



Intersections, a news digest published by CNA’s China and Indo-Pacific Security Affairs Division, describes the interplay between the People’s Republic of China (PRC’s) technology acquisition efforts, US and partner nation responses, and critical and emerging technology risks for the US defense industrial base that stem from these technology acquisitions efforts. CNA has documented a wide range of [legal and illegal techniques to acquire foreign technologies](#) that the PRC uses to achieve its national security objectives and build military capabilities.¹

This issue features a special section on how the PRC and various US allies and partners are responding to the new US export control rule that imposes certain restrictions on advanced semiconductors and associated technology. We also discuss the Chinese Communist Party’s (CCP’s) 20th Party Congress and policies to promote investment in the PRC. We conclude with recent US and partner actions to protect critical mineral supply chains. Click [here](#) to read *Intersections* in your [browser](#).

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SEMICONDUCTOR EXPORT CONTROLS

As covered in [Issue 1](#) of *Intersections*, in October 2022, the US Department of Commerce (DOC) issued a new [rule](#) that drastically restricts the export of advanced semiconductors and chip-making equipment by both US firms and persons and by foreign entities that use US equipment or technology in their processes.²

Definitions: Semiconductors, Microchips, and Integrated Circuits

A [semiconductor](#) is a type of material “whose electrical conductivity is between that of a conductor [i.e., a metal like copper] and an insulator [i.e., like rubber].”³ The electrical properties of semiconductor material—particularly silicon—are essential to the functioning of modern computer chips. A *microchip* is the physical wafer that holds an [integrated circuit](#) (IC), which is a “tiny complex of electronic components and their connections that is produced in or on a small slice of [semiconducting] material.”⁴ Examples of microchips and ICs include Central Processing Units, the logical “brain” of a modern computer; Graphics Processing Units and memory chips that store information.

The new US export rule includes the following measures:

- It requires companies to obtain a license to supply advanced chips, chip-making equipment, or related products to China. DOC will adopt a “presumption of denial” in reviewing license requests.⁵
- It bans export of a range of US microchip products to PRC companies on the US Entity List.
- It restricts US citizens from supporting PRC advanced semiconductor manufacturing, production of integrated circuits, or the development of advanced integrated circuits.⁶

The announcement of the rule has triggered widespread reactions by the PRC as well as US allies and partners. The PRC government and firms are taking steps to mitigate the rule’s impact on domestic semiconductor production, while US ally and partner nations and semiconductor companies are evaluating how the rule will affect their interests and how to respond. In the weeks since the rule was announced, the US has taken a number of additional policy actions related to export controls.

IMPACT ON PRC MICROCHIP PRODUCTION

Leading PRC chip company faces risks to continued production from new US export controls.

According to the [Financial Times](#), PRC-based memory chip producer Yangtze Memory Technologies Corp. (YMTC) has been stockpiling equipment in an effort to delay the impact of the new US export rule.⁷ YMTC is one of China’s leading chip manufacturing companies.⁸ The *Financial Times* reports that, in response to the new rule, three US semiconductor toolmakers halted all “sales and services” to YMTC. In addition, several executives and other key staff at YMTC who hold US citizenship or residency have recently [resigned](#).⁹ These resignations are a result of the new rule requiring individuals to seek DOC permission for supporting advanced PRC chip fabrication plants—permission that DOC has said it is unlikely to grant.

The Center for Strategic and International Studies [notes](#) that these US policy actions may have the effect of severely limiting YMTC’s growth.¹⁰ In October 2022, YMTC was [added](#) to the US government’s “unverified list” (UVL), meaning the US had been unable to verify that YMTC was not providing chips to the People’s Liberation Army, or for other unauthorized purposes, because the PRC government had been unwilling to allow end-

user inspections inside China.¹¹ In December 2022, the *Financial Times* reported that a senior US official [mentioned](#) the PRC “had started letting American officials inspect some Chinese companies,” perhaps to avoid being added to the Entity List.¹² Some PRC companies [reportedly](#) “passed” these inspections and were removed from the UVL, but YMTC—along with 35 other PRC companies—was placed on the Entity List on December 16.¹³

The [US Entity List](#) imposes trade restrictions on foreign persons, businesses, research institutions, governments, or private organizations. DOC’s Bureau of Industry and Security (BIS) manages the US Entity List and describes it as a tool “to restrict export, reexport, and in-country transfer of items subject to the Export Administration Regulations.”

