Sino-Russian Military-Technical Cooperation: A Primer

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THE ISSUE

China and Russia, both cited as long-term strategic competitors to the United States in the Trump administration's 2018 National Defense Strategy (NDS), have prioritized strengthening their bilateral defense relationship in recent years. This report examines a key aspect of Sino-Russian defense ties, military-technical cooperation (MTC), which includes arms sales, joint research and development of weapons systems, technology transfers, and sharing of technical knowledge. It concludes by offering policy recommendations for U.S. policymakers.

It is no secret that the deepening military-to-military relationship between the People's Republic of China (PRC) and the Russian Federation has generated serious consternation within the U.S. national security community. These concerns are well documented in the myriad of U.S. official statements, government and think tank reports, congressional testimonies, news articles, and expert commentaries that outline the negative implications that China and Russia's growing defense ties pose for U.S. security interests. A majority of this analysis focuses on broad strategic issues like the growing alignment of China and Russia's strategic ambitions and the debate over whether or not the relationship constitutes a "de-facto alliance." Other analysis highlights flashier components of the relationship like joint military exercises.

However, flying under-the-radar is an important but often overlooked aspect of China and Russia's bilateral defense relationship: military-technical cooperation (MTC). As Ethan Meick of the U.S.-China Economic and Security Review Commission notes, MTC encompasses "a wide range of defense industry engagement, including arms sales, joint research and development, weapons licensing agreements, technological transfer, sharing of technical knowledge, and maintenance of weapons systems."[1] MTC is an important component of Sino-Russian defense ties, as evidenced by then-Chinese Defense Minister Liang Guanglie's statement in 2009 that "military and military-technical cooperation between the two countries is an important content of the Sino-Russian relations and strategic partnership."[2] Like other key aspects of China and Russia's military-to-military engagement, including high-level contacts and joint-military exercises, Sino-Russian MTC has deepened significantly in recent years, prompting Russian Foreign Minister Sergei Lavrov to comment in November 2014, that "we can now even talk about the emerging technological alliance between the two countries."[3]

To better illuminate this under-explored aspect of Sino-Russian defense ties, this article seeks to briefly survey

the major trends and developments in Sino-Russian MTC in the post-Cold War era. It concludes that since the early 1990s, MTC between China and Russia has evolved from a one-sided relationship largely predicated on Chinese purchases of Russian weapons systems into an increasingly interdependent relationship characterized by long-term joint production of military equipment and the transfer of more advanced weapons systems. This recent history can be broken into three distinct periods: 1992 to 2006, 2006 to 2014, and 2014 to the present.

1992-2006: MASSIVE RUSSIAN ARMS SALES TO PRC

In 1992, China and Russia signed the Military-Technical Cooperation Agreement, establishing a legal framework for MTC between the two Eurasian powers.[4] Beijing and Moscow subsequently formed the Mixed Intergovernmental Commission on Military-Technical Cooperation (MICTIC), which became China and Russia's formal platform for the development of bilateral MTC. The MICTIC's annual meeting, usually co-chaired by the vice-chairman of the Chinese Communist Party's Central Military Commission and the Russian defense minister, is the main venue for senior Chinese and Russian defense officials to discuss bilateral MTC.[5] Meick notes that the meeting "typically discusses major arms sales and defense industry cooperation more broadly, reviews cooperation over the previous year, and decides on the upcoming year's priorities."[6]

Sino-Russian MTC during this period was characterized by large transfers of Russian military equipment to China. Estimates indicate that Russian arms sales to China accounted for nearly 80 percent of China's arms imports and nearly a quarter of Russia's arms exports during this period.[7] Meick notes that by some estimates, Russian arms sales to China totaled roughly $26 billion from 1992-2006.[8] China's purchases included major weapons systems including export versions of Russia's Su-27 and Su-30 multirole fighters, S-300 surface-to-air missile defense systems, and Kilo-class diesel-electric attack submarines.[9] These systems helped vastly improve the capabilities of China's People's Liberation Army Air Force (PLAAF) and People's Liberation Army Navy (PLAN) while neutralizing the impact of Western arms embargoes on Beijing.[10]

