Strategic Competition for Space Partnerships and Markets

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Abstract

China and Russia's global space footprint in the economic and financial (E&F) domain is not well understood today. This chapter, through analyses of space-related transactions of China and Russia globally, describes the pro-active approach to international space partnerships by these two state actors. It concludes that these partnerships are often skewed, exposing recipient countries to

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vulnerabilities and dependencies on the benefactor(s). The more subtle strategy deployed in the developed, democratic countries to gain influence is conducted on an incremental basis (e.g., through commercial contracts, academic exchanges, scientific research). The other approach, described as "space sector capture," mostly involves developing countries and consists of offering package deals of capabilities, services, and financing, creating sore-source supplier relationship and long-term dependencies. The chapter argues that the pace and nature of these international space partnerships concluded by China and Russia present a strategic and competitive challenge for Europe, the USA, and other allies, including the development of global space governance, as well as market based on transparency, good governance, and disclosure.

Introduction

The actions and conduct of Russian and Chinese state-owned and -controlled enterprises (SOEs) are often driven by both commercial *and* strategic considerations. This has become increasingly evident with the emergence of new brands of soft power projection adopted by both countries. In the economic and financial (E&F) domain, this means seeking to gain influence and strategic advantage over targeted states via ostensibly commercial, legal transactions, and projects (e.g., acquisitions, partnerships, loans, joint ventures, minority investments).

There is a dearth of understanding concerning how China and Russia are using the legitimate E&F domain to compromise the integrity of the space sectors of various countries that lack space programs, adequate funding, operating personnel, and technical expertise. These include various levels of "space sector capture" achieved through the offer of end-to-end capabilities (i.e., vertically integrated packages of design/manufacturing of satellite(s), launch services/launch insurance, ground segment construction/equipment, provision of operating personnel, the training of local staff, and financial assistance) (Robinson et al. 2019).

These offers often involve the use of nonmarket trade and financial practices for the purpose of expanding their global space footprint at a strategic level (with a number of associated operational, political, geographic, and military benefits). This is being accomplished through securing desired foreign projects/assets, beachheads in priority regions, the acceptance of subsidized loans often to non-creditworthy state borrowers to acquire political leverage and/or secure the collateralized assets in default scenarios. China's and Russia's economic and financial activities in the developed, democratic countries involve more incremental approach, often through seemingly benign scientific research/development, academic exchanges, individual commercial contracts, or broader funding commitments beyond the space sector (Robinson 2018a).

As the economies of China and Russia are inextricably linked with their governments, its companies do not operate as traditional commercial enterprises. Many decisions pertaining to overseas investments are subject to approval by government authorities. State-controlled enterprises, including quasi-private companies, usually

have some level of state involvement in their management structures and are obliged to comply with government policies and directives.

The activities of these companies in the international trading and financial systems are designed to appear benign and commercial, providing space aspirants with capabilities they crave, ostensibly to advance the prosperity and security of these targeted countries. Countries lacking a space program, adequate funding, and technical expertise are generally open to such seemingly magnanimous offers, even if it means their countries could well become perilously dependent on these outside benefactors (Robinson 2018b).

Such international partnerships result in dependency, even control, over the space sectors of the recipient countries (e.g., Belarus, Bolivia, Nigeria, Pakistan, Sri Lanka, and Venezuela). The transactions, including offers of large-scale financing at below-market terms, are primarily for the purpose of expanding China and/or Russia's global space footprint at a strategic level (with a number of associated operational, political, geographic, and military benefits) (Robinson 2018c).

This article provides an overview concerning how China and Russia are using the legitimate E&F domain to compromise the integrity of the space sectors of various countries that lack space programs, adequate funding, operating personnel, and technical expertise. Through granular analysis of space-related transactions of Chinese and Russian state-controlled enterprises, the article demonstrates that this trend represents a material risks to the targeted countries from the perspectives of national security and sovereignty. In short, this chapter introduces a new risk category within the space security portfolio, namely the economic and financial (E&F) operations of nondemocratic state actors. It brings forward the above-referenced "space sector capture" concept and delineates its elements. It then describes the transactional approach of China and Russia to international space partnerships. Finally, it offers key findings and recommendations.

Global Chinese and Russian Economic and Financial Space Activities

The analysis provided in this section draws from the research, including an open-source database, of the Prague Security Studies Institute (Robinson et al. 2019) concerning the strategic and commercial dimensions of space-related Chinese and Russian economic and financial activities globally. It provides an overview of prominent space-related partnering arrangements, which often involve partial or full dependency of the recipient countries on Chinese or Russian financing, technology, equipment, services, and/or expertise.

As of February 2020, China and Russia have been actively engaged in space partnerships in at least 78 countries (see Fig. 1). These two state actors have been especially active in Latin America, Europe, South/Southeast Asia, and Africa. China has also increased substantially its outreach to the Arctic countries in the past decade (Figs. 2 and 3).