PRC local governments increase support for domestic chip industry. An October [report](#) from the Hong Kong-based *South China Morning Post* (*SCMP*) observes that local governments in China are increasing financial incentives for domestic semiconductor companies to spur greater national self-sufficiency in production.¹⁴ According to *SCMP*, cities like Shanghai and Shenzhen that have long been centers of high-tech innovation in China, and cities such as Nanjing and Zhejiang Province’s Lishui, are offering new measures, including generous cash incentives, for PRC firms to develop their own chip designs.

Relatedly, on December 13, Reuters [reported](#) that China’s largest chip manufacturer, SMIC, had received as much as \$140 billion USD of PRC government support to ramp up production of 28 nanometer chips, an older chip technology that is used globally in automotive technologies and the “internet of things.”¹⁵ The Reuters article notes that “with U.S. export controls making it impossible to produce advanced chips, SMIC is doubling down on mature technology chips.” Experts and former administration officials are quoted in the article as explaining that the PRC’s actions could both undercut competition in the global market and “give Beijing coercive leverage” over industries and countries that rely on the chips.

ALLY AND PARTNER RESPONSES TO US MICROCHIP EXPORT CONTROLS

Taiwan pledges to follow new US semiconductor export restrictions, says that economic impact “will not be too large.” The *Washington Post* reported in October 2022 that Taiwan’s Minister of Economic Affairs, Wang Mei-Hua, has [pledged](#) that Taiwan’s semiconductor industry companies would follow the new US export controls.¹⁶ Wang admitted that the controls would “hurt some businesses” in Taiwan, but claimed that the limitations would not curtail Taiwan’s ability to produce and export chips for consumer electronics, which form a large portion of the global market for semiconductors. Wang also opined in the *Washington Post* article that the US had undertaken the new policy “for very good strategic and security reasons,” and that Taiwan therefore had limited room to bargain and must comply with the policy.

Taiwan’s response highlights the challenges its government and semiconductor industry face in balancing their reliance on US technology and the US with their manufacturing presence in mainland China. For example, Taiwan’s dominant chip producer, TSMC, has a mainland manufacturing facility in Nanjing, and reportedly requested (and received) a one-year [waiver](#) from the US government to continue production there following the release of the new export rule.¹⁷ At the same time, TSMC is partnering closely with US federal, state, and local governments to increase production in the US, for example, receiving [tax incentives](#) to construct a \$12 billion facility in Arizona.¹⁸

Selected reactions from other countries and companies:

- According to the [Financial Times](#), UK company Arm, which is owned by Softbank Holdings (a Japanese firm) recently concluded that it is unable to export its most advanced chip designs to PRC tech giant Alibaba because of the new US export restrictions.¹⁹
- A Japanese chip equipment supplier, Ferrotec, has stated it is accelerating plans to [expand production](#) outside China “in response to requests from US clients” who are prohibited from providing sales and maintenance to PRC-based semiconductor facilities under the new US export rule.²⁰ Ferrotec produces parts used in chips and currently has 80 percent of its production in China. The company plans to diversify its supply chain outside the PRC, including \$120 million for building a new plant in Malaysia.
- South Korean chipmaker SK Hynix stated in the [Financial Times](#) that it expects difficulties upgrading its plant in Wuxi, China, following the new US export restrictions.²¹ SK Hynix President Noh Jong-won claimed that geopolitical issues were affecting the company’s business decisions and stated that “the related restrictions are painful.” President Noh also added that the firm could face “critical trouble” in maintaining its China operations by the late 2020s.

ADDITIONAL US ACTIONS RELATED TO EXPORT CONTROLS

Biden administration considers additional export controls in other technology areas. According to the [New York Times](#), following the imposition of new export controls on microchip technology, the Biden administration is considering extending similar controls to other sectors, such as biotechnology and artificial intelligence (AI).²² Some actions on AI have already occurred: for example, in September 2022, the US DOC [blocked](#) US chipmaker Nvidia and rival AMD from exporting to China certain chips used in machine learning and AI.²³ The [New York Times](#) cites a senior administration official as saying that any additional controls would be intended to protect US national security rather than to limit PRC economic development.²⁴

Biden administration weighing new export restrictions on quantum computing technology. A November 2022 article in *Protocol*, a technology-focused online magazine, notes that the DOC is considering new trade [restrictions](#) on quantum computing technology.²⁵ According to the article, the US National Security Agency is concerned with how the technology “could be used to decrypt sensitive US information and how it could be used to access encrypted data from adversaries.” However, according to the *Protocol* article, quantum computing’s nascent state of development means that significant uncertainty remains as to which quantum technologies should be export controlled because “no one knows exactly what successful quantum computers will look like.” Another challenge is that other countries—such as Japan and Germany—that are investing heavily in quantum computing “do not appear as willing to take actions under the guise of national security that could threaten the development of their domestic quantum economics.” DOC’s BIS has reportedly been holding discussions with IBM, Google, and other US quantum startups about these issues.