Russian arms transfers to China during this period helped both Moscow and Beijing mitigate the respective strategic challenges they faced in the early 1990s. The collapse of the Soviet Union in 1991 had ravaged the Russian economy, leaving Russian defense firms desperately in need of foreign export markets to remain viable.[11] Meanwhile, Beijing's ambitious drive to modernize the People's Liberation Army (PLA), deemed necessary by Chinese Communist Party for regime survival, had been severely curtailed by Western arms embargos levied on China in response to the 1989 Tiananmen Square Massacre.[12] Thus, Russian arms transfers to China served both countries vital national interests, granting the PLA access to the military technology it needed to modernize while providing Russia's defense firms the revenue they required to stay viable.[13]

This immediate post-Cold War period also saw significant bilateral technology transfers and joint development of military technology between Moscow and Beijing. Alexander Korolev, lecturer in politics and international relations at the University of New South Wales, Sydney, notes that, "By the mid-2000s, joint ventures and technology transfers reached 30 percent of the total transfer of military equipment from Russia to China."[14] Further highlighting the important role MTC played in China and Russia's broader bilateral relationship, Korolev cites multiple instances of then-Russian Defense Minister Sergei Ivanov lauding Sino-Russian MTC as "the backbone of the China-Russia strategic partnership."[15]

2006-2014: A PAUSE IN MTC AND ITS EVENTUAL RESUMPTION

Around 2006, Sino-Russian MTC ground to a halt. From 2006 to 2010, there were no transfers of major weapon systems from Russia to China.[16] In addition, the MICTIC's annual meeting of was cancelled in 2006 and 2007.[17]

The disruption in MTC during this period stemmed from several causes. By 2006, China had become unhappy with Russian contract negotiation policies as well the

poor quality of Russian arms exports.[18] More importantly, China's defense industry had matured to the point that it could satisfy many of the PLA's requirements domestically. With its basic military requirements met at home, China increasingly looked to Russia to purchase more advanced weapons systems and their underlying technology to further the PLA's modernization.[19]

However, Russia was reluctant to export its most advanced military equipment to China for several reasons. Moscow was concerned about Beijing's intellectual property theft of Russian military technology and unlicensed reverse-engineering of Russian weapons systems. A famous example of China's reverse-engineering of Russian weapons systems is the PLA's J-11 fighter, an unlicensed copy of Russia's Su-27/Su-30 fighter.[20] Russia worried that Chinese exports of reverse-engineered Russian weapon systems would create competition in Russia's traditional arms exports market. Additionally, the Kremlin was increasingly apprehensive of China's growing military capabilities and was unwilling to sell advanced technology to Beijing that could potentially pose a threat to Russia in a future conflict.[21]

By 2008, Sino-Russian MTC had resumed. Regular meetings of the MICTIC were reinstated, and on December 11 China and Russia signed the Agreement of Intellectual Property in Military Technical Cooperation to alleviate Russian concerns about Chinese intellectual property theft. A subsequent agreement was reportedly signed in 2012 that aimed to strengthen the 2008 agreement.[22]

While major arms sales remained paused, Russian arms exports to China did gradually increase. In 2009, Beijing accounted for 9 percent of Russia's arms exports. By 2012, this figure increased to 12 percent. Russian defense firms signed four separate contracts in 2011-2012 to sell Beijing 150 AL-31F aircraft engines, 123 AL-31FN aircraft engines, 184 D-30 KP-2 aircraft engines, and 140 AL-31F aircraft engines respectively.[23]

Additionally, China purchased Russian Mi-17 helicopters for $660 million in in 2012.[24] In March 2013, Beijing and Moscow signed a framework agreement for the supply of four Russian Lada-class diesel-electric submarines to China.[25]

2014-PRESENT: SIGNIFICANT POST-CRIMEA DEEPENING OF MTC

It was not until 2014, however, that Sino-Russian MTC began to significantly deepen. Moscow's economic and diplomatic isolation from the West following its illegal annexation of Crimea in early 2014 catalyzed a major strategic reorientation away from the West and towards Beijing. Moscow subsequently prioritized strengthening all aspects of its bilateral relationship with China, including MTC, becoming increasingly reliant on Beijing to counter Western sanctions and diplomatic pressure. According to Alexander Gabuev, chair of the Carnegie Moscow Center's Russia in the Asia-Pacific Program, Russia's pivot to China was driven in part by the findings of a 2014 interagency policy review which concluded that in response to Western sanctions, "Russia would have no other choice than to be more accommodating of China – even if it turned Moscow into the junior partner in the relationship."[26] As a result, the nature of Sino-Russian MTC changed considerably post-Crimea, becoming a more reciprocal and interdependent relationship that simultaneously reinforced Moscow's status as the "junior partner" in its bilateral relationship with Beijing.

