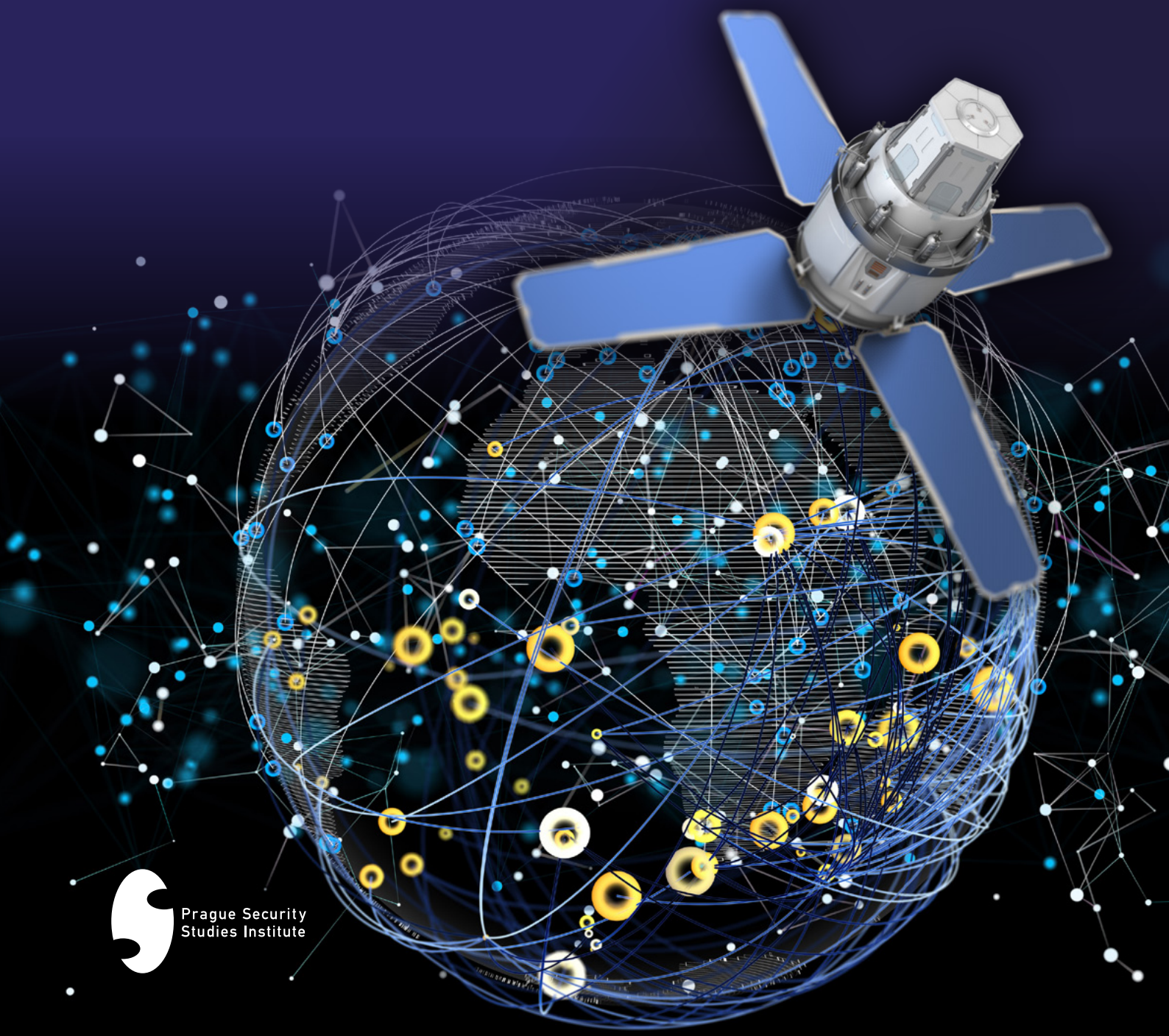
STRATEGIC COMPETITION FOR INTERNATIONAL SPACE PARTNERSHIPS AND KEY PRINCIPLES FOR A SUSTAINABLE GLOBAL SPACE ECONOMY

JANUARY 2022

Project Lead: **Jana Robinson, Ph.D.**
Project Research Team: **Patrik Martínek, Jakub Pražák, Kristína Sikoraiová**



Prague Security Studies Institute

PSSI Mission

The mission of the Prague Security Studies Institute (PSSI) is to help safeguard and strengthen the individual freedoms and democratic institutions of the countries of Central and Eastern Europe and beyond. The Institute also seeks to illuminate select, unconventional threats emanating from authoritarian governments that challenge the transatlantic alliance and other partners globally, especially in the economic & financial, and space domains. PSSI is dedicated to the education and training of new generations of security-minded students and young professionals, including through its programmatic activities and growing academic network in the Czech Republic and abroad.

About the Project

This project was conducted by the Prague Security Studies Institute. The analyses, findings, and recommendations are those of PSSI alone.

For More Information

Contact the Project Lead, Dr. Jana Robinson (jrobinson@pssi.cz)

Copyright Notice

STRATEGIC COMPETITION FOR INTERNATIONAL SPACE PARTNERSHIPS AND KEY PRINCIPLES FOR A SUSTAINABLE GLOBAL SPACE ECONOMY

JANUARY 2022

Project Lead: **Jana Robinson, Ph.D.**
Project Research Team: **Patrik Martínek, Jakub Pražák, Kristína Sikoraiová**

Prague Security Studies Institute

Table of Contents

1. Background

The space domain, a major component of national political, economic, and military power, has now taken center stage in the competition among the major space powers and aspirant nations. Space industry majors, as well as other private sector companies have become an integral part of the space domain transformation as governments are putting forward innovative ideas for public-private partnerships and various investors are taking a keen interest in acquiring stakes in space-related companies. Moreover, traditional space alliances and new space partnerships are taking on renewed importance in the strategic positioning of the major space players.

Alongside ample discussions concerning potential conflict in space, future competition for strategic vantage points in space and space resources, there is a more subtle, steady, and global ground-based space game being undertaken by our competitors – mainly China and Russia – that is forging strategic partnerships with nations across the globe. These partnerships often stem from economic and financial assistance, including offers of space hardware, expertise, and large-scale subsidized financing.

China and Russia have advanced significantly in the use of these non-military means for achieving their goals which are, in fact, reflecting a deeper transformation than just the positioning and deployment of military power. This includes concluding partnerships with at least 83 countries.[i]

Are we well-positioned to deal with vertically-integrated space packages of the type offered by Beijing and Moscow to space newcomers? Are we worried about our future space market share given the regular use of unfair trade practices and sole-source contracts? How will these partnerships influence the forging of international space norms and standards?

This report first reviews how the proliferation of China's and Russia's model of international space partnerships negatively affects the recipient countries. It then discusses the broader implications of skewed international space partnerships for current efforts to set the norms and standards governing future space activities and the shrinkage of future markets for the equipment, technologies, and services of Western commercial space companies. Finally, it reviews available measures and response options to ensure that our values and principles form the foundation of a sustainable global space economy over the long haul.