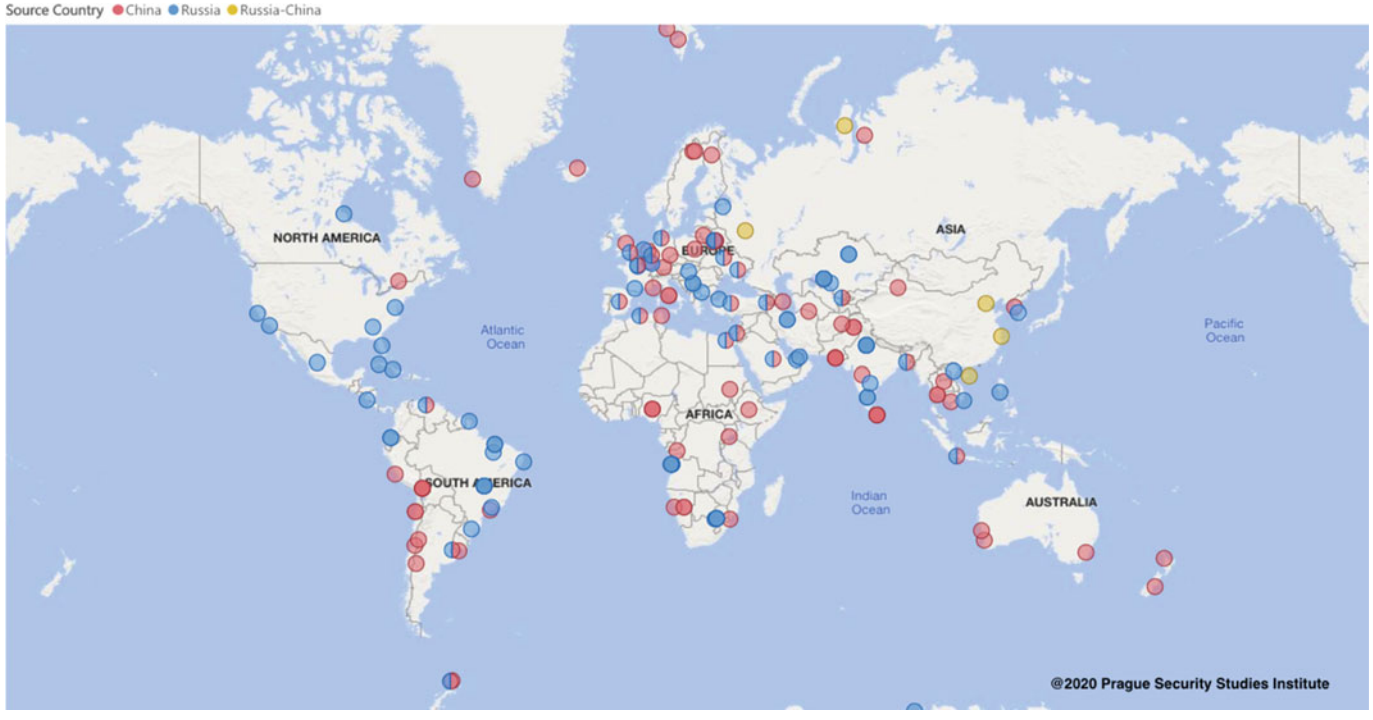

Fig. 1 Prague Security Studies Institute (PSSI) global map of space transactions of China and Russia as of February 2020 (does not include the Arctic and Antarctica)

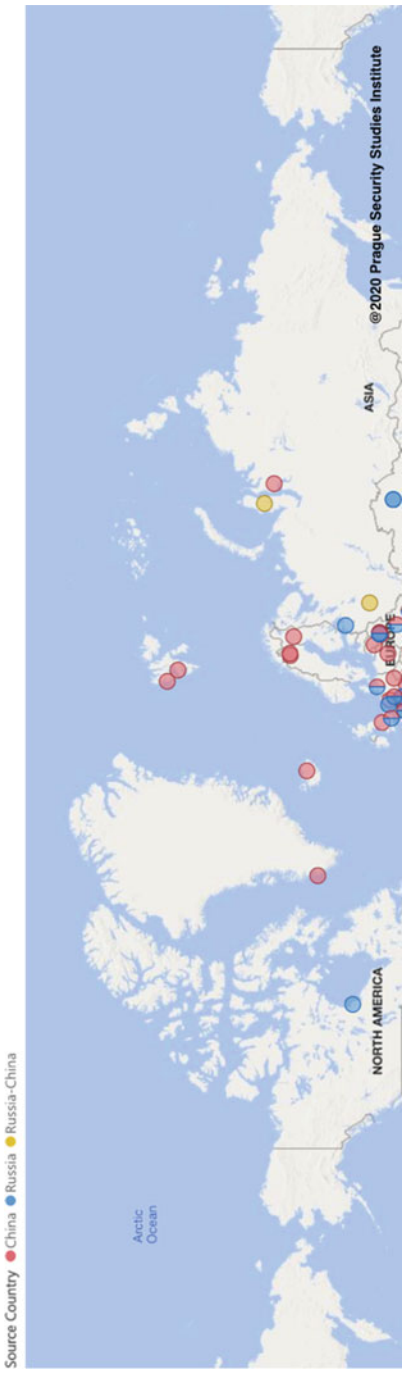

Fig. 2 PSSI map of space transactions of China and Russia in the Arctic as of February 2020 (does not include the Arctic and Antarctica)