Most notably, the Kremlin acquiesced to Chinese pressure and ended its informal ban on the sale of its most advanced weapons systems to Beijing. Russia's 2014 policy review concluded that "that the military-strategic threat that China posed to Russia was severely overblown."[27] The policy review also partially ameliorated Russia's concerns over Chinese IP theft and illegal reverse-engineering of advanced Russian military technologies. It concluded that "China's military industry sector was far more advanced than previously hoped," and that within a decade China could develop the same weapons systems Moscow hoped to sell to Beijing, thereby reducing the risks to Russia's defense industry posed by Chinese reverse-engineering of Russian weapons systems.[28] Additionally, the review revealed that many of the military technologies Beijing

had allegedly stole from Moscow in the 1990s were actually developed by cash-strapped Russian companies through contracts with China's defense firms.[29]

Moscow subsequently resumed the large-scale transfer of weapons systems to China, including the sale of advanced technology Moscow had previously refused to sell Beijing. From 2014-2018, Russia accounted for 70 percent of China's arms imports.[30] Notable Russian arms sales to China during this period include:

S-400 surface-to-air missile (SAM) defense systems. In 2015 Russia announced the sale of two S-400 regiments to China for an estimated $3 billion. The sale is notable because Russia was previously hesitant to sell the S-400, Russia's most advanced air defense system, to China. Russia completed delivery of the first regimental set in May 2018, and delivery of the second regimental set began in July 2019. The sale reportedly includes a training course provided by Russia to Chinese operators of the S-400.[31]

Su-35 multi-role air-superiority fighter. In November 2015, China signed a $2.5 billion contract for 24 Su-35 planes. The Su-35 is an advanced fourth-generation, twin-engine, multirole air superiority fighter aircraft. Russia was previously hesitant to sell China the Su-35 due to concerns China would reverse engineer the Su-35's powerful AL-41FS, also known as the ALS-117S, thrust-vectoring engine. Russia completely the delivery of the Su-35 to China in April 2019. The sale also includes the delivery of ground support equipment and spare engines.[32]

Additionally, although an agreement would likely not be reached for a few years, it is worth noting Russia's reported interested in selling the fifth-generation Su-57 multi-role fighter to China. A March 2019 report by Jane's Defense Industry quoted an official from Russian defense conglomerate Rostec as stating, "in the next two years [China] will make a decision…to buy a fifth-generation [Su-57] aircraft."[33] As Robert Farley of the Diplomat notes, "Acquiring the Su-57 would allow the Chinese to more effectively concentrate their efforts on long-range strike, interception, and carrier aviation. Buying the plane would also help cement the defense relationship with Russia."[34]

However, despite Russia's recent willingness to sell China its most advanced military technologies, Russian concerns over Chinese IP theft and reverse engineering have persisted. In December 2019, Yevgeny Livad, chief of Rostec's intellectual property projects, publicly commented that "unauthorized copying of our equipment abroad is a huge problem," citing some 500 such cases since 2002. [35] However, as Schwartz contends, it appears that Russia's "long-standing concerns over intellectual property and security simply appear to have been overridden" in order to court Beijing's continued economic and diplomatic support.[36]

Other aspects of bilateral MTC have become significantly more reciprocal in recent years. Reflecting the rapid modernization of China's domestic defense industry, Beijing has become a critical source of key military and dual-use technologies for Russia as a result of sanctions that prevent it from purchasing similar technologies from the West. Russia is now dependent on China to provide critical items including electronic components for its aerospace programs, composite materials, UAV technology, and marine diesel engines for the Russian Navy.[37]

China and Russia have also emphasized deepening bilateral scientific and technological collaboration. As Samuel Bendett and Elsa Kania note, "the Sino-Russian strategic partnership has increasingly concentrated on technology and innovation."[38] In June 2016 China's Ministry of Science and Technology and Russia's Ministry of Economic Development signed the "Memorandum of Understanding on Launching Cooperation in the Domain of Innovation," codifying the increased levels of trust and cooperation between China and Russia's scientific and defense communities. [39] Building on the 2016 memorandum, Russian President Vladimir Putin signed a decree in December 2019 designating the year 2020 "as the year of Russian-Chinese Scientific, Technical and Innovation Cooperation."[40] Beijing and Moscow seek to jointly develop dual-use technologies including next-generation telecommunications, robotics and artificial

intelligence, biotechnology, and internet and data governance.[41]