This report benefited from the insights of participants of PSSI's closed online roundtable discussion that took place on April 22, 2021, attended by 60 distinguished security and space experts and government officials. The event's agenda and the list of participants are available in Annex 2.

i This number is based on the PSSI database of Chinese and Russian space transactions, which is continuously being updated.

2. Proliferation of State-Led Model of International Space Partnerships by China and Russia

"Industry talks to us routinely, however, about many bad behaviors that they are experiencing in the global market, mainly from China. Things like industrial espionage, intellectual property theft and artificial pricing." **(Kevin O'Connell, former Director of the Office of Space Commerce at the US Deparment of Commerce)**

Geostrategic Background

The geopolitical environment has deteriorated significantly over the past several years reflecting the continued ambitions of China and Russia to assume leadership roles regionally and globally. China has promoted its space interests and partnerships via its Space Information Corridor[1] and its industrial strategies "Made in China 2025" and "China Standards 2035,"[2] which are to help China become a leading space power by 2045.[3] China is also pursuing "civil-military fusion", which is an aggressive, national strategy to develop a "world class military" by 2049.[4]

Moscow discovered the multipronged benefits of space partnership outreach in projecting strategic influence back in the Soviet era, notably through its Interkosmos space program. Although plagued by a lack of financial resources stemming from the sanctions imposed on Russia following the 2014 annexation of the Crimean Peninsula and continuing occupation of the Donetsk and Luhansk oblasts, Russia's statecraft in conducting multipolar outreach remains significant, aimed at political influence, economic opportunities, and strategic bases, with the added incentive of reducing its dependency on Western markets.

In its 2021 National Security Strategy,[5] Russia emphasizes its unilateral geostrategic and economic interests, including in the space domain. The strategy states that: *"Outer space and the information space are actively becoming new domains of military operations"* (Космическое и информационное пространства активно осваиваются как новые сферы ведения военных действий); economic security is to be achieved through strengthening its leading position in "rocket and space industries", and foreign policy and foreign policy goals are to be carried out through "ensuring the interests of the Russian Federation related to the development of outer space, the World Ocean, the Arctic and Antarctica" (обеспечение интересов Российской Федерации, связанных с освоением космического пространства, Мирового океана, Арктики и Антарктики).[6]

Besides partnering with more established space actors (e.g. South Korea, India, etc.), Russia has focused more heavily on developing countries, such as Brazil and South Africa.[7] It has also pursued strengthened collaboration with China (including on military space activities). Simultaneously, Russia began making efforts to reduce its dependency on the West, for example, via its plan to withdraw from the collaboration with the International Space Station (ISS) partners in 2025 and the launch of its own space station by 2030.[8] In addition, China and Russia revealed their plan for an "International Lunar Research Station", consisting of a Moon base and a space station in lunar orbit, which should be ready for crew visits by 2036.[9]

To achieve their strategic goals, however, China and Russia repeatedly circumvent, or even violate, internationally negotiated norms. China has repeatedly been accused of industrial espionage,[10] intellectual property theft[11] and heavily subsidized pricing which is supported by China's non-transparent ownership structures and unfair business practices.[12]

The 2020 U.S. Report to Congress On China's World Trade Organization (WTO) Compliance states that China's compliance with the terms of its WTO membership remains poor and China continues its state-led, non-market and mercantilist approach to the economy and

trade which is in conflict with the open, market-oriented policies of WTO.[13] The same report on Russia states that the *"past year has brought very few, if any, positive developments in terms of Russia's implementation of a WTO compliant trade regime"* and, although Russia managed to implement final tariff binding, *"in most other areas, Russia continues to reject the market-opening goals of the WTO."*[14] The issue relates, for instance, to unsatisfactory transparency in the development of technical regulations or poor enforcement of intellectual property rights.[15,16]

China and Russia lead extensive economic cyber espionage campaigns against European and American governments and non-governmental entities. The 2018 report on Foreign Economic Espionage in Cyberspace by the National Counterintelligence and Security Center states that China, Russia (and Iran) *"stand out as three of the most capable and active cyber actors tied to economic espionage and the potential theft of U.S. trade secrets and proprietary information"*.[17] Moreover, the 2021 European Commission Report on the Protection and Enforcement of Intellectual Property Rights (IPR) in Third Countries classified China as the sole country in the Priority 1 category *"because of the scale and persistence of problems in the area of IPR protection and enforcement"*.[18] In the same report, Russia, along with India, Turkey and Ukraine, ended up among Priority 2 countries where *"[s]erious systemic problems have been identified in the area of IP*[ii] *protection and enforcement in these countries, causing significant harm to EU businesses"*.[19]

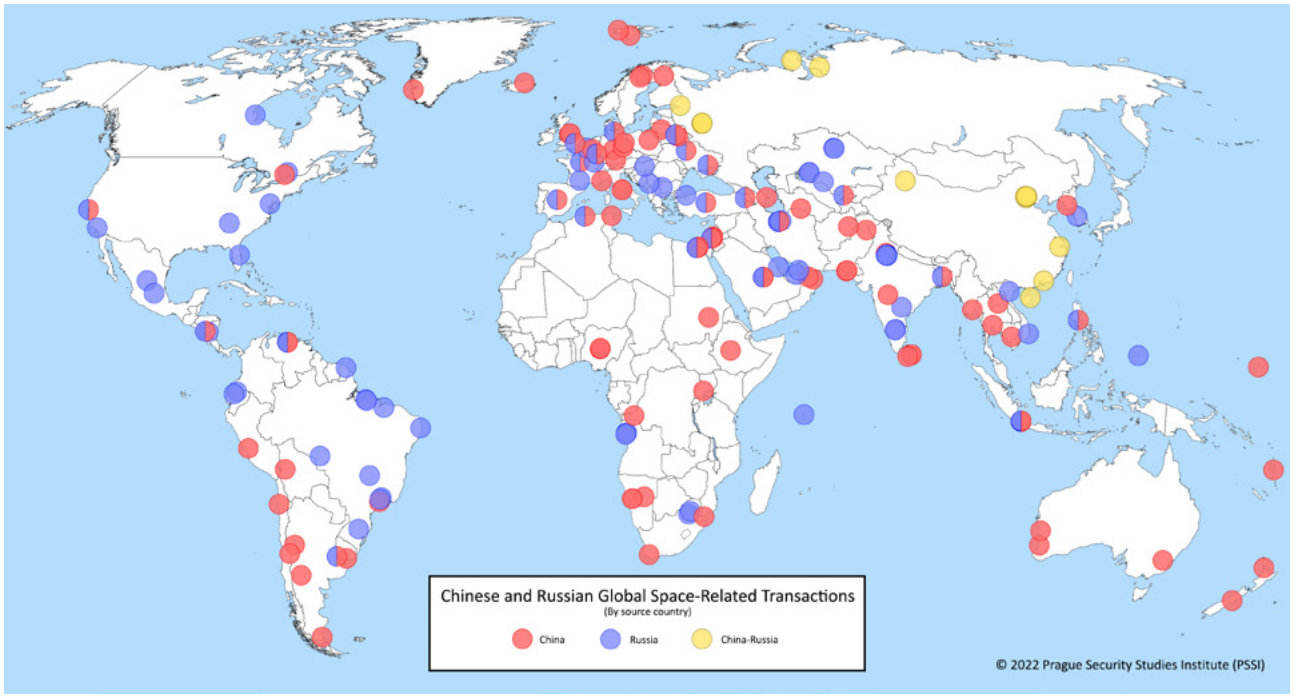
As a 2021 report on "How China Lends: A Rare Look into 100 Debt Contracts with Foreign Governments" pointed out, Chinese contracts often contain confidentiality clauses that do not permit the borrowers to reveal the terms, or even the existence, of a debt. In addition, collateral arrangements often accompany the contracts (such as lender-controlled revenue accounts, etc.),[20] giving Chinese lenders a hidden advantage over other creditors in low-income countries, including committing the borrower to exclude the debt from restructuring by the Paris Club of official bilateral creditors.[21] The situation subsequently leads to dependencies with unclear conditions concerning the repayment of the debts, giving China the needed leverage over the recipient countries' domestic and foreign policies.

