between China and the Latin America-Caribbean (LAC) countries depends on satellite-linked technologies (Rimmer, 2014; Johnston et al., 2015). Trade and investment agreements are informed, in part, by satellite imagery and remote sensing data concerning the resources in question (Arvor et al., 2011; Breunig et al., 2011). Communications, entertainment, and scientific research all depend on a robust and orderly international satellite infrastructure. Remarkably, diverse international satellite infrastructures have been constructed in spite of the intense international conflicts of the past five decades. This state of affairs depends entirely on the peaceful doctrines promulgated by mid-twentieth-century international treaties governing the use of outer space, the drafting of which was shaped by Latin American countries (Gorove, 1979). Perhaps the success of the treaty regime explains why the satellite infrastructure so fundamental to contemporary life has been largely ignored outside of specialist audiences: this peaceful global regime has functioned so well that most social scientists have not had to worry about its dysfunction adversely affecting conventional domains of inquiry.

Nevertheless, this peaceful global regime governing human engagement with outer space has been characterized by inequalities among and within states. Desires to overcome these inequalities served as an important catalyst for China-Brazil space cooperation in the 1980s, when both governments sought independence from the U.S. for satellite data concerning their own territories (Zhao, 2005). Ideals of South-South solidarity continue to motivate space relations between Latin American countries and China, and those relations now encompass multiple sectors.[1] [2] Cheaper defense deals with fewer strings attached made military cooperation with China a more attractive option for some Latin American governments around the turn of the millennium (Paz, 2006; Ellis, 2011). In the past three decades, scientific and technological cooperation between Latin American scientists and Chinese counterparts has deepened and in many cases preceded broader diplomatic ties (Mora, 1999; Martini, 2002; Patrick, 2011; Xinhua, 2008). Indeed, space cooperation between China and LACs has been a key component of the

changing geography and geopolitics of the Americas, China, and the world since the late twentieth century. The physical infrastructures and the new institutional networks of Latin America-China space cooperation have co-constituted the diverse geographical transformations wrought by deepening trans-Pacific ties.

Beyond interdisciplinary Latin America-China scholarship, outer space cooperation between China and Latin American countries is also absent from geographical literature. As this article shows, the trans-Pacific space cooperation that reconfigured physical space in Earth's orbits and shaped institutional geographies in the Americas precedes conventionally defined "contemporary" China-LAC relations by more than a decade. The spatial transformations most often discussed in these relations—the expanding soy frontier (Hecht, 2005; Fearnside, 2001; Oliveira & Schneider, 2014; Oliveira & Schneider 2014), large-scale investment and infrastructure projects (Gransow, 2015; Gallagher & Irwin, 2015), and land grabs (Oliveira, 2013; Borras Jr. et al., 2012)—were preceded and are supported by the transformation of the space above Earth's atmosphere into a logistical infrastructure.

Both orbital space and the infrastructure within it are a source of data for multiple national space agencies, among which agencies in China and Latin America play a key role. Therefore Latin America-China outer space cooperation can be understood in three historical geographical ways: (1) as integral to evolving Latin America-China relations unfolding across global space, including in (and in relation to) Earth orbits; (2) as an aspect of shifting space geopolitics from the last decade of the twentieth century to the present; (3) as a component of multilateral outer space cooperation networks spearheaded by the space programs of global South countries.

SOUTH-SOUTH SOLIDARITY, OUTER SPACE GEOGRAPHIES, AND LATIN AMERICA-CHINA RELATIONS

Although scientists using data from China and Latin America's space infrastructure publish scientific papers in multiple languages, there is remarkably little social science research on China and Latin America space relations published in English, Spanish, Portuguese, or Chinese. It is mentioned in passing in in English publications, with calls for the US policymaking establishment to pay more attention (Delgado-López, 2005). Portuguese and Spanish publications discuss China's space program in comparative perspective, often to highlight institutional deficiencies in Latin American programs (Costa Filho, 2002), to explore historical or potential developments (R. Acevedo, Becerra, Orihula, & Varela, 2011; R Acevedo, Varela, & Orihula, 2010; Colodro, 2011; de Oliveira, 2009), or to describe foreign policy (Cepik, 2011; A. P. d. da Silva, 2012; P. H. da Silva, 2014; Lemus Delgado, 2012; Rios, 2016). Chinese publications focus on policy analysis and technological progress (See, inter alia, Guo & Nan, 2017; M. Li, 2003; Liu, 2016; Zhang, 2000). However, the role of space cooperation in producing the geographies of China-Latin America relations has not been examined.

Considering Latin America-China rela-

tions in terms of outer space requires us to rethink several key tenets prevailing in the contemporary literature, including the character of South-South cooperation between China and Latin America, the position of outer space in Earth's geographies and geopolitics, and the elements that constitute Latin America-China relations.

As envisioned during the Cold War in a series of conferences among newly or nearly independent states[3], South-South cooperation would consist of mutual support and solidarity among Third World, developing, or nonaligned states. By sharing technology, expertise, and capital, delegates from these countries envisioned a world in which formerly subjugated nations would build modern and prosperous societies (Tsing, 2005; Prashad, 2007; Mielniczuk, 2013). Many have critiqued China's twenty-first century "South-South" and "win-win" rhetoric toward Latin American countries as a ploy to advance asymmetrical, pro-China agendas that reinforce Latin America's subordinate position in the global division of labor (Jenkins, 2012; Barbosa, 2010; Moreira, 2007). Although the picture is demonstrably more complex (Mora, 1999; Oliveira, 2004; Klinger, 2015; Narins, 2017; Oliveira, 2017), these critiques arise from legitimate environmental, economic, and geopolitical concerns (Queiroz, 2009; Escudé, 2011; Ray et al., 2017; Ray, 2017; Pirzkall, 2017). However, it is noteworthy that in keeping with the mid-twentieth-century ideals of South-South cooperation, in the outer space sector the exchange of scientific and technological expertise has actually occurred, with several African, Asian, and Latin American countries supporting the advancement of one another's space programs (Wood & Weigel, 2012; Sarli et al., 2015; Peter, 2006; Nagendra, 2016).