As a result, joint Sino-Russian research and development (R&D) projects have blossomed post-Crimea, including the development of multiple advanced weapons systems. As Korolev notes, the joint development of advanced weapons systems (and the accompanying exchange of technical expertise) demands a considerable amount of trust between partners, requiring "a high level of coordination between multiple institutions (research centers, manufacturers, and various government agencies), shared procedures, and the standardization of training."[42] Although China and Russia had previously undertaken joint R&D projects, until recent years these projects had not included the development of sophisticated weapons systems. Significant Sino-Russian R&D projects undertaken in recent years include:

Missile-Attack Early-Warning System. In October 2019, President Putin announced that Russia's defense industry is helping the PLA build a modern missile-attack early-warning system. At least one $60 million contrast has reportedly been signed for a Russian defense firm to develop software for a future PLA early-warning missile defense network.[43]

Next Generation Heavy Lift Helicopter. In 2015, Russian Helicopters and the Aviation Industry Corporation of China signed a deal to jointly produce a next-generation heavy-lift helicopter. China will reportedly be responsible for developing the helicopters avionics systems and materials while Russia will develop the helicopter's design, transmission, and de-icing equipment.[44]

***Lada*-class Submarine.** In March 2013, China and Russia signed an official agreement for the joint production of four Russian *Lada*-class diesel-electric attack submarines. The agreement stipulated that two of the submarines would be produced in Russia and two in China. The first submarine was reportedly delivered in October 2014. According to the U.S. Department of Defense (DoD), China has subsequently pursed a joint-design and production program with Russia for an advanced diesel-electric attack submarine based on the *Lada*-class.[45]

Z-10 Attack Helicopter. In 2013 Sergie Mikheyev, General Designer of the Russian firm Kamov Design Bureau, revealed that his firm had secretly contributed to the design of China's Z-10 attack helicopter. Previously, China had suggested that the helicopter's manufacturer, Changhe Aircraft Industries Corporation, had the sole lead in the Z-10's development process.[46]

GAZ "Tigr" Infantry Mobility Vehicle. In 2011, The Russian Military Industrial Company began to assemble its GAZ "Tigr" all terrain, multipurpose infantry mobility vehicles in China.[47]

LOOKING FORWARD

Looking forward, it is highly probable that Sino-Russian MTC will continue to deepen in the near future. Bilateral MTC will likely play a major role in China and Russia's ambitions to promote and sustain their respective defense industries in the face of Western sanctions and arms embargoes. In an era where the United States' technological military advantages are "eroding," the mutual transfer and joint development of advanced military technologies by the United States' two main strategic competitors must be viewed as a severe challenge to the security of the United States. However, there are few policy prescriptions available to U.S. policymakers to deter or disrupt future Sino-Russian MTC.

Because China and Russia's growing defense ties are driven largely by their "common perception and mutual interest in opposing the United States and its allies,"[48] any punitive measures taken by the United States to curb Sino-Russian MTC are likely to tie Beijing and Moscow's respective defense industries closer together. This is particularly true regarding the use of sanctions by the United States against China and Russia. As the U.S.-China Economic and Security Review Commission noted in its 2019 annual report, "U.S. policy actions sanctioning China and Russia have reinforced their perceived common interests and pushed the two

countries closer together." A key example of U.S. sanctions fostering deeper Sino-Russian defense ties occurred in September 2018, when the United States imposed sanctions on the PLA's Equipment Development Department (EED), the branch of the PLA responsible for weapons and equipment, and its director, Li Shangfu, under the 2017 Countering America's Adversaries Through Sanctions Act (CAATSA).[49] The sanctions were imposed in response to China's 2017 purchase of Su-35 combat aircraft and 2018 purchase of S-400 SAM systems from Russia.[50] Rather than deter future Chinese purchases of Russian military equipment, the imposition of CAATSA sanctions on the EED prompted Geng Shuang, spokesman for China's Foreign Ministry, to vow that "China will continue to work with Russia to promote strategic cooperation at an even higher level."[51]

In addition, U.S. punitive actions such as the imposition of sanctions under CAATSA may deteriorate strategic stability by undermining other aspects of the United States' relationships with China and Russia. For example, after the imposition of CAATSA sanctions on the EED in September 2018, China postponed a round of scheduled bilateral military talks with the United States.[52] At a time when military tensions between the United States and China were (and still are) extremely high, the disruption of bilateral military engagements designed to "manage and reduce" risk between Washington and Beijing could further strain the bi-lateral military-to-military relationship and contribute to mutual misunderstandings or inadvertent escalation between the two countries.