Building space infrastructure and proliferation of related technologies, equipment and services to other countries is a substantive part of both China's and Russia's strategic goals. In a 2018 report,[22] PSSI pointed out that Chinese and Russian economic and financial (E&F) activities will represent a serious challenge to the Western companies in emerging space markets due to sole-source contracts and dependency-generating partnerships.

The "E&F" domain, a rather under-researched segment of space security, is becoming increasingly prominent as Chinese and Russian state-owned enterprises (SOEs) and quasi-private companies proliferate in the growing global markets for space equipment, products, and services. For example, China and/or Russia provides a targeted country with one or more satellites, launch services, the construction of ground stations, the provision of operating personnel, training of local personnel, 100% subsidized financing, their services (such as those derived from Global Navigation Satellite Systems [GNSS]), and so on – the net effect of which is to create a sole-source supplier relationship and a perilous level of dependency. Inevitably, there are significant strategic and material (economic and financial) risks for Western allies stemming from these E&F activities.

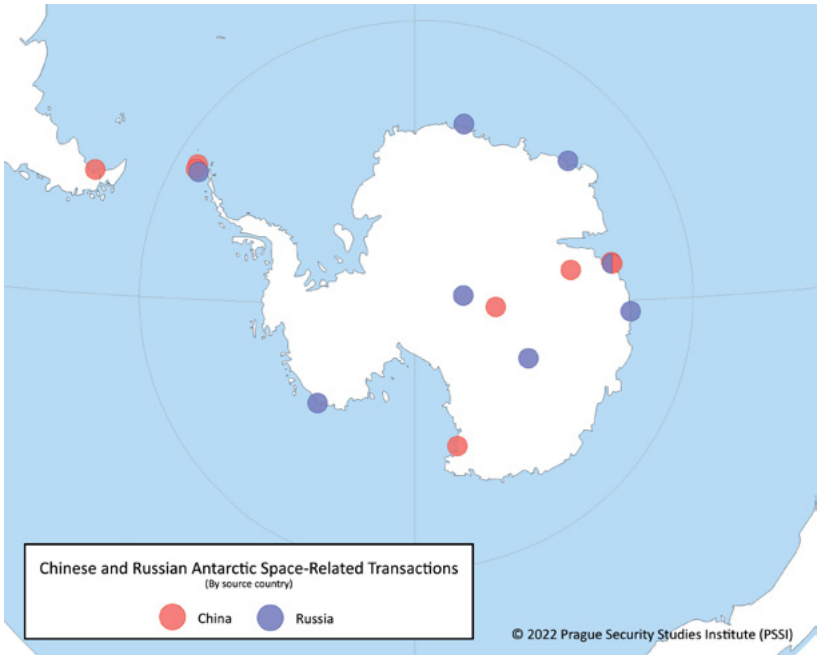
As of January 2022, PSSI has identified globally 302 Chinese and Russian transactions targeting 83 countries.[iii] 13 of those transactions are between China and Russia. We also identified 13 "international" transactions (which we define as international multilateral agreements sponsored by either Russia and/or China). Out of the total number of recorded (bilateral) transactions China accounted for 146 transactions targeting 71 countries, Russia for 130 transactions targeting 43 countries.[iv]

ii IP – Intellectual Property
iii Included are transactions that are still "pending" or have been "cancelled".
iv Multilateral transactions and transactions between China and Russia are not included.



Map 1 - Chinese and Russian Global Space-Related Transactions (Source: PSSI. The map includes 289 bilateral transactions. Overlapping locations result in darker color. The map does not include 13 international multilateral transactions which involve other countries besides China and Russia.)

Vertically integrated, or "end-to-end" package deals are a hallmark of Chinese (and to a lesser extent Russian) influence attempts. In the Latin American telecommunications sector, for example, China delivered complete package deals to Bolivia, Brazil, and Venezuela. Beijing also provided assistance to Chile and Cuba.[23] Russia provided assistance to, among others, Angola, Egypt, Iran, and Uzbekistan. In South and Southeast Asia, China actively collaborates on space projects with, for example, Pakistan, Sri Lanka, and Thailand. Other collaborations included Cambodia and Laos. Of these countries, Pakistan and Sri Lanka face the greatest risks related to debt unsustainability from China. In Africa, China has extensive collaboration with Nigeria, Ethiopia, Egypt, Tunisia, and Algeria, while Russia has provided, for example, package deals to Angola and Egypt. Consequently, many of these countries are susceptible, or already a victim, to what PSSI describes as partial or complete "space sector capture".



Map 2 - Chinese and Russian Space-Related Transactions in Antarctica (Source: PSSI)

In the latest trend, in 2019, six groups, including state-owned Aerospace Science and Technology Corporation (CASC) and China Aerospace Science and Industry Corporation (CASIC) established The China Commercial Space Alliance with the aim to encourage and regulate the commercial space market and foster international partnerships via the Belt and Road Initiative (BRI).[24]

Examples of Chinese and Russian Partnering Arrangements in Asia, Latin America, and Africa

Asia — Thailand

Declared fully operational in August 2020, the Chinese global navigation satellite system, BeiDou, has become the latest tool that Beijing uses to forge strategic partnerships, namely the proliferation of BeiDou-related equipment, data, products, and services. The use of below-market pricing suggests that China aims to expand its strategic influence rather than merely increase commercial gains.[25] BeiDou has reportedly been exported to more than 120 countries and is used by hundreds of millions of people in Asia, Europe, Africa and elsewhere.[26] China is gradually penetrating the global GNSS market by providing subsidized GNSS-related equipment and services in foreign countries at the expense of GPS and Galileo.