This is not to suggest that outer space cooperation is benign or apolitical. Existing inequalities and political struggles on Earth are manifest in outer space development (e.g. Committee, 2009; Jasentuliyana, 1994). A growing body of geographical literature analyzes outer space as a key area in which Earthly politics are expressed and an increasingly important arena with which Earthly political economies are coproduced (Beery, 2011; Messeri, 2016). The manner in which outer space is imagined and represented is dialectically related to ongoing practices of resource use, technological development, and scientific research on Earth (Geppert, 2007; Beery, 2016; Klinger, 2017). Human engagement with outer space reflects unequal power relations on Earth, while also holding the potential to either mitigate or exacerbate structural injustices. In an important recognition of the capacity for human society to engage in outer space for better or for worse, the international community enshrined outer space as the "province of all mankind [sic]," and mandated that it be used only for peaceful purposes in the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (hereafter Outer Space Treaty, or OST) (UN, 1967).

Because the services provided by space-based technologies are so crucial to economic, political, and cultural globalization, access to outer space and use of space-based data is important to culture, scientific progress, development, and geopolitical competition

(Penley, 1997; Parks & Schwoch, 2012; Harrison, 2013). Therefore, contemporary society cannot be understood without considering "the ever-increasing dependence of mankind [sic] on space-based services," (Al-Rodhan, 2016, p. 124). This includes the importance of outer space to capital accumulation (Dickens, 2007; Klinger, 2017), military strategy (Dolman, 2002; Sage, 2008), and the maintenance of heteropatriarchy (Pesterfield, 2016; Weitekamp, 2004). The accumulating significance of outer space-based technologies compels us to rethink those areas of outer space in which human activity is concentrated as immediately relevant to Earthly affairs at all levels, rather than as being beyond the global. This requires social scientists to rescale our inquiries to account for a defining feature of our age: the behavior of markets, states, social movements, and scientists is mediated through outer space-based technologies. These technologies link local, national, and international actors and institutions to their enabling infrastructures in outer space. Practically speaking, this means that orbital space is another critical scale of inquiry in social science in general, and in Latin America-China relations in particular.

This mirrors a similar insight with respect to scholarship on Latin America-China relations after the first decade of the twenty-first century. As relations between the two regions expanded beyond high-level state-to-state meetings with the growing protagonism of subnational and transnational actors, several researchers adjusted their epistemological frameworks to account for the important processes taking place at scales other than the nation-state that formed the substance of bilateral relations (Armony & Strauss, 2012; Klinger, 2015; Oliveira, 2018 [forthcoming]; Klinger & Muldavin, 2018 [forthcoming]). Taking a cue from diaspora studies (Ma & Cartier, 2003) and geographic critiques of state-centric international relations theories (Agnew, 1994, 2010), this scholarship views Latin America-China relations as playing out on many scales in addition to the nation-state. Taking the role of outer space-based technology and cooperation into account broadens the geographical scope of existing literature to consider a crucial arena in which Latin America-China relations are forged. For China and various Latin American states, outer space is a critical site for national development, in which the projection of sovereignty and geopolitical power serves as a democratizing mechanism in global fields of science, technology, and strategy. Understood in this way, the recent history of Latin America-China engagement acquires a more expansive theoretical, empirical, and historical-geographical character. Each of these aspects are briefly examined in turn.

Theoretically, the spirit of scientific collaboration in outer space and related research, vouchsafed by the mandates for peaceful use in the 1967 Outer Space Treaty, provides an important check to geopolitically charged framings that tend to predominate China-LAC scholarship (Carver, 1987; Markoff, 1976; Zhao, 2016). Both the history and the significance of China-LAC space cooperation are largely unknown, even among practitioners, policymakers, and scholars of this dynamic and growing relationship. This means research and policy debates have proceeded with little awareness or appreciation

of the profound scientific and technological ties between China and Latin America in this sector. As a result, key developments such as joint satellite launches and the construction of space-related infrastructure tend to be treated as a novelty at best, or with passing alarmism at worst, rather than examined for new theoretical insights about the cooperative configurations of contemporary geopolitics.

Empirically, trade, investment, and the impact of both comprise the bulk of the literature on Latin America-China relations. Cooney (2016), Ray (2017), Domingues (2009), inter alia, maintain that the expansion of Latin America-China relations has led to the "reprimarization" of Latin American economies as China demands ever-greater shares of the region's agricultural and mineral production. While this is demonstrably the case across several Latin American states (Escher, Schneider, & Ye, 2017), there is more to the picture. Outer space cooperation is fundamental to the political economy of Latin America-China relations beyond what it enables in primary commodity extraction. There is significant overlap between space programs and aerospace, scientific, and defense initiatives in international relations in general (Sarli et al., 2015; Pekkanen & Kallender-Umezu, 2010; Cloud & Clarke, 1999; Hulse, 2007). In the case of Latin America, outer space cooperation tends to facilitate scientific and military cooperation, particularly if China agrees to launch LAC satellites. For example, the China National Space Administration (CNSA) launched an Ecuadorian satellite at the Jiuquan Launch Center in Inner Mongolia in 2013 (BBC, 2013). This was followed by a series of high-level exchanges between military officials of both countries every year since, during which the satellite launch was mentioned in formal remarks (CMO, 2017).

The significance of satellite technologies is even greater than the support services they provide to the existing political economy or blossoming defense industries. In the case of Brazil and China, space cooperation enabled both sides to independently develop satellites and generate Earth observation data without relying on the United States for imagery essential to monitoring weather, environmental changes, and their respective territories (Furtado & Filho, 2003; da Silva, 2014). In addition to supporting scientific research in both countries, this was a crucial step toward Southern autonomy in outer space and constituted an important realization of the ideals of South-South cooperation (Lino, Lima, & Hubscher, 2000; Zhao, 2005; Epiphanio, 2005). This enabled, among other things, Brazil's space program to develop the world's preeminent tropical forest monitoring program (Stokstad, 2017). Therefore, examining Latin America-China relations in the space sector reveals empirical data on the geography, history, and motivations of Latin America-China cooperation in general, and on a key overlooked area of global space politics in particular.