US, PARTNER ACTIONS FOR TECH PROTECTION

The US and other advanced industrial countries are taking steps in areas beyond export controls to strengthen their domestic technology protection policies.

A Government Accountability Office (GAO) report identifies shortcomings in data on visiting students and scholars that could help assess technology transfer risks. According to a November 2022 report by the GAO, US Immigrations and Customs Enforcement (ICE) is increasing its efforts to [collect data](#) on

visiting students and scholars as part of its mission of ensuring compliance with visa conditions. These efforts could aid other agencies such as the FBI in investigating unlawful technology transfers to foreign countries, including the PRC.²⁶ The GAO report observes that the current database²⁷ used by universities to track visiting student information for visa compliance does not enable collection of information that would help assess technology transfer risk, such as visiting students' and scholars' participation in foreign government-sponsored talent programs or whether students or scholars are conducting research in areas deemed sensitive. The GAO report notes that ICE officials have cited potential privacy concerns in collecting such information, as well as the need to avoid the perception of bias against individuals of Chinese descent in decisions to open an investigation.²⁸

US government seeks to decrease reliance on PRC supply chains for lithium and other critical minerals. An October 2022 [article](#) in the American Chemical Society's magazine *Chemical and Engineering News* examines how the US and partner nations are addressing their reliance on Chinese-processed lithium.²⁹ [Lithium](#) is an essential component of the lithium-ion batteries that power everything from phones to electric vehicles.³⁰ US Deputy Secretary of Defense Kathleen Hicks has [described](#) "battery technology and lithium-ion batteries specifically" as "essential to thousands of military systems from handheld radios, to unmanned submersibles and to future capabilities like lasers, directed energy weapons and hybrid electric tactical vehicles."³¹ The demand for lithium is rising significantly, in part because of increasing global electrification; a 2022 [report](#) compiled by Belgian university KU Leuven and commissioned by Eurometaux predicts that the global lithium supply may be insufficient to meet demand by 2030.³²

Chemical and Engineering News notes that the PRC controls 58 percent of the world's lithium processing capacity.³³ According to a 2021 White House [report](#), a high concentration of the production of a critical mineral in one country could leave the production of that mineral vulnerable to single-point disruption. Furthermore, when discussing critical minerals, the White House report notes that the PRC government "has focused on capturing discrete strategic and critical material markets as a matter of state policy," often to the detriment of critical mineral production in other countries.³⁴ In light of these concerns, the US and its allies are considering measures to diversify critical mineral supply chains. The Biden administration has funded the domestic lithium industry with grants, tax credits, and loans under the 2021 [Infrastructure Investment and Jobs Act](#) and the [Inflation Reduction Act of 2022](#).³⁵ In addition, in June 2022, the US partnered with Japan, Australia, South Korea, and other allies to create the [Minerals Security Partnership](#), which aims to encourage private and public investment in all levels of the critical minerals supply chain.³⁶

PRC TECHNOLOGY PRIORITIES

The PRC provides information about its technology goals and priorities in a number of publicly available fora. These include Party Congress reports that provide information about strategic themes, Five Year Plans on how the PRC leadership will carry out its policies, Central Economic Work Conferences, and reports generated during the National People's Congress.³⁷ The graphic at the end of this newsletter provides a summary of how these priorities are translated into action.

