



Written by CNA's China and Indo-Pacific Security Affairs Division, *Intersections* is a news digest describing the interplay between the People's Republic of China's (PRC's) technology acquisition and defense industrial base development efforts, US and partner nation responses, and critical and emerging technology risks and challenges with military implications. This issue covers recent PRC advances in undersea sensing and cable technology, continued PRC development of artificial intelligence (AI) and chip technology with military implications, new PRC export restrictions on critical minerals, and China's efforts to develop a commercial industry for space-based internet services to compete with the current market leader, Starlink.

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## FEATURE: PRC ADVANCES IN SUBSEA SENSING

Maritime domain awareness has been a long-standing area of focus for China. In 2004, then premier Hu Jintao stated that “developing the ocean is a strategic task” and thus China “must increase unified surveying and mapping work.” China’s 14th Five-Year Plan, which includes long-range objectives out to 2035, includes requirements to develop “real-time online monitoring systems and overseas observation [monitoring] stations for the marine environment” in order to “strengthen observation and research on marine ecosystems, ocean currents, and maritime meteorology.”<sup>1</sup> China State Shipbuilding Corporation, a PRC state-owned enterprise, announced plans in 2016 to build a network of undersea sensors in the South China Sea, referring to that system as the “underwater Great Wall.”<sup>2</sup>

Advances in undersea surveillance, including subsea<sup>3</sup> sensors, are creating opportunities for civilian actors to monitor civilian marine traffic, understand the marine environment, and make subsea telecommunications cables more resilient. Yet all of these facets of underwater sensing also have military implications. As one recent report prepared for the US-China Economic and Security Review Commission noted, “Accurate civilian remote sensing data about undersea features would be an important input for the PLAN [People’s Liberation Army (PLA) Navy] to track and target undersea capabilities more accurately.” As a result, the report concluded that such sensing capabilities represent a concern for the US Navy.<sup>4</sup> The US Department of Defense (DOD) also stated in a 2024 report to the US Congress that “the PLA has used lasing, aerobatics [and] acoustic devices...that impinged on the ability of nearby aircraft and vessels to maneuver safely” in China’s exclusive economic zone.<sup>5</sup> The following subsection discusses a recent technological advancement by PRC entities that may enhance China’s ability to gain undersea domain awareness.

### CHINESE SUBSEA CABLE DEVELOPMENTS

Since 1998, Chinese firms have been involved in nearly 100 subsea cable projects.<sup>6</sup> Participants in subsea cable projects from Asia to Africa and Europe have included Huawei, HMN Tech, China Unicom, China Telecom, and China Mobile, as well as many corporations that have contributed to researching and developing this technology—achieving advances that also hold potential benefits for the PLAN.<sup>7</sup> The following story addresses recent advances in subsea cable-laying technology by three PRC entities, at least two of which have previously collaborated with the PLA.

**Three PRC entities successfully test a winch system that can reportedly deploy optic electronic cables at depths of up to 11,000 meters.** On November 19, 2024, *Science and Technology Daily*, the official newspaper of the PRC’s Ministry of Science and Technology, reported that the Haiwei GD11000 optic electronic cable winch system developed by three PRC entities had completed its first deep-sea survey in the South China Sea. This winch system and its accompanying 13,000-meter-long armored cable, which can be used to deploy undersea vehicles and other towed systems, are the first of such systems to have been developed fully in the PRC. According to the report, traditional winch systems cannot operate at all depths because they struggle to support the weight of armored cables. The Haiwei GD11000, however, can reportedly operate with loads of up to 15 tons and at depths of up to 11,000 meters. As noted in the article, the Haiwei GD11000 would be able to operate in the deepest locations in the world and could enable the PRC’s deep-sea exploration and resource exploitation efforts.<sup>8</sup>

The Haiwei GD11000 contributes to the PRC's ability to operate in, and collect information about, the deep sea, which could in turn enhance PLA undersea capabilities. The Haiwei GD11000's ability to lay cables at greater depths could support enhanced information collection about the deepest parts of the ocean, and it could improve the PLA's undersea surveillance capabilities. There is historical precedent for civilian oceanographic research being used in the development of undersea naval capabilities; during the Cold War, for example, the US Navy worked closely with civilian researchers to study the deep-sea environment with the goal of improving US Navy acoustic sensing and antisubmarine warfare capabilities.<sup>9</sup>

Given the potential military implications of the PRC gaining enhanced deep-sea awareness, it is noteworthy that two of the three PRC entities involved in developing the Haiwei GD11000—Dalian Maritime University and Jiangsu Hengtong Huahai Science and Technology Ltd. (also known as "Hengtong Huahai")—have PLA ties.