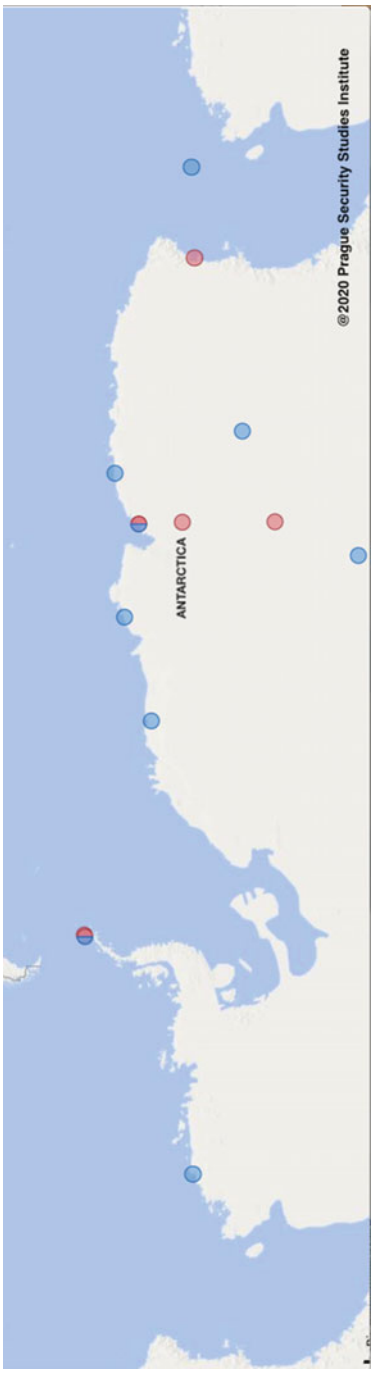

Fig. 3 PSSI map of space transactions of China and Russia in Antarctica as of February 2020 (China in red, Russia in blue)

Africa

Both Russia and China have assisted a number of African countries in establishing, or expanding, their space activities. Russia has worked with Angola, Algeria, Egypt, and South Africa and China has reached out to Algeria, Democratic Republic of Congo, Egypt, Ethiopia, Mozambique, Namibia, Nigeria, Sudan, Tunisia, and Uganda. In all of these cases, space ground infrastructure was provided, often through subsidized lending arrangements or even taking stakes in local companies.

Russia, for example, launched a satellite for Egypt in 2014 and also assisted in the development of their third Earth observation (EO) satellite that was launched in 2019 from Baikonur. It has offered engineering and other assistance to Ethiopia and helped South Africa in developing a satellite surveillance program.

Notable examples of China's activities in Africa are those in Nigeria. China entered Nigeria's space sector in 2004, manufacturing Nigeria's first communications satellite, NigComSat-1 (based on the Sinosat-2), which was launched in 2007. It failed after 18 months in orbit. Its replacement, NigComSat-1R, was launched in 2011 (Krebs 2017). Both satellites were built and launched under a contract with the state-controlled China Great Wall Industry Corporation (CGWIC), and the second satellite was subsidized 100% by China. It was the first time that China had reached out to a foreign country in this fashion and the first time that CGWIC provided all aspects of in-orbit delivery of a satellite for an international customer. This means China also provided two ground stations (one tracking station in Kashi, China, and one fully operational station in Abuja, Nigeria), training of personnel, financing, and insurance. In 2018, China agreed to finance (through the Export-Import Bank of China) the building of two new communication satellites, but in exchange for CGWIC's stake in state-owned NigComSat Ltd. (Nigeria's satellite communications operator and service provider). China also offered to possibly send a Nigerian astronaut to space in the 2030s.

The Nigeria example demonstrates that a recipient country can become largely dependent on its benefactor (China in this case) for its space program through this strategy of offering a complete "package deal." In a similar fashion, China has offered a satellite "package deal" to Ethiopia, Algeria, Sudan, and Congo. As for Russia, it offered a package deal to Angola and Egypt.

Latin America

Both China and Russia successfully built and operate space infrastructure in this region. There is a robust increase in China's influence in Latin America, including through promises and agreements to provide space-related technology, expertise, and services. China has worked with Argentina, Bolivia, Brazil, Chile, Cuba, and Venezuela.

A controversial project was built by the China Harbour Engineering Company (CHEC), a subsidiary of People's Liberation Army (PLA)-affiliated China Communications Construction Company (CCCC), in Argentina – a satellite tracking,

telemetry, and command station in the Patagonia region, operational since 2017. CHEC is also involved in illegal island-building, and the militarization of same, in the South China Sea. China was able to secure a 50-year lease agreement of the land and facility and does not permit the entry of local officials. It also does not employ local personnel (Londoño 2018). The Neuquen TT&C station in Argentina is in the proximity of a number of infrastructure assets constructed by China in South America, the Fibre Optic Austral in Chile and the China-funded multi-billion-dollar turnkey railway and infrastructure projects in Argentina (Giri 2018). China also built a 60 cm-diameter telescope which resides in the Observatorio Astronomico "Felix Aguilar" (OAFA) of the National University of San Juan (UNSJ). It provides data to the International Laser Ranging Service (ILRS). Another China-Argentina Radio Telescope (CART) is planned to be completed by June 2020.

More recently, an Argentinean company, Satellogic (developing a constellation of EO satellites with panchromatic, hyperspectral, multispectral and infrared capabilities), announced that it would launch its fleet of spacecraft on Chinese rockets under a contract with CGWIC. It is the largest single contract for Chinese launch industry in the international commercial market in more than 20 years (Clark 2019). The first two satellites were launched in January 2020.

Brazil is subject to US export control-related restrictions and indirectly affected by the US ban on space commerce with China. It has viewed collaboration with China and Russia in space as fundamental to its efforts to overcome bottlenecks related to the development of its space program (without any apparent concern over the country's dependency on China and Russia in this strategic sector).