Crucially, there are currently no significant "wedge issues" that the United States could effectively utilize to decouple China and Russia's defense industries. Where areas of disagreement between Beijing and Moscow do exist, such as Russia's long-standing concerns about Chinese reverse-engineering and IP theft, the two states have worked to smooth over differences in order to support the strengthening of the overall bi-lateral relationship. Thus, there is likely very little the United States can do to half further Sino-Russian MTC.

U.S. POLICY OPTIONS

However, there are steps the United States government can take to ensure it maintains its qualitative edge over its strategic competitors in emerging dual-use and military technologies such as artificial intelligence, hypersonic and directed-energy weapons, advanced robotics, syntenic biology, and quantum technology. Over the last several years, Congress has enacted legislation intended to improve the U.S. governments ability to develop emerging technologies relevant to national security. For example, the 2020 National Defense Authorization Act (NDAA) directed DoD to create a "process" to ensure the Department effectively formulates and updates policies relating to emerging technologies. However, thus far the steps taken by both the executive and legislative branches have been insufficient to invigorate the U.S. defense industrial base. By taking concrete actions including increasing federal R&D funding, implementing measures to attract, education, and retain a highly skilled science and technology workforce, fostering partnerships with the private sector, and working closer with allies, the U.S. can maintain or regain its advantage in these critical technologies.

U.S. efforts to catalyze innovation and technological development in the national security sector should start at home. One critical step the U.S. government must take is investing greater resources into R&D. As a recent report by an independent Council on Foreign Relations (CFR) task force argues, "U.S. leadership in science and technology is at risk because of a decades-long stagnation in federal support and funding for research and development."[53] In 2018, federal R&D spending as share of U.S. GDP was 0.61 percent, its lowest level since 1955.[54] Though this figure is in large part reflective of the changing structure of global R&D - characterized by enormous increases of private-sector R&D investment relative to government investment - government investment in R&D remains critical to ensuring the U.S. retains its technological edge. As Andrew Hunter, Director of the Defense-Industrial Initiatives Group at the Center for Strategic and International Studies (CSIS) notes, government investment is critical for advancing

early-stage R&D of sophisticated military-relevant technologies that commercial firms are not incentivized to attempt, stating simply that "government investment retains a critical investment strategy…in making the kinds of investments that the private sector won't."[55]

In its recently released budget request for fiscal year 2021 (FY21), the Trump Administration appeared to recognize the importance of increasing R&D funding, asserting that the request, " supports critical investments to regain and sustain U.S. technological superiority to counter and overmatch emerging threats."[56] The request included $106.6 billion to fund DoD research, development, test, and evaluation (RDT&E) efforts, including over $14 billion in investments for programs related to key emerging technologies including AI, quantum information science, 5G, and biotechnologies as well as DoD modernization priorities including hypersonic weapons and directed energy weapons.[57] The $106.6 billion requested is a $2 billion increase over the FY20 enacted figures.[58] However, the moderate increase in R&D investment proposed by the Administration falls woefully short of the amount experts assert is necessary to ensure the U.S. retains its technological superiority. For example, the CFR task force recommends increasing annual federal R&D funding by 57.5 percent, which if applied to the FY 2021 budget request would equal $167.9 billion in DOD funding for RDT&E. [59]

Because the private sector will play an increasingly significant role in developing future technologies relevant to national security, it is also important that the USG follows through on its stated ambitions to foster stronger partnerships with the private sector. To so do, Congress should heed the Reagan Institute Task Force's recommendation that it "provide sustained, predictable, increased funding for the DIU [Defense Innovation Unit]."[60] Strengthening the DIU, a DoD organization formed to help the Department better leverage emerging military-relevant commercial technologies, would help DoD foster the public/private partnerships it will need to maintain the strength of the US defense innovation base.