- **Dalian Maritime University:** According to the Australian Strategic Policy Institute, researchers at the Dalian Maritime University, which specializes in maritime engineering research, have completed projects for the PRC's Central Military Commission, which oversees the PLA, as well as other PRC government organs.<sup>10</sup> Hengtong Huahai's partnership with Dalian Maritime University is thus an example of collaboration between a PRC company and a PLA-affiliated research institution to advance China's undersea domain awareness.<sup>11</sup>
- **Hengtong Huahai:** Also of note, Hengtong Huahai is a partially owned subsidiary of the PRC company Jiangsu Hengtong Optic-Electric, which was put on the US Entity List in 2021 for "acquiring and attempting to acquire" US technology to support PLA military modernization.<sup>12</sup> Hengtong Huahai's involvement is another example of the complex web of ties that exists between PRC corporate entities with known PLA ties and those engaged in cutting-edge undersea technology development.<sup>13</sup>

Both of these examples show the extent to which Beijing is relying on its military-civil fusion strategy to pursue breakthroughs in undersea domain awareness that could have military implications.

## ONGOING PRC EFFORTS REGARDING CHIPS AND AI

PRC actors are deploying economic tools and tactics to continue advancing in two areas that Beijing views as strategically and militarily critical: integrated circuits and AI.

Chinese Communist Party (CCP) Chairman Xi Jinping has emphasized that China needs to make rapid progress in "key core technologies," including semiconductors and AI.<sup>14</sup> In a 2021 speech, Xi called for an "all-out effort" to develop various scientific areas including "high-end chips" and to "target [the development of] artificial intelligence" and related technologies, given that China's "development and national security are at stake." In pursuit of Xi's vision, PRC civilian and military researchers are leveraging both foreign technologies, such as large language models (LLMs), and China's own domestic resources, such as large-scale government financing.<sup>15</sup>

**PRC researchers leverage US firm's AI model for military applications.** PRC researchers are leveraging at least one open-source LLM developed by a leading US technology firm for military purposes. Llama is a publicly available LLM developed by Meta that can handle human dialogue and question answering. According to a Reuters [report](#), a team of six Chinese researchers, including two affiliated with the PLA's

Academy of Military Science, used an early version of Llama as a base to develop their own custom LLM called "ChatBIT."<sup>16</sup> Per the report, the researchers have claimed, without providing specific performance criteria, that ChatBIT nearly matches the performance of the latest version of the well-known LLM ChatGPT for "military field" question-answering tasks. They have stated that ChatBIT is currently being applied to "intelligence analysis" but may be applied to strategic planning, simulations, and command decision-making in the future.

In addition, the Reuters report noted other instances in which PRC entities with PLA ties have made use of Llama. For example, per the report, two researchers with the PLA-affiliated Aviation Industry Corporation of China have claimed to have used a Llama version for "the training of airborne electronic warfare interference strategies." Although Meta publishes terms of use that prohibit Llama from being used for military purposes, the model is publicly accessible, so it is unclear to what extent Meta is able to enforce those restrictions. In the Reuters report, the company notes it is taking measures to prevent misuse. However, the broader point—according to William Hannas of Georgetown University's Center for Security and Emerging Technology—is that collaboration on AI development between leading PRC and US scientists remains too extensive for PRC scientists to be excluded from access to many AI developments.<sup>17</sup>

PLA researchers' use of Llama exemplifies the ways in which China is leveraging the outputs of ongoing international research collaborations that are freely available for any country to use. For example, as noted in the Reuters report, PLA-affiliated researchers have downloaded software frameworks created by US technology firms and researchers to support PLA innovations in critical technologies such as AI. China may be doing so in ways that are legal (or difficult to enforce if illegal), yet the fact that the PLA continues to gain from these collaborations presents a challenge to the US and other countries with open economies that seek to foster open innovation while not enabling the military capabilities of a competitor.

