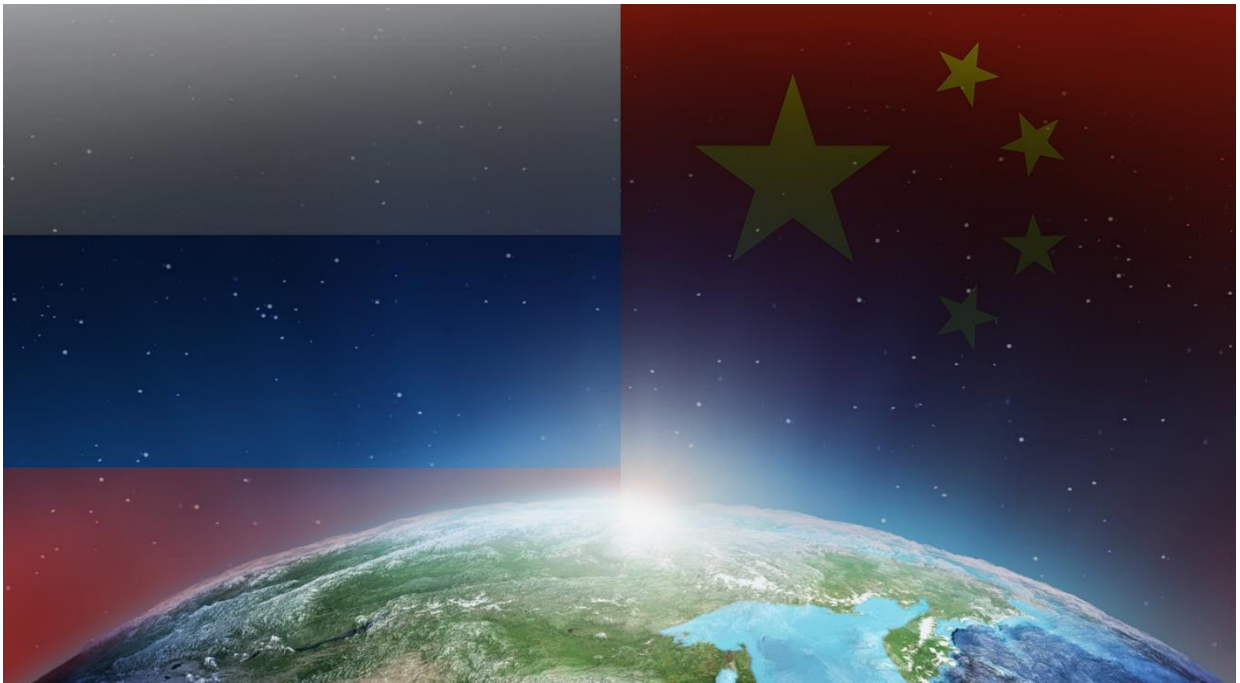




C H I N A A E R O S P A C E
S T U D I E S I N S T I T U T E



**China-Russia Space Cooperation:
The Strategic,
Military, Diplomatic, and
Economic Implications of a Growing Relationship**

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CNA

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Executive Summary

Over the past two decades, the relationship between the People's Republic of China (PRC) and Russia has transitioned from what some described as a relationship of convenience to what both countries now call a “comprehensive strategic partnership.” The growing strategic partnership between China and Russia is reflected in a burgeoning China-Russia space relationship. Once the dominant power in the space relationship, Russia now appears to be taking a secondary role. China's growing expertise in space, matched with the financial capabilities to sustain a large and growing space enterprise, signals not only China's rise as a major space power but also the geopolitical transition taking place between China, Russia, and the United States.

Key findings

China-Russia space relations are indicative of a broader effort to build mutual trust, further Chinese and Russian influence and counter Western political and economic pressure, facilitate multipolarization, and achieve common national security goals.

Any limitations of the China-Russia relationship do not appear to be significant enough to derail the broader relationship. Indeed, not only do Beijing and Moscow seem to have successfully compartmentalized such irritants, but bilateral cooperation in sensitive dual-use areas of scientific and technological research suggests that they may be gradually overcoming—or are working to overcome—their mutual mistrust.

In this context, China-Russia space cooperation is intended to enhance each country in several ways:

- *Strategically*, through joint efforts that balance against U.S. dominance
- *Militarily*, through combined military exercises, technology transfer, coordinated actions, and confidence-building measures
- *Diplomatically*, through proposed activities that demonstrate Chinese and Russian space leadership separate from U.S. cooperative space frameworks
- *Economically*, through technology transfer agreements and joint development efforts that reduce the technological and budgetary risk of space programs and promote space products and services
- *Technologically*, through agreements that provide alternatives to Western technologies

China-Russia space relations indicate deepening trust between the two countries.

While not an alliance, the burgeoning cooperation between Russia and China on issues of space and space-related technology has a breadth and depth that indicate a growing strategic partnership. The expanding and increasingly sensitive nature of China-Russia space cooperation may make it more difficult for the United States to influence the two countries' cooperative space activities.

- A 2019 agreement to transfer sensitive missile defense technology allows China access to technologies dominated by the United States and Russia.
- A 2017 agreement covering intellectual property rights (IPR) protection on the transfer of space technologies suggests that Russian concerns over Chinese technology theft, a hindrance to previous China-Russia technological cooperation, have been assuaged or at least suggests that Russia has come to accept technology theft as an inherent risk of doing business in China. It is unknown to what extent the funding shortfalls in Russia's space program provided China with leverage in these negotiations.
- Depending on the level of cooperation, a 2021 joint lunar exploration memorandum of understanding (MOU) could tie the two countries together in ways that make success contingent on both countries' participation.
- Although the improvement in China-Russia space relations is a sign of the increasing trust between the two countries, U.S. political and economic sanctions against both countries' space programs also likely play a role in bringing the two countries closer together.

China-Russia space relations indicate an effort to balance against U.S. dominance.

China-Russian space cooperation is driven by the same forces that drive the overall strategic relationship. While the two countries do not share completely overlapping security concerns, they do share a strong desire to counter U.S. leadership, including in outer space. They share concerns over interpretation of U.S. space initiatives and see U.S. space-based capabilities and dominance, especially anything related to missile defense, as threatening to their strategic nuclear arsenals.

China-Russia space relations indicate an effort to deter and counter the U.S. militarily.

China-Russia space cooperation involves activities related to national defense. These include cooperative activities on ballistic missile defense (BMD), space debris monitoring, and satellite navigation.

Ballistic missile defense

China possesses BMD systems that have capabilities similar to those of the U.S. Patriot and Theater High Altitude Area Defense (THAAD) systems. Unofficial Chinese sources have linked an interest in developing more advanced BMD capabilities to the withdrawal of the United States from the Intermediate Range Nuclear Forces agreement and the U.S. development of long-range missile capabilities. China has stated opposition to global missile defense systems, and it is unknown to what extent BMD cooperation is limited to tactical and regional capabilities.

- Russian assistance could aid China in developing ground- and space-based missile warning systems that would raise the effectiveness of China's existing missile defense systems and speed the development of new systems.
- Combined Chinese-Russian air and missile defense exercises indicate an effort to improve defenses against ballistic and cruise missile attack and demonstrate the growing closeness of the relationship. It is unknown to what extent the combined exercises reflect an intent to develop an actual combined air and missile defense capability.
- We found no evidence to support the speculation of media and subject matter experts concerning the development of a joint missile early warning system. Such an agreement would be a significant step forward in the two countries' relationship, making it similar to an alliance. Cooperation in this area could create mutually supportive relationships that not only would provide each country with enhanced capabilities but would also impose shared responsibilities that could increase the risk of escalation by drawing both countries into conflict with the United States.

A hypothetical joint missile early warning system would complicate U.S. efforts to deny, degrade, or destroy Chinese or Russian BMD systems. Depending on the extent to which the Chinese and Russian systems were mutually supportive, attacks intended to suppress either the Chinese or Russian BMD system individually would risk escalating the conflict by involving both countries.

Space debris monitoring

China and Russia signed an agreement on space debris monitoring and data exchange in November 2018. Little is known about this cooperation, but it could involve two activities:

- Technical cooperation to develop space debris monitoring capabilities
- Mechanisms to allow for notification of conjunction events between spacecraft and debris

Due to the dual-use nature of space debris monitoring, China-Russia cooperation could have potential military applications. The similarity of space debris monitoring capabilities to military space surveillance capabilities could enhance the ability of both countries to collect intelligence on adversary space systems and aid in the tracking and targeting of U.S. satellites. The development of space surveillance capabilities could potentially leverage cooperation on missile early warning systems.

Satellite navigation

China-Russia cooperation in satellite navigation appears to be one of the most robust space-related activities between the two countries. In 2014, the two countries signed an MOU on satellite navigation cooperation concerning compatibility and interoperability, and the establishment of ground stations in each other's countries, among other issues. China-Russia cooperation on satellite navigation could provide an alternative signal in the event that either country's national satellite navigation system was denied or degraded. U.S. actions to deny either China or Russia satellite

navigation would have to take into account each country's access to both Beidou and GLONASS as well as the escalatory implications of denying both systems. Promoting interoperability between the civil signals of satellite navigation systems is common practice, however. The United States and China signed a joint statement on civil signal compatibility and interoperability in 2017, and the European Galileo system and Beidou are interoperable.

China-Russia space cooperation effort is likely intended to increase Chinese and Russian influence in international space diplomacy.

In March 2021, China and Russia signed an MOU on joint lunar exploration, covering the establishment of a lunar research base in lunar orbit and/or on the surface of the Moon. Although not acknowledged by either China or Russia, cooperation on lunar exploration and their openness to additional participants appears to be a response to the U.S.-led Artemis Accords that established a set of principles for the exploration and commercial use of space. Neither China nor Russia has introduced a similar set of principles individually or jointly, though.

China-Russia cooperation does not appear to significantly advance commercial competitiveness.

China-Russia economic space cooperation appears to be most pronounced in satellite navigation. Agreements to increase interoperability and compatibility will likely facilitate the use of the Beidou and GLONASS satellite navigation systems in both countries.

China-Russia space cooperation indicates a desire to reduce technological and budgetary risk.

For China, this means acquiring technology from Russia, especially rocket engine technology that would be too complicated or too costly to develop alone. Technology transfer flows both ways, however. Russia's interest in Chinese aerospace electronic components suggests the intent to create an alternative supply chain for its space industry, necessary because the European Union imposed sanctions on dual-use components to Russia after the 2014 Russian invasion of Ukraine.

China-Russia technological cooperation also reflects the Russian aerospace industry's need for funding. Chinese purchases of Russian technology likely provide a much-needed infusion of cash to Russian aerospace companies. China may also look to the partnership as a way to reduce the budgetary demands of space exploration, given the cost and few tangible benefits associated with lunar exploration.

China-Russia space relations indicate a shifting power dynamic between the two countries.

For much of the history of China-Russia space relations, Russia has been the leading space power in the relationship, providing much-needed technology and know-how to a small and inexperienced Chinese space program. This relationship dynamic appears to be undergoing a fundamental shift because of China's improving technological capabilities and sustained funding. China now appears to be positioning itself to be the leading space power in the relationship in which Russia plays an important, but nonetheless secondary, role as a provider of capabilities to Chinese-led space endeavors.

A lack of transparency to outside observers adds uncertainty to determining the true nature of China-Russia space relations.

China-Russia space cooperation lacks transparency. As their cooperation in defense-related fields has deepened, it has also become more secretive. Much of the media reporting only mentions signed agreements and provides little specific information. Although the number and types of cooperation agreements indicate a growing strategic partnership, it is possible that some or many of the agreements examined here lack substance, were not fully carried out, or were cancelled. Alternatively, the lack of transparency could also hide a more substantive relationship than the one presented here. Either finding would necessarily call for a reevaluation of the China-Russia space relationship.