An historical and geographical analysis of space cooperation shows that Latin America-China relations are deeper than is generally presumed (Kurlantzick, 2006; Li, 2007). China-LAC space relations began two decades before the widely accepted "start" of contemporary China-LAC relations in the

2000s (Zhao, 2005; Filho, 1997), and has since grown to include bilateral agreements between China and Bolivia, Peru, Argentina, Chile, Ecuador, Mexico, Venezuela, and Uruguay, respectively. This has transformed the political geography of Earth orbits from space dominated by the United States and Russia to a more pluralistic space with technologies from sixty-seven countries, ten of which are Latin American.

Furthermore, twentieth century South-South science and technology cooperation laid the diplomatic groundwork for the expansion of Latin America-China relations after the turn of the millennium (Mora, 1999). In this arena, Ecuador spearheaded global coalition-building for greater equality in outer space by articulating the interests of an international space community outside of U.S.-USSR dominance, culminating in the Equator Principles. Declared on December 3, 1976, in Bogotá, Colombia, equatorial countries asserted their national sovereign rights[4] over geosynchronous orbits (Delegations, 1976). The geosynchronous orbit is located approximately 35,800 kilometers (22, 245 miles) above Earth's equator. At this distance, satellites orbit the Earth at the same velocity as the Earth's rotation, which enables them to remain above a fixed point on Earth. The geosynchronous orbit is particularly useful for communications satellites, and allows antennas on Earth to be pointed at a fixed region of the sky. Therefore, an extension of national airspace would give equatorial countries greater power in international affairs, because countries and firms wishing to launch communications satellites would have to first attain authorization from equatorial states. Although the Equator Principles did not tangibly advance the sovereignty of equatorial states over the geosynchronous orbit, it served as an important moment of solidarity-building among Third World countries in relation to outer space (Beery, 2011).

High levels of mutual confidence and international goodwill are necessary for scientific and technological cooperation to proceed (Flink & Schreiterer, 2010). In many cases, scientists and ministers were engaged in trans-Pacific negotiation and cooperation for nearly two decades before the rapid expansion of bilateral agreements that characterized the twenty-first century. This history of space-related scientific and technological exchange must be taken into account in order to construct a more accurate picture of Latin America-China relations.

INSTITUTIONAL OVERVIEW OF CHINA AND LATIN AMERICA SPACE COOPERATION

This section provides an overview of the national, bilateral, and multilateral evolution of space cooperation between Latin American countries and China. Twentieth-century bilateral engagements between China and Latin American countries occurred several years after the establishment of national space programs, but multilateral engagements through the UN treaty process predate all bilateral agreements. The expansion of bilateral agreements among China and Latin American countries in other sectors has also engendered new multilateral space initiatives.

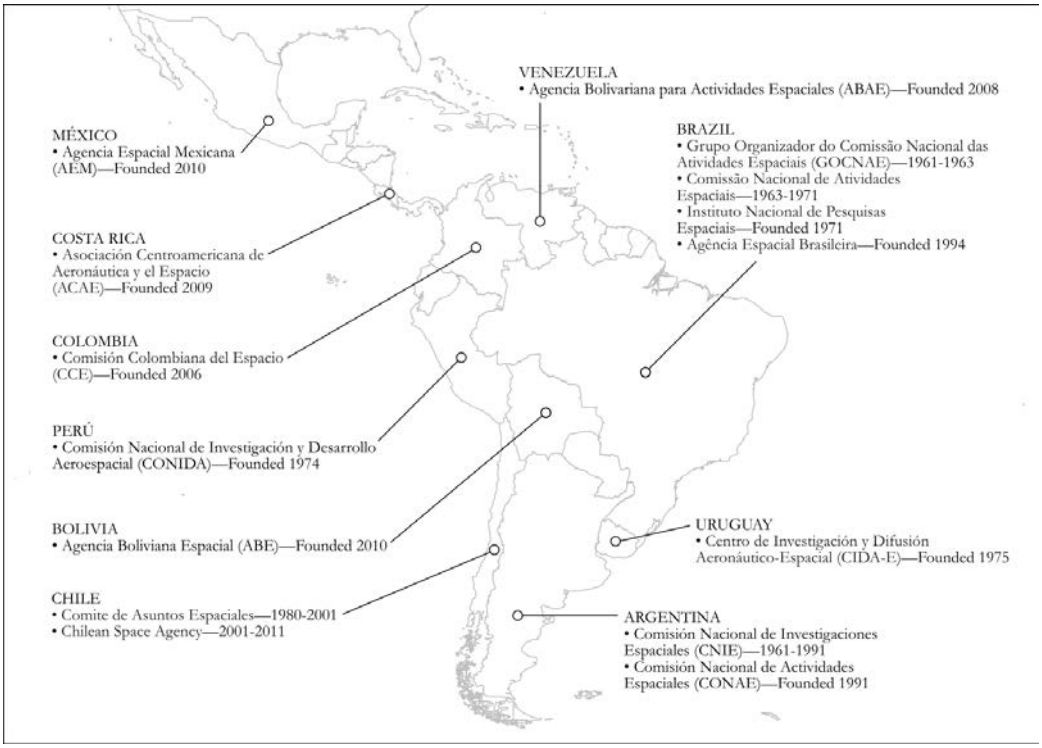

Figure 1. This figure shows the national space agencies of Latin American countries, including previous institutional incarnations. Data compiled by author. Image by MRoy Cartography.

EVOLUTION OF NATIONAL INDUSTRIES

Founded in 1956, CNSA was the third national space agency established in the world, following Greece and the former Soviet Union, and preceding NASA by two years. CNSA launched its first satellite in 1970 (Wang, 1996). Ten Latin American countries currently have space agencies, as shown in Figure 1.