The flagship project of Beijing's space collaboration with Brazil is the China-Brazil Earth Resources Satellites CBERS program. It is a collaboration between CAST (China Academy of Space Technology) and INPE (Instituto de Pesquisas Espaciais). China provided the technology, launch service, and subsidized financing. Data from the project have been shared since 2004, with third parties (ESA 2019).

Russia was the first to offer collaboration to Brazil in the area of global navigation. As of February 2020, Brazil hosted four GLONASS ground stations on its territory (the largest number outside Russia). Besides Brazil, Russia established GLONASS stations in Argentina, Ecuador, Nicaragua, and Venezuela. China is also seeking to launch collaboration with Brazil on its global satellite navigation system, BeiDou (which it asserts will be global by 2020) (Selding 2015). Russia also partnered with Brazil on its Russian telescope at Pico dos Dias Observatory in Brazopolis, Minas Gerais, operational since 2018. This electro-optical facility is designed to help fill the observation gaps in the geostationary orbit. Russia is reportedly planning to deploy an optical-electronic monitoring station in Chile, Mexico, and South Africa (Ibeh 2019).

Cuba, not surprisingly, hosted a large Russian signals intelligence facility between 1962 and 2002. It is said to have reopened in 2014 (Kelley 2014). Interestingly, that same year Russia wrote off some 90% of Cuba's $32 billion Soviet-era debt. Currently, Cuba's largest international creditor and trading partner is, perhaps not surprisingly, China. In May 2018, satellite images revealed a newly

constructed radome within the signals intelligence base in Bejucal, Cuba. It is believed that Beijing financed this new facility (Lee 2018).

China also seeks to expand its space observation capabilities through its collaboration with Chile, establishing an astronomical research center at the Catholic University of Chile in 2013 and a plan to build its own observatory some 30 km from Chile's Paranal Observatory. As Chile has relatively good governance and strong institutions, however, China may not have gotten a preferential deal, typically involving public procurement regulations beneficial to Chinese companies, or Chinese loans and investments (Ellis 2017).

When it comes to the telecommunications sector in Latin America, China delivered complete packages (involving construction, financing, delivery, ground stations, and operations) to Bolivia, Venezuela, Cuba, and Uruguay. Argentina, Bolivia, Brazil, and Venezuela are all laboring under a troubling degree of space sector dependency with a common thread of China financing their projects through direct investments.

Europe

Unlike in Africa and Latin America, where China, and to a lesser degree Russia, have been frequently offering vertically integrated space sector packages (partial or complete), including large-scale subsidized financing, their approach in the developed, democratic countries is more subtle and incremental, often involving seemingly benign scientific research/development initiatives, academic exchanges, individual commercial contracts, or broader funding commitments beyond the space sector.

Russia has benefited from its established ties in Europe, especially in the launch subsector. Germany, France, Spain, and the Netherlands have all been recipients of Russia's launch services. For instance, in February 2014, TsSKB-Progress signed a $400 million supply agreement with Arianespace to provide a batch of seven Soyuz-ST rockets for launch from Kourou in French Guiana. This agreement was built on a previous arrangement between Roscosmos and the French company to launch "mid-class Soyuz-ST rockets over 15 years" (Nowakowski 2016). Russian VNIIEM Corporation also managed to secure an agreement in the EO subsector when it signed a cooperation protocol with a British company Surrey Satellite Technology in 2015 "for the creation of a small Earth remote-sensing (ERS) satellite" (Glavkosmos 2019).

There are interesting cases of corporate acquisitions by China in Germany. For example, on June 19, 2018, it was announced that Fosun International had agreed to acquire FFT Produktionssysteme GmbH & Co. from ATON GmbH for an undisclosed sum. Subsequently in August 2018, Fosun won regulatory approval from the European Commission for the acquisition, as it was deemed that no competitive concerns would arise (European Commission 2018). Similarly, in 2018, Changzhou QFAT Composite Material, a subsidiary of China Iron and Steel Research Institute, acquired aerospace firm Cotesa after the approval of German

regulators in April 2018 (Xinhua 2018). Another acquisition of the controlling 94.55% stake of the robotics firm Kuka by Midea in 2016 demonstrates that such acquisition can quickly turn into an opening for other Chinese entities to enter the local market (Taylor 2016). Within a year from the acquisition, Kuka signed a memorandum of understanding with a Chinese company Huawei to "deepen their global partnership" (Williamson 2017). Many experts believe that Huawei represents a serious national security risk.

A similar effort was discovered in Ukraine. The Beijing-based Skyrizon acquired the majority stake in Ukraine's aerospace company Motor Sich in 2017, following a PLA contract with Motor Sich for 250 jet engines for JL-10/L-15 jets, a deal worth $380 million concluded in 2016 (Wang 2018). As the Pentagon, NATO officials, and G7 diplomats raised concern over Skyrizon interest in Motor Sich, Ukraine's antitrust authority eventually launched an investigation into the case to potentially block the deal. As of late February 2020, the antitrust authority says it might have a strong case against the deal and it appears that it could be canceled (Gorchinskaya 2020).

As a backdrop to these developments, in November 2017 Ukrainian representatives signed a long-term cooperation program with their Chinese counterparts that included some 70 projects that involve, among other areas, "implementation of China's Lunar Exploration Program, a mission to study the planets of the solar system, new materials development, and remote sensing" (Interfax-Ukraine 2017). Russia's complex involvement in Ukraine, following the 2014 invasion of its southeastern territory, involved the reintegration of some of its Soviet-built infrastructure into its ground station network (Foust and Bodner 2016) in an extraordinary breach of international law.