In 2013, Thailand, a long-time U.S. ally, became a BeiDou client by signing a 2 billion yuan ($322 million) deal with Wuhan Optics Valley BeiDou Holding Group Co. Ltd., involving the construction of three Continuously Operating Reference Stations (CORS) and a ground station, along with an industrial park for the manufacturing of BeiDou equipment for the Southeast Asian region. In 2014, Thailand allegedly considered an acquisition of Chinese multiple rocket launcher systems utilizing BeiDou navigation. In 2018, China announced the development of a high-precision positioning system for the city of Bangkok.[27]

Subsequent projects included a 10 billion yuan ($1.45 billion) deal with Wuhan Optics in 2017 and an Memorandum of Understanding (MoU) between Thai satellite operator, Thaicom Plc, and China Great Wall Industry Corporation (CGWIC) for the development of GNSS applications for Unmanned Aerial Vehicles in 2019.[28] BeiDou is a critical component of China's military autonomy,[29] and since the U.S. reduced cooperation with Thailand after its 2014 coup, military imports from China increased considerably.[30] Thailand also collaborates with China in other areas. In 2016, CGWIC, for example, won a $208 million contract from the Thaicom subsidiary International Satellite Co. Ltd. to construct and launch the Ka-band broadband satellite.[31] Earlier, in 2013, Thaicom also signed a framework agreement with China Telecom Satellite Communications Limited to sell the services of IPSTAR Company Limited (a Thaicom subsidiary) in the People's Republic of China.[32] Although it appears that Thailand's space allegiance to China has been on the decline lately, there are serious concerns related to the risks stemming from closer military ties with China.

Latin America — Argentina

Taking advantage of the corrupt Cristina Fernandez de Kirchner government, in 2012 China was able to secure a 50-year lease of land in the province of Neuquen, where it built the Espacio Lejano Space Station, a Telemetry, Tracking and Control (TT&C) station operational since 2017.[33] Built by the China Harbor Engineering Company (CHEC), a subsidiary of the People's Liberation Army (PLA)-affiliated China Communications Construction Company (CCCC), the station is part of the Chinese Deep Space Network. Although China claims the station serves solely civilian purposes, secrecy about the agreement and unclear motives behind the construction and operations have raised concern about its military and strategic uses.[34,35] It is in the vicinity of a number of infrastructure assets constructed by China in Latin America, including the Fiber Optic Austral in Chile and China-funded multi-billion-dollar turnkey railway and infrastructure projects in Argentina.

Chinese-built TT&C Station in Neuquen, Argentina[36]

China also built a 60cm-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), approved in 2010, is under construction at the El Leoncito Astronomical Complex, and when completed would be the largest single-dish radio telescope in Latin America.[37]

China also secured the largest single launch industry contract in early 2019, when the Argentinian company Satellogic (developing a constellation of Earth observation satellites with black-and-white, hyperspectral, and infrared capabilities) decided to use Chinese rockets under a contract with the CGWIC to put in orbit its fleet of more than 90 spacecraft[38] (by the end of 2020, 17 satellites had been launched). However, this contract seems to have been annulled as Satellogic announced in mid-2021 a merger with special purpose acquisition company CF Acquisition Corp. V (trading under the ticker CFV), and the company has changed in preference of securing launches by SpaceX[39] (to date SpaceX launched 13 of its newest satellites and is expected to launch the remaining approx. 66 satellites). Regardless, Satellogic still appears to have an ongoing contract with the Chinese Zhong Ke Guang Qi Space Information Technology Co., Ltd ("ABDAS") for „exclusive access to geospatial imagery services" exposing it to potential intellectual property theft (IPT).[40]

Although former President Mauricio Macri sought to slow down the Chinese advances into Argentina's space sector, the country renewed its commitment to work with China on space projects in July 2020, under President Alberto Fernandez, with Cristina Fernández de Kirchner as the Vice President. The agreement coincided with the renewal of a currency swap line of some $18 billion, bolstering Argentina's foreign reserves.[41]

In 2021, the Argentinian Ascentio Technologies S.A. company joined forces with Chinese Satelliteherd (also known as Beijing Aerospace Yuxing Technology Co.) in building a satellite ground station with six antennas that will provide TT&C services for commercial satellites. The station will be constructed at an industrial park in Rio Gallegos near the South Pole, providing a strategic location for downloading data from polar orbit satellites.[42]

Africa — Algeria

Algeria, as the region's largest economy and gas- and oil-exporter, has been an important partner for Europe, Russia, and China. Beijing, with its expanding footprint in the Middle East and North Africa (MENA) region, is

potentially an attractive partner for Algeria. Indeed, China was the first non-Arab country to recognize the Algerian provisional government in December 1958. Today, Sino-Algerian engagements have been taking place through the Forum on China Africa Cooperation (FOCAC) and the China-Arab States Cooperation Forum (CASCF).

The First China-Arab States BDS Cooperation Forum[43]

China is engaging Algeria with its BeiDou satellite-based augmentation system (BDSBAS), which it operates over its territory in accordance with Civil Aviation Organization (ICAO) standards[44] and is likewise expanding it to the African continent. In 2017, Algeria launched Alcomsat-1 satellite that was developed by the China Academy of Space Technology.[45] It is equipped with the Al-SBAS augmentation system that was constructed by the China Aerospace Science and Technology Corporation and covers Algeria and surrounding areas.[46] This is directly competing with the European Geostationary Navigation Overlay Service (EGNOS) satellite-based augmentation system (SBAS) that provides services over Europe but also North Africa.[47]

Russia also has strong relations with Algeria dating back to the Soviet era.[48] Russia was the first country[v] to de facto recognize the Algerian Republic in 1960 and has provided military, financial, and technical assistance. Although collaboration declined somewhat in the 1990s, with the beginning of the new millennium it started to pick up again, and Russian support, including arms deals, recommenced. As reported by the Stockholm International Peace Research Institute's (SIPRI) latest report on the Trends in International Arms deals, Algeria has been the #3 importer of Russian arms between 2015-2020, making Russia, by far, Algeria's main long-term arms supplier.[49,50] Since 2018, Moscow has been providing Algiers with military-grade high-precision GLONASS signals, as well as assistance with the incorporation of new sensors for the Algerian Air Force's strike aircraft fleet.[51] In return for this 10-year contract, Algeria is obligated *"not to resell GLONASS equipment to third countries, nor to dismantle it in order to design its own systems."*[52] Russia provides this type of signal to only a small group of countries (e.g. India and Kazakhstan, among others).

v At that time USSR.

Implications

> ***"Frankly, so much of what China and Russia offer to nations sounds enticing in the beginning, but there are voluminous examples where countries make agreements, and then understand in execution that all is not what they hoped it would be. We have to be able to highlight that with as much fact and objective data as possible, and then offer alternatives that make sense for the nations and markets." (General David D. Thompson, Vice Chief of Space Operations, United States Space Force)***

In the past few years, there has been a growing emphasis on the development of space commerce. There are, however, substantial differences in the approach of Europe, the U.S. and other allies (such as Japan), and China and Russia.