National space programs in Latin America can be classified into four generations. The first generation, from 1960 to 1970, counts Argentina and Brazil among its members. The second generation, from 1970 to 1980, includes Chile, Peru, and Uruguay. The third generation, from 1980 to 2000, is effectively lost. No new Latin American space programs were established during this "lost decade" characterized by the debt crisis of the 1980s, the end of the Cold War, and the imposition of IMF-mandated structural adjustment programs in Latin American countries (Bértola & Ocampo, 2012). Each of these processes caused significant public upheaval and resulted in sharp cuts to public expenditures (Crisp & Kelly, 1999; Chossudovsky, 2003; Sparr, 1994; Bradshaw & Huang, 1991) in areas such as education, health care, and state-sponsored scientific research. A full accounting of the setbacks imposed by structural adjustment programs, particularly to the advancement of the sciences in Latin America, remains to be seen. The fourth generation, from 2000 to 2010,

Table 1. Major Latin American Space Agreements with China, organized alphabetically by country

Country	Date	Event
Argentina	**2004**	Bilateral agreement under which China will provide commercial launch services, satellite components, and other space-related technology
	2005	Argentina becomes observer to Asia-Pacific Space Cooperation Organization San Juan University collaborates with China National Astronomical Observatories and China National Academy of Science to develop a satellite laser ranging facility
	2015	Joint Argentina-China defense and weapons sales agreement that also authorizes construction of Chinese satellite tracking and control center in Neuquén Province; base is considered sovereign Chinese territory
Bolivia	**2010**	Bolivia signs $300 billion contract with China Great Wall Industry Corporation to build the Bolivia's first communications satellite; China funds 85 percent of costs
	2013	China launches second Chinese-built satellite for a Latin American partner state from Xichang Satellite Launch Center in Sichuan, China; operated by Beijing-trained Bolivian personnel
Brazil	**1984**	Joint agreement to develop the China-Brazil Earth Resources Satellite program
	1988	Protocols established for joint research and production of satellites
	1999	First China-Brazil Earth Resources Satellite (CBERS-1) launched from Taiyuan Satellite Launch center in Shanxi, China
	2003	Second China-Brazil Earth Resources Satellite (CBERS-2) launched from Taiyuan Satellite Launch center in Shanxi, China
	2005	Brazil invited to be observer to Asia-Pacific Space Cooperation Organization
	2007	Third China-Brazil Earth Resources Satellite (CBERS-2B) launched from Taiyuan Satellite Launch center in Shanxi, China
	2013	Launch failure of CBERS-3 due to Chinese rocket malfunction
	2014	Fourth successful China-Brazil Earth Resources Satellite (CBERS-4) launched from Taiyuan Satellite Launch center in Shanxi, China

Chile	**2005**	Chile invited to be observer to Asia-Pacific Space Cooperation Organization
	2011	China makes unsuccessful bid to build and launch Chilean Earth observation satellite
Ecuador	**2013**	Following delays at Russian launch site, Ecuadorian satellite NEE-1 launched from Jiuquan Satellite Launch Center in Inner Mongolia Autonomous Region, China
Mexico	**2015**	Mexico joins the Asia-Pacific Space Cooperation Organization
Peru	**2005**	Peru is a founding member of Asia-Pacific Space Cooperation Organization
Venezuela	**2005**	Venezuela Science and Technology Ministry signs joint satellite launch agreement with China Great Wall Industry Corporation
	2008	VeneSat-1 launched from China; first Chinese-built satellite launched for Latin American partner state
	2011	Venezuela signs $144.8 billion contract with China to build and launch Venezuelan Remote Sensing Satellite (VRSS-1)
	2012	VRSS-1 launched from Jiuquan Launch Center, Inner Mongolia Autonomous Region, China
	2014	Second agreement for China to build and launch Venezuelan Remote Sensing Satellite (VRSS-2)
	2017	VRSS-2 launched from Jiuquan Launch Center, Inner Mongolia Autonomous Region, China

includes Bolivia, Colombia, Mexico, Costa Rica, and Venezuela.

First- and second-generation Latin American space agencies developed independently, or in collaboration with NASA prior to the first formal trans-Pacific agreements (Sahade, 1983; Gall, 1987). Argentina's CNIE carried out some of the first southern hemisphere atmospheric physics research with rockets and stratospheric balloons, in cooperation with NASA, beginning in 1963 (Frutkin & Griffin, 1968). In 1965, Brazil built a launch center at Barreira do Inferno in the state of Rio Grande do Norte, from which Brazil's CNAE successfully launched the Sonda I and II rockets in 1967 and 1969, respectively (Sarli et al., 2015). In 1968, Chile's national telecommunications company, ENTEL, began operating the first satellite ground station in South America for data and communications services (Colino,

1968). First- and second-generation Latin American space programs now have a number of programs and international partnerships, of which those with China compose one important part.

Among fourth-generation Latin American space programs, the relationship with China is more uneven. Neither Costa Rica nor Colombia currently cooperate on outer space with China, despite vibrant partnerships in other sectors (Valderrama, 2013; Ramírez & Paladini, 2013). Venezuela and Bolivia have developed in closer collaboration with China, purchasing their first satellites from Chinese firms and sending personnel to be trained in Beijing (EC, 2017; Arasme, 2008; Mendoza, 2012).

EXPLORING BILATERAL VARIATIONS

This difference among the generations of Latin American space programs in relation to China can be explained in part by the fact that the People's Republic of China was not in a position to provide substantial space technology support to other countries during the first three decades of its existence (Harvey, 2004; Kulacki & Lewis, 2009). The first Latin America-China space agreement, with Brazil, was undertaken because both sides identified complementary needs in space research and development. As Table 1 shows, outer space cooperation between China and Latin American countries dates back to 1984, when Brazil and China signed a series of technological agreements to develop the China-Brazil Earth Resources Satellite (CBERS). It is an important antecedent to what is generally considered the "new" or "contemporary" era of Latin America-China relations, beginning after the turn of the millennium. Early agreements differed from contemporary agreements, where Chinese counterparts act as patrons and powerful investors. In outer space relations, the CBERS collaboration most closely resembles the peer-to-peer ideals set forth in the mid-twentieth-century South-South conferences.