Belarus is a prime example of a country's space sector being shaped by both China and Russia. As a former Soviet republic, its space sector has been closely tied to that of Russia. China made its foray into Belarus through its state-owned enterprises, monitored by a special Committee established by Belarus called the Belarusian-Chinese Intergovernmental Committee on Cooperation. The 91.5 km^2 "Great Stone Industrial Park" located outside Minsk was stood up in 2010 under an agreement between Belarus Economy Ministry and China CAMC Engineering Co. Ltd. (CAMCE) and is overseen by the China-Belarus Industrial Park Development Company (JSC), owned 60/40 by the Chinese and Belarusian governments, respectively. Chinese telecom giants ZTE and Huawei have been heavily involved in the development of this industrial park. Both companies have a history of assisting China's intelligence operations and the alleged theft of intellectual property (Pai 2019).

PLA-affiliated China Aerospace Science and Technology Corporation (CASC) signed a letter of intent in March 2018 to become an anchor company in the industrial complex (Belta 2018a). In addition, the China-Belarus Cooperation Center for Science and Technology Achievement is to be built by another Great Stone resident, China No. 15 Metallurgical Construction Group (15MCC), and "funded using an economic and technical assistance grant from the Chinese government" (Belta 2018b).

The same Chinese entity (CAMCE) overseeing Chinese investment into Great Stone in Belarus signed a memorandum of understanding with Lithuanian Kaunas Free Enterprise Zone regarding the development of a pilot free trade zone, which should involve funding for research and development in biotechnology, information technology, space research, and photonics. While the current status of the joint project is not available in the open source, the Chinese side has made a connection between the zones in Lithuania and Belarus saying: "Minsk and Kaunas will be developed as inland terminals for the North and Baltic Seaports (especially Klaipeda Seaport)" (Rail Working Group 2016).

Belarus is also a recipient of a comprehensive package deal involving the construction, launch, training, ground station, and temporary management of a communications and broadcasting satellite, Belintersat-1 offered through the China Great Wall Industry Corporation (CGWIC). The satellite's launch (from Xichang) in January 2016 coincided with a sharp increase in exports (75.5% in the first 9 months) from the Belarusian military-industrial complex to China. This was the first CGWIC contract with a European client. (CGWIC previously launched six other satellites for international clients). It was also the first time that CGWIC got involved in the satellite's operations (Hill 2011).

Belarus stands as a post-Soviet state that is largely compelled to remain Moscow's strategic ally through economic, political, and diplomatic leverage, as well as hybrid operations. Interestingly, Belarus has sought to attract China's investment possibly to help offset Russia's inordinate influence. In 2018, Minsk was the destination of Chinese Defense Minister Wei Fenghe's first foreign visit (together with Moscow), demonstrating Beijing's strategic interest in this region. Although it may seem as a smart move to reduce traditional Russian domination, Minsk seems to be on the path of full space sector dependency on Beijing and Moscow.

The Arctic

As an Arctic state, Russia's space-related activity in the Arctic largely remains confined to its vast amount of its claimed Arctic territory, and, as such, is not analyzed in this article. That said, Russian companies have been identified as having other business ties in certain Arctic states, including Svalbard.

China's space activities in the region have been expanding. In December 2018, the relatively new Ministry of Natural Resources (MNR), which now oversees the Chinese Arctic and Antarctic Administration (CAA), launched the "Arctic Environment Satellite and Numerical Weather Forecasting Project." According to MNR, it is to assist China's role in the governance of the Arctic and in the building of the Polar Silk Road (Eiterjord 2019). China currently has its stations in Kiruna (Sweden), Karholl (Iceland), Ny-Ålesund (Svalbard), and Longyearbyen (Svalbard), and plans to establish ones in Finland (Sodankyla) and Greenland (Nuuk).

The China Remote Sensing Satellite North Polar Ground Station (CNPGS) in Kiruna, Sweden, is the first Chinese overseas EO satellite data receive station. CAS declared CNPGS in

Kiruna to be an important part of China's Gaofen project (launched in 2010) – a global EO satellite network to be completed in 2020. Concerns have been raised about its potential dual-use purpose. In January 2019, the Swedish Defense Ministry's Defence Research Agency (FOI) publicly expressed a concern that the ostensibly civilian cooperation with China could, in fact, be controlled by the PLA and used to supplement military surveillance of the Arctic region with implications for Sweden's national security (Hinshaw and Page 2019).

The China-Iceland Arctic Science Observatory (CIAO) in Karholl, Iceland, is jointly operated by PRIC and the Icelandic Centre for Research (Rannis). The facility, not far from the Icelandic port town Akureyri, has been operational since October 2018. China's Ny-Ålesund Yellow River Station on Svalbard Island, operational since 2004, has the world's largest space physics observatory and is able to accommodate 37 personnel in summer and 4 in winter (the highest occupancy of any other country with facilities there).

China's interest in Finland spiked in the period of its Chairmanship of the Arctic Council from 2017–2019, resulting in, among other developments, a China-Finland Joint Action Plan (2019–2023), which laid the groundwork for additional Chinese investment in the country going forward (MFA Finland 2019). Implementation of this action plan has included an agreement between Chinese RADI and Finnish Meteorological Institute to establish a joint Research Center for Arctic Space Observations and Data Sharing to be built in Sodankyla, Lapland.