China and Russia are actively employing malign economic and financial statecraft globally and have forged their brand of partnership arrangements with more than 83 countries. Commercial contracts, academic exchanges, and sponsorship of scientific research are among the soft power tools used by Beijing and Moscow to gain influence in the targeted countries. More obvious forms of space sector capture are in evidence with respect to countries with no prior space experience. In these cases, package deals for infrastructure, data, products, services and financing are more effective Chinese and Russian recruitment tools and present a greater challenge to Europe, the United States and other allies.

Moreover, initiatives such as Beijing's "civil-military fusion", launched in 2012, which aims at combining state-owned defense enterprises and quasi-commercial companies to bolster innovation in dual-use technologies, are examples of a state-led, engineered approach involving heavy subsidies and investment incentives. The number of commercial companies that are being instructed by Beijing to support the military industry and security services through these arrangements, is on the rise.[53]

In addition, a number of Chinese state-controlled entities, deployed for this purpose, have already raised national security and human rights concerns and some have been previously sanctioned by — or are currently under various sanctions regimes of — the U.S. and/or allied governments. Among the reasons for these penalties are: their links to the PLA; enabling egregious human rights abuses; supporting Beijing's surveillance state architecture (at home and abroad); contributing to China's civil-military fusion programs; engaging in weapons proliferation, espionage, cyber-attacks and other malevolent activities (e.g., Aviation Industry Corporation of China, China Aerospace Science and Industry Corporation, China Electronics Technology Group Corporation, etc.).

This trend has been accelerated by Chinese President Xi Jinping's ambitious and aggressive pursuit of authoritarian principles at home, including centralizing control over the business sector through various measures, such as inserting Chinese Communist Party (CCP) cells into the senior management structures of all Chinese companies, or Article 7 of the National Intelligence Law which compels all Chinese enterprises to engage in espionage and other strategic/military activities on demand of the Communist Party, as well as the sharing of their stores of data with the state authorities.

Through the provision of subsidized financing, China and Russia build problematic, long-term dependencies that do not support the sustainability of space sector development in the recipient countries and retard the domestic growth of capacities, capabilities, and expertise.

Space partnerships are steadily gaining prominence in the operational, political, and strategic competition among major space powers. Europe, the United States, and its allies are seeking to extend their global space footprint with new partners, but often face unfair, non-market competition from China and Russia. This unfair competition is generally evidenced by the use of economic and financial practices which contravene the free market international order. At a strategic level, these predatory practices undermine Western leadership in promoting global norms of space conduct based on democratic values and principles, as well as space markets based on free and fair competition, transparency, good governance, proper disclosure, risk management, and the rule of law.

3. Recommendations for Achieving a Sustainable Space Economy

"Our values-based approach to security cooperation along with our unrivaled partnership and Alliance relationships remain our enduring advantage that our competitors just cannot match." (Heidi Grant, former Director of Defense Security Cooperation Agency)

The transatlantic allies and their like-minded partners are well-positioned to select and leverage "cross-domain" issue portfolios to forge an effective strategy to preserve free market principles and democratic values for a sustainable global space economy.

The first step is to assess the impact on Western industrial democracies of the state-led, non-market practices of China and Russia described in this report (e.g., financial subsidies, non-transparency, lack of discipline and regulatory safeguards, and other non-market behavior).

It will then be crucial to remove current obstacles that the allies and their industry partners face in operationalizing various partnering arrangements and to prompt financial and developmental organizations and government institutions to help fund competitive outreach to non-traditional partners.

Finally, the allies also have a responsibility to promote free market principles as well as democracy and respect for human rights when conducting space commerce. Important elements of this undertaking are as follows:

- At the transatlantic level, continuing to expand collaboration on information sharing, research and development, and acquisition processes; space policy alignment; and the promotion of sustainable best practices, standards and norms globally.
- With respect to non-traditional partners, pursue transparent, accountable and reciprocal partnering arrangements, preserving the independence and sovereignty of the recipient states.
- Engage the industry proactively in leveraging technological advances designed to forge new alliances. This could involve the provision of defensive weapon systems, joint space initiatives, cooperative projects, official personnel exchanges and direct commercial sales.
- Contrast the short-term benefits of the authoritarian model of space partnerships (often leading to unwelcome dependencies) to the long-term gains of partnering with democracies that are genuinely dedicated to the sustainable construction of space capabilities well-suited to their nations.

References

1 Mingmei. 2019. "China To Further Promote Space Cooperation For UN Sustainable Development". *Xinhuanet.Com*. http://www.xinhuanet.com/english/2019-04/24/c_138005579.htm.

2 Robinson, Jana, Patrik Martínek, Jakub Pražák, and Kristína Sikoraiová. 2021. *China Deploys BeiDou to Project Power and Influence*. Ebook. Prague: PSSI. https://www.pssi.cz/download//docs/8509_08-pssi-perspectives-china-deploys-beidou-to-project-power-and-influence-3.pdf.

3 Chi, Ma. 2017. "China Aims To Be World-Leading Space Power By 2045". *Chinadaily.Com.Cn*. https://www.chinadaily.com.cn/china/2017-11/17/content_34653486.htm.

4 *Military-Civil Fusion And The People's Republic Of China*. 2020. Ebook. U.S. Department of State. https://www.state.gov/wp-content/uploads/2020/05/What-is-MCF-One-Pager.pdf.

5 pravo.gov.ru. «Указ Президента Российской Федерации От 02.07.2021 № 400 · Официальное Опубликование Правовых Актов · Официальный Интернет-Портал Правовой Информации». 2021. *Publication.Pravo.Gov.Ru*. http://publication.pravo.gov.ru/Document/View/0001202107030001.

6 pravo.gov.ru «Указ Президента Российской Федерации От 02.07.2021 № 400 'О Стратегии Национальной Безопасности Российской Федерации'». 2021. *Ips.Pravo.Gov.Ru*. http://ips.pravo.gov.ru:8080/default.aspx?pn=0001202107030001.

7 Vidal, Florian. 2021. *Russia'S Space Policy: The Path Of Decline?*. Ebook. Études de l'Ifri. https://www.ifri.org/sites/default/files/atoms/files/vidal_russia_space_policy_2021_.pdf

8 Trevelyan, Mark, and Jonathan Oatis. 2021. "Russia Plans To Launch Own Space Station After Quitting ISS". *Reuters*. https://www.reuters.com/lifestyle/science/russia-plans-launch-own-space-station-after-quitting-iss-2021-04-21/.

9 Pultarova, Tereza. 2021. "Russia, China Reveal Moon Base Roadmap But No Plans For Astronaut Trips Yet". *Space.Com*. https://www.space.com/china-russia-international-lunar-research-station.

10 Wu, Chu. 2020. "Tensions Mount Over China's Industrial Espionage In US". *Voanews.Com*. https://www.voanews.com/east-asia-pacific/voa-news-china/tensions-mount-over-chinas-industrial-espionage-us.