**Huawei and China's Semiconductor Manufacturing International Corporation continue efforts to produce advanced AI chips despite a low yield rate.** In November 2024, Reuters [reported](#) that China's Huawei, in partnership with China's leading chip manufacturer Semiconductor Manufacturing International Corporation (SMIC), planned to move ahead with producing a new generation of AI chips despite being denied access to the most cutting-edge chipmaking equipment as a result of US export restrictions.<sup>18</sup> According to the report, SMIC is proceeding with manufacturing Huawei's newest chip design, the Ascend 910C, using less-advanced equipment that gives the chip a "yield rate" of only around 20 percent, meaning that only one in five 910C chips that comes off SMIC's assembly line is free of defects.

The report noted that for a given chip design to be commercially viable, the yield rate must be at least 70 percent. Because the production of both the Ascend 910C and the older generation 910B are well below the 70 percent yield rate, SMIC has struggled to produce sufficient advanced chip volume to fulfill orders from PRC firms and has had to defer shipments to companies such as Bytedance, the parent company of TikTok. As a result, the report stated that Huawei and SMIC are prioritizing "strategic government and corporate orders." Although the report did not specify which government customers might have placed orders, Huawei has previously collaborated with PLA and PRC state [security services](#)<sup>19</sup> and is on DOD's [list](#) of PRC military companies.<sup>20</sup>

Despite SMIC currently not being able to manufacture the 910C profitably, Huawei and SMIC have continued to pour resources into seeking a commercially viable breakthrough. One factor influencing these investments may be the massive PRC government subsidies both firms receive. For example, according to a *South China Morning Post* [report](#), Huawei received 7.3 billion yuan (roughly \$1 billion USD) in 2023, and

SMIC received 2.6 billion yuan.<sup>21</sup> The main source for these subsidies has been the China Integrated Circuit Industry Investment Fund (also known as the “China IC Fund”), a major PRC government-backed investment vehicle that plays a central role in Xi’s stated objective for China to achieve self-sufficiency in semiconductor manufacturing.

Generous PRC state investment support for strategic industries, particularly industries deemed critical to national defense (e.g., semiconductors and AI), is one of the main economic tactics Beijing uses to gain market dominance over critical technologies. According to an [analysis](#) by Merics, a German think tank, Beijing views becoming self-sufficient in the entire semiconductor supply chain as a strategic imperative given US-China competition, and Huawei and SMIC are receiving continued state funding in their role as “national champion” companies working toward that objective.<sup>22</sup>

## PRC CONTROL OVER CRITICAL MINERALS

In December 2024, the US Commerce Department’s Bureau of Industry and Security (BIS) announced the latest in a series of increasingly stringent [restrictions](#) on the export of semiconductor technology to China. According to a BIS press release, the new restrictions ban the export of 24 additional types of chip manufacturing equipment and 3 types of software tools used for chip design, and they introduce new controls on certain high-performance memory chips.<sup>23</sup> In addition, BIS added 136 PRC [entities](#) to the Entity List.<sup>24</sup> According to BIS, these more robust restrictions are designed to [close loopholes](#) and shore up the chip export controls first introduced in October 2022, with the ultimate goal of denying the PRC access to high-end computing that could have military applications.<sup>25</sup>

*Intersections* previously [covered](#) the intent and details of US semiconductor export controls. However, the latest round of US restrictions is noteworthy because of China’s willingness to retaliate by imposing export restrictions of its own in industries in which it has a competitive advantage. The following article addresses what actions China is taking and considers potential effects on the US defense industry.

