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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) 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 features the emergence of DeepSeek, a large language model (LLM) developed by a PRC start-up, and its security and military implications for US-China competition. Other stories in this issue include recent PRC domestic policy changes to promote innovation, US ally and partner approaches to semiconductor export policies, PRC company advances in lidar technology, and recent updates to China's mineral export controls.

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FEATURE: DEEPSEEK RIVALS COMPETITORS

When DeepSeek, a PRC artificial intelligence (AI) start-up founded in July 2023, announced the launch of a new AI chatbot in January 2025, the news sent shockwaves through the AI developer and user communities and among corporate and government observers around the world.[1] The DeepSeek chatbot is notable for its cost-effectiveness: it supposedly can achieve similar performance metrics as other LLMs that use much higher (and therefore more expensive) computational resources.[2] The chatbot's creation suggests that China has the ability to create an advanced LLM domestically, even though US export controls on chip technology have limited China's access to the computing power previously believed to be required for cutting-edge LLM development.[3] The following articles explore how the creation of the DeepSeek chatbot may influence US-China AI competition, as well as potential military implications for both China and the US.

DeepSeek illustrates the bottom-up, decentralized nature of China's AI ecosystem. China's AI innovation ecosystem is a combination of centralized planning directives and decentralized execution and implementation (for more, check out CNA's *China AI and Autonomy Report*). In 2017, the PRC government released its *New Generation Artificial Intelligence Plan*—an example of how China's leadership provides top-down guidance.[4] Yet in general, China's AI ecosystem is large and diverse, with thousands of small firms attempting to reach the status of such firms as Google and Meta in the US or Baidu, Alibaba, and Tencent in the PRC. Some of these small Chinese AI firms may be finding success because they are responding to PRC state-led efforts to develop China's AI ecosystem. These state-led efforts emphasize pursuing alternative paths to generalized AI that, in contrast to the current efforts of large western firms, do not center around the development of resource-intensive, large-scale LLMs, as discussed in a recent Center for Security and Emerging Technology (CSET) report on Chinese critiques of LLMs.[5]

Liang Wenfeng, DeepSeek's founder and also the head of DeepSeek's financial backer (the private equity firm High-Flyer Capital Management), has said that DeepSeek's R1 model has achieved major advances in both efficiency and cost.[6] According to Caixin, a Beijing-based media group, DeepSeek uses fewer Nvidia graphics processing units (GPUs) than are required by US firms such as OpenAI. The Caixin article stated that DeepSeek "consumed less than 3 million GPU hours, compared with over 30 million hours by Meta's Llama," an LLM we discussed in the previous *Intersections* issue.[7] According to *Forbes Australia*, the market value of DeepSeek's R1 model may now exceed $1 billion.[8]

Although PRC sources claim that DeepSeek's chatbot represents a major breakthrough, sources outside China are more skeptical. According to a Reuters report, the US Commerce Department is investigating whether DeepSeek used export-restricted chips to train the AI model used in its chatbot.[9] Per the report, some evidence suggests that DeepSeek may have acquired certain high-performance chips in 2023, when the export of those chip types to China was still legal, but some additional chips may have also been illegally smuggled to the company. Although DeepSeek's apparent LLM breakthrough may be genuine in many respects, the Commerce Department investigation highlights that in many instances, China's progress on AI and LLMs may still be reliant on overseas technology.

DeepSeek and similar LLMs under development in China could support People's Liberation Army (PLA) decision-making. Despite having been available to the public only since January 2025, DeepSeek has already attracted considerable attention from the US military and the PLA—with the former expressing concerns about how DeepSeek could boost the PLA's capabilities and threaten US national security, and the latter expressing optimism about the opportunities it represents for China's military modernization.