Three trends emerge from this overview of bilateral space cooperation between Latin American countries and China. The first is that China's space agencies are often one of several international parties bidding for satellite construction and launching contracts. China Great Wall Industries Corporation (CGWIC), for example, placed successful bids to build satellites for emerging space powers such as Bolivia and Venezuela (Acevedo et al., 2011; ABI, 2011). In both cases, CGWIC won the open international bidding process and provided the majority of the financing for satellite development and launch. In the case of Venezuela, CGWIC won subsequent bids. In the case of Bolivia, CGWIC subsequently lost to European agencies. This shows that the relationship Bolivia's and Venezuela's space programs have with international partners remains open and competitive, despite rhetoric on the part of both countries' leadership to favor China above Western partners (Linehan, 2016; Achtenberg, 2017).

The second trend shows an extensive history of data sharing among China's space agency, researchers, and their partners in Latin America. CBERS is one long-standing ex-

ample of data sharing through joint satellite initiatives, but China also provides satellite data to Latin American partner states from its own satellites. Following Ecuador's 7.8 magnitude earthquake in 2016, for example, CNSA provided satellite imagery and remote sensing capabilities to aid in disaster management and recovery (Xinhua, 2016).

The third trend is that outer space cooperation among Latin American and Chinese counterparts is viewed by actors on all sides as essential to fulfilling multiple development and diplomatic agendas. These diverse partnerships are consistent with Section 9 of the

Table 3. Major Twentieth-Century Space Treaties

Date	Treaty	Purpose	Parties/ Signatories
1967	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST)	Establishes basic legal framework for space law; defines outer space as the province of all humankind; mandates peaceful use, prohibits weaponization or claims of sovereignty, and establishes an international reporting protocol	107/23
1968	Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space (ARRA)	Any state party must provide all possible assistance to rescue the personnel of a spacecraft in distress; the state must provide full assistance to personnel who have landed in their territory, regardless of reason	92/24
1972	Convention on International Liability for Damage Caused by Space Objects (LIAB)	Expands the liability provisions of OST to clarify that states bear international responsibility for all space objects that are launched within their territory, regardless of the origin of the object; joint launch partners share joint liability	89/22
1976	Convention on Registration of Objects Launched into Outer Space (REG)	Requires states to report the object and orbit to the United Nations	63/25
1979	Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (MOON)	Establishes a regime to govern the use of the Moon and other celestial bodies, similar to the United Nations Convention on the Law of the Sea	17/11

2016 Policy Paper on Latin America and the Caribbean issued by China's Ministry of Foreign Affairs, which states:

> China will actively explore cooperation between the two sides in such fields as communication and remote sensing satellites, satellite data application, aerospace infrastructure, and space education and training, and promote space technology application in disaster prevention and mitigation, agricultural and forestry monitoring, climate change and other fields. China will pay full attention to the role of space technology as a driving force for the scientific, technological, and industrial development of Latin American and Caribbean countries, and promote sustainable development in science and technology and the economic fields (MOFA, 2016, n.p.).

As with most policy papers issued by China's government, the stated priorities reflect existing practices and signal the intention to continue them into the near future. Spacefaring Latin American governments have responded with official declarations in favor of this vision, while also reframing it to suit domestic priorities identified by national policymakers. Although there is considerable internal debate within countries as to the merits of investment in space in general, and collaboration with China in particular, these policy positions have been formulated according to the frameworks provided by major United Nations treaties. They are supported by the emergence of South-led multilateral space institutions that include other developing countries beyond bilateral Latin America-China ties.

MULTILATERAL INSTITUTIONS

Multilateral governance is essential to managing human activity in outer space. This is because activities in outer space occur beyond the reach of any single nation state, by virtue of the geographical relationship between Earth and outer space. Earth is in motion relative to the rest of the cosmos, and this includes any objects placed there by humans. Therefore, the space of outer space is in dynamic relation to the physical geographies of Earth, including the satellites in Earth orbit. Hence the misuse of outer space by any single party could create significant vulnerabilities for people across the globe, constrain the options of non-spacefaring states, and damage the space technology assets of other actors.

This collective realization stimulated concerted international activity through the United Nations at the dawn of the space age. The Committee on the Peaceful Uses of Outer Space was created by the UN General Assembly in 1959 with the mandate "To govern the exploration and use of space for the benefit of all humanity: for peace, security, and development" (UNOOSA, 2017). Fourteen[5] Latin American countries were founding members of the committee, which subsequently developed the five principle UN treaties on outer space. Table 2 summarizes these treaties and their objectives.

Awareness of the potential promise and perils of human engagement with outer space compelled all major spacefaring countries to