### **PRC retaliates against newly updated US chip export controls by banning certain dual-use minerals.**

On December 3, one day after BIS announced its new chip export controls, China’s Commerce Ministry (MOFCOM) stated it would “prohibit the export to the US of dual-use items that include gallium, germanium, antimony” and various “superhard materials” while also tightening controls on graphite.<sup>26</sup>

All of the minerals targeted by MOFCOM for export restrictions have broad applications not limited to particular US military systems but instead span large swaths of the entire US defense industrial base. The following are just some of the uses of the minerals subject to Beijing’s most recent export restrictions:

- Gallium is increasingly used to produce [microelectronics](#) for electronic warfare, aviation, and space applications, among other areas.<sup>27</sup>
- Germanium has a variety of [military uses](#), including infrared sensors, night-vision devices, and satellite imagery sensors.<sup>28</sup>
- Antimony [is used](#) as a hardening agent for bullets, as a fire retardant for military clothing, in the production of explosives and nuclear weapons, and in many other military applications.<sup>29</sup>
- Graphite has numerous [military applications](#), including bombs, artillery, and gun barrels.<sup>30</sup>

What all these minerals have in common (besides their broad use across the US defense industrial base) is PRC control over production: China provides roughly half the US supply of gallium and germanium,<sup>31</sup> 60 percent of US antimony,<sup>32</sup> and 42 percent of US graphite.<sup>33</sup>

The PRC's market dominance over this versatile list of minerals, combined with Beijing's increasing willingness to impose broad export controls, thus poses a significant challenge to the US defense industrial base in US attempts to reduce its reliance on the PRC.

## CHINA'S COMMERCIAL SPACE GOALS

Space and counterspace capabilities are critical elements of China's military modernization objectives and its efforts to increase the commercial footprint of global initiatives such as the Digital Silk Road. As the recently released US DOD's *China Military Power Report* notes, "Space technologies can serve a civilian and military purpose," and "the PRC has a growing commercial space sector that supports government objectives, including remote sensing, launch, and communication services."<sup>34</sup>

Many of China's new systems are the result of China's [military-civilian fusion](#) efforts and are set to become critical parts of China's global economic presence. For example, China has predicted that "Beidou products and services will be worth \$156 billion by 2025 and [could] be exported to more than 100 million users in 120 countries."<sup>35</sup> Beidou is China's satellite navigation system, which reached initial operating capability in 2018.<sup>36</sup> The PLA uses Beidou for "high-accuracy" positioning, navigation, and timing services to enable force movements and precision-guided munitions delivery.<sup>37</sup> Although Beidou is an example of PRC state- and military-led technological development potentially yielding commercial benefits,<sup>38</sup> the reverse pathway is also possible: PRC commercial space industry developments could ultimately yield military benefits, as has taken place in the US with the Starlink satellite program<sup>39</sup> The following article discusses recent developments in China's commercial space industry.

**PRC state-owned and private investors announce plans for commercial satellite deployment.** China has recently undertaken a series of commercial space and low Earth orbit (LEO) satellite network projects in hopes of catching up to Starlink, the global market leader in space-based internet services. Currently, Elon Musk's [Starlink](#), in combination with launch company [SpaceX](#), leads the market for global internet via LEO satellites<sup>40</sup> China's innovation-driven development strategy calls for "indigenous innovation, and increasing the scale and scope of domestically produced satellite communications networks will be an important measure of China's success in that effort."<sup>41</sup> CCP Chairman Xi has called on both state-sponsored and private firms to pursue innovation in "strategic emerging industries" in which space networks are a part, and in December 2023, Xi stated in a speech at the CCP's Central Economic Work Conference in Beijing that China "must not fall behind on the new track" of these industries, including commercial space projects.<sup>42</sup>

In his speech, Xi also noted that "entrepreneurial investment and equity investment" are key to this technological innovation. Investors in China appear to have heard the call, and a range of state-owned and private firms are entering the commercial space sector in hopes of competing with SpaceX's Starlink network. One such company is state-owned China Satellite Network Group, which was founded in 2021<sup>43</sup> and reportedly has more than USD \$1.4 billion in funds.<sup>44</sup> This group launched an initial deployment of satellites in December and has proposed to launch 13,000 LEO satellites by 2034.