Within the US military, concern about DeepSeek's use by US personnel is such that the US Navy has already banned both sailors and civilian employees from using the model, citing "security and ethical concerns."[10] Further discussions are ongoing across the US government, Congress, and US state governments regarding potentially imposing broader restrictions on DeepSeek's use.[11]

The rapid growth in DeepSeek's adoption poses several distinct risks to US national security, as well as to the US' relative position in the US-China balance of military capabilities:

- According to an Associated Press report, researchers at Feroot, a Canadian cybersecurity company, discovered code buried deep within DeepSeek's chatbot that links to computer infrastructure owned by the PRC state-owned telecom company China Mobile.[12] Of note, China Mobile is on the US Department of Defense's (DOD's) list of Chinese military companies.[13] These connections raise the possibility that information entered into the chatbot could wind up on China Mobile's servers and ultimately in the possession of the PRC government or PLA.
- DeepSeek is heavily censored to avoid giving responses at odds with the Chinese Communist Party's (CCP's) official positions on topics deemed off-limits by the CCP, including the status of Taiwan, events in Xinjiang and Tibet, and China's political system.[14] Widespread use of the chatbot outside China could therefore potentially shape foreign views of these questions in a direction favorable to Beijing.
- Various PLA analysts are enthusiastic about DeepSeek's potential military applications. Analysts have cited DeepSeek's low compute cost,[15] its ability to assist with creating wargaming scenarios, its potential ability to detect cyber threats,[16] and its potential for integration with uncrewed and autonomous vehicles[17] as potential advantages to the PLA if it adopts the system.

The last point represents a potentially game-changing application of LLMs in the military: autonomous vehicles. Recent research by PRC academics has focused on the potential for LLM-equipped uncrewed aerial vehicles (UAVs) to understand and execute commands in natural language by human operators in an operational context. For example, a swarm of drones could receive a command from a human pilot (e.g., to attack a target) and then autonomously coordinate among themselves to accomplish the objective.[18] Although it is unclear to what extent DeepSeek is optimal for such applications, the model's high performance and relatively minimal demand for computing power have already generated a wave of speculation, both inside and outside China, regarding its potential military value. If DeepSeek can contribute to China's development of autonomous UAV activities, the PLA could gain a significant operational advantage over the US.

PRC POLICY DEVELOPMENTS

The PRC announces new restrictions on the release of military-related content online. In late January, the Cyberspace Administration of China, alongside multiple other PRC government institutions, issued new guidance on the dissemination of military information online, titled "Measures for the Management of the Dissemination of Online Military Information." The document states that the measures are intended to protect national security and that military-related content ought to support "the correct political direction" and information security, as well as serving the "construction of the military and national defense."[19] According to an analysis by the Jamestown Foundation, this guidance is meant to address multiple issues, including limiting the domestic spread of potentially derogatory information about the military.[20]

Another potential aim of the measures, however, could be to further restrict the amount of information about China's military that is publicly available and therefore vulnerable to open-source collection. As noted in the Jamestown Foundation analysis, in 2023, the US Defense Intelligence Agency stated that it seeks to use open-source intelligence as a "first-resort" source of information for decision-makers.[21] By making that first-resort source of information less plentiful, the new PRC military content restrictions could make it more difficult for the US military to understand and make well-informed assessments about the PLA.

Xi Jinping signs reforms meant to enhance innovation in military equipment related to scientific research. In February, Xi, in his position as chairman of the CCP's Central Military Commission, signed and released a newly revised set of regulations on military equipment scientific research. The regulations, which went into effect on March 1, are intended to support China's ability to conduct military-related scientific research and to develop military equipment by enhancing innovation, quality, and cost control.[22] According to a spokesperson from China's Ministry of National Defense, the new regulations have five key characteristics:

1. Make the "generation of warfighting ability" the primary standard for designing the system of military equipment scientific research.
2. Provide the institutions conducting military equipment scientific research with modernized management requirements.
3. Optimize the methods for classifying and approving different types of research projects in order to provide various flexible methods for managing research projects.
4. Specify requirements and concrete measures for quality control, cost control, inspections and reviews, and results-based management.
5. Refine industry supervision and oversight measures.[23]

If successful, these reforms could enhance the ability of the PLA to develop and field innovative military equipment and systems.