11 Wray, Christopher. 2020. "Responding Effectively To The Chinese Economic Espionage Threat". *Federal Bureau Of Investigation*. https://www.fbi.gov/news/speeches/responding-effectively-to-the-chinese-economic-espionage-threat.

12 Radu, Sintia. 2020. "China Is Hurting Innovation, Report Shows". *U.S. News*. https://www.usnews.com/news/best-countries/articles/2020-01-07/chinas-unfair-trade-practices-hurt-global-innovation-report-says.

13 Ustr.gov. *2020 Report To Congress On China'S WTO Compliance*. 2021. Ebook. United States Trade Representative. https://ustr.gov/sites/default/files/files/reports/2020/2020USTRReportCongressChinaWTOCompliance.pdf.

14 *2020 Report On The Implementation And Enforcement Of Russia'S WTO Commitments*. 2020. Ebook. United States Trade Representative. https://ustr.gov/sites/default/files/files/reports/2020/Russia2020WTOReport.pdf.

15 Ibid.

16 Hine, Thompson. 2021. "USTR Continues To Criticize China And Russia For Poor WTO Compliance". *Lexology*. https://www.lexology.com/library/detail.aspx?g=bbc89347-e5a6-485c-9289-669f801b7043.

17 *Foreign Economic Espionage In Cyberspace*. 2018. Ebook. National Counterintelligence and Security Center. https://www.dni.gov/files/NCSC/documents/news/20180724-economic-espionage-pub.pdf.

18 *Report On The Protection And Enforcement Of Intellectual Property Rights In Third Countries*. 2021. Ebook. European Commission. https://trade.ec.europa.eu/doclib/docs/2021/april/tradoc_159553.pdf. pp. 10,11

19 Ibid.

20 Gelpern, Anna, Sebastian Horn, Scott Morris, Brad Parks, and Christoph Trebesch. 2021. *How China: Lends A Rare Look Into 100 Debt Contracts With Foreign Governments*. Ebook. https://www.cgdev.org/sites/default/files/how-china-lends-rare-look-100-debt-contracts-foreign-governments.pdf. p.2

21 Wheatley, Jonathan. 2021. "China'S Secret Loan Contracts Reveal Its Hold Over Low-Income Nations". *Ft.Com*. https://www.ft.com/content/7e98795f-159b-4455-903e-6e21c345d4a9.

22 Robinson, Jana, Martina Šmuclerová, Lapo D. Innocenti, Lisa Perrichon, and Jakub Pražák. 2018. *Europes's Preparedness To Respond To Space Hybrid Operations*. Ebook. PSSI. https://www.pssi.cz/download//docs/8252_597-europe-s-preparedness-to-respond-to-space-hybrid-operations.pdf.

23 Robinson, Jana, Roger W. Robinson, Andrew K. Davenport, Tereza B. Kupková, Patrik Martínek, Samuel A. Emmerling, and Angela Marzorati. 2019. *State Actor Strategies In Attracting Space Sector Partnerships: Chinese And Russian Economic And Financial Footprints*. Ebook. https://www.pssi.cz/download//docs/8177_686-executive-summary.pdf.

24 Jones, Andrew. 2019. "China Creates Commercial Space Alliance, Expands Launch Complex". *Spacenews*. https://spacenews.com/china-creates-commercial-space-alliance-expands-launch-complex/.

25 Robinson, Jana, Patrik Martínek, Jakub Pražák, and Kristína Sikoraiová. 2021. *China Deploys BeiDou to Project Power and Influence*. Ebook. Prague: PSSI. https://www.pssi.cz/download//docs/8509_08-pssi-perspectives-china-deploys-beidou-to-project-power-and-influence-3.pdf.

26 Ibid.

27 "Thailand Is Next ASEAN Country To Benefit From Chinese Satellite Technology". 2018. *People's Daily Online*. http://en.people.cn/n3/2018/0912/c90000-9499868.html.

28 Robinson, Jana, Patrik Martínek, Jakub Pražák, and Kristína Sikoraiová. 2021. *China Deploys BeiDou to Project Power and Influence*. Ebook. Prague: PSSI. https://www.pssi.cz/download//docs/8509_08-pssi-perspectives-china-deploys-beidou-to-project-power-and-influence-3.pdf.

29 Messier, Doug. 2020. "China Completes Beidou Satellite Navigation System". *Parabolicarc.Com*. http://www.parabolicarc.com/2020/06/28/china-completes-beidou-satellite-navigation-system/.

30 Storey, Ian. 2019. *Thailand'S Military Relations With China: Moving From Strength To Strength*. Ebook. ISEAS – Yusof Ishak Institute. https://www.iseas.edu.sg/images/pdf/ISEAS_Perspective_2019_43.pdf.

31 Selding, Peter. 2016. "China Wins Breakthrough Contract For Thaicom Telecommunications Satellite". *Spacenews*. https://spacenews.com/china-wins-breakthrough-contract-for-thaicom-telecommunications-satellite/.

32 *Framework Agreement Signing To Provide IPSTAR Services In People'S Republic Of China*. 2013. Ebook. Thaicom. https://www.thaicom.net/wp-content/uploads/2019/07/20130102-THCOM-SET01-EN.pdf.

33 Londoño, Ernesto. 2018. "From A Space Station In Argentina, China Expands Its Reach In Latin America". *Nytimes.Com*. https://www.nytimes.com/2018/07/28/world/americas/china-latin-america.html.

34 Ibid.

35 Garrison, Cassandra. 2019. "China's Military-Run Space Station In Argentina Is A 'Black Box'". *Reuters*. https://www.reuters.com/article/us-space-argentina-china-insight-idUSKCN1PP0I2.

36 REUTERS/Agustin Marcarian. 2019. From: "China's Military-Run Space Station in Argentina is a 'Black Box'". Reuters. https://www.reuters.com/article/us-space-argentina-china-insight-idUSKCN1PP0I2

37 Zhihao, Zhang. 2018. "Two Nations Look To The Stars With Massive Telescope Project In Southern Hemisphere". *China Daily*. https://www.chinadaily.com.cn/a/201812/01/WS5c01d5d5a310eff30328c2b8.html.

38 Foust, Jeff. 2019. "Satellogic selects China Great Wall to launch satellite constellation". Spacenews. https://spacenews.com/satellogic-selects-china-great-wall-to-launch-satellite-constellation/

39 Messier, Doug. 2022. "Satellogic Announces Multiple Launch Agreement with SpaceX for its Next 68 Sub-Meter Resolution Earth Observation Satellites". Parabolic Arc. http://www.parabolicarc.com/2022/05/04/satellogic-announces-multiple-launch-agreement-with-spacex-for-its-next-68-sub-meter-resolution-earth-observation-satellites/

40 "Form F-1 Satellogic Inc.". 2022. SEC.report. https://sec.report/Document/0001193125-22-039746/#rom274113_13

41 Gillespie, Patrick. 2020. "China And Argentina Resume Joint Venture For Space Exploration". *Buenos Aires Times*. https://www.batimes.com.ar/news/argentina/china-and-argentina-resume-joint-venture-for-space-exploration.phtml.