Separately, Shanghai Spacecom Satellite Technology (SSST) is a firm that has raised more than USD \$943 million and is backed by the Shanghai municipal government.<sup>45</sup> SSST proposes to launch a separate satellite

constellation known as “Thousand Sails” (*Qianfan* in Chinese) that is intended to include 600 satellites by 2025 and 15,000 satellites by 2030.<sup>46</sup> The *Financial Times* has also [reported](#) that SSST, which outside China also goes by the name SpaceSail, has reached an agreement with Brazil to develop high-speed internet services for the country and to compete with Starlink.<sup>47</sup> As noted by the US DOD, “The expansion of non-state-owned PRC launch vehicle and satellite operation companies” highlights both military-civil fusion efforts and China’s goals to “enhance R&D and spur technological innovation.”<sup>48</sup>

## NOTES

<sup>1</sup> PRC National Development and Reform Commission, *14th Five-Year Plan for National Economic and Social Development of the People’s Republic of China and Outline of the Vision for 2035* [中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要], Mar. 13, 2021, [http://www.gov.cn/xinwen/2021-03/13/content\\_5592681.htm](http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm).

<sup>2</sup> Catherine Wong, “‘Underwater Great Wall’: Chinese Firm Proposes Building Network of Submarine Detectors to Boost Nation’s Defence,” *South China Morning Post*, May 19, 2016, <https://www.scmp.com/news/china/diplomacy-defence/article/1947212/underwater-great-wall-chinese-firm-proposes-building>.

<sup>3</sup> Throughout this issue, we use the terms *subsea*, *submarine*, and *undersea* interchangeably.

<sup>4</sup> Tate Nurkin, Christian Le Miere, Chris Eusebi, Stephen Rodriguez, Hassan Almaala, and Andrew Gonzales, *China’s Remote Sensing*, Dec. 2024, <https://www.uscc.gov/research/chinas-remote-sensing>.

<sup>5</sup> US Department of Defense, *Military and Security Developments Involving the People’s Republic of China 2024: Annual Report to Congress*, Dec. 2024, p. 18, <https://media.defense.gov/2024/Dec/18/2003615520/-1/-1/0/MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA-2024.PDF>.

<sup>6</sup> April Herlevi, “China’s Strategic Space in the Digital Undersea,” Mapping China’s Strategic Space, National Bureau of Asian Research, Mar. 14, 2024, <https://strategicspace.nbr.org/chinas-strategic-space-in-the-digital-undersea/>; Australian Strategic Policy Institute (ASPI), “Mapping China’s Tech Giants,” 2021, <https://chinatechmap.aspi.org.au>.

<sup>7</sup> Herlevi, “China’s Strategic Space in the Digital Undersea”, ASPI, “Mapping China’s Tech Giants.”

<sup>8</sup> Zhang Yun (张蕴), “Our Country’s First All Sea Depth Optoelectronic Cable Winch System Completes First Deep-Sea Survey Mission [我国首套全海深光电缆绞车系统完成首次深海调查任务],” *Science and Technology Daily* [科技日报], Nov. 19, 2024, [https://www.stdaily.com/web/gdxw/2024-11/19/content\\_260553.html](https://www.stdaily.com/web/gdxw/2024-11/19/content_260553.html).

<sup>9</sup> See: Naomi Oreskes, “A Context of Motivation: US Navy Oceanographic Research and the Discovery of Sea-Floor Hydrothermal Vents,” *Social Studies of Science* 33, no. 5 (2003): 697–742, <https://www.jstor.org/stable/pdf/3183066.pdf>; “History of *Alvin*,” WHOI, <https://www.whoi.edu/what-we-do/explore/underwater-vehicles/hov-alvin/history-of-alvin/>.

<sup>10</sup> ASPI, “Dalian Maritime University,” China Defence Universities Tracker, May 13, 2021, <https://unitracker.aspi.org.au/universities/dalian-maritime-university/>.

<sup>11</sup> In addition to hosting Dalian Maritime University, the city of Dalian, China, is also home to Dalian Naval Academy—the PLA Navy’s oldest academy established in 1949—and other PLA Navy facilities including a major naval shipyard.