SEMICONDUCTOR EXPORT CONTROL UPDATES

The Dutch government's policy of nondisclosure of certain types of dual-use exports may result in sales to China being understated. According to *Nikkei Asia* (based on Reuters reporting), "The Dutch government excludes billions of euros of sales by technology company ASML to China from disclosures on sensitive goods exports."[24] Whether this is true comes down to the interpretation of one word. The European Union considers *extreme* ultraviolet (EUV) lithography as dual-use and sensitive, so those items are on its restricted list.[25] However, the Dutch Foreign Ministry has stated that these restrictions do not extend to *deep* ultraviolet (DUV) lithography—a technology that is one generation behind EUV equipment but still advanced.[26]

Following the issuance of US semiconductor export controls in October 2023 (explained in Issue 1 and Issue 2), the Netherlands joined a trilateral agreement with the US and Japan to restrict certain types of semiconductor manufacturing equipment (as discussed in Issue 3). This past fall, the Minister for Foreign Trade for the Netherlands announced that controls on DUV equipment would now be included in the restrictions. However, the Dutch government stated that "this is not an export ban" and that export license

applications would be reviewed on a case-by-case basis.[27]

The Dutch government's differentiation of DUV versus EUV exports to China—both in terms of which technologies Dutch authorities choose to place under a formal "export ban" and which types of sales they publicly disclose—highlights the regulatory, legal, and political complexities of the US and its allies attempting to enforce a unified set of export restrictions on advanced semiconductor technology. US and ally nation chip manufacturers and chipmaking-equipment makers sometimes have incentives to argue that their particular technology is not sufficiently cutting edge or game changing (for national security or defense applications) to be worth banning, and many have lobbied for exemptions from or looser interpretations of export control rules.[28]

For their part, PRC chipmakers with close ties to the Party-state, backed by the equivalent of billions of US dollars in subsidies,[29] have made large purchases of foreign chips and chipmaking equipment with performance specifications just below the threshold set by export controls.[30] In this way, Beijing has used the size of its domestic market, combined with state-directed capital, to incentivize foreign chipmakers and equipment makers to continue selling to China.

PRC ADVANCES IN LIDAR TECHNOLOGY

China's Hesai, the world's largest maker of lidar sensors, promotes widespread deployment of lidar in both civilian and military applications. In December 2024, the Foundation for Defense of Democracies (FDD), a US-based think tank, released a report on PRC objectives for and advances in lidar technology.[31] *Lidar* stands for "light detection and ranging," and it uses the timing of laser pulses to create detailed three-dimensional maps of the surrounding environment.[32] First developed by the US military in the 1960s, lidar is increasingly being used for autonomous navigation in vehicles, and PRC companies are integrating the technology into China's growing electric vehicles sector. Lidar also has military uses, including terrain mapping, missile guidance, and obstacle avoidance for helicopters.[33]

Both the United States and the PRC have recognized the value of lidar in multiple warfighting domains. For example, in the maritime domain, "The US military has explored using the technology to identify and determine the depth of littoral sea mines," according to a Congressional Research Service (CRS) report.[34] Meanwhile, the PRC is investing heavily in the military applications of laser technologies generally and of lidar specifically. A 2024 article in *PLA Daily*, the PLA's official newspaper, notes that recent scientific advances in extremely short-duration laser pulse technology will bolster lidar's abilities in distance measurement, which will in turn "improve the accuracy of target tracking, missile guidance, terrain following, and other [military] tasks."[35]

In the race to develop and integrate lidar into military applications, the PRC's rapid commercial development of the technology is a major advantage. The PRC's Hesai Group is the "world's largest maker of lidar sensors for autonomous driving," according to a recent Reuters report.[36] In November 2024, Hesai announced that in 2025, it would cut the price of its main product—a lidar system for autonomous driving—in half.[37] One factor behind Hesai's ability to cut prices may be strong demand by PRC electric vehicle manufacturers, which use lidar in sensors. The Reuters report notes that Hesai supplies a dozen automakers in China and is also looking to expand overseas. However, lidar's development in China is not driven solely by market demand—the PRC government is also using an array of economic tools to build China's international market position in the technology.