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Chapter 1: Introduction

Over the past two decades, the relationship between the People’s Republic of China (PRC) and Russia has made important progress. In 2019, China and Russia characterized the relationship as a “comprehensive strategic partnership.”¹ The growth in the relationship is occurring at the same time that both countries’ relations with the United States are deteriorating. China and Russia are now engaged in a growing number of activities that draw them closer together economically, diplomatically, and militarily. China is using its relationship with Russia to modernize its military capabilities and advance technological innovation, while Russia uses its relationship with China for economic gain. Both countries use the relationship to counter U.S. power and influence globally.

The China-Russia space relationship is also deepening and expanding. Cooperative agreements signed between the two countries cover a broad range of space endeavors such as lunar and Mars exploration, technology transfer of rocket engine technologies, cooperative activities in the strategically important areas of ballistic missile defense (BMD) and satellite navigation, and diplomatic efforts in space arms control. (See the appendix for a list of China-Russia space cooperation agreements.)

Space activities, however, cannot be divorced from earthly endeavors. The improvement in China-Russia space relations not only mirrors the broader relationship but also serves as an indicator of its nature. Although China-Russia space cooperation does not indicate the formation of an alliance, closer space cooperation between the two countries does signal a meaningful strategic partnership intended to advance each country’s national interests.

Within this context, China-Russia space relations are indicative of a broader effort to further Chinese and Russian influence and to deter the U.S. militarily. China-Russia space cooperation is intended to enable the countries to counter Western political and economic pressure, facilitate multipolarization, and achieve common national security goals. As a result, China-Russia space cooperation is intended to enhance each country in several ways:

- *Strategically*, through joint efforts that balance against U.S. dominance
- *Militarily*, through combined military exercises, technology transfer, coordinated actions, and confidence-building measures
- *Diplomatically*, through proposed activities intended to demonstrate Chinese and Russian space leadership separate from U.S. cooperative space frameworks

- *Economically*, through technology transfer agreements that reduce technological and budgetary risk of space programs and promote space products and services
- *Technologically*, through agreements that provide alternatives to Western technologies

The improvement in China-Russia space relations also reflects the changing power dynamic between China and Russia. For much of the history of China-Russia space relations, Russia has been the leading space power in the relationship, providing much-needed technology and know-how to a small and inexperienced Chinese space program. This relationship dynamic appears to be undergoing a fundamental shift because of China's improving technological capabilities and sustained funding. China now appears to be positioning itself to be the leading space power in the relationship in which Russia plays an important, but nonetheless secondary, role as a provider of capabilities to Chinese-led space endeavors. As a result, the China-Russia space relationship reflects the overall rise of China as a great power and the diminishing capabilities of Russia.

Chapter 2: The China-Russia Relationship

China-Russia ties have grown increasingly close in recent years, and the improvement in diplomatic and strategic relations between the two countries is a trend that has been observable for decades. Indeed, according to Chinese and Russian leaders, the relationship is currently at a historically high level.² The relationship has consolidated in the context of both states' deteriorating ties with the U.S. and their shared and growing perception that the U.S. and its allies pose a threat to their national security. Over the last decade, China-Russia bilateral cooperation has significantly expanded across the diplomatic, military, economic, and information domains. Nevertheless, the relationship is limited by mutual mistrust and the reluctance to incur costs on the other's behalf that has led to a debate about the extent to which the two countries are truly close.

This chapter explores the bilateral relationship over time. It argues that whatever limitations the relationship has, they do not appear to be significant enough to derail the broader relationship. Indeed, not only do Beijing and Moscow seem to have successfully compartmentalized such irritants, but bilateral cooperation in sensitive dual-use areas of scientific and technological research suggests that they may be gradually overcoming—or are working to overcome—their mutual mistrust.

Post-Soviet Union China-Russia relations

Although relations between China and Russia have become significantly closer over the last several years, bilateral ties have been improving for decades and predate the collapse of the Soviet Union.³ In the 1990s, Beijing and Moscow began the process of resolving their border disputes, and Russia resumed supplying China with weapons; by the middle of the decade, the two states had established a “strategic partnership of cooperation.”⁴ Also beginning in the 1990s, China and Russia issued numerous joint declarations addressing some of the most fundamental and strategically salient issues in international affairs.⁵ In 1997, for example, they issued a joint declaration at the UN, calling for “a multipolar world” and a “new international order,” and in the years since, Beijing and Moscow have routinely reiterated such calls.⁶

In 2001, the two states served as founding members of the Shanghai Cooperation Organization (SCO), a multilateral institution intended in part “to maintain and ensure peace, security, and stability in the [Central Asian] region.”⁷ In 2003, China and Russia began holding combined military exercises, both bilaterally and multilaterally under the auspices of the SCO.⁸ A number

of analysts have noted that the 2008-2009 global financial crisis served to further deepen political and economic cooperation: both Beijing and Moscow viewed the global financial system, designed and led by the U.S. and the West, as unstable and potentially threatening.⁹ In a May 2008 joint statement on “major international issues,” China and Russia declared that they shared “the same or similar views and stances on the root causes of the crisis and the reform of the global financial system and the international financial institutions.”¹⁰

Deteriorating ties with the United States

The increasing closeness of the China-Russia relationship has corresponded with a deterioration in both states’ relationships with the United States. Beginning in the late 2000s, Chinese officials bristled as the United States increasingly expressed concerns with China’s conduct in the South China Sea,¹¹ and the Obama administration’s rebalance to the Pacific was widely portrayed by government- and party-affiliated analysts, as well as official state media, as a hostile initiative intended to contain China.¹² Following Russia’s 2014 invasion and annexation of Crimea, Moscow’s relationship with the United States and the West entered its worst crisis of the post-Cold War era.¹³ Confronted with diplomatic isolation and economic sanctions, Moscow turned increasingly to Beijing for support.¹⁴

Indeed, authoritative Chinese and Russian documents released over the last decade illustrate a shared view of the United States as a national security threat.¹⁵ China’s 2019 defense white paper highlighted several U.S. security initiatives as undermining China’s national security and global strategic stability.¹⁶ Similarly, Russia’s 2015 National Security Strategy states that the United States and its allies are implementing a “policy of containing Russia.”¹⁷ Chinese and Russian leaders have traditionally been careful to disavow any suggestion that their relationship is driven by, or aimed at, a third party. However, when PRC defense minister Wei Fenghe visited Moscow in 2018, he declared, “The Chinese side has come to show Americans the close ties between the armed forces of China and Russia ... we’ve come to support [Russia].”¹⁸

Deepening convergence

It has been in this context that the China-Russian relationship has burgeoned. In 2014, Russian president Vladimir V. Putin said of China, “We are natural partners and natural allies,” and in 2019 Chinese leader Xi Jinping characterized Putin as “my best friend and colleague.”¹⁹ In 2019, the two countries announced their intention to form a “comprehensive strategic partnership of coordination for a new era,” and in the same year, Xi and Putin issued a joint statement in which the bilateral relationship was described as reaching “the highest level in history.”²⁰ In 2020, a PRC Foreign Ministry spokesman stated that “there is no limit to the traditional China-

Russia friendship and no restricted areas for expanding our cooperation.”²¹ This characterization appears broadly consistent with the U.S. intelligence community’s assessment: in 2019, Dan Coates, the director of national intelligence, stated, “China and Russia are more aligned than at any point since the mid-1950s” when the two states were formal allies.²²

Security cooperation

Over the last decade, combined military exercises between the two countries have become more frequent and have expanded geographically. The 2001 China-Russia Friendship Treaty, which serves as the political foundation of their relationship, does not contain a mutual defense clause. However, Beijing and Moscow have established a number of military and security coordination mechanisms that one could argue are ostensibly similar to the kind that undergird a formal allied relationship.²³ In 2017, China and Russia signed a roadmap governing military cooperation from 2017 to 2020 that was described by the PRC Ministry of National Defense (MND) as “the embodiment” of the “high-level of strategic mutual trust and strategic collaboration” between the two countries and “conducive to meeting new threats and challenges.”²⁴ With the exception of the Arctic, the Chinese and Russian militaries have now operated and exercised around the Eurasian landmass, making the current defense relationship transregional.²⁵ The two militaries have also exercised on land, at sea, and in the air.²⁶

Economic ties

The China-Russia economic and trade relationship has similarly expanded. In 2018, bilateral trade surpassed the \$100 billion mark for the first time and did so again in 2019 and 2020.²⁷ Chinese firms have made large investments in Russian energy projects in the Far North, and since 2014 Russia’s ambivalence about facilitating a larger Chinese presence in the Arctic appears to have declined.²⁸ In 2014, China and Russia concluded a landmark natural gas agreement, and in 2019 the Power of Siberia gas pipeline that supplies natural gas to China was opened.²⁹ Also in 2019, the first road bridge connecting the two states was completed; the first rail link between the two is expected to open in 2022.³⁰

Media

Chinese and Russian media companies have also begun to cooperate with each other to produce narratives that are consistent and are favorable to each other and the bilateral relationship. In June 2019, for example, the China Media Group and *Rossiyskaya Gazeta* formed a “commentary workroom” in Moscow to generate “articles related to major issues and events concerning the China-Russia relationship.”³¹ The two countries have also held an annual Media

Forum, which government officials have used to “tell each other’s stories well.”³² According to an official with China’s Central Cyberspace Affairs Commission, China and Russia should work together to “establish a healthy international public opinion environment” and to “jointly fight against attacks and provocations from Western countries.”³³

Science and technology cooperation

In recent years, China and Russia have also deepened cooperation in a number of science and technology fields. In addition to partnerships covering the basic sciences, bilateral cooperation now spans the following fields: biotechnology, neuroscience, nanotechnology, big data, robotics, artificial intelligence, telecommunications, alternative energy, and optics.³⁴

The 2019 joint statement on developing a “Comprehensive Partnership of Strategic Coordination for a New Era” repeatedly underscores that technological cooperation constitutes an important vector in the China-Russia relationship and that the two countries intend to “expand the depth and breadth of scientific and technological innovation cooperation.”³⁵ In 2016, China’s vice minister of science and technology and his Russian counterpart agreed to establish a China-Russia Innovation Dialogue, organize a bilateral forum on innovation, and strengthen China-Russia science and technology parks.³⁶ Officially sanctioned bilateral technology and innovation exchanges have since convened regularly.³⁷ In 2016 and 2017, Chinese and Russian entities established two new bilateral innovation parks: one research center focusing on medical robotics, and one start-up incubator.³⁸ In 2019, organizations under the Chinese Academy of Sciences and the Russian Academy of Sciences established the China-Russia Research Center for Atmospheric Optics in China’s Anhui Province.³⁹

In August 2020, Beijing and Moscow declared “the China-Russia Year of Scientific and Technological Innovation.”⁴⁰ The governments reportedly scheduled over 1,000 activities to be conducted over the course of the year.⁴¹ In a congratulatory letter sent to President Putin to mark the beginning of the year, Xi Jinping stated that bilateral technology cooperation is intended to position China and Russia “to make greater contributions to the reform of the global governance system.”⁴²

Response to U.S. sanctions

A number of Western and Chinese analysts have suggested that increased China-Russia cooperation in the science and technology domain is, in part, a product of recent U.S. efforts to bar Chinese and Russian firms from accessing American technology and markets.⁴³ The Chinese telecommunications firm Huawei is a case in point. As the Trump administration moved to restrict its ability to do business with U.S. suppliers, Huawei accelerated its efforts to expand into the Russian market and to partner with Russian IT companies and research institutions.⁴⁴ In 2019, for example, the firm announced that it would more than double the

number of research and development centers in the country and that it would invest \$7.8 billion in training Russian IT specialists over a five-year period.⁴⁵ In the same year, Huawei signed an agreement with a Russian telecommunications firm to build a test 5G network in Moscow and concluded a cooperative agreement with Russia's government-backed Center for Artificial Intelligence Research.⁴⁶