20TH PARTY CONGRESS TECHNOLOGY THEMES

Party Congress report identifies China's technology priorities and future challenges. The Chinese Communist Party's (CCP)'s 20th National Party Congress, held in October, provided an opportunity for CCP Chairman Xi Jinping to reflect on the PRC accomplishments and outline themes for the future.³⁸ Xi's [formal report](#) to the Congress asserted that China has "joined the ranks of the world's innovators" and "grown

strong in basic research.” The Party Congress report also highlighted PRC technology success stories over the past five years, including manned spaceflight, lunar and Martian exploration, deep sea and deep earth probes, supercomputers, satellite navigation, quantum information, nuclear power technology, new energy technology, airliner manufacturing, and biomedicine. Looking ahead, the report calls for cultivating “new growth engines such as next-generation information technology, artificial intelligence, biotechnology, new energy, new materials, high-end equipment, and green industry.”³⁹

Despite these successes, the report warned that “there are many bottlenecks hindering high-quality development and China’s capacity for scientific and technological innovation.”⁴⁰ To overcome those challenges, the CCP has argued for strengthening and prioritizing basic research and “original innovation,” and creating an “enabling environment” for small and medium-sized technology companies.⁴¹

Finally, while not expressly mentioning US semiconductor export controls, Xi’s report stated that the PRC would develop “mechanisms for countering foreign sanctions, interference, and long-arm jurisdiction.”⁴² PRC firms have been affected by [US sanctions on Russia](#), semiconductor [export controls](#), and sanctions related to other countries, such as [Iran](#).⁴³

PRC NATIONAL GUIDANCE TO PROMOTE FOREIGN INVESTMENT

PRC government issues updated “Encouraged Foreign Investment Catalogue.” PRC efforts at technology acquisition include policies designed to attract foreign investment into China’s technology sectors.⁴⁴ The PRC National Development and Reform Commission and the Ministry of Commerce regularly publish an official foreign investment catalogue outlining guidance for which sectors are open (or closed) to foreign investment.

According to [Xinhua](#), the focus of this year’s catalogue is on “high-quality development of the manufacturing sector and technological upgrading,”⁴⁵ which is consistent with elements of Xi’s report to the 20th Party Congress.⁴⁶ Of the approximately 500 categories in the investment catalogue, more than 70 percent are related to the manufacturing industry.⁴⁷ The 2022 Catalogue also lists AI and new materials as encouraged technology sectors.

USING ESPIONAGE TO ACQUIRE US TECHNOLOGY

PRC intelligence officer sentenced to 20 years in prison for attempting to steal jet engine technology.

On 16 November, a Cincinnati federal court [sentenced](#) PRC national Xu Yanjun to prison following Xu’s 2021 [conviction](#) for attempting to steal proprietary aviation technology from US-based GE Aviation, a manufacturer of civilian and military aircraft components.⁴⁸ Xu served as an officer of the Ministry of State Security (MSS), the PRC’s principal intelligence agency, and organized the theft of aviation technology from leading companies in the US and elsewhere. Xu identified experts at leading aviation companies and cultivated them as contacts by inviting them to give presentations and receive a stipend at PRC universities and other PRC institutions. If a contact was unwilling or unable to directly provide Xu with proprietary information, Xu would hack into a contact’s professional computer when it was unattended, or he would enlist contacts to implant malware on company devices that allowed the MSS to infiltrate the company’s computer network.⁴⁹ In 2017, Xu began targeting a GE Aviation employee with the goal of obtaining technology related to the company’s proprietary composite engine fan modules, which are central components of GE’s cutting-edge jet engines.⁵⁰

Xu’s case is not an isolated incident. Earlier this year, as noted in our [previous issue](#), a San Jose, California, resident was charged with smuggling aviation software with military applications to a Beijing university with ties to the PLA.⁵¹ This incident also fits into the wider trend of PRC attempts to modernize its aviation

industry. According to a 2019 [report](#) by the China Aerospace Studies Institute, a think tank associated with the US Air Force's Air University, the PRC's drive to enhance its domestic aviation industry faces glaring technological gaps, such as its inability to manufacture advanced jet engines domestically.⁵²

HOW DO EXTERNAL OBSERVERS KNOW WHAT TECHNOLOGIES THE PRC WANTS?

The diagram below illustrates how PRC national-level priorities are translated into efforts to acquire foreign technology. Official national-level guidance from the CCP and PRC government provides insights into the types of technologies that PRC organizations, firms, and individuals are encouraged to obtain or develop. Technology priorities appear in the form of Party Congress reports, Five Year Plans, laws, policies, regulations, and catalogues. The PRC government then provides a variety of economic and financial incentives to organizations, companies, and individuals to turn those priorities into action. Those incentives include preferential treatment for inbound or outbound investment, subsidies, and tax reductions; each of these incentives is meant to encourage domestic production or efforts to obtain technology from abroad.