<sup>12</sup> Jiangsu Hengtong Optic Electronic Ltd. (江苏亨通光电股份有限公司), *Announcement from Jiangsu Hengtong Optic Electronic Ltd. Regarding Purchasing a Minority Stake of Jiangsu Hengtong Huahai Science and Technology Ltd.* [江苏亨通光电股份有限公司关于收购江苏亨通华海科技股份有限公司少数股权的公告], Shanghai Stock Exchange [上海证券交易所]

易所], Nov. 29, 2024, [https://www.sse.com.cn/assortment/stock/list/info/company/index.shtml?COMPANY\\_CODE=600487&tabActive=1](https://www.sse.com.cn/assortment/stock/list/info/company/index.shtml?COMPANY_CODE=600487&tabActive=1).

<sup>13</sup> *Military and Security Developments Involving the People's Republic of China 2023: Annual Report to Congress*, US Department of Defense, Oct. 19, 2023, <https://www.defense.gov/News/Releases/Release/Article/3561549/dod-releases-2023-report-on-military-and-security-developments-involving-the-pe/>.

<sup>14</sup> Xi was using the phrase “key core technologies” at least as early as 2018. See, for example: Xi Jinping (习近平), “Xi Jinping Delivers Speech at the 19th General Assembly of the Chinese Academy of Sciences and the 14th General Assembly of the Chinese Academy of Engineering [习近平在中国科学院第十九次院士大会、中国工程院第十四次院士大会],” *People's Daily*, May 29, 2018, [https://www.gov.cn/xinwen/2018-05/28/content\\_5294268.htm](https://www.gov.cn/xinwen/2018-05/28/content_5294268.htm).

<sup>15</sup> Xi Jinping (习近平), “Speech at the 20th General Assembly of the China Academy of Sciences, 15th General Assembly of the China Academy of Engineering, and the 10th National Congress of the China Association for Science and Technology [在中国科学院第二十次院士大会、中国工程院第十五次院士大会、中国科协第十次全国代表大会上的讲话 (2021年5月28日)],” *People's Daily*, May 29, 2021, <http://jhsjk.people.cn/article/32116652>.

<sup>16</sup> James Pomfret and Jessie Pang, “Exclusive: Chinese Researchers Develop AI Model for Military Use on Back of Meta’s Llama,” Reuters, Nov. 1, 2024, <https://www.reuters.com/technology/artificial-intelligence/chinese-researchers-develop-ai-model-military-use-back-metas-llama-2024-11-01/>.

<sup>17</sup> “Exclusive: Chinese Researchers Develop AI Model for Military Use on Back of Meta’s Llama.”

<sup>18</sup> Fanny Potkin, “Exclusive: Huawei Aims to Mass-Produce Newest AI Chip in Early 2025, Despite US Curbs,” Reuters, Nov. 21, 2024, <https://www.reuters.com/technology/artificial-intelligence/huawei-aims-mass-produce-newest-ai-chip-early-2025-despite-us-curbs-2024-11-21/>.

<sup>19</sup> See, for example: Eva Dou, “Huawei Documents Show Chinese Tech Giant’s Involvement in Surveillance Programs,” *Washington Post*, Dec. 14, 2021, <https://www.washingtonpost.com/world/2021/12/14/huawei-surveillance-china/>.

<sup>20</sup> “Entities Identified as Chinese Military Companies Operating in the United States in Accordance with Section 1260H of the William M. (‘Mac’) Thornberry National Defense Authorization Act for Fiscal Year 2021 (Public Law 116-283),” US Department of Defense, Jan. 31, 2024, <https://media.defense.gov/2024/Jan/31/2003384819/-1/-1/0/1260H-LIST.PDF>.

<sup>21</sup> Che Pan, “Tech War: China Pumps Up State Subsidies for Chip Industry to Counter US Sanctions,” *South China Morning Post*, Sept. 25, 2024, <https://www.scmp.com/tech/tech-war/article/3274599/tech-war-china-pumps-state-subsidies-chip-industry-counter-us-sanctions>.

<sup>22</sup> Antonia Hmaidi, “Huawei Is Quietly Dominating China’s Semiconductor Supply Chain,” Mercator Institute for China Studies, Apr. 9, 2024, <https://merics.org/en/report/huawei-quietly-dominating-chinas-semiconductor-supply-chain>.