42 "Chinese Space Contractor To Install New Satellite Ground Station In Southern Argentina". 2021. *RWR Advisory Group*. https://www.rwradvisory.com/chinese-space-contractor-to-install-new-satellite-ground-station-in-argentina/.

43 "Second Edition China-Arab States BDS Cooperation Forum" 2019. BDS-Aicto. http://bds-aicto.org

44 Yang, Changfeng. 2020. "Directions 2021: BDS Marches To New Era Of Global Services". *GPS World*. https://www.gpsworld.com/directions-2021-bds-marches-to-new-era-of-global-services/.

45 Barbosa, Rui C. 2017. "Chinese Long March 3B Lofts Alcomsat-1 For Algeria". *Nasaspaceflight.Com*. https://www.nasaspaceflight.com/2017/12/chinese-long-march-3b-alcomsat-1-algeria/.

46 Li, Rui, Shuaiyong Zheng, Ershen Wang, Jinping Chen, Shaojun Feng, Dun Wang, and Liwen Dai. 2020. "Advances In Beidou Navigation Satellite System (BDS) And Satellite Navigation Augmentation Technologies". *Satellite Navigation* 1 (12). doi:10.1186/s43020-020-00010-2. pp. 5,6

47 "About EGNOS". 2021. *Egnos-User-Support.Essp-Sas.Eu*. https://egnos-user-support.essp-sas.eu/new_egnos_ops/egnos-system/about-egnos.

48 McGregor, Andrew. 2018. "Defense Or Domination? Building Algerian Power With Russian Arms". *The Jamestown Foundation*. https://jamestown.org/program/defense-or-domination-building-algerian-power-with-russian-arms/.

49 Fleurant, Aude, Pieter D. Wezeman, Siemon T. Wezeman, Diego Lopes Da Silva, Nan Tian, and Alexandra Kuimova. 2020. *TRENDS IN INTERNATIONAL ARMS TRANSFERS, 2019*. Ebook. SIPRI. https://www.sipri.org/sites/default/files/2020-03/fs_2003_at_2019.pdf.

50 Wezeman, Pieter D., Alexandra Kuimova, and Siemon T. Wezeman. 2021. *TRENDS IN INTERNATIONAL ARMS TRANSFERS, 2020*. Ebook. SIPRI. https://www.sipri.org/sites/default/files/2021-03/fs_2103_at_2020_v2.pdf.

51 "Algeria Modernizes Its Air Force: Upgrading Its SU-24S". 2020. *Second Line Of Defense*. https://sldinfo.com/2020/04/algeria-modernizes-its-air-force-upgrading-its-su-24s/.

52 „Alger Acquiert Le Système De Géo-Positionnement Par Satellites, GLONASS". 2018. *Le Monde Arabe*. https://lemonde-arabe.fr/30/06/2018/algerie-russie-armement/.

53 Hull, Andrew W., David R. Markov, and Eric Griffin. 2021. *"Private" Chinese Aerospace Defense Companies*. Ebook. China Aerospace Studies Institute. https://www.airuniversity.af.edu/Portals/10/CASI/Books/CASI_Chinese_Aerospace_Defense_Companies.pdf.

Appendices

Appendix 1
Results of Mentimeter Poll Conducted During PSSI's Space Security Roundtable

The two visuals presented below capture the results of the interactive Mentimeter poll conducted during PSSI's Space Security closed roundtable entitled "*Strategic Competition for International Space Partnerships and Key Principles for a Sustainable Global Space Economy*" that took place on April 22, 2021. The participants were given two open-ended questions: what words in their opinion best characterize the Chinese and Russian methods of attracting international space partnerships; and which leading objectives come to mind when trying to promote sustainable global space commerce that reflects our values. The results of the poll consist of keywords reflecting the opinions of the participants of the roundtable.

Appendix 2
Agenda and List of Participants of PSSI's Closed Online Roundtable Held on April 22, 2021

AGENDA

STRATEGIC COMPETITION FOR INTERNATIONAL SPACE PARTNERSHIPS AND KEY PRINCIPLES FOR A SUSTAINABLE GLOBAL SPACE ECONOMY

VENUE: **ONLINE (CISCO WEBEX PLATFORM)**

PROCEEDINGS:

15:00–15:05 **INTRODUCTION AND SETTING FORTH ROUNDTABLE OBJECTIVES**

Dr. Jana Robinson, Managing Director and Space Security Program Director, PSSI

A great power competition is already well underway and the leader/winner will likely accrue adequate leverage to shape the space domain according to their strategic vision and value system. PSSI has been at the forefront of supporting the transatlantic allies and their partners in strengthening the global acceptance of disciplined, open, fair, and transparent principles to govern this domain. It has also written extensively on the necessity of responding firmly and persuasively, especially in the economic and financial domain, to space-related transgressions. Some questions to help shape this roundtable are as follows:

What key principles should guide international space cooperation, partnerships and fair commerce?

What is at stake for the allies with regard to the reality that the state-led, non-market economic and financial practices employed by China and Russia have made steady and significant gains in international markets and, between them, have forged partnerships with the space sectors of some 90 countries?

What approaches, measures and response options should be adopted to ensure that our values and principles form the foundation of a sustainable global space economy over the long haul?

15:05–15:20 **KEYNOTE ADDRESS:**

Heidi Grant, Director, Defense Security Cooperation Agency

15:20–16:05

SESSION ONE: ECONOMIC AND FINANCIAL THREATS TO STABLE INTERNATIONAL SPACE PARTNERSHIPS

Moderator:	**Dr. Jana Robinson,**	Managing Director and Space Security Program Director, PSSI
Speakers:	**Kevin O'Connell,**	CEO, Space Economy Rising, LLC, and former Director of the Office of Space Commerce, U.S. Department of Commerce
	Dr. Scott Pace,	Director, Space Policy Institute, George Washington University and former Executive Secretary of the U.S. National Space Council
	Augusto Gonzalez,	Adviser for EU Space Diplomacy, DG for Defence Industry and Space (DG DEFIS), European Commission

This session will discuss the international economic and financial (E&F) space activities of China and Russia. These largely overlooked E&F elements of their "ground game" urgently need to be addressed, particularly given the scores of foreign governments that have come under the sway of China and/or Russia. The knowing creation of undue space-related dependencies also represents a threat to the development of a sustainable global space economy.

Some of these worrying E&F activities include: non-market, subsidized loan arrangements; damaging fair competition in the space sub-sectors due to a government's intervention on behalf of its enterprises; compromising the sovereignty of countries via financial indebtedness and the resulting seizure of assets; and insisting on sole source contracts for much of a country's space sector development, potentially leading to what PSSI terms "space sector capture". Developing, often cash-strapped, countries are most vulnerable to such aggressive marketing approaches and only discover the downside implications too late. Democratic countries are also not immune to these E&F predations, although often couched in seemingly benign individual commercial contracts, scientific collaboration, academic exchanges, or broader funding commitments beyond the space sector.