With regard to Greenland, although it has resisted, to date, Chinese demarches, it remains a target for Chinese investment. In 2017, rather discreetly, a Chinese-funded satellite ground station and a research facility were launched in Greenland, a collaboration between a local Greenland Institute of Natural Resources and Global Change and Earth System Science Research Institute of the Beijing Normal University (BNU) (CAS 2018).

Antarctica

With regard to space-related activities in Antarctica, Russia's GLONASS stations and Chinese BeiDou stations have been installed in this region and both countries have research stations there some of which have space capabilities. China's research stations include the Changcheng (Great Wall), Zhongshan (established in 2010), Kunlun (since 2013), and Taishan (since 2014). The Polar Research Institute plans to build China's fifth station on the Inexpressible Island with construction to be completed by 2022. This research station would be close to the world's largest Antarctic station – McMurdo Station of the United States as well as New Zealand's Scott Base (Liu 2018).

Russia reopened in 2006 its Molodyozhnaya Research Station, the Soviet Union's largest station in Antarctica. Russia's most important location in Antarctica is its newer Progress station. Its other stations include the Vostok Research Station, Novolazarevskaya Research Station, Bellingshausen Research Station, and the oldest Mirny Research Station. The activities of both countries in Antarctica demonstrate their determination to bolster their presence in this strategic outpost.

The Middle East

Russia and China's space presence in this region has sharply increased in the past few years with the signing several state-to-state Memorandum of Understanding (MoUs) on future collaboration. Russia, for example, has used human space flight as a diplomatic tool. The United Arab Emirates (UAE) has already had their astronaut sent to the ISS in September 2019 with Russian assistance. Saudi Arabia and Bahrain are in talks with Roscosmos, and Egypt and Iran are also believed to be interested in having their astronauts sent into orbit by Russia.

Russian activity in this region was recorded in the UAE, Israel, Iran, and Turkey. Roscosmos and other Russian companies (i.e., VNIIEM and Barl) are assisting Iran as it seeks to create its own remote sensing capabilities. The assistance comes in many forms, including the supply of parts and technology, ground network equipment, and potential launches of spacecraft which could be provided by Roscosmos.

Iran's first satellite, Sina-1, was built and launched in 2005 by Russia (NPO Polyot). At that time, information concerning the satellite's payload was not disclosed. Roscosmos is to potentially provide future launches as Iran struggles to build its own reliable launch infrastructure, despite being ostracized from the international community for its nuclear program. Russia also signed a deal with Iran (2005) promising to build and launch two telecommunications satellites, Zohreh 1 and Zohreh 2. The deal was terminated for unknown reasons but could possibly be resurrected.

Russia's collaboration with the UAE takes advantage of the UAE's strategy of funding high-tech projects to promote the country's capabilities. Moscow can offer its space hardware and expertise, including in the Space Situational Awareness (SSA) SSA and GNSS subsectors. Research and development projects include, for example, the "Martian Town" project which is to be built in Dubai by 2023.

Chinese involvement in the Middle East has included collaboration with Israel, Saudi Arabia, and Turkey, largely through CGWIC. The company facilitated China's collaboration with the King Abdulaziz City for Science and Technology (KACST) of Saudi Arabia. KACST developed an optical micro-camera that was launched in May 2018 on one of China's Longjiang (Dragon River) microsatellites for lunar orbit operations. It was part of China's Queqiao Chang'e-4 relay satellite mission in May 2018. China also launched the Saudi-made SaudiSat 5A and SaudiSat 5B EO satellites in December 2018, demonstrating its reliable low-Earth orbit (LEO) launch services.

Interestingly, the development of the two SaudiSat-5 satellites was based on the Saudi Arabia-Belarus agreement from May 2016, in an effort to bolster Riyadh's own manufacturing capabilities (Barbosa 2018). In December 2012, CGWIC also assisted Turkey in the launch of its EO satellite (GÖKTÜRK-2). China has also sought to expand its GNSS presence in the Middle East and North Africa (MENA) region through its "BeiDou Center of Excellence" in Tunis, Tunisia.

South and Southeast Asia

Both Beijing and Moscow have a formidable network of partnerships in this region. China has provided assistance to Afghanistan, Bangladesh, Cambodia, Indonesia,

Laos, Pakistan, Sri Lanka, and Thailand. Overall, most of China's activities involved construction and launch of telecommunications satellites (Afghanistan, Pakistan, Sri Lanka, Cambodia, and Indonesia), often through some form of package deal. Other transactions focused on sole launches (e.g., Palapa-D, SupremeSAT-I, PakTES-1A) and the use of BeiDou system (e.g., construction of BeiDou stations in Pakistan or lease of BeiDou for Thailand).

Space sectors dependent on China include those of Sri Lanka (SupremeSAT, Pallekele Space Academy, etc.), Indonesia (Palapala-N1), Cambodia (Techo-1), and Pakistan (PakSat-1R). Pakistan, Thailand, and Sri Lanka also facilitate BeiDou's coverage, hosting stations on their territories. Bangladesh is the only country in which CGWIC lost a bid for the manufacturing and launch of Bangladesh's first telecommunications satellite, Bangabandhu Satellite-1, to Thales Alenia Space (Shamrat 2018).