NOTES

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- ⁶ *Ibid*, parts B and C, p. 26-29.
- ⁷ Qianer Liu, Eleanor Olcott and Demetri Sevastopulo, "China's chip darling YMTC thrust into spotlight by US export controls," *Financial Times*, Oct. 13, 2022, <https://www.ft.com/content/404d36cc-9e4a-4ac6-9291-b5580c27cc05>.
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- ¹⁵ Jane Lanhee Lee, Josh Horwitz, and Alexandra Alper, "Analysis—China's massive older chip tech build up raises U.S. concern," Reuters on Yahoo! News, Dec. 13, 2022, <https://news.yahoo.com/analysis-chinas-massive-older-chip-202813160.html>.
- ¹⁶ Jeanne Whalen and Aaron Schaffer, "Taiwan, a major producer of semiconductors, says it will abide by U.S. rules: More than 60 percent of Taiwan's chip exports go to China," *Washington Post*, Oct. 21, 2022, <https://www.washingtonpost.com/politics/2022/10/21/taiwan-major-producer-semiconductors-says-it-will-abide-by-us-rules/>.
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³⁸ Xi Jinping, *Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects*, Report to the 20th National Congress of the Communist Party of China, Xinhua, Oct. 16, 2022, <https://news.cgtn.com/news/files/Full-text-of-the-report-to-the-20th-National-Congress-of-the-Communist-Party-of-China.pdf>. Chinese language version of the report is available at http://www.news.cn/politics/cpc20/2022-10/25/c_1129079429.htm. Party congresses also confirm the Politburo, Politburo Standing Committee, and key leadership positions responsible for enacting those policies.

³⁹ Ibid, p. 25.

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⁴⁴ PRC National Development and Reform Commission and Ministry of Commerce, 鼓励外商投资产业目录 2022 年版 [Encouraged Foreign Investment Sectors Catalogue 2022 Edition], Issued Oct. 26, 2022, Effective Jan. 1, 2023, http://www.gov.cn/zhengce/zhengceku/2022-10/28/content_5722417.htm.

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⁴⁶ Xi Jinping, *Hold High the Great Banner of Socialism with Chinese Characteristics*, p. 23-28. Section 4, “Accelerating the Creation of a New Development Pattern and Pursuing High-Quality Development,” states that the PRC government should encourage efforts “to shore up weaknesses in sectors vital to China’s development.”

⁴⁷ CNA analysis of top-level categories. We did not include the location-specific guidance in the total category count. There were 13 top-level categories and 519 separate items within those categories; 368 items were related to the manufacturing industry.

⁴⁸ US Department of Justice, “Jury convicts Chinese intelligence officer of espionage crimes, attempting to steal trade secrets,” Nov. 5, 2021, <https://www.justice.gov/opa/pr/jury-convicts-chinese-intelligence-officer-espionage-crimes-attempting-steal-trade-secrets>; US Department of Justice, “Chinese government intelligence officer sentenced to 20 years in prison for espionage crimes, attempting to steal trade secrets from Cincinnati company,” Nov. 16, 2022, <https://www.justice.gov/opa/pr/chinese-government-intelligence-officer-sentenced-20-years-prison-espionage-crimes-attempting>;

⁴⁹ US Department of Justice, “Chinese government intelligence officer sentenced to 20 years in prison for espionage crimes, attempting to steal trade secrets from Cincinnati company,” Nov. 16, 2022,

<https://www.justice.gov/opa/pr/chinese-government-intelligence-officer-sentenced-20-years-prison-espionage-crimes-attempting>; US Department of Justice, “Jury convicts Chinese Intelligence officer of espionage crimes, attempting to steal trade secrets,” Nov. 5, 2021, <https://www.justice.gov/opa/pr/jury-convicts-chinese-intelligence-officer-espionage-crimes-attempting-steal-trade-secrets>

⁵⁰ Ibid.

⁵¹ US Department of Justice Attorney’s Office Northern District of California, “South Bay resident charged with smuggling and exporting American aviation technology to Beijing University,” May 26, 2022, accessed Nov. 23, 2022, <https://www.justice.gov/usao-ndca/pr/south-bay-resident-charged-smuggling-and-exporting-american-aviation-technology-beijing>

⁵² Peter Wood and Robert Stewart, *China’s aviation industry: lumbering forward*, China Aerospace Studies Institute, Aug. 2019, [https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Infrastructure/2019-08-02%20Lumbering Forward Aviation Industry.pdf](https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Infrastructure/2019-08-02%20Lumbering%20Forward%20Aviation%20Industry.pdf).

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1/10/2023

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DNL-2022-U-034039-Final2

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