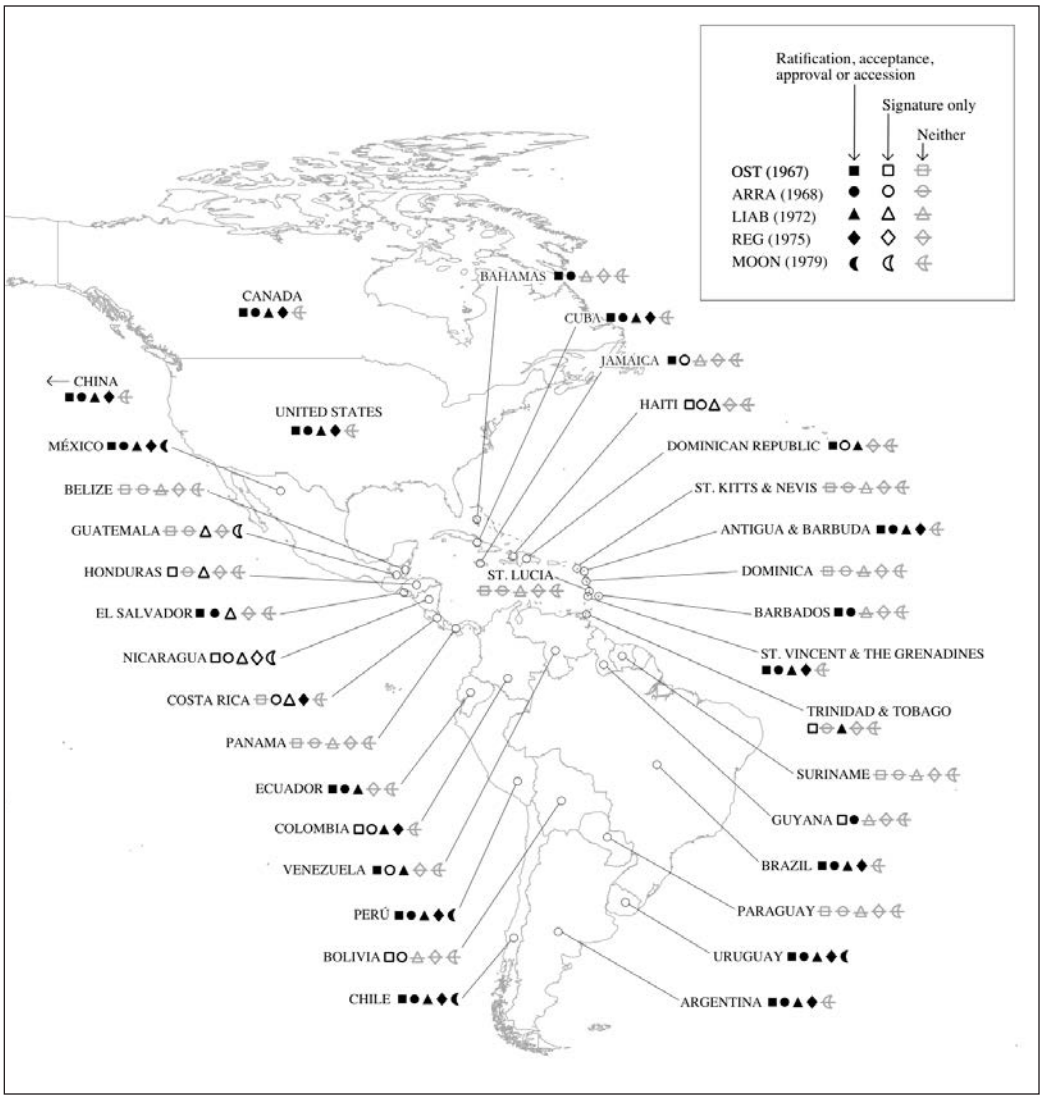

Figure 2. Source: United Nations Office for Outer Space Affairs

sign the 1967 Outer Space Treaty, which prohibits the weaponization of outer space and expressly prohibits claims of sovereignty "by means of use or occupation, or by any other means" (UN, 1967). This is the first and most widely adopted space treaty. It was formulated at the height of the Cold War to prevent the militarization or colonization of outer space by early spacefaring powers. Significantly, both the United States and the former Soviet Union were early signatories. They were compelled by the recognition that an infinite theater for the Cold War arms race would likely drive both countries to bankruptcy (Garthoff, 1980). Since then, the United Nations Office of Outer Space Affairs has been the primary international institution through which space activities have been reported and monitored.

Participation in this and other major outer space treaties serves as an international confidence-building mechanism that has facilitated space cooperation among parties that might otherwise have active conflicts (Sagdeev, Eisenhower, & Lodgson, 2008). It is noteworthy that Latin America-China space cooperation is strongest among partner states that have signed or ratified the majority of the major UN outer space treaties. Figure 2 shows the participation of China and Latin American countries in these treaties.

The UN provided a forum though which China and Latin American states interacted on questions of outer space cooperation at the international level prior to bilateral agreements. Through their engagements with UN treaty processes and their participation in the United Nations Committee on the Peaceful Uses of Outer Space, several Latin American countries have actively shaped the international legal and political context in which the first space age unfolded, particularly around questions of peaceful use and equitable distribution of benefits (Delegations, 1976). In the years that followed the signing of OST, a number of international coalitions presented additional treaties, principles, and resolutions to provide greater specificity on the conduct permitted in outer space, with special attention to the rights of developing and non-spacefaring states (e.g. UN, 2016). Nevertheless, there is a clear declining trend of participation in treaties subsequent to the 1967 OST. Treaties that attempted to extend and clarify provisions in OST intended to reconfigure outer space as a place where Earthly inequalities might be mitigated had fewer signatories, despite the apparent interests of Latin American countries that would be served by such treaties. This requires further research that is beyond the scope of this article.

Beyond the UN, Latin America-China outer space cooperation is diversified and operational at multiple scales, from interuniversity partnerships to joint launch agreements to building new multilateral institutions. These new alliances further democratize outer space, even as access to and control over space-based resources remains uneven. Not all Latin American countries participate in these new multilateral institutions in which China plays a key role, which is both indicative and generative of uneven power relations among Latin American countries.

ASIA-PACIFIC SPACE COOPERATION ORGANIZATION

China's National Space Administration and affiliated policymakers across the developing world have advanced multilateral space cooperation through APSCO. The organization was cofounded in 2005 by space agency representatives from Peru, China, Iran, Bangladesh, Pakistan, Mongolia, Thailand, and Turkey. The establishment of APSCO was preceded by thirteen years of Asia-Pacific Workshops on Multilateral Cooperation in Space Technology and Applications (AP-MCSTA). At the conclusion of the first workshop, in 1992, participants voted unanimously to establish APSCO as an institutional mechanism to promote multilateral cooperation in space technology and its applications. AP-MCSTA convened annually in each of the member states. At the 2001 meeting, members voted to establish the sec-

retariat in Beijing. Representatives from the founding member states met frequently over the next two years to draft the APSCO convention, which was then circulated for commentary in November 2003. Representatives from Chile, Brazil, and Argentina joined delegates from founding member states at the 2005 signing in the Great Hall of the People in Beijing.

The ideals of the organization were formulated in deliberate contrast to superpower space programs, which APSCO accused of non-scientific motivations: "Past experience shows that during the Cold War years, space policies of the superpowers primarily rested on political considerations. They spent huge amounts of money in space just for rivalry, claiming hegemony in space" (He, 1994, p. 207). By contrast, early AP-MCSTA delegates noted that interest in developing national space capacities appeared to be waning in the post-Cold War years in the United States and Russia, which created an opportunity for developing countries to expand their space programs.