Russia has worked with Bangladesh, Indonesia, India, the Philippines, and Vietnam. Relations with India are most extensive. In 2010, Russia and India signed an intergovernmental agreement on granting India access to the encrypted high-accuracy military GLONASS signal (Sputnik 2018). In May 2015, Roscosmos signed an MoU with the Indian Space Research Organization (ISRO) to increase their cooperation in a series of subsectors (e.g., satellite navigation, launch vehicle development, remote sensing, the use of ground infrastructure) and provide India's Space Program with GLONASS technology (TASS 2018). Out of these agreements emerged several potential projects that are in their initial stages. These include a joint communications satellite, creating a remote sensing constellation, training of Indian personnel to send them to the International Space Station on board a Russian spacecraft, monitoring of Indian Railways, and construction of ground stations in India (including Russian global navigation satellite system (GLONASS) stations) (Cozzens 2019).

Western, Central, and Eastern Asia

Although China has sought to establish ties in this region, and reached out to Armenia, Azerbaijan, Turkmenistan, and Armenia, Russia remains the more prominent space player in this region, working with Armenia, Azerbaijan, South Korea, Kazakhstan, and Uzbekistan.

Russia has been historically active in Kazakhstan mainly because of the existing launch infrastructure located in Baikonur, the lease of which expires in 2050. Kazakhstan was granted access to GLONASS military signal in 2018. (India (in 2010) and Algeria (in 2019) also received access to the GLONASS military signal.) A GLONASS station was also opened at the Byurakan Observatory in Armenia, which included some modernization of the existing station. Following this transaction, Russia, aiming to further strengthen its ties with Armenia, promised to train an Armenian astronaut for a mission to the International Space Station.

Russia also recently reached out to Uzbekistan. It was reported on May 1, 2018, that Roscosmos offered the Uzbek State Space Research Agency (Uzbekcosmos) to

finance a program that would enable the country to launch its first satellites. Shortly thereafter, a proposal on a trilateral (Russia, Uzbekistan, and Kazakhstan) satellite launch was tabled (SpaceWatchGlobal 2018).

Top Space Sector Capture Trends

When analyzing partnering arrangements described in section two of this article, there seem to be four prominent space sector capture trends. They include vertically integrated package deals (e.g., in Angola, Belarus, Brazil, Congo, Ethiopia, Bolivia, Pakistan, Nigeria, Algeria, Venezuela); the active involvement of China and Russia in the Arctic and Antarctica; China's global space power projection through EO and space observation partnerships; and expanding the number of GNSS (GLONASS and BeiDou) ground stations abroad enhancing the capabilities of the respective systems.

The package deals are a hallmark of Chinese and Russian influence attempts and have been most evident in the telecommunications subsector (but also found, for example, in the EO subsector). While the general pattern of the package deals is similar across the board, the number and type of components in each offer varies.

China has been a driver of multilateral Space and Earth observation partnerships. China leads the international Asia-Pacific Ground-based Optical Space Objects Observation System (APOSOS) initiative, launched through the Asia-Pacific Space Cooperation Organization (APSCO). The stated goal is to build a global optical observation network with at least one facility in each of the APSCO Member States and elsewhere. China has sensors in all eight APSCO member countries, as well as in Brazil and Ukraine. Mexico joined the APOSOS network in 2017 (IDA 2018).

The primary objective of this organization is to build a data sharing platform and use existing infrastructures from Member States. A second objective is to bring new capabilities to the table and extend the ability to observe MEO and GEO. It is to be operated under APSCO observation mission management department. For example, new telescopes (manufactured by the Changchun Institute of Optics, Fine Mechanics and Physics of CAS) have been completed and declared functional in Iran, Pakistan, and Peru.

China has also tied its economic and strategic interests to the grouping of Brazil, Russia India, China, and South Africa (BRICS) nations, providing financial backing to a sizeable portion of their activities. This includes the first BRICS space project – sharing of EO data with an intention to eventually build a remote sensing satellite constellation. While a specific timeline has not been made available, the current plans are for the project to have two phases: (1) the creation of a remote sensing data-sharing system, making the data from each of the member countries' existing EO satellites available to all the other members; and (2) the creation of a new EO satellite constellation (Campbell 2017). There is also an EO collaboration between Europe and China through the Dragon program (currently in its 4th iteration) between MOST's National Remote Sensing Centre of China and the European Space Agency (ESA).

Spearheaded by China and Russia, BRICS was configured as a platform for engagement of emerging market economies and developing countries. Initially, the initiative struggled to fund itself, but the creation of the BRICS Development Bank, now called the New Development Bank (NDB), based in Shanghai, represented an important pivot operationally. In April 2017, Brazil was the recipient of the bank's first development loan. Together with the Asian Infrastructure Investment Bank and the Silk Road Fund, NDB is a key investment tool for China's power projection strategy abroad (Reuters 2018).

With regard to the GNSS sector, both Russia and China continuously work on global expansion of their respective systems. Russian President Vladimir Putin prioritized the GLONASS system's restoration in the early 2000s. The full constellation of satellites was reestablished by 2011. GLONASS satellites have undergone several upgrades over the years, the latest being the GLONASS-K. The GLONASS stations have been (or are planned to be) placed in Antarctica, Argentina (planned), Armenia, Cuba (planned), Ecuador (planned), India (two stations, both planned), Kazakhstan (one existing and one planned), Nicaragua, South Africa, South Korea (envisioned), UAE (planned), and Venezuela (planned).

With regard to China, on December 27, 2018, China's BeiDou Navigation Satellite System (BDS) was declared to be providing global service as the construction of the BDS-3 primary system had been completed. China wants BeiDou to become an alternative to America's Global Positioning System (GPS). The BeiDou applications are also promoted through the Belt and Road Initiative (BRI). The more widespread use of Russia's and China's GNSS will help them integrate these countries into their respective economic and military orbits.