Limitations

Despite the progress in the China-Russia relationship, it still has limitations. For one thing, it has become increasingly asymmetrical in economic terms, as the Chinese economy has experienced consistent high growth and the Russian economy has struggled.⁴⁷ Russia's 2014 invasion of Crimea exacerbated this dynamic by increasing Russia's economic and financial dependence on China in the face of Western sanctions.⁴⁸ At least some Russian elites appear to bristle at this dynamic.⁴⁹ Moreover, analysts note that while Beijing has used its position to acquire Russian natural resources on favorable terms, PRC investment in the Russian economy has been lacking.⁵⁰ According to the International Monetary Fund, between 2009 and 2019 China was never among Russia's top 10 sources of direct investment, and in only one year (2014) was it in the top 15.⁵¹

Furthermore, although senior Chinese and Russian officials routinely affirm that their relationship is characterized by great trust, subject matter experts from both countries note that mutual mistrust continues to present problems.⁵² In their most sensitive political and military challenges, China and Russia have offered each other only limited support. For example, in their respective territorial disputes Beijing and Moscow maintain what Zhao Huasheng, a leading observer of Sino-Russian relations at Fudan University, has termed "friendly neutrality."⁵³ Their position of neutrality in such sensitive disputes suggests that both parties are eager to avoid incurring costs on the other's behalf. The following examples are illustrative:

- **Georgia:** Beijing neither supported Moscow's 2008 military campaign in Georgia nor followed Moscow in recognizing South Ossetia and Abkhazia as independent states.⁵⁴
- **Crimea:** In 2014, Beijing, rather than vetoing, abstained from voting on a UN Security Council resolution urging the international community not to recognize Crimea's post-invasion referendum on seceding from Ukraine and joining Russia.⁵⁵
- **South and East China Seas:** While Moscow has provided Beijing with a degree of diplomatic and symbolic support, Russia does not officially endorse China's controversial territorial and maritime claims.

Chapter 3: Brief Overview of the China-Russia Space Relationship

China-Russia space cooperation began robustly in the 1950s. The Soviet Union transferred R-1, R-2, and R-11F ballistic missiles to China and sent Soviet engineers to assist the Chinese in developing strategic weapons technology.⁵⁶ In 1960, however, the Soviet Union ceased these activities when its relations with China ruptured over differences in ideology, Soviet concerns over what was considered Chinese adventurism in regard to Taiwan, and Chinese concerns over perceived Soviet intentions to subordinate China to Soviet influence in Asia.⁵⁷

Sino-Soviet split and PRC “self-reliance”

From the 1960s to 1991, cooperation between China and the Soviet Union was either nonexistent or conducted at very low levels. During this time, Chinese space research and development has been described as entering a period of “self-reliance.” Despite the near-complete cutoff of foreign technology, China was able to make progress in ballistic missiles, space launch vehicles, and satellites. In 1960, China launched the first Dongfeng (“East Wind”) series of ballistic missiles. In 1970, it launched the first Long March series of space launch vehicles as well as its first satellite, the Dongfanghong-1 (“East is Red”) satellite.⁵⁸ Over the next two decades, China expanded both the types and numbers of its ballistic missile inventory, space launch vehicles, and satellites, although in terms of both numbers and technical sophistication it lagged well behind the Soviet Union and the United States.

Post-Cold War and human spaceflight

Relations between the two countries thawed toward the end of the Cold War. In 1992, China’s decision to conduct human spaceflight opened up new opportunities for space cooperation between China and (now) Russia. Russia’s extensive experience in human spaceflight was instrumental in the success of the Chinese human spaceflight program.⁵⁹ Russia transferred several technologies to China, including a docking apparatus, but what appears to have been more important was the technical know-how provided by Russian engineers. Beginning in 1991, China had begun inviting Russian engineers to discuss the technical aspects of their human spaceflight program in order to provide a venue for Chinese engineers to learn human spaceflight research and development (R&D) and to address challenges that they faced in their projects. In 1994, Moscow and Beijing signed the “Intergovernmental Agreement on the

Cooperation on the Study and Use of Outer Space for Peaceful Purposes.”⁶⁰ This agreement resulted in 93 contracts, including the sale of Russian Soyuz spacecraft designs, spacesuits, and a training package for two Chinese astronaut candidates at the Cosmonaut Training Center.⁶¹

China-Russia space subcommittee

In 1997, China and Russia signed an agreement to establish regular meetings between the countries’ premiers. This agreement also established a space subcommittee to promote cooperation between the two countries in space. The subcommittee held its first meeting in May 2000 in Beijing and appears to have continued meeting on an annual basis, overseeing two-year agreements.⁶² Unfortunately, little information is available on the cooperative activities covered in these agreements. According to one Russian source, these meetings resulted in few tangible results.⁶³ However, speaking in 2016, China National Space Administration (CNSA) deputy director Wu Yanhua stated that since 2001, China and Russia had cooperated on more than 100 projects.⁶⁴

2013-2017 China-Russia Space Cooperation Agreement

Beginning in 2013, China-Russia space cooperation began to be governed under five-year agreements. The “2013-2017 China-Russia Space Cooperation Agreement” was described as “expanding and deepening” cooperation in launch vehicle technologies and rocket engines, deep space exploration, human spaceflight, Earth observation, satellite navigation, space-related electronic parts and components, and other areas.⁶⁵ According to Wu Yanhua, the agreement also included the new area of space science.⁶⁶

Both Russian and Chinese sources state that China-Russia space cooperation began to take on renewed vitality after the 2014 Russian invasion of Ukraine resulted in the United States, the European Union (EU), and other countries imposing diplomatic and economic sanctions against Russia that resulted in a ban on exports of space-related electronic components to Russia.⁶⁷ As one Russian media source stated when commenting on improved relations with China:

In fact, the logic of this decision is simple: if there are a huge number of opponents, in the absence of like-minded people you need to be friends with someone. Moreover, in the conditions of economic downturn, when the financing of the industry is constantly subjected to sequester, it is almost impossible to implement ambitious projects (such as lunar or Martian missions) alone.⁶⁸

Potentially signifying the importance now given to space cooperation, the two countries signed an intellectual property rights (IPR) agreement for space technologies in the summer of 2016, which appears to have been ratified in 2017.⁶⁹ An IPR agreement was reportedly the main condition under which Russia would begin substantive cooperation and reflected its long-standing concern over Chinese technology theft.⁷⁰ The agreement appears to have been especially important in advancing negotiations on the Russian transfer of rocket engine technology.⁷¹

CNSA and Roscosmos 2018-2022 Space Cooperation Outline

The second five-year agreement on space cooperation, the “China National Space Administration (CNSA) and Roscosmos 2018-2022 Space Cooperation Outline” is described as a significant step forward for China-Russia space cooperation. It governs space activities between the two countries in the area of launch vehicles and rocket engines, space planes, lunar and deep space exploration, Earth remote sensing, space electronics, space debris, satellite navigation, and satellite communications.⁷²

According to PRC media, the agreement signaled that Russia and China had entered “an important stage of strategic cooperation.”⁷³ According to Yin Liming, president of the Chinese space industry’s China Great Wall Industry Corporation, the agreement demonstrates that “China and Russia have great opportunities for deeper cooperation.”⁷⁴ According to one article, “Even though this is not the first agreement between China and Russia in the area of space cooperation, it is the most important” and “will allow both sides to achieve higher goals.”⁷⁵

Chapter 4: Lunar Exploration

On March 9, 2021, China and Russia signed the “Memorandum of Understanding between the Government of the People’s Republic of China and the Government of the Russian Federation Regarding Cooperation for the Construction of the International Lunar Research Station.”⁷⁶ The MOU covers joint lunar exploration missions centering on the construction of an International Lunar Research Station (ILRS) that will involve a “cis-lunar transportation facility” that will orbit around the Moon to facilitate travel between Earth and the Moon and between the facility and the lunar surface. In addition, a “long-term support facility” will be located on the lunar surface.⁷⁷ The research program focuses on the lunar South Pole, an area identified as most likely to sustain a human presence on the Moon due to the presence of water ice. According to the two countries, the ILRS will be open to international participation.⁷⁸ The MOU follows the October signing of the U.S.-led Artemis Accords, an agreement between the United States and 10 other countries governing lunar and space exploration and commercial activities.

China’s missions to the Moon

China’s lunar exploration program was approved on January 23, 2004. China to date has launched five lunar exploration missions under its Chang’e program and has three more missions planned. China has used a three-stage process for these missions, encompassing two missions that orbited the Moon (Chang’e-1 and -2), two missions that landed on the Moon (Chang’e-3 and -4), and one mission that landed on the Moon and returned to Earth (Chang’e-5).⁷⁹ Details of each mission are as follows:

- *Chang’e-1.* The Chang’e-1 mission was launched in 2007 and mapped the lunar surface using a 3D imager, analyzed the lunar soil, measured its depth, and explored the environment between Earth and the Moon. After completing its mission, the spacecraft was crashed into the lunar surface so that scientists could analyze the composition of the lunar dust kicked up by the impact.⁸⁰
- *Chang’e-2.* Chang’e-2 was launched in 2010. The spacecraft, similar to the Chang’e-1, also mapped the lunar surface. After completing its lunar exploration mission, the spacecraft traveled to the Earth-Sun L2 Lagrange Point, where spacecraft can maintain their orbit with minimal adjustments. China is only the third country to visit this point. While stationed at the L2 point, China tested deep space communications and tracking capabilities. In April 2012, the spacecraft conducted a flyby of the asteroid 4179 Toutatis.⁸¹

- *Chang'e-3.* Chang'e-3 was launched in 2013. The mission conducted a soft lunar landing and deployed the Yutu rover to further explore the lunar surface.⁸²
- *Chang'e-4.* Chang'e-4 landed on the far side of the Moon and deployed the Yutu-2 rover. Prior to the Chang'e-4 mission, the PRC launched the Queqiao data relay satellite to facilitate communication between the Chang'e-4 lander and the Yutu-2 rover. Queqiao was stationed at the Earth-Moon L2 Lagrange Point, the first spacecraft to be placed in that orbit.⁸³
- *Chang'e-5.* The Chang'e-5 mission collected and returned to Earth samples of the lunar soil.⁸⁴

China's next series of lunar missions, starting in 2024, is described as another three-stage process of "surveying, constructing, and exploiting."⁸⁵ Chang'e missions 6 through 8 will focus on the first step, surveying.