It is also vitally important that the U.S. attract, educate, and retain a highly skilled science and technology workforce. The CFR report recommends that the U.S. government develop a National Defense Education Act that would support up to twenty-five thousand competitive STEM (science, technology, engineering, and mathematics) undergraduate and five-thousand graduate fellowships "with the goal of expanding the pipeline of talent in science, technology, engineering, and mathematics."[61] A recent report by the Ronald Reagan Institute makes a similar recommendation, arguing that Congress should authorize the creation of a national "STEM Corps" modeled after the Reserve Officers' Training Corps (ROTC) in which promising students would be selected to received full tuition to attend public universities and study specific disciplines related to national security technology. In return, the students would commit to spending several years serving in in "active" or "reserve" components of the STEM Corps, working within the U.S. defense industrial community.[62]

It is also important that the United States attract and retain highly-talented foreign nationals in its technology workforce. To do so, the Ronald Reagan Institute report calls for Congress to create a "National Security Innovation Base Visa," that would encourage "appropriately vetted, highly skilled" foreign nationals to come to the United States and incentive foreign nationals studying relevant fields at U.S. universities to remain and work in the United States.[63] Similarly, the CFR task force recommends that Congress grant "lawful permanent residence to those who earn a STEM master's degree or doctorate."[64] By implementing programs similar to those proposed by the CFR and Ronald Reagan Institute task forces, the USG could ensure that a steady pipeline of talented enters the science and technology workforce.

It is also critical that the United States enhance MTC with technologically advanced allies and partners to advance shared national security interests. The United States' global network of alliances and partnerships is a unique strength that Washington can leverage in its strategic competition with Russia and China.

Strengthening defense-industrial collaboration with key allies would "link technology ecosystems and create scale in a globalized system of innovation,"[65] fostering greater scientific and technological breakthroughs by diffusing R&D costs and combining top scientific talent. Steps that Washington could take to deepen MTC with its allies and partners include establishing joint research centers, increasing scientific exchanges between relevant USG bodies (such as DoD's Defense Innovation Unit and Defense Advanced Research Projects Agency) and their allied counterparts, and incentivizing major US defense contractors to collaborate with allied defense firms.

A few recent examples of MTC between the United States and its security partners highlight the important role MTC can play in maintaining the United States' qualitative military edge over its strategic competitors. In 2018 the U.S. Navy selected the Naval Strike Missile (NSM) as its future over-the-horizon anti-ship missile for the Littoral Combat Ship (LCS).[66] Jointly developed by Norwegian defense firm Konsberg and U.S. defense contractor Raytheon, the NSM provides the U.S. Navy a critical capability that allows the LCS to "operate in environments where enemy standoff weapons would otherwise hold it at bay."[67] Konsberg and Raytheon also jointly developed the Joint Strike Missile, a long-range, multi-mission strike weapon that is currently the only missile currently scheduled for integration onto the F-35 stealth fighter.[68] Like the NSM, the Joint Strike Missile to attack enemy targets outside the range of enemy standoff weapons.[69]

One specific step Congress could take to streamline the joint development of advanced technologies with friendly countries is making program-wide licenses available, "such that companies and governments need not seek individual licenses for each component part of a particular technology or at each stage of project development."[70] For complex projects such as the development of the F-35 aircraft, in which eight partner states and over 1,000 contractors and sub-contractors participated, program-wide licenses permitting the exchange of project-relevant technologies between U.S. and partner agencies and manufacturers could reduce development time by eliminating bureaucratic red-tape.

Lastly, it is not enough for the United States to strengthen its defense innovation ecosystem, it must also protect it against economic and industrial espionage. U.S. strategic competitors, most notably China, have engaged in multi-faceted efforts to steal U.S. technological and intellectual property in order to bolster their own defense innovation bases at the expense of the United States. At a recent event at a recent conference held by CSIS, Federal Bureau of Investigation (FBI) Director Christopher Wray stated that China has "pioneered an expansive approach to stealing innovation through a wide range of actors, including not just Chinese intelligence services but state-owned enterprises…certain kinds of graduate students and researchers, and a whole variety of other actors all working on their behalf."[71] Wray outlined how China utilizes a wide array of legal and illicit methods, including forced technology transfers, cyber and physical theft, and the co-opting of individuals at research institutions and industrial firms, to steal U.S. technological and intellectual property, which costs the U.S. an estimated $400 billion to $600 billion per year in IP theft as a matter of provable losses.[72] By stealing U.S. defense-industry trade secrets and know-how, adversaries like China are able to Avoid developing sophisticated technologies having to develop sophisticated technologies and can instead focus on incrementally innovating advanced US technologies.[73] It is critical that the USG communicate clearly to industry and university partners threats posed by foreign actors.

If it implements these or similar measures, the U.S. can strengthen its defense innovation base and maintain its military-technical edge over China and Russia. Conversely, if the United States fails to invigorate its domestic defense industry and bolster MTC with allied and partnered states, the likelihood that China and Russia surpass the United States in key emerging technological domains increases.

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