<sup>23</sup> US Department of Commerce Bureau of Industry and Security, “Foreign-Produced Direct Product Rule Additions, and Refinements to Controls for Advanced Computing and Semiconductor Manufacturing Items,” Federal Register, Dec. 5, 2024, <https://www.federalregister.gov/documents/2024/12/05/2024-28270/foreign-produced-direct-product-rule-additions-and-refinements-to-controls-for-advanced-computing>.

<sup>24</sup> US Department of Commerce Bureau of Industry and Security, “Additions and Modifications to the Entity List; Removals from Validated End-User (VEU) Program,” Federal Register, Dec. 5, 2024, <https://www.federalregister.gov/documents/2024/12/05/2024-28267/additions-and-modifications-to-the-entity-list-removals-from-the-validated-end-user-veu-program>.

<sup>25</sup> “Commerce Strengthens Export Controls to Restrict China’s Capability to Produce Advanced Semiconductors for Military Applications,” US Department of Commerce Bureau of Industry and Security, Dec. 2, 2024,



[https://www.bis.gov/sites/default/files/press-release-uploads/2024-12/FINAL%20DOC%20Nat%20Sec%20Action%20RIs%20Dec%20%2024\\_0.pdf](https://www.bis.gov/sites/default/files/press-release-uploads/2024-12/FINAL%20DOC%20Nat%20Sec%20Action%20RIs%20Dec%20%2024_0.pdf).

<sup>26</sup> “MOFCOM Spokesperson Answers Questions on Strengthening Export Controls on Relevant Dual-Use Items to the US [商务部新闻发言人就加强相关两用物项对美出口管制应询答记者问],” PRC Ministry of Commerce, Dec. 3, 2024, [https://www.mofcom.gov.cn/xwfb/xwfyrrth/art/2024/art\\_1fb6c837ed174fc69db96a97471eed0b.html](https://www.mofcom.gov.cn/xwfb/xwfyrrth/art/2024/art_1fb6c837ed174fc69db96a97471eed0b.html).

<sup>27</sup> Mathew P. Funaiolo, Brian Hart, and Aidan Powers-Riggs, *Mineral Monopoly: China’s Control Over Gallium Is a National Security Threat*, Center for Strategic and International Studies, July 18, 2023, <https://features.csis.org/hiddenreach/china-critical-mineral-gallium/#:~:text=Now%2C%20the%20development%20of%20a,solar%20cells%20and%20electric%20vehicles>.

<sup>28</sup> Donald Fink and Julia Culver-Hopper, *Germanium Requirements for National Defense*, Institute for Defense Analyses, July 1991, <https://apps.dtic.mil/sti/pdfs/ADA240992.pdf>.

<sup>29</sup> Brian Daigle and Samantha DeCarlo, *Antimony: A Critical Mineral You’ve Probably Never Heard Of*, US International Trade Commission, Oct. 2021, [https://www.usitc.gov/publications/332/executive\\_briefings/ebot\\_a\\_critical\\_material\\_probably\\_never\\_heard\\_of.pdf](https://www.usitc.gov/publications/332/executive_briefings/ebot_a_critical_material_probably_never_heard_of.pdf).

<sup>30</sup> “Understanding Graphite as a Material for Military Components,” MWI Carbon & Graphite Solutions, June 25, 2024, <https://mwi-inc.com/blog-post/understanding-graphite-as-a-material-for-military-components/>.

<sup>31</sup> Rishi Iyengar and Christina Lu, “Biden Tees Up Trump with a Final China Chip Battle,” *Foreign Policy*, Dec. 5, 2024, <https://foreignpolicy.com/2024/12/05/us-china-trade-semiconductor-chips-gallium-germanium-export-control-ban/#:~:text=With%20gallium%20and%20germanium%2C%20for,60%20percent%20of%20U.S.%20imports>.

<sup>32</sup> “Biden Tees Up Trump with a Final China Chip Battle.”

<sup>33</sup> “Biden Tees Up Trump with a Final China Chip Battle.”

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