- *Chang'e-6.* Chang'e-6 will extract soil samples from the lunar South Pole and is scheduled to be launched around 2024.⁸⁶ While the final payloads have yet to be announced, one possible candidate is a joint Chinese-Russian mission to detect water on the lunar surface.⁸⁷
- *Chang'e-7.* The Chang'e-7 mission will involve multiple craft to explore the Moon's South Pole: a lunar orbiter, a lander, a rover, a flying probe, and a communications relay satellite. It is set to launch in 2024.⁸⁸
- *Chang'e-8.* The Chang'e-8 mission "will test key technologies to lay the groundwork for the construction of a scientific research base on the Moon."⁸⁹ It is scheduled to be launched around 2025.⁹⁰ According to Hu Hao, chief designer for the lunar exploration program's third stage, "a prototype scientific research station" is scheduled to be built on the Moon by 2030.⁹¹

Russia's missions to the Moon

Russia (then the Soviet Union) has not conducted a lunar exploration mission since 1976 when the Luna-24 mission landed and brought back lunar rock samples.⁹² Russia has now reinvigorated its lunar exploration program with five scheduled missions:

- *Luna-25.* Luna-25 is set to launch in 2022 and will land at the Moon's South Pole. Its mission is to study the composition of the lunar regolith and the plasma and dust components of the lunar exosphere.⁹³
- *Luna-26.* Luna-26 will launch in the 2023-2024 timeframe and will orbit the Moon to facilitate communications between future landers and Earth.⁹⁴ While in orbit, it will also create a 3D map of the lunar surface.⁹⁵

- *Luna-27*. Luna-27 is scheduled for launch in the 2024-2025 timeframe and will land at the Moon's South Pole to search for water ice.⁹⁶
- *Luna-28*. Luna-28 is scheduled for launch in 2026-2027 and will retrieve lunar soil samples.
- *Luna-29*. Luna-29 is scheduled to be launched at an unknown date. The mission will involve a rover to research the lunar surface.⁹⁷

China-Russia cooperation on lunar exploration

As stated earlier, China and Russia signed the Memorandum of Understanding on the ILRS in March 2021.⁹⁸ A statement issued by CNSA describes the station's purpose as "a comprehensive scientific experiment base with the capability of long-term autonomous operation." According to CNSA, the ILRS "will carry out multi-disciplinary and multi-objective scientific research activities such as the lunar exploration and utilization, lunar-based observation, basic scientific experiment, and technical verification."⁹⁹

PRC articles refer to the ILRS as involving "extensive consultation, joint contribution, and shared benefits" between China and Russia.¹⁰⁰ *China Daily* stated that the station will "serve as a platform to boost scientific exchanges and foster peaceful exploration and development of outer space."¹⁰¹ Roscosmos director Dmitry Rogozin also emphasized the peaceful intent of the ILRS: "The idea is not about confrontation but is about cooperation in lunar exploration."¹⁰² The cooperation also has practical benefit. According to Rogozin, "In deep space, considering that the distance to the Moon is farther than to the International Space Station, mutual support is extremely important. We never know what can happen, and how would we help our astronauts and recover lost equipment."¹⁰³

A document released by CNSA and Roscosmos in June 2021 describes an extensive program of collaboration between the two countries that will establish a space station in lunar orbit to facilitate travel between Earth and the Moon and between the space station and the lunar surface and a lunar base on the surface of the Moon. The program will culminate in joint human exploration of the Moon. The program will be divided into four phases, supported by launches from both China and Russia.¹⁰⁴ These are described below.

2021-2025

China and Russia will explore the lunar surface with the coordination of Chang'e missions 6 and 7 and Luna missions 25, 26, and 27, described above. This phase will also involve the design of the ILRS and selection of ILRS site(s).

2026-2030

China and Russia will conduct Chang'e mission 8 and Luna mission 28, described above. The joint document also states that this phase will begin joint operations between China and Russia that involve “technology verification for the command center for the ILRS” and “massive cargo delivery and secure, high-precision soft landing.”

2031-2035

China and Russia will jointly conduct ILRS missions 1-5 that will establish the in-orbit and lunar surface facilities for the ILRS. These include power generation, communications, and transportation facilities as well as the verification of in-situ facilities for the utilization of Moon resources. The objective is to support lunar research and technology development as well as to support human exploration of the Moon.

- *ILRS-1*. This mission will establish the command center and basic power generation and communication facilities.
- *ILRS-2*. This mission will establish lunar research and exploration facilities to study lunar physics, geography, and lava tubes, and to collect lunar samples.
- *ILRS-3*. This mission will establish in-situ resource utilization for lunar resources.
- *ILRS-4*. This mission will verify technologies for biomedical experiments and lunar sample return.
- *ILRS-5*. This mission will establish lunar astronomical and Earth observation capabilities.

2036

This phase will begin full operation of the ILRS.

Additional partners

The ILRS is also open to additional international cooperation.¹⁰⁵ A day before the 2021 China Space Day event, during a subcommittee meeting of the UN Committee on the Peaceful Uses of Outer Space, China and Russia reiterated the ILRS’s openness to other countries.¹⁰⁶ CNSA’s and Roscosmos’ joint statement emphasized that countries could contribute as they are able and could join at “any aspect of the mission at every stage” such as “planning, design, research, development, implementation, and operations.”¹⁰⁷ CNSA’s deputy head, Wu Yanhua, stated that the ILRS is “another major contribution that China and Russia shall make to the promotion of long-term and sustainable development of UN outer space activities.”¹⁰⁸

PRC and Russian reaction to the Artemis Program and Artemis Accords

The China-Russia lunar exploration MOU may be a response to the U.S.-led Artemis Program to return humans to the Moon and the October 2020 signing of the Artemis Accords, but could also be a natural outcome of decades of space cooperation.¹⁰⁹ The Artemis Accords are a U.S.-led effort involving 10 other countries to “establish a common vision via a practical set of principles, guidelines, and best practices to enhance the governance of the civil exploration and use of outer space with the intention of advancing the Artemis Program.”¹¹⁰ The Accords are intended to cover activities that may take place on the Moon, Mars, comets, and asteroids, including their surfaces and subsurfaces, as well as in orbit of the Moon or Mars, in the Lagrange Points for the Earth-Moon system, and in transit between these celestial bodies and locations.¹¹¹

Although both countries have stated that they are open to cooperation with other countries, they appear to be unwilling to sign the Accords.¹¹² Russia, for example, has not explicitly ruled out signing the Accords, but Dmitry Rogozin, director general of Roscosmos, has stated that the Accords are “in its current form...too U.S.-centric” and has likened the Artemis program to NATO.¹¹³ Nikolai Sevastyanov, CEO of the Energia Rocket and Space Corporation, has also appeared to not completely rule out participation in the Artemis Program, stating that his company can provide a crewed spacecraft and a super-heavy-lift rocket for any lunar exploration program.¹¹⁴

Although China also has not explicitly ruled out participation in the Artemis Accords, its Foreign Ministry has stated that China supports discussions of space resource development that are consistent with the 1967 Outer Space Treaty and conducted within the United Nations.¹¹⁵ Others have expressed skepticism or outright concern over the Accords. An *Observer* article states that the Accords’ provision for a “safety zone” is controversial and may violate the 1967 Outer Space Treaty.¹¹⁶

Dr. Wang Guoyu, deputy director of the CNSA Space Law Center and legal counselor in space law at the CNSA Lunar Exploration and Space Project Center, writing in a personal capacity, has stated that the Accords are intended “to create a favorable international environment for space resources exploitation and utilization led by the United States”; that they would likely exacerbate competition between the United States and China; and that they “may become another platform to isolate China in space, and make Sino-U.S. space relations even worse.”¹¹⁷ According to the semi-official *Global Times*, “Chinese space analysts believe that the development fits a larger trend of both Russia and China encountering a range of difficulties in working with the U.S. for different reasons, and becoming increasingly worried over how the U.S. is pushing its space agenda...aggressively and with an obsolete cold war mentality.”¹¹⁸

However, even if China and/or Russia were willing to join the Artemis Accords, it does not appear that the United States has invited either country. Moreover, it is uncertain whether the legal restrictions governing NASA's activities with China prohibit it from participating in the Accords.

Academic cooperation on space exploration

China and Russia are also involved in academic cooperation on lunar resource exploration. According to Professor Vladimir Khmelyov of Altai State Technical University, China and Russia will jointly conduct research on an ultrasonic drilling project. The Russian Fundamental Research Fund and the China National Natural Science Fund will fund the project to explore lunar water ice. Russian media outlet TASS reported that this project will look at the far side of the Moon for drilling sites. An unidentified Harbin-based university will support the project from the Chinese side. An unidentified Chinese scientist remarked that finding locations where water is present on the Moon would help identify potential locations for the lunar research station.¹¹⁹

Chapter 5: Human Spaceflight and Deep Space Exploration

China and Russia cooperate across several areas in human spaceflight and deep space exploration. This includes potential Russian participation in a PRC space station, PRC support for the Spektr-M satellite, and joint research into deep space exploration. These activities are examined in more detail below.

Human spaceflight

In addition to China-Russia collaboration on a lunar research station, both countries are building, or are planning to build, their own space stations. China is constructing a space station that is to be completed in 2022.¹²⁰ Construction will require 11 missions. The first mission, to launch the space station's core module, was in April 2021. In that same month, Roscosmos' director for Advanced Programs and Science announced plans for constructing a Russian space station between 2030 and 2035 that will be at a higher orbit than the International Space Station (ISS) and at a tilt to allow "more opportunities to study deep space."¹²¹ The construction of the Chinese space station and the announcement of a potential Russian space station come at a time when the future of the ISS is uncertain. The ISS may be retired by 2025 if commercial operators do not take over its operation; its retirement would set the stage for China to possess the only operational space station. In April 2021, Roscosmos director general Dmitry Rogozin unofficially announced Russian intentions to withdraw from the ISS in 2025.¹²² Rogozin has also stated that Russia is interested in participating in the Chinese station and in June 2021 stated that Russia was in negotiations with China over sending crewed missions to the space station.¹²³ In June 2021, Rogozin was reported as stating that Russian participation in the ISS would depend on the lifting of U.S. sanctions against the Russian space industry, although he later appeared to back away from his remarks.¹²⁴

Spektr-M in-orbit observatory

The Russian Spektr-M observatory, named in the December 2020 Joint Communiqué of the 25th Regular Meeting Between Chinese and Russian Prime Ministers, is a space telescope that will scan the sky in the submillimeter and far-infrared wavelength ranges.¹²⁵ Reported launch dates for Spektr-M conflict. A May 2020 TASS article states that Spektr-M "will be launched to

the Lagrangian point L2 after 2025.”¹²⁶ A December 2020 *South China Morning Post* article, however, cites Russian media as saying that the mission will launch around 2030.¹²⁷

Similar to the Russian lunar program, Spektr-M also appears to face budgetary pressure. According to the *South China Morning Post* article, the project’s budget was cut in 2019.¹²⁸ According to one PRC scholar and commentator, the Russian motivation for working with China is financial: “China needs Russia’s deep-space experience, while Russia desires Chinese research funding to keep [advancing its] space research program, as well as help Russian scientists to keep their jobs.”¹²⁹ The chief of another Russian satellite project, Spektr-RG, corroborated this assessment, stating that “Russia is doing as much as possible with the budget available” and adding that “it means slow progress” in space.¹³⁰

Mars exploration

In 2015, China and Russia agreed to cooperate on Mars exploration and, in 2007, had signed a joint agreement on the exploration of Mars and one of its moons, Phobos.¹³¹ Little is known about the 2015 agreement. In 2011, Russia launched a spacecraft to Phobos that carried China’s first Mars orbiter, Yinghuo-1, which was planned to examine the planet’s magnetic field and ionosphere, and photograph the Martian surface.¹³²

Phobos-Grunt (also called Fobos-Grunt) was tasked with collecting samples from Phobos. It launched from the Baikonur Cosmodrome on November 8, 2011, but because of failures with the spacecraft’s propulsion system, was stranded in low Earth orbit (LEO).¹³³ Phobos-Grunt remained in LEO until it broke up in the atmosphere on January 15, 2012.¹³⁴ An investigative report, released in February 2012,¹³⁵ cited “a programming error which led to a simultaneous reboot of two working channels of an onboard computer” that put the craft into safe mode.¹³⁶

China-Russia cooperation on deep space exploration

China and Russia also are teaming up on an upcoming mission to a near-Earth asteroid and a comet in the asteroid belt. The Russian Academy of Science’s Space Research Institute will cooperate on this Chinese-led space mission, proposals for which CNSA put out a call in 2019. Expected around 2024, it will entail returning a sample collection from Kamo’oalewa, a near-Earth asteroid, and then traveling to and orbiting Elst-Pizarro, a comet in the asteroid belt.