According to the CRS report,[38] China's lidar industry has benefitted from a range of PRC state support efforts and policies, including the following:

- Government subsidies and procurement contracts
- Policies that encourage foreign investment in China's lidar sector
- PRC efforts to promote the adoption of PRC-developed lidar performance and safety standards in international organizations
- Requirements for foreign lidar companies to partner with PRC firms to transfer intellectual property

PRC lidar companies have also purchased technology from overseas firms. For example, Hesai has a partnership with the German firm Bosch, a major automotive parts supplier (of note, Bosch holds key lidar patents).[39] In 2024, Hesai also incorporated the United States under the name "American Lidar."[40]

Even if the focus of most PRC lidar technology firms is primarily commercial, PRC civilian advances in lidar have implications for PRC military capabilities, potentially giving the PRC advantages over the US—both because of the PRC's military-civil fusion strategy and because lidar is inherently a dual-use technology. According to the CRS report, Hesai "makes equipment used in autonomous warfighting vehicles" and has ties to the state-owned China Electronics Technology Group Corporation (CETC).[41] CETC is a major supplier of electronics to the PLA and is on the US Department of Commerce's Entity List and the DOD's list of PRC military companies.[42]

Although Hesai's potential to support the PLA's incorporation of lidar technology is concerning from the perspective of US national security, the prospect of PRC lidar technology being used in the United States may be even more concerning. The FDD report argues that the widespread use of lidar systems from PRC companies in the US would pose a range of security risks, including vulnerability to cyberattacks and exfiltration of US citizen data to the PRC government.[43]

MORE CRITICAL MINERAL EXPORT CONTROLS

The PRC Ministry of Commerce and the PRC Customs Administration add more items to export control list. On February 4, *S&T Daily*, an official PRC newspaper that covers science, technology, and innovation and is overseen by the PRC Ministry of Science and Technology, announced that five additional minerals would be added to China's export controls: tungsten, tellurium, bismuth, molybdenum, and indium. Key applications of these minerals, many of which are military or dual-use, include the following:

- Tungsten is used in artillery shells and armor plating.[44]
- Tellurium is a byproduct of copper refining and has been used in solar cells and to produce other metals used in thermoelectric devices.[45]
- Bismuth is used for a wide variety of pharmaceutical and metallurgical applications.[46]
- Molybdenum is typically used as an alloy for iron and steel, as well as in chemical applications.[47]
- Indium-related items are often used for electrical conductivity, such as materials needed for semiconductors and liquid crystal displays.[48]

These recent additions add to a growing list of critical minerals (see Table 1) that the PRC now restricts from

export or requires an export license for. According to one policy analysis, although international exports of previously restricted minerals such as gallium and germanium have resumed in general, in 2024, China did not "export any gallium or germanium to the United States or the Netherlands…suggesting that the PRC is retaliating against coordinated semiconductor manufacturing controls."[49]

Table 1. PRC export controls on critical minerals

Item	Action	Date	Estimated PRC Share of Global Supply (%)
Gallium	Initial controls	July 2023	98
Germanium	Initial controls	July 2023	60
Graphite-related products	Initial controls	October 2023	77
Gallium	Outright ban	December 2024	98
Germanium	Outright ban	December 2024	60
Antimony	Outright ban	December 2024	48
Tungsten	Initial controls	February 4, 2025	80
Tellurium	Initial controls	February 4, 2025	67
Bismuth	Initial controls	February 4, 2025	80
Molybdenum	Initial controls	February 4, 2025	40–45
Indium-related items	Initial controls	February 4, 2025	70

Sources: US Geological Survey, *Mineral Commodity Summaries: Tellurium*, Jan. 2024, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024.pdf; Ashitha Shivaprasad, Amy Lv, and Lewis Jackson, "What Are the Five Critical Metal Exports Restricted by China?" Reuters, Feb. 4, 2025, https://www.reuters.com/markets/commodities/what-are-five-new-critical-metal-exports-restricted-by-china-2025-02-04/.
Note: *Intersections* issues 5, 6, and 12 discuss previous export controls.

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