Key Findings

Although it is not possible to accurately assess the precise number and status of all existing space partnerships that China and Russia have concluded globally with the use of open source materials, it has been possible to determine that the number of these partnerships has expanded substantially, especially on the part of China. A Chinese media source asserts that, as of April 2018, China had signed 121 space cooperation agreements with 37 countries and four international organizations (MFA PRC 2018). Back in 2016, according to the State Council Information Office on China's space activities, China had signed 43 space cooperation agreements with 29 countries, space agencies, and international organizations (SCIO PRC 2016). If accurate, this would mean an increase of 78 international cooperation agreements over about 15 months. PSSI has identified Chinese space relationships with 60 countries as of February 2019.

Russia has been less transparent when it comes to declaring publicly the number of international space partnerships it has concluded. It has mentioned international cooperation in relation to its technological development goals in its "Russian Federal Space Program 2016–2025" (Roscosmos 2016). Russia has mostly focused on reviving, or maintaining, its post-Soviet ties. CIS states are important targets

(especially Belarus, Kazakhstan, and Armenia, but also Azerbaijan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan) (Roscosmos 2020). PSSI unearthed Russian space partnerships with 44 countries.

Overall, Chinese and Russian economic and financial activities in various regions indicate that space sector partnerships that create various levels of dependencies (and even full-scale space sector capture) have been vigorously pursued with respect to both developing and developed countries. As democratic countries have more rigorous requirements for transparency, accountability, and the rule of law, a more subtle, incremental approach is evident (e.g., projects related to scientific research/development, academic exchanges, or individual commercial contracts).

The research suggests that China and Russia enter into space partnerships globally for two main reasons: (1) because the recipient state is in an important, or even strategic, geographic location for enhancing Chinese/Russian space capabilities (e.g., for GLONASS/BeiDou, SSA, EO); and (2) a country has strategic importance that a space partnership helps leverage (e.g., a country's energy resources, mineral wealth, supportive geopolitical policy positions). In some cases, these motivations are co-mingled, such as the case of the Arctic countries (e.g., Greenland).

The second pattern of behavior described above (where space considerations are not the prime mover) most often occurred in less economically successful, but resource-rich, countries (e.g., Bolivia, Nigeria, Venezuela), or countries that are geographically and/or geopolitically strategic for China or Russia (e.g., Pakistan for China, Iran for Russia, and Cuba for both countries). In the case of China, some of these recipient countries (e.g., Belarus, Cambodia, Laos, and Pakistan) are valued clients of its BRI, without a direct linkage to space.

Incremental space sector dependencies in the developed countries are more difficult to detect and guard against (e.g., academic exchanges, scientific and research projects, broader funding commitments beyond the space sector). More visible space sector capture largely takes place via the offering of vertically integrated "package deals." On a number of occasions, China and Russia have been able to construct successfully dual-use space infrastructure and services due to hospitable political relations, corruption, and internal economic and social strife in the targeted countries (e.g., Argentina, Brazil, Cuba, Colombia, Nicaragua, Nigeria, Pakistan, Sri Lanka, Venezuela).

China and Russia generally use their state-controlled enterprises (e.g., China Great Wall Industry, Roscosmos) to penetrate a specific country's space sector. These state companies position themselves as preferred "go-to" entities. This is, in no small part, because of generous financing that often does not reflect the targeted country's creditworthiness.

The pattern of Chinese and Russian space-related transactions reveals a global approach, signaling that both countries are determined to expand their space stature and competitiveness, and close the gap with Europe and the United States. Some targeted countries receive financial backing well beyond the space sectors. Influencing/capturing the space sector is just part of a broader strategic outreach (e.g., in Bolivia).

Conclusion

Tracking and visually mapping the international transactions of Chinese and Russian state-controlled enterprises in the space sectors of various countries revealed that Beijing and Moscow offer assistance to the nascent space programs that, in many cases, create dependencies, including a full-scale space sector capture.

Today, the implications of the active pursuit of international space partnerships globally by China and Russia to increase their influence over the space domain through such means as the offer of vertically integrated "package deals" of capabilities and services are not well-understood. The economic and financial largesse provided by these state actors, including subsidized financing, are accepted, and often even welcomed, by the recipient countries which lack their own space funding, technical expertise, and human resources, even if it exposes them to partial or complete dependency on these outside "benefactors."

One of the risks stemming from these global networks of space dependencies is the opening for China and Russia to increasingly shape applicable rules, norms, and standards for access to, and operations in, space. This asymmetric threat to global space governance stemming from these hybrid economic and financial maneuvers needs to be better appreciated, including the underlying rationales for these activities.

The United States, Europe, and other allies, including Japan, need to also review their space partnership approaches and configure more effective and attractive offers to their nontraditional space partners to counter Chinese and Russian predatory economic and financial practices. It is clear that countries of all economic performance levels are intent on benefiting from the value provided by space. If upgraded space-related engagement and an enhanced level of support do not occur from Western countries, the void is likely to be filled – as we are already witnessing – from these nondemocratic actors, with negative consequences.

As in other domains, a sustainable model of international partnerships cannot be established without transparency, good governance, accountability, respect for national sovereignty, and the rule of law. Western nations will have to be able to demonstrate that there is a clear benefit in collaboration with countries that respect free and fair market principles and behavior versus state-controlled economies that often show little regard for such principles.

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