The Russian technology aboard the Chinese spacecraft includes ULTIMAN and ULTIWOMAN, which detect ions and electrons, and an instrument to detect the impact of solar wind plasma on Kamo’oalewa and Elst-Pizarro. In addition to collecting samples from Kamo’oalewa, this

mission will examine Elst-Pizarro's atmosphere and ionosphere.¹³⁷ At the 2021 China Space Day event, an individual from the Chinese Academy of Sciences stated that this mission also will look at "detecting possible water and organics on the comet and studying the formulation and evolution of the solar system."¹³⁸

Other deep space cooperation includes Russia's 5-100 Plan, which allows Russian universities to work with Chinese universities in the space field. Two joint research laboratories have been established: one that studies space cable systems (shared by Russia's Samara State Aerospace University and China's Northwestern Polytechnical University); and one on engine manufacturing (with Nanjing University of Aeronautics and Astronautics). In addition, the Saint Petersburg State Institute of Technology has contracts looking at the welding of nano-composite materials in space with HengE (Shanghai) Medical Technology Co., Ltd., and Shanghai Miaosheng Intelligent Technology Co., Ltd. Kazan Federal University is cooperating with Guangzhou University on a "Moon-centric navigation network." Tomsk Polytechnic University has a project on space material science and collaborates with Tsinghua University in engineering physics.¹³⁹ It is unclear whether Tsinghua works on this project.

Chapter 6: Ballistic Missile Defense

China-Russia cooperation on ballistic missile defense (BMD) could have important implications for the United States in terms of the U.S. nuclear deterrent and long-range strike capabilities. China-Russia cooperation on missile defense includes arms transfers, technology development, combined exercising, and confidence-building measures. China-Russia cooperation on ballistic missile defense became prominent on October 3, 2019, when Russian president Vladimir Putin announced that the two countries were discussing cooperative efforts. According to Putin, “I don’t think I will reveal a big secret, this will become evident after all.... We are now helping our Chinese partners to create a missile warning system. This is a very serious thing that will drastically enhance the defensive capacity of the People’s Republic of China.”¹⁴⁰

Background

China has been interested in developing ballistic missile defense systems since the 1960s. In 1963, Mao Zedong agreed to the development of a ballistic missile defense system, which began in 1964. Due to the technological complexity of missile defense, the project was cancelled in 1982.¹⁴¹ Evidence suggests that Chinese research on BMD was restarted in the mid 1990s.¹⁴²

According to the Department of Defense, “China is working to develop ballistic missile defenses consisting of exo-atmospheric and endo-atmospheric kinetic-energy interceptors” and has expressed “the intent to develop both land-based and sea-based missile defense systems.”¹⁴³ In January 2010, China announced that it had conducted a land-based mid-course missile defense test, adding that the test was “defensive in nature” and “not targeted at any country.”¹⁴⁴ Additional declared mid-course missile defense tests were conducted in 2010, 2013, 2014, 2018, and 2021.¹⁴⁵ According to an unnamed U.S. defense official, China likely will not have an operational mid-course missile defense system until the late 2020s.¹⁴⁶

PRC position on missile defense

Since at least the late 1990s, the PRC government has been opposed to national ballistic missile defense, arguing that U.S. missile defense systems would harm international strategic stability. In 2020, the PRC government expressed opposition to *global* missile defense systems and the deployment of space-based missile defense systems that can defend against intercontinental ballistic missiles (ICBMs).¹⁴⁷ The withdrawal of the United States from the Antiballistic Missile Defense Treaty in 2002 reinforced the PRC’s perceptions that U.S. missile defense systems

could negate China's nuclear deterrent capability. PRC government officials also argued that missile defenses would promote the proliferation of nuclear weapons by forcing countries to develop more and better missiles to overcome defenses. PRC subject matter experts have also expressed concern that U.S. missile defense efforts could further drive the U.S. and its allies, especially Japan, to develop a regional missile defense system.¹⁴⁸ Finally, the PRC government is concerned that the deployment of space-based missile defenses could lead to the weaponization of space.¹⁴⁹

PRC opposition to missile defense is not absolute, however. As early as 1999, China stated that it did not oppose lower-tier missile defense, such as the U.S. Patriot system, which provides point defense against tactical ballistic missiles.¹⁵⁰

PRC rationales for missile defense

PRC writings provide several reasons for developing missile defense capabilities. The PRC may perceive that its attempts to curtail U.S. missile defense efforts have failed and that it requires its own missile defense system. This need may have been made more important by the U.S. withdrawal from the Intermediate Range Nuclear Forces (INF) Treaty in 2019. According to a professor from the PLA's National Defense University, China needs a missile warning system that can detect ICBMs launched from the United States as well as intermediate-range missiles launched within the region. As a result, "China needs a more sensitive missile attack warning system that can cover longer ranges and detect incoming missiles faster, so as to buy time for defense and retaliation."¹⁵¹

In this regard, some PRC writings have characterized China's development of missile defenses as inherently stabilizing and U.S. missile defenses as inherently destabilizing. PRC researchers have argued that China's BMD system will not be strategically destabilizing because it will be too small to threaten the large ICBM force of the United States. At the same time, the PRC fears that the U.S. system, although limited in capabilities, will be able to negate China's smaller ICBM force and may require China to increase its nuclear arsenal.¹⁵²

According to a 2010 commentary in the journal *Liaowang* contrasting the U.S. and Chinese missile defense programs, "To pursue the development of strategic offensive weapons and missile defense for hegemonic interests will give people tumult and painful disaster, but the pursuit of strategic defensive weapons for the pursuit of peaceful goals will increase the choices for strategic balance."¹⁵³ In this respect, one commentator sees missile defense as one way in which China is "shouldering global responsibilities to build a harmonious world" characterized by an impartial and equitable international political order.¹⁵⁴

PRC commentators also portray an increasingly complicated regional threat environment that requires the development of BMD. One potentially destabilizing influence is North Korea's

missile programs. Chinese commentators also note that India, South Korea, and Pakistan have ballistic missile programs.¹⁵⁵

China-Russia cooperation on missile defense

China-Russia cooperation on ballistic missile defense is conducted on four tracks: arms transfers, technology development, combined exercises, and confidence-building measures. These are discussed below.

Arms transfers

According to the Department of Defense, “The PRC has utilized Russian-developed missile defense systems while indigenously producing its own increasingly capable missile defenses and radars.”¹⁵⁶ China purchased the Russian S-300 air defense system in 2010 and first purchased the S-400 system in 2014 with a second shipment in 2020.¹⁵⁷ The Department of Defense describes the S-400 as having “some capability to engage ballistic missiles, depending on the interceptors and supporting infrastructure.”¹⁵⁸

Technology development

China has also deployed its indigenously developed HQ-9 and HQ-19 air and missile defense systems that the Department of Defense describes as having “a limited capability against ballistic missiles.”¹⁵⁹ The HQ-19 appears similar to the U.S. THAAD system and may have begun operations in the country’s west. According to the Department of Defense, the system “has undergone tests to verify its capability against 3,000-km class ballistic missiles.”¹⁶⁰

Some sources speculate that the HQ-9 and HQ-19 air defense systems were both based on Russian designs. Janes, for example, notes that the HQ-9 resembles the Russian S-300, although shorter.¹⁶¹ China and Russia are also reported to have cooperated on the development of the HQ-19 theater defense missile system that is considered to be based on the Russian S-400 missile defense system.¹⁶² According to the U.S. Department of Defense, the HQ-19 “appears to be very similar to the S-400.”¹⁶³ Janes notes that “the HQ-19 system appears to use the same missiles, sensors, battle management, and launch vehicles as the Russian S-400.”¹⁶⁴

In regard to Russian president Putin’s announcement of missile defense cooperation in 2019, the U.S. Department of Defense states the following:

Russia announced plans to assist China in developing their missile-attack early warning network, including aiding the development of ground-based radars and potentially extending to space-based sensors. China already has several ground-based large phase array radars—similar in appearance to U.S. PAVE PAWS radars—that could support a missile early warning role.¹⁶⁵

Vasily Kashin of the Russian Higher School of Economics has stated that China is likely not intending to copy Russian systems but instead is likely leveraging Russian experience in developing key technologies.¹⁶⁶ Kashin writes that only one contract related to missile warning has been identified: a \$60 million contract for the development of BMD software.¹⁶⁷ Kashin notes, however, that BMD cooperation “likely consists of numerous small contracts that address various problems in the Chinese system.”¹⁶⁸ Nevertheless, Kashin also speculates that this cooperation likely represents a significant increase in trust between the two countries due to the sensitive nature of BMD. Technological cooperation would likely reveal sensitive technological details that would ordinarily not be shared because of fears of compromising the system.¹⁶⁹

Combined missile early warning system

Putin’s missile defense cooperation announcement in 2019 drew speculation that the two countries will cooperate on operating an integrated missile defense system that relies on sensors located in China and Russia. Sensors located in Russia would provide warning of missiles coming from the north and west of China, and sensors located in China could warn of missiles coming from the east and south of China. Together the two systems would form a more complete early warning system than what could be accomplished by either country alone.¹⁷⁰

According to commentary on a Chinese news site, *The Paper*, “Strategic missile defense technologies are a country’s core secret and all countries are cautious about cooperation. But there is some space for cooperation in regards to strategic early warning. If the United States continues to promote the global missile defense system, strengthened China-Russia cooperation on missile defense cannot be ruled out.”¹⁷¹ No evidence was found to support this speculation, however, and an integrated China-Russia missile early warning system would likely be a significant advancement in the relationship, verging on an alliance.

Combined exercises

In May 2016, China and Russia held their first combined training exercise involving air and missile defense, called “Air and Space Security-2016.” The exercise was a computer-assisted command and staff exercise held at the Russian Defense Ministry’s Aerospace Defense Force’s Central Research Institute. The Russian Defense Ministry’s press release added that the exercise aimed “to practice combined operations of Russian and Chinese air and missile defense task forces to provide protection from accidental and provocative attacks of ballistic and cruise missiles,” and were not directed against a third country.¹⁷² The PRC MND issued a similar statement.¹⁷³ According to PRC media citing Russian media, the exercise involved combined command posts and missile early warning systems, missile defense systems, space-based sensors, launch, and the tracking of targets.¹⁷⁴

In December 2017, China and Russia held the second exercise in this series, named “Air and Space Security-2017.” The PRC MND press release describing the event was identical to the press release describing the 2016 exercise.¹⁷⁵ The exercise consisted of combined air and missile defense planning and the coordination of air and missile defense fires against ballistic and cruise missiles. According to one article, this second exercise was expanded to include field exercises.¹⁷⁶ A PRC MND spokesperson said that the exercise was not directed at any third party, and added, “China and Russia both oppose developing global missile defense systems. The two militaries strengthening practical missile defense cooperation is to jointly protect Chinese and Russian security interests and regional strategic stability.”¹⁷⁷

The exercises do not appear to have been conducted since 2017. According to Russian and Chinese media reporting, planning for Air and Space Security-2019 took place in April 2019, but there is no evidence that the exercise occurred.¹⁷⁸

Confidence-building measures

In 2009, China and Russia signed a confidence-building measure on the mutual notification of ballistic missile and space launches. This agreement was renewed in 2020.¹⁷⁹ Although little is known about this agreement, it is likely intended to reduce the chance of an accidental nuclear exchange by forewarning each party of imminent rocket launches. The agreement is likely similar to the agreement between the United States and the Soviet Union, signed at the 1971 Strategic Arms Limitation Talks, that required each side to notify the other of missile launches that would extend beyond the country’s border. This agreement was later codified by the Strategic Arms Reduction Treaty that required each side to provide telemetry data from every ICBM and SLBM launch.¹⁸⁰