This session will also discuss the broader implications of skewed international space partnerships, mainly the expansion of the Chinese and Russian global space footprints (including the shaping of global space norms and standards) and the shrinkage of future markets for the equipment, technologies, and services of Western commercial space companies.

On the matter of competitive commercial pressures, it should be noted that Chinese and Russian space enterprises — including those that are publicly traded and whose securities are held widely in Western capital markets — are often already subject to US and/or other official sanctions and have regularly engaged in corporate national security and human rights abuses that have not been properly disclosed or penalized.

16:05–16:50 **SESSION TWO:**
ESTABLISHING KEY PRINCIPLES FOR A SUSTAINABLE GLOBAL SPACE ECONOMY

Moderator:	**Dr. John P. Stopher,**	Senior Fellow, PSSI
Speakers:	**Jonathan Moore,**	Principal Deputy Assistant Secretary, Bureau of Oceans and International Environment and Scientific Affairs, United States Department of State
	Kay Sears,	Vice President and General Manager for Military Space, Lockheed Martin
	Dr. Jill Stuart,	Visiting Fellow, Department of Government, The London School of Economics and Political Science

The Transatlantic allies and their partners need to leverage cross-domain actions to achieve an effective, comprehensive strategy. This session will discuss possible modalities to keep in check the growing space-derived influence of China and Russia. It will not be an easy task, due, in part, to the abundance of opportunities that China and Russia have to utilize unfair practices in the economic and financial sphere (e.g., financial subsidies, non-disclosure, lack of discipline and regulatory safeguards, and other non-market behavior), not to mention outright corruption. There are, however, measures that can be taken by the U.S. and its allies to help mitigate these types of existing and future risks; improve the competitive playing field for Western space companies and create barriers to space commerce that violates the global system of free and fair trade.

16:50–17:00 **CLOSING REMARKS**

LIST OF PARTICIPANTS

PSSI SPACE SECURITY ROUNDTABLE, APRIL 22, 2021 (15:00–17:00 CET) STRATEGIC COMPETITION FOR INTERNATIONAL SPACE PARTNERSHIPS AND KEY PRINCIPLES FOR A SUSTAINABLE GLOBAL SPACE ECONOMY

Bill Adkins
Professional Staff US House of Representatives, Defense Appropriations Subcommittee

Jorge Aguilera
Defense Security Cooperation Agency (DSCA)

Laura Alami
Head of the Institutional Capacity Building Division Defense Security Cooperation Agency (DSCA)

Hiroko Asakura
Deputy Director JAXA Office Paris

Frank Asbeck
Senior Fellow PSSI

Tereza Balková
Assistant to Deputy Minister for Strategy and Policy Czech Ministry of Defense

Svenja Berrang
Legal Advisor German MoD

Jaime Bowen
Lockheed Martin

Richard Buenneke
Senior Advisor, Space Policy U.S. Department of State

Jean-Francois Bureau
Chairman IOCONSEIL (Innovation & Organizations Counsel) Eutelsat consultant

Timothy Deaver
Director, National Security Space Programs Airbus USA

David Edmondson
Policy Head, Space Security and Advanced Threats, Security Policy Department, Defense and International Security Foreign, Commonwealth and Development Office (FCDO), UK

Steve Eisenhart
Senior Vice President for Strategic and International Affairs Space Foundation

Pascal Faucher
EUSST Chairman, and Security and Defense CNES

Heidi Grant
Director Defense Security Cooperation Agency (DSCA)

Augusto Gonzales
Adviser for Innovation DG DEFIS, European Commission

Laura Haverstick
Defense Security Cooperation Agency (DSCA)

Peter Hays
Senior Policy Advisor, Falcon Research Policy & Integration Directorate (SAF/SPI) Office of the Assistant Secretary of the Air Force for Space Acquisition and Integration Pentagon

Henry Heren
Lieutenant Colonel NATO JAPCC

Diane Howard
Chief Counsel for Space Commerce U.S. Department of Commerce

Arkadiusz Chimicz
PhD Student War Studies University, Poland

Robert (Bob) Johnson
Bureau of Oceans and International Environmental and Scientific Affairs, Department of State

Campbell Kane
Defense Security Cooperation Agency (DSCA)

Václav Kobera
Director, Intelligent Transport Systems, Space Activities and R&D Department Czech Ministry of Transport

Alexander Konrad
Referent für Weltraumpolitik German Ministry of Defence

Tomáš Kopečný
Deputy Minister for Industrial Cooperation Czech Ministry of Defense

Hiroshi Koyama
Electronic Systems Group, Fellow Mitsubishi Electric Corporation

Travis Langster
Vice President / General Manager COMSPOC

Lauren Kelley
Lockheed Martin

James Lawrence
Chief, Strategic Outreach Defense Security Cooperation Agency (DSCA)

Patrik Martínek
Program Assistant PSSI

Peter Marquez
Head of Space Policy Amazon Web Services

Takehiko Matsuo
Director-General National Space Policy Secretariat, Cabinet Office

Joseph Michaels
Works with Audrey Schaffer OSD Space Policy

John Mittleman
Naval Research Laboratory

Jonathan Moore
Principal Deputy Assistant Secretary Bureau of Oceans and International Environment and Scientific Affairs

Jamie Morin
Vice President of Defense Systems Operations, Defense Systems Group Aerospace Corporation

Kevin O'Connell
CEO Space Economy Rising, LLC

Scott Pace
Director of Space Policy Institute GWU

Regina Peldszus
Senior Policy Officer on Secondment (Space Security, Space Surveillance) Federal Ministry for Economic Affairs & Energy Unit IV D 5 - Space Agency, Technologies and Security

Margaret Polkowska
Professor University of War Studies, Poland

Jakub Pražák
Project Assistant PSSI

Nicholas Reese
Space Policy Lead - U.S. Department of Homeland Security Office of Strategy, Policy and Plans

Jana Robinson
Managing Director PSSI

Roger Robinson
Chairman and Co-Founder PSSI

Victoria Samson
Director of Washington, DC Office Secure World Foundation

Kay Sears
VP/GM Military Space Lockheed Martin

Audrey Schafer
Acting DASD, Space Policy Office of the U.S. Secretary of Defense

Kai-Uwe Schrogl
German Ministry of Economy, seconded from ESA

Kristína Sikoraiová
Project Assistant PSSI

John Stopher
Senior Fellow PSSI

Jill Stuart
Visiting Fellow, Department of Government The London School of Economics and Political Science

Katsuya Sudo
Director JAXA Paris Office

Ryuta Suzuki
Electronic Systems Group, Space Systems Department, Deputy General Manager Mitsubishi Electric Corporation

Dave Turner
Acting Director Office of Space Affairs, Bureau of Oceans and International Environment and Scientific Affairs, U.S. Department of State

Kota Umeda
Deputy Director JAXA Washington DC Office

Uwe Wirt
Civilian Operations Director of GSSAC DLR

Susumu Yoshitomi
Special Counselor Japan Space Forum

Prague Security
Studies Institute