In the early 2000s, UN delegates from AP-MCSTA countries reframed their aspirations using the language of sustainable development: "The use of space technology is becoming the most important tool for the sustainable socioeconomic development of a nation, especially for developing countries" (UN, 2002). This new discourse reflects shifting global hegemonies from the unsettled moment at the end of the Cold War to the consolidation of multilateral alliances under the banner of sustainable development.

"Sustainable development" is a broad term that has been enlisted to advance many complex and sometimes contradicting causes (Roy et al., 2016). APSCO's continued use of this term is no different. The organization has an explicit policy to promote the industrialization of space technology and its applications among member states. Concretely, this has meant technology-sharing agreements and contracts between the space agencies of APSCO countries and contractors in China for a variety of purposes, some of which can be described as sustainable and others that can be classified as development. The same satellites that support climate science are also providing data to support environmentally destructive development plans. The most prominent example of this to date is the alignment of APSCO policy with the implementation of China's Belt and Road Initiative.

An APSCO forum convened in Beijing on October 27, 2015, with the title The Belt and Road Initiative for Facilitating Space Capabilities Building of the Asia-Pacific Countries. With the unanimous support of all members, APSCO issued the following declaration:

> We believe that the objective of jointly building a community of shared interests, responsibility and destiny proposed by China's "The Belt and Road" strategy conforms to the mission of APSCO, and the Space-Based Integrated Information Corridor concept proposed by China is consistent with the vision of the development and cooperation of APSCO and its Member States (APSCO, 2015).

This was followed by a 2016 statement by CNSA outlining its focus on the "Construction of the Belt and Road Initiative Space Information Corridor, including Earth observation, communications and broadcasting, navigation and positioning, and other types of satellite-related development; ground and application system construction; and application product development" (SC, 2016b). The APSCO declaration included the support of Latin American member states and observers. This indicates an evolving multilateral outer space geography beyond Latin America but in which Latin American member states are invested—beyond the more obvious bilateral engagements such as China's Argentina base and Latin American satellite launches using Chinese rockets. It is also a concrete manifestation of the links between terrestrial and outer space when it comes to development and geopolitics. Infrastructure integration initiatives cannot be understood apart from the space-based infrastructure used to plan, support, and securitize these projects.

Space infrastructure shows the direct and indirect linkages between the Eurasian infrastructure project and Latin America. Directly, space-based navigation, positioning, and communications infrastructure is essential to getting Latin American commodities to East Asia, while the Eurasian infrastructure of the Belt and Road is pitched to Latin American counterparts as providing access to new markets for Latin American goods. This has fired the imaginations of Latin American leaders, with Chilean President Michelle Bachelet proposing a trans-Pacific fiber optic cable and systems of highways and tunnels across the Andes Mountains to link remote regions of South America to Asia (Telesur, 2017). Although specific projects linking Latin America to Central Eurasia via the "Twenty-First Century Maritime Silk Road" (Jiao, 2013) remain aspirational at this point, the endorsement of the initiative by leaders of several Latin American countries is important to generating the international political capital to silence detractors, principally from the United States.

BRICS SATELLITE INITIATIVE

The BRICS countries represent another key locus in which two players in Latin America-China relations, China and Brazil, are transforming the political geography of satellite space in order to transform global resource geopolitics and global political economies of development, trade, and investment more generally. On October 31, 2016, the heads of space agencies of the BRICS member states met in Zhuhai, China, to discuss the construction of joint satellite arrays for Earth observation and remote sensing. Less than a year later, on July 3, 2017, the parties convened in Haikou, China, to draft the BRICS Remote Sensing Satellite Constellation Agreement. A technical meeting in Brasília, Brazil, followed on September 18–20, 2017, which served as the first official BRICS Remote Sensing Satellite Forum.

Although there is considerable variation among BRICS national space programs, all member states possess technological capacity and ground-based infrastructures that they can reclassify as part of the initiative. Brazil will contribute Earth observation data from the joint China-Brazil Earth Resources

Satellite, CBERS-4. This satellite scans the entire surface of the Earth every twenty-six days. Russia's Kanopus-V1 is a remote sensing satellite that monitors natural disasters, agriculture and land use change, forest fires, and major pollution incidents. India's Resoursesat-2 primarily monitors land use change in South Asia. China's Gaofen-1 and Ziyuan-3 provide near-real-time observations of disasters to support prevention and relief. Each of these satellites have a resolution of one to three meters, which allows for a variety of scientific, commercial, and security uses. Among many other applications, the coordination of a BRICS remote sensing network will provide the BRICS-founded New Development Bank with the data and imagery that is critical to development project planning, implementation, and monitoring. South Africa currently does not have an Earth observation satellite larger than a nanosat, but the South Africa National Space Agency is responsible for aggregating Earth observation data for southern African countries. It is part of the International Space Environmental Service and monitors weather for the southern African region. At present it is contributing terrestrial infrastructure to the effort, with plans to expand its satellite capabilities in the next decade.

The BRICS remote sensing initiative is proceeding in two phases. The first is to construct a legal geography hospitable to this initiative by realigning national space activities and policies to facilitate technology transfer and information sharing among the BRICS member state space agencies. These legal and institutional transformations are intended to create the global circuits of power, expertise, and visibility necessary to support the second phase in 2020 or 2021, which is the launch of a BRICS remote sensing satellite constellation.

A GEOGRAPHICAL APPROACH TO LATIN AMERICA-CHINA OUTER SPACE COOPERATION

This history of cooperation between China and Latin American countries since the dawn of the space age has carried with it new geographies of power, institutions, and expertise. Their respective roles in multilateral forums, as well as the technological capacity advanced through these partnerships, has been critical to sectors as diverse as military strategy, environmental protection, commodity speculation, entertainment, and development finance—all of which shape the contemporary geographies in the Americas, China, and the world. The cases of APSCO and the BRICS satellite initiative show that Latin America-China space relations do not exist in a vacuum. Instead, they are part of global outer space politics. This compels us to rethink twentieth-century space developments as driven by multiple protagonists with diverse means of engagement—rather than as characterized by the bipolar relationship between the U.S. and the former USSR—and to understand the political economy of Latin America-China engagement as more expansive than the commodity-based trade and investment relations that tend to dominate the literature.