Chapter 7: Space Debris Monitoring

Little information is available on China-Russia cooperation on space debris monitoring. According to a press release by the PRC government, the “The Agreement Between the PRC National Space Administration and the Russian Federation Roscosmos on Space Debris Monitoring and Data Utilization Cooperation” was signed on November 11, 2018. The two sides agreed to establish a “joint low earth orbit information exchange system” intended to “more effectively” contribute to the removal of space debris.¹⁸¹ According to the press release, “China and Russia jointly carrying out research on space debris monitoring and the laws and regulations governing the long-term sustainability of space reflects the role of responsible powers.”¹⁸²

Although detailed information is unavailable, cooperation on space debris could involve a variety of activities, including the following:

- Technical cooperation to develop space debris monitoring capabilities
- Mechanisms to allow for notification of conjunction events between spacecraft and debris

Chapter 8: Satellite Navigation

China-Russia cooperation on satellite navigation appears to be one of the most robust space cooperation activities between the two countries. Since 2011, China and Russia have held numerous meetings and signed multiple agreements on satellite navigation. In 2014, a joint committee on satellite navigation cooperation was established.¹⁸³ According to the China Satellite Navigation System Management Office, cooperation in satellite navigation is “highly valued” by both the Chinese and Russian leadership.¹⁸⁴ At an economic forum held in Vladivostok in September 2016, Wu Yanhua, the deputy director of CNSA, stated that cooperation on satellite navigation, as part of overall space cooperation with Russia, had “achieved very good results.”¹⁸⁵

The Beidou and GLONASS satellite navigation systems

Beidou navigation satellite system

China’s Beidou Navigation Satellite System (Beidou) was developed to reduce China’s reliance on the U.S. Global Positioning System (GPS). Like GPS, Beidou began as a military program and has since been expanded to include a sizable civilian component. Beidou’s architecture, however, differs from GPS in terms of technology and number of satellites.

Beidou was completed in 2020 with a constellation of 30 satellites, whereas GPS has a minimum of 24 satellites. This global system will be expanded to 35 satellites, with 30 in medium Earth orbit and 5 in geosynchronous orbit.¹⁸⁶ Beidou’s accuracy is reportedly similar to that of GPS. The Beidou system is supported by a domestic network of ground stations that augment the signal to achieve accuracies down to the millimeter level. This ground station network is being expanded internationally. Unlike GPS, Beidou offers a short messaging service in which users can send messages up to 1,000 Chinese characters long for users in and around China and 40 characters for global users.¹⁸⁷

Global satellite navigation system

Like GPS, Russia’s Global Satellite Navigation System (GLONASS) is composed of at least 24 satellites. It first became operational in 1996 but fell into disrepair during Russia’s economic difficulties. Since 2011, the system has been fully operational. Although a global system, GLONASS is optimized to provide better accuracies for more northern latitudes in order to

better serve Russia. The accuracy of the GLONASS civil signal is similar to that of GPS at those latitudes but may not perform as well as GPS at other latitudes.¹⁸⁸

Strategic considerations

China-Russia cooperation on satellite navigation is conducted for technological, political, and economic reasons. While official agreements and communiqués do not explicitly mention competition with the U.S., a *People's Daily* article referred to satellite navigation cooperation as a way to “break the ‘hegemonic’ position of the United States in the field of satellite navigation.”¹⁸⁹ According to an article from Sputnik, China-Russia satellite navigation cooperation would benefit “the member states of BRICS group and the Shanghai Cooperation Organization.”¹⁹⁰ In 2015, China and Russia planned a project “to create a global navigation system based on China’s Beidou and Russia’s GLONASS satellite navigation for the member states of BRICS group and the Shanghai Cooperation Organization.”¹⁹¹

Beidou and GLONASS are complementary systems. Because Russia is located higher in the northern hemisphere, the GLONASS system is optimized to cover northern latitudes while Beidou is optimized to cover more southern latitudes. According to the director of Roscosmos, Dmitry Rogozin, “Their complementariness would result in the biggest and most powerful competitor to any navigation system.”¹⁹²

China-Russia satellite navigation cooperation

Russia-China Project Committee on Major Strategic Cooperation in Satellite Navigation

The Russia-China Committee on Major Strategic Cooperation Projects in Satellite Navigation was the result of an MOU on satellite navigation cooperation signed in October 2014 and was formally established in January 2015.¹⁹³ The committee held its first meeting in February 2015 and has met on an annual or biannual basis since then. The committee has four working groups that meet on a more frequent basis and focus on the following topics:¹⁹⁴

- Ensuring compatibility and interoperability between the GLONASS and Beidou navigation systems
- Augmentation, including mutual allocation of measuring stations within the territories of Russia and China
- Performance monitoring
- The application of satellite navigation technologies¹⁹⁵

The joint committee has produced a number of outcomes, although little information on them is in the public domain. These outcomes include the following:

- *Joint Statement on the System Compatibility of Beidou and GLONASS*. Signed in May 2015, this joint statement was described by the PRC government as “an important symbol of the international development of the Beidou system.” It was also described as “marking a new stage in China-Russia satellite navigation cooperation” that strengthened cooperation between the Beidou and GLONASS systems in order to promote compatibility and interoperability.¹⁹⁶
- *Agreement on Technical Protection Measures for Cooperation between the Government of the People's Republic of China and the Government of the Russian Federation on the Construction and Use of Launch Vehicles and Ground Facilities and Equipment in the Field of Peaceful Research and Utilization of Outer Space*. Signed in December 2015, the agreement was reported to promote cooperation on the application of the Beidou and GLONASS systems in order to provide higher quality satellite navigation services to users worldwide.¹⁹⁷
- *Cooperation Agreement between Russia's Roscosmos State Space Corporation and the China National Space Administration in the Area of Electronic Components for Space Equipment*. The PRC State Administration for Science, Technology, and Industry for National Defense announced a deal in 2015 on the “development and production of aerospace components” between China and Russia involving satellite navigation technologies.¹⁹⁸
- *Fifth meeting of the China-Russia Committee on Major Strategic Cooperation Projects in Satellite Navigation*. This meeting was held in Beijing on September 28, 2018. The meeting recognized progress on nine cooperative projects. These included construction of augmentation stations, monitoring and evaluation service platforms, and cross-border transportation applications. It also considered the adoption of the Beidou/GLONASS Precision Agricultural Cooperation Demonstration Project as the 10th cooperative project.¹⁹⁹
- *Cooperation Agreement between the Government of the People's Republic of China and the Government of the Russian Federation on the Peaceful Use of the Beidou and GLONASS Global Navigation Satellite Systems*. Signed on November 7, 2018, this agreement provided the legal and organizational basis for cooperation in the field of satellite navigation.²⁰⁰
- *Sixth meeting of the China-Russia Committee on Major Strategic Cooperation Projects in Satellite Navigation*. This meeting was held on August 30, 2019, in Kazan, Russia. The committee agreed on the text of the “Cooperation Agreement on China Satellite Navigation System Commission (People's Republic of China) and the Russian National Aerospace Corporation (Russian Federation) Regarding Beidou and GLONASS Global Satellite Navigation System Synchronization”; the completion of the survey certificate at the site of the China-Russia Satellite Navigation Monitoring Station; the

consideration and adoption of the feasibility study report for the precision agricultural project, and the release of the “Global Signal Multimode Multi-Frequency RF Chip of the Sino-Russian Satellite Navigation System.”²⁰¹

Peaceful use and monitoring station agreement

In November 2018, China and Russia signed an agreement on the “peaceful use” of Beidou and GLONASS that was described as providing “a legal and organizational guarantee for the large-scale cooperation in the satellite navigation field between the two countries.”²⁰² The cooperation agreement’s language has not been made publicly available; however, the agreement is reported to have encouraged system compatibility and interoperability, construction of monitoring stations, monitoring and evaluation, joint technology development, and IPR protection.²⁰³ Russian monitoring stations in China were to be located in Shanghai, Urumqi, and Changchun. Chinese monitoring stations in Russia were to be located in Obninsk, Irkutsk, and Petropavlovsk-Kamchatsky.²⁰⁴

Road maps and outlines

The seventh joint satellite navigation committee meeting was held in October 2020, when the “2021-2025 China-Russia Space Navigation Cooperation Road Map” was discussed. The committee also approved a joint research report on satellite-based augmentation system testing and certification technology.²⁰⁵ No additional information is available on either document, however.

Belt and Road Initiative and satellite navigation

China and Russia are also cooperating on providing satellite navigation to China’s Belt and Road Initiative, which seeks to advance a “Space Silk Road.”²⁰⁶ According to the Russian space agency’s Information and Analysis Center, China and Russia conducted a project on utilizing Beidou and GLONASS within Russia.²⁰⁷ Phase one of the project, testing the two systems’ performance, was completed in 2018.²⁰⁸

Chapter 9: Rocket Engines

Proposed China-Russia cooperation on rocket technology centers on the Russian RD-180 rocket engine. The RD-180 is a staged combustion liquid oxygen-kerosene engine manufactured by the Russian company NPO Energomash and capable of producing 860,000 pounds of thrust. The RD-180 is a downsized version of the RD-170 that was developed by Soviet engineers in the 1970s. The RD-170's staged closed-cycle combustion approach was known by U.S. engineers at that time but was considered impossible to engineer successfully.²⁰⁹ Although the design offered significantly improved performance, it was also much more prone to explode. Due to superior engineering skills and the large amount of funding characteristic of Cold War-era programs, Soviet engineers were able to develop a reliable engine that was much more efficient and powerful than other engines of its size.²¹⁰

The RD-180 has been used on U.S. Atlas V rockets since 2002. The incorporation of the RD-180 into the Atlas design allowed the number of first-stage rocket engines to be reduced from six to one and reduced the number of parts by 15,000, a modification that also increased the reliability of the rocket from 0.9876 to 0.9955.²¹¹ Over 85 launches, the Atlas V has had only had one partial failure and no complete failures.²¹² Despite the proven performance and reliability of the RD-180, political pressure to use American rocket engines, especially after the 2014 Russian annexation of Crimea, prompted Congress to mandate that purchases of the RD-180 cease on December 31, 2022.²¹³

PRC interest in the RD-180 appears to date to 2015.²¹⁴ According to Dmitry Rogozin, the head of Roscosmos, "We and our Chinese partners see the provision of rocket engines themselves as part of broader cooperation, for example, in the field of future heavy rocket design, in space stations, and in long-range spaceflight."²¹⁵

China's interest in the RD-180 appears to be related to the development of the engines for the Long March-9 (LM-9) super-heavy-lift launch vehicle that is planned to become operational by 2030. At 93 meters long and featuring a 10-meter-diameter core and a mass at liftoff of 4,140 metric tons, the LM-9 will be similar in size to the Saturn V used in the Apollo program. Like the Saturn V, the LM-9 is intended to be used in a potential Chinese manned lunar program as well as other deep space and Mars exploration missions.

The first stage of the LM-9 is planned to be powered by four Chinese-developed YF-130 kerosene-liquid oxygen rocket engines that can each produce a thrust of over 1.1 million pounds, which will enable the rocket to lift 140 tons into low Earth orbit or 50 tons into trans-lunar injection. ²¹⁶ In March 2021, it was reported that the first test of the YF-130 was successful.²¹⁷

Russian assistance in developing the YF-130 engines for the LM-9 could prove invaluable by helping to reduce expenses and shorten timelines. It is also possible that China could use parallel tracks for the LM-9 engine development, prioritizing the YF-130 engine while maintaining the option of moving forward with the RD-180 in case the YF-130 design fails. A presentation by Long Lehao, chief designer of the Long March series of rockets, in June 2021, made no mention of using the RD-180 engine in the LM-9, casting doubt on whether the proposed deal had gone through.²¹⁸

IPR issues

In April 2016, it was reported that China's non-membership in the Missile Technology Control Regime required the two sides to establish a "legal and regulatory basis" for the sale, apparently in order to prevent the transfer of RD-180 technology to third countries, especially North Korea.²¹⁹ This impasse was apparently resolved. According to the Russian news agency TASS, in June 2016, China and Russia reached an agreement on IPR protection intended to facilitate the sale of the RD-180. At the same time, it was also reported that the two countries were working on an agreement for Russia to sell the RD-180 to China for aerospace microelectronics.²²⁰ In October 2016, PRC media reporting on Russian press reports, stated that NPO Energomash general manager Igor Albtsov had said that talks with the PRC over the export of the RD-180 were only in the preliminary stages and that Russia was only interested in selling complete engines and not the knowledge and skills necessary for the manufacture of the engines.²²¹

The IPR agreement appears to have been ratified in 2017. According to Energomash CEO Igor Arbuzov, "We were restrained in our negotiating process (with the Chinese) until the end of 2017 as the agreement between the governments of Russia and China...was not ratified."²²² Following ratification, discussions between the two sides were described as "substantive" and "practical."²²³ According to TASS:

The areas of cooperation in the sphere of rocket engines were defined by the protocols of sessions of the Russian-Chinese commission for cooperation in carrier rockets and rocket engines held in 2018 and were approved on September 28, 2018 in Beijing by a protocol of the 19th session of the sub-committee for interaction in outer space of the Russian-Chinese committee for preparing regular meetings of the heads of governments. After that, Energomash will draft and submit a package of documents to Russia's State Space Corporation Roscosmos for a government resolution on the possibility of cooperation in this area, the statement says.²²⁴

Other rocket engine cooperation

In 2018, it was reported that Energomash and the Sixth Academy of the China Aerospace Science and Technology Corporation (CASC) signed an agreement to jointly develop and manufacture liquid rocket propellants. According to an Energomash press release, the two companies would cooperate on developing liquid rocket propellants using “oxygen-kerosene, oxygen-hydrogen and oxygen-methane propellant components.” It was agreed that the Sixth Academy would send technical work requirements to Energomash and would hold a meeting in January 2019 to finalize the cooperation.²²⁵ It is unknown whether this meeting occurred.

Chapter 10: Space Arms Control

For the past two decades, China and Russia have cooperated closely in pushing for negotiations regarding Prevention of an Arms Race in Outer Space (PAROS) at the UN Conference on Disarmament (CD), the main multilateral disarmament negotiating forum of the international community.²²⁶ After a few years of producing joint working papers and hosting meetings on issues related to PAROS in the early 2000s, in 2008 China and Russia proposed the first draft of the “Treaty on Prevention of the Placement of Weapons in Outer Space and the Threat or Use of Force against Outer Space Objects (PPWT).”²²⁷ The draft treaty received a mixed reception, with some countries (mostly in the developing world) welcoming its introduction and others, such as the United States and the EU countries, stating that it had significant shortcomings and would need to be revised in order to be effective.²²⁸

2014 draft "Treaty on the Prevention of the Placement of Weapons in Outer Space and the Threat or Use of Force against Outer Space Objects"

In 2014, China and Russia proposed a revised second draft of the treaty to the CD, based on feedback on the 2008 version. The core treaty obligation of the 2014 version (Article II) states the following:

- The States Parties to this Treaty undertake:
 - Not to place any weapons in outer space;
 - Not to resort to the threat or use of force against outer space objects of States Parties to the Treaty;
 - Not to engage, as part of international cooperation, in outer space activities that are inconsistent with the object and purpose of this Treaty;
- Not to assist or induce other States, groups of States, international, intergovernmental or non-governmental organizations, including non-governmental legal entities established, registered, or located in territory under their jurisdiction and/or their control, to participate in activities inconsistent with the object and purpose of this Treaty.²²⁹

Despite revisions to the 2008 treaty, there were some enduring issues in the 2014 treaty that continued to cause concern.²³⁰ The United States submitted an analysis of the treaty, stating

that, like the 2008 version, the 2014 version was still “fundamentally flawed” in the following areas:

- *Need for a verification regime:* There was no “integral verification regime” to help monitor or verify the limitation on the placement of weapons in space. Existing technology and/or cooperative measures also could not “effectively verify an agreement banning space-based weapons.”²³¹
- *Limited scope for space-based arms control:* There were “no prohibitions” on the “research, development, production, and terrestrial storage of space-based weapons,” enabling a party to the treaty to “build and have in its inventory a readily deployable space-based antisatellite weapon (ASAT) or BMD capability.”²³²
- *No limits on terrestrially based antisatellite weapons:* The treaty did not address terrestrially based antisatellite weapon systems. There was “no prohibition on the research, development, testing, production, storage, or deployment of terrestrially-based anti-satellite weapons”; such capabilities could be used to “substitute for, and perform the functions of, space-based weapons.”²³³

Table 1 gives a summary of the activities prohibited and not prohibited by the 2014 draft PPWT based on US analysis.²³⁴

Table 1. The 2014 PRC-Russian Draft PPWT: Summary of Implications

Basing mode	Space-based counter-space	Space-based missile defense	Ground-based counter-space	Sea-based counter-space	Air-based counter-space
Research	Permitted: No constraints or limitations				
Development	Permitted: No constraints or limitations				
Testing against own country's space objects	Prohibited	Prohibited	Permitted	Permitted	Permitted
Production	Permitted: No constraints or limitations				
Storage	Permitted: No constraints or limitations				
Deployment	Prohibited	Prohibited	No constraints or limitations		
Operational use against another country's space objects	Prohibited if constitutes “use of force” or “threat of force” (except when required for “self-defense”)				

The draft in its most recently updated (2014) form remains one of the few active options for a treaty regarding PAROS; however, its prospects are limited since resistance to it remains and the CD adopts its decisions based on consensus.²³⁵ In addition to the aforementioned

shortcomings of the PPWT, skepticism towards it has also arisen based on Russian and Chinese activities to develop ASAT capabilities. In 2020, for example, Russia conducted a space-based antisatellite weapons test, casting doubt on its commitment to PAROS.²³⁶

Chapter 11: Conclusions

The burgeoning China-Russia space relationship is indicative of the growing overall strategic partnership between China and Russia. Russia, once the dominant power in the space relationship, now appears to be taking a secondary role. China's growing expertise in space, matched with the financial capabilities to sustain a large and growing space enterprise signals not only China's rise as a major space power, but also the geopolitical transition taking place between China, Russia, and the United States.

The findings presented in this report, however, are based on incomplete data. China-Russia space cooperation lacks transparency. As their cooperation in defense-related fields deepens, it has also become more secretive. Much of the media reporting only mentions signed agreements and provides little specific information. Although the number and types of China-Russia space cooperation agreements indicate a growing strategic partnership, it is possible that some or many of the agreements examined here lack substance, were not fully carried out, or were cancelled. Alternatively, the lack of transparency could also hide a more substantive relationship than the one presented here. Either finding would necessarily call for a reevaluation of the China-Russia space relationship.

Key findings

China-Russia space relations indicate a deepening trust between the two countries.

While not an alliance, the burgeoning cooperation between Russia and China on issues of space and space-related technology has a breadth and depth that indicate a growing strategic partnership. The expanding and increasingly sensitive nature of China-Russia space cooperation may make it more difficult to separate the two countries' cooperative space activities.

- The agreement to transfer sensitive missile defense technology allows China access to technologies dominated by the United States and Russia.
- Joint lunar exploration could tie the two countries together in ways that make success contingent on both countries' participation.
- An agreement covering IPR protection on the transfer of space technologies suggests either that Russian concerns over PRC technology theft—a hindrance to previous China-Russia technological cooperation—have been assuaged or at least that Russia has come to accept technology theft as the price of doing business in China. It is

unknown to what extent Russian funding shortfalls provided China with leverage in this negotiation.

- Although improving China-Russia space relations are a sign of the increasing trust between the two countries, U.S. political and economic sanctions against both countries' space programs have also likely played a role in bringing the two countries closer together.

China-Russia space relations indicate an effort to balance against U.S. dominance.

China-Russian space cooperation is driven by the same forces that drive the overall strategic relationship.²³⁷ While the two countries do not have completely overlapping security concerns, they do share a strong desire to counter U.S. leadership, including in outer space. They share concerns over interpretation of U.S. space initiatives and see U.S. space-based capabilities and dominance, especially anything related to missile defense, as threatening to their strategic nuclear arsenals. According to then deputy prime minister Dmitry Rogozin (now director of Roscosmos), "Our technological partnership should be directed at the countries that are close to us in mentality and which in general constitute an emerging geopolitical force that we could rely on in opposing a unipolar world."²³⁸

China-Russia space relations indicate an effort to deter and counter the U.S. militarily.

China-Russia space cooperation involves activities related to national defense. These include cooperative activities on BMD, space debris, and satellite navigation.

Ballistic missile defense

Chinese sources have linked their interest in developing more advanced BMD capabilities to the withdrawal of the United States from the INF and the U.S. development of long-range missile capabilities. Both China and Russia have stated opposition to global missile defense systems. However, it is unknown to what extent BMD cooperation will be limited to tactical and regional capabilities.

- Russian assistance could aid China in developing ground- and space-based missile warning systems that would raise the effectiveness of China's existing missile defense systems and speed development of new systems.
- Combined PRC-Russian air and missile defense exercises indicate an effort to improve defenses against ballistic and cruise missile attack and demonstrate the growing closeness of the relationship. It is unknown to what extent the combined exercises reflect an intent to develop an actual combined air and missile defense capability.
- We found no evidence to support the speculation of media and subject matter experts concerning the development of a joint missile early warning system. Such an agreement would be a significant step forward in the two countries' relationship that would be similar to an alliance. Cooperation in this area could create mutually

supportive relationships that not only provide each country with enhanced capabilities, but also impose shared responsibilities that could increase the risk of escalation by drawing both countries into conflict with the United States.

A hypothetical joint missile early warning system would complicate U.S. efforts to deny, degrade, or destroy Chinese or Russian BMD systems. Depending on the extent to which the Chinese and Russian systems were mutually supportive, attacks intended to suppress either the Chinese or Russian BMD system individually would risk escalating the conflict by involving both countries.

Space debris monitoring

Due to the dual-use nature of space debris monitoring, China-Russia cooperation in this area could have potential military applications. The similarity of space debris monitoring capabilities to military space surveillance capabilities could enhance the ability of both countries to collect intelligence on adversary space systems and aid in the tracking and targeting of U.S. satellites. The development of space surveillance capabilities could potentially leverage cooperation on missile early warning systems.

Satellite navigation

China-Russia cooperation on satellite navigation could provide redundancy. Improving interoperability between Beidou and GLONASS could provide an alternative signal in the event that either country's national satellite navigation system was denied or degraded. U.S. actions to deny either China's or Russia's satellite navigation would have to take into account each country's access to both Beidou and GLONASS, as well as the escalatory implications of denying both systems.

Promoting interoperability between the civil signals of satellite navigation systems is common practice, however. The United States and China signed a joint statement on civil signal compatibility and interoperability in 2017, and the European Galileo system and Beidou are interoperable.²³⁹

China-Russia space cooperation effort is likely intended to increase influence in international space diplomacy.

The China-Russia lunar exploration MOU appears intended to establish a space cooperation framework independent from U.S.-led efforts. Although not acknowledged by either China or Russia, cooperation on lunar exploration appears to be a response to the U.S.-led Artemis Program that is intended to return humans to the Moon and the U.S.-led Artemis Accords that established a set of principles for the exploration and commercial use of space. Although neither China nor Russia has introduced a similar set of principles individually or jointly, the creation of a joint exploration program and its openness to additional participants suggest that the two countries are establishing an alternative framework to explore and use space. This effort is likely intended to increase Chinese and Russian influence in international space

diplomacy by establishing the two countries as alternative leaders in space exploration. The association of joint China-Russia lunar exploration with the United Nations appears to be an effort to further distinguish their plans from the Artemis Accords by promoting the plans as inclusive and peaceful.