It then follows that neither China nor Latin American countries confine their international space cooperation to bilateral agree-

ments. Space agencies from all countries discussed here are embedded in global science and technology networks in the global North and global South. For example, Peru, Mexico, Chile, Brazil, and Argentina engage through APSCO while also cooperating with North American and European space programs on legal, technological, and research-based endeavors. The BRICS collaboration is meant to build a global satellite array beyond the purview of the United States and for the development agendas of BRICS member states, but must coexist with current agreements with U.S., European, and Australian space agencies. As the preponderant institution in both multilateral initiatives, China National Space Administration highlights the complementarity of APSCO objectives and the BRICS satellite initiative (SC, 2016a), while space agency representatives from BRICS member states are actively seeking closer collaboration with APSCO (APSCO, 2017). This increases the prominence of Brazil, Peru, and Argentina in global space affairs, which shows that the engagement on the part of Latin American countries in global outer space politics is characterized by uneven participation and diverse strategies. This reflects differences among Latin American countries, characterized by regional politics of power and hegemony (Schenoni, 2014; Diez, 2016), and requires further analysis.

These power and policy differences are tangible. They manifest in the construction of space-related infrastructure on Earth and in orbit. The construction of this physical infrastructure followed critical political transformations over the course of the twentieth century. It has, in turn, generated new political alliances that transform patterns of production, consumption, and distribution across the globe.

The way these technologies are used influences politics, culture, and development within China and Latin American states with space programs, as well as those subject to surveillance by these satellites beyond national borders. In some aspects, as in the case of China's Neuquén base, Latin America-China space relations resemble colonial era placement of space infrastructure in South America by global North space programs (Redfield, 2001). In other aspects, Latin America-China space cooperation reflects the ideals of South-South solidarity, wherein both sides have tangibly increased their national autonomy relative to the global North in the production of space-related knowledge and power. All of these power dynamics coexist in the dialectical production of Earthly and orbital geographies in (and in relation to) Latin America and China.

In each context, these configurations of space-based technologies and their terrestrial infrastructures entangle with immediate and longer term processes constitutive of the power and politics of each place. Further research and theory building are required in order to account for the diverse ways in which Latin America-China outer space cooperation has shaped 20th and 21st century geographies. An important area for historical research would be the intersection between particular moments in global geopolitics, national developmentalist agendas, and local struggles over the placement, meaning, and use of outer space infrastructure, such as Mitchell's (2017) account of multiscalar ra-

cial politics and land conflict surrounding the construction of Brazil's Alcântara launch site, or Blinder's (2017) analysis of the geopolitical imaginaries of Chinese and European space infrastructures in Argentina. Further inquiries will build on a small but robust body of literature that explores these themes in the construction of terrestrial space infrastructure in Latin America (Blinder, 2017; Lane, 2010; Messeri, 2016; Mitchell, 2017; Redfield, 2001), but currently emphasizes the role of the US and Europe.

An investigation into why some Latin American states did not sign on to important space treaties following the 1967 OST could yield new insights into the diverse interests shaping outer space governance, particularly during a time when major space powers are destabilizing this treaty regime. In the contemporary moment, the deployment of joint satellite technologies to support the planning and securitizing operations of major infrastructure projects, such as IIRSA in South America, or the Belt and Road in Eurasia, require immediate attention, both for their potential to democratize the use of orbital space as well as for the potential uses of these technologies to intensify local dispossession.

CONCLUSION

This article provided an initial overview and framing of Latin America-China space cooperation. In so doing, it contextualized Latin America-China space cooperation within: (1) existing literature and practice on Latin America-China relations; (2) contemporary and historical global space geopolitics; (3) global governance frameworks concerning the use of outer space. Latin America-China space relations emerged from the Cold War struggles for development and recognition on the part of global South countries, and are a key part of twenty-first-century global political economy and resource geopolitics.

Failing to account for outer space weakens theorizations of China and Latin American relations, as well as our most fundamental empirical understandings of the origins, operations, and ongoing transformations forged by these evolving transpacific geographies. Research on space cooperation between Latin America and China should concern not only the "big" questions of international politics—or the significance of these collaborations to the advancement of environmental sciences, climate change research, disaster monitoring, and development projects, to name a few—but also the local questions of displacement, environmental (in)justice, and freedom of movement that can be helped or hindered depending on the manner in which satellite technologies are used. Who has access to satellite-linked technologies, and under what conditions, increasingly defines the horizons of political, economic, scientific, and cultural possibility. Until now, these questions have been largely overlooked, particularly outside of the US. This is part of a larger problem in which the history, broader significance, and future prospects of these international scientific and political practices are unstudied and under-theorized in the social sciences in general and in relation to China and Latin American countries in particular. Going forward, these will provide productive areas for further geographical inquiry.

NOTES

1 Interview 1, China Academy of Science, Beijing, March 2013.

2 Interview 2, National Space Research Institute, São José dos Campos, Brazil, June 2017.

3 For example: the 1955 Afro-Asian Conference in Bandung; the 1961 Afro-Asian Women's Conference in Cairo; the 1961 Non-Aligned Movement Conference in Belgrade; the 1966 Tricontinental Conference in Havana, inter alia.

4 From the text of the declaration: "Equatorial countries declare that the geostationary synchronous orbit is a physical fact linked to the reality of our planet because its existence depends exclusively on its relation to gravitational phenomena generated by the Earth, and that is why it must not be considered part of the outer space. Therefore, the segments of geostationary synchronous orbit are part of the territory over which Equatorial states exercise their national sovereignty."

5 Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Mexico, Nicaragua, Peru, Uruguay, Venezuela.

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