China and Russia's efforts for a space arms control treaty show commitment to arms control efforts to restrict U.S. space-based weapons and missile defenses.

Chinese and Russian cooperation on space arms control appears intended to portray both countries as striving for the peaceful use of space while doing little to constrain Chinese and Russian acquisition and use of terrestrial-based space weapons. Such efforts may also serve to reinforce the narrative that while Russia and China are trying to achieve arms control in space, the United States is a destabilizing global influence.²⁴⁰

China-Russia cooperation does not appear to significantly advance commercial competitiveness.

China-Russia space cooperation to advance the two countries' commercial interests appears to be limited and focused mainly on satellite navigation. Agreements to increase interoperability and compatibility will likely facilitate the use of the Beidou and GLONASS satellite navigation systems in both countries.

China-Russia space cooperation indicates a desire to reduce technological and budgetary risk.

In addition to geopolitical considerations, China-Russia space cooperation also appears to be aimed at reducing the technological and budgetary risk of space. The Russian and Chinese space industries have the potential to benefit from each other: Although China is rapidly developing its own space industry, it can learn from Russian know-how and technological expertise. At the same time, Russia's space industry is struggling and Chinese funding and technology may help it regain some of its former momentum.

- Chinese interest in Russian space technology, especially rocket engine technology, is intended to acquire technologies that are too complicated and/or too costly to develop alone. Use of Russian technologies may be one way to facilitate development of the super-heavy-lift LM-9 launch vehicle.
- Russian interest in Chinese aerospace electronic components indicates the intent to create an alternative supply chain for its space industry after the EU imposed sanctions on dual-use components to Russia after the 2014 Russian invasion of Ukraine.
- China-Russia technological cooperation may also reflect the Russian space industry's need for funding. The Russian space industry is hampered by the overall weakness of

Russia's political and economic system. Russian state-owned enterprises, such as Roscosmos, tend to be inefficient and prone to corruption.²⁴¹

The U.S. decision to develop a replacement for the RD-180 and the U.S. development of human-rated launch vehicles and crewed spacecraft—which would eliminate the need to launch U.S. astronauts on Russian rockets—will likely exacerbate the revenue shortfalls in the Russian space industry.

- Russia appears to have accepted the value of co-development over aggressively protecting technology. According to Vasily Kashin of the Russian Higher School of Economics, the Russian space industry does not consider China to be a competitor. Instead, the U.S. company SpaceX, with its partially reusable rockets, is the most concerning. According to Kashin, Chinese production costs are higher than Russian costs, with Chinese salaries at times higher than the salaries of the Russian space workforce.²⁴² Technology theft, on the other hand, “is a shared problem for all companies who do business in China, but there haven't been any cases of reverse engineering causing anyone turning away from the Chinese market—the most valuable market in the world.”²⁴³
- China may also look to the partnership as a way to reduce the budgetary demands of space exploration, given the cost and few tangible benefits associated with lunar exploration.

China-Russia space relations indicate a shifting power dynamic between the two countries.

For much of the history of China-Russia space relations, Russia has been the leading space power, providing much-needed technology and know-how to a small and inexperienced Chinese space program. This relationship dynamic appears to be undergoing a fundamental shift. Due to its increasing capabilities and strong funding, China appears to be positioning itself to be the leading space power in the relationship in which Russia plays an important, but nonetheless secondary, role as a provider of capabilities to Chinese space endeavors. In this respect, Russian participation appears to be aimed at maintaining its legacy as a space power through its involvement in assisting China's space program. As a result, the China-Russia space relationship reflects the overall rise of China as a great power and the attempt by Russia to use its relationship with China to maintain its global stature despite its diminishing capabilities.

Appendix: List of China-Russia Space Cooperation Agreements

Table 2, below, lists the space cooperation agreements between China and Russia from 2009 through 2021.

Table 2. Space cooperation agreements between China and Russia

Year Signed	English	Chinese	Russian
2021	CNSA and Roscosmos Joint Statement on the Cooperative Construction of the International Lunar Research Station	中国国家航天局和俄罗斯国家航天集团公司关于合作建设国际月球科研站的联合声明 ²⁴⁴	Меморандум о взаимопонимании о сотрудничестве в области создания Международной научной лунной станции (МНЛС). ²⁴⁵
2021	Memorandum of Understanding between the Government of the People's Republic of China and the Government of the Russian Federation Regarding Cooperation for the Construction of the International Lunar Research Station	中华人民共和国政府和俄罗斯联邦政府关于合作建设国际月球科研站的谅解备忘录 ²⁴⁶	Меморандум о взаимопонимании между Правительством Китайской Народной Республики и Правительством Российской Федерации о сотрудничестве в области создания Международной научной лунной станции (МНЛС) ²⁴⁷
2020	2021-2025 China-Russia Satellite Navigation Cooperation Road Map	2021 至 2025 年中俄卫星导航领域合作线路图 ²⁴⁸	Дорожная карта сотрудничества России и Китая в области спутниковой навигации на 2021 - 2025 годы с целью перспективного планирования и уточнения дальнейших направлений сотрудничества ²⁴⁹

Year Signed	English	Chinese	Russian
2019	CNSA and Roscosmos Cooperation Agreement on the Coordinated Implementation of the "Chang'e-7" Lunar Polar Exploration Mission and the "Luna-Resurs 1" Orbiter Mission	中华人民共和国国家航天局与俄罗斯联邦国家航天集团公司关于协同实施“嫦娥七号”月球极地探测任务和“月球-资源-1”轨道器任务合作协定 ²⁵⁰	Соглашение между Госкорпорацией «Роскосмос» и Китайской национальной космической администрацией о сотрудничестве в рамках координации российской миссии с орбитальным космическим аппаратом «Луна-Ресурс-1» и китайской миссии исследования полярной области Луны «Чанъэ-7» ²⁵¹
2019	Cooperation Agreement Between CNSA and Roscosmos on the Establishment of a Joint Lunar and Deep Space Exploration Data Center	中华人民共和国国家航天局与俄罗斯联邦国家航天集团公司关于建立联合月球与深空探测数据中心的合作协定 ²⁵²	Соглашение между Госкорпорацией «Роскосмос» и Китайской национальной космической администрацией о сотрудничестве в области создания объединенного Центра данных по исследованию Луны и дальнего космоса ²⁵³
2019	Cooperation Agreement on China Satellite Navigation System Commission (People's Republic of China) and the Russian National Aerospace Corporation (Russian Federation) Regarding Beidou and GLONASS Global Satellite Navigation System Synchronization	中国卫星导航系统委员会（中华人民共和国）与俄罗斯国家航天集团（俄罗斯联邦）关于北斗和格洛纳斯全球卫星导航系统时间互操作的合作协议 ²⁵⁴	Соглашение о сотрудничестве в области обеспечения взаимодополняемости систем ГЛОНАСС и Бейдоу ²⁵⁵

Year Signed	English	Chinese	Russian
2018 (enacted in 2019)	Cooperation Agreement between the Government of the People's Republic of China and the Government of the Russian Federation on the Peaceful Use of the Beidou and GLONASS Global Navigation Satellite Systems	中华人民共和国政府和俄罗斯联邦政府关于和平使用北斗和格洛纳斯全球卫星导航系统的合作协定 ²⁵⁶	Соглашение Между Правительством Российской Федерации И Правительством Китайской Народной Республики О Сотрудничестве В Области Применения Глобальных Навигационных Спутниковых Систем Глонасс И Бэйдоу В Мирных Целях ²⁵⁷
2018	CNSA and Roscosmos 2018-2022 Space Cooperation Outline	中华人民共和国国家航天局与俄罗斯联邦国家航天集团公司 2018—2022 年航天合作大纲 ²⁵⁸	Программы развития сотрудничества в области космической деятельности между Роскосмосом и КНКА на 2018-2022 годы ²⁵⁹
2018	Letter of Intent on Cooperation between the China National Space Administration and the Russian National Aerospace Corporation on the Moon and Deep Space Exploration	中国国家航天局与俄罗斯国家航天集团关于月球与深空探测的合作意向书 ²⁶⁰	Меморандум о взаимопонимании между Правительством Китайской Народной Республики и Правительством Российской Федерации о сотрудничестве в области создания Международной научной лунной станции (МНЛС) ²⁶¹
2016 (China) 2017 (Russia)	Agreement on Technical Protection Measures for Cooperation between the Government of the People's Republic of China and the Government of the Russian Federation on the Construction and Use of Launch Vehicles and Ground Facilities and Equipment in the Field of Peaceful Research and Utilization of Outer Space	中华人民共和国政府和俄罗斯联邦政府关于在和平研究与利用外层空间领域建造和使用运载工具及其地面设施设备合作的技术保护措施协定 ²⁶²	Соглашение между Правительством Российской Федерации и Правительством Китайской Народной Республики о мерах охраны технологий ²⁶³

Year Signed	English	Chinese	Russian
2015	Joint Statement on the System Compatibility of Beidou and GLONASS	中国北斗和俄罗斯格洛纳斯系统兼容与互操作联合声明 ²⁶⁴	Совместное заявление о совместимости и взаимодополняемости китайской системы “Бэйдоу” и российской системы “ГЛОНАСС” ²⁶⁵
2014	Memorandum of Understanding on Cooperation between the China Satellite Navigation System Committee and the Russian Federal Space Agency in the Field of Global Satellite Navigation	中国卫星导航系统委员会与俄罗斯联邦航天局在全球卫星导航领域合作谅解备忘录 ²⁶⁶	Меморандум о взаимопонимании между Китайской комиссией по навигационной спутниковой системе и Федеральным космическим агентством России о сотрудничестве в области глобальных навигационных систем ²⁶⁷
2013	2013-2017 China-Russia Space Cooperation Outline	2013-2017 年中俄航天合作大纲 ²⁶⁸	Программа российско-китайского сотрудничества на период 2013-2017 гг. ²⁶⁹
2009	2010-2012 China-Russia Space Cooperation Project Outline	2010-2012 年中俄航天合作项目大纲	Программа сотрудничества между Россией и Китаем в области космоса на 2010-2012 годы ²⁷⁰
1994	Intergovernmental Agreement on the Cooperation on the Study and Use of Outer Space for Peaceful Purposes	中俄两国航天局关于和平利用与研究宇航空间方面进行合作的议定 ²⁷¹	Межправительственное соглашение о сотрудничестве в области исследования и использования космического пространства в мирных целях ²⁷²

Abbreviations

ASAT	Antisatellite weapon
BMD	Ballistic missile defense
BRICS	Brazil, Russia, India, China, and South Africa
CD	UN Conference on Disarmament
CNSA	China National Space Administration
EU	European Union
GLONASS	Global Satellite Navigation System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICBM	Intercontinental ballistic missile
ILRS	International Lunar Research Station
INF	Intermediate range nuclear forces
IPR	Intellectual property rights
ISS	International Space Station
MND	Ministry of National Defense
MOU	Memorandum of understanding
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
PAROS	Prevention of an Arms Race in Outer Space
PPWT	Prevention of the Placement of Weapons in Outer Space and the Threat or Use of Force against Outer Space Objects
PRC	People's Republic of China
R&D	Research and development
SCO	Shanghai Cooperation Organization
SDA	Space domain awareness
SLBM	Submarine-launched ballistic missile
THAAD	Theater High Altitude Area Defense
UN	United Nations
US	United States
USSR	Union of Soviet Socialist Republics

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