DEFENSE, EMERGING TECHNOLOGY, AND STRATEGY PROGRAM

Emerging Tech & American Isolationism

Consequences for AI, Drone, and Space Launch Technologies

Jake Steckler
Robert Mayville

HARVARD Kennedy School
BELFER CENTER

50 YEARS
OF RESEARCH, POLICY, AND LEADERSHIP

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The Defense, Emerging Technology, and Strategy (DETS) program has a dual mission to

1. advance policy-relevant knowledge and strategy on the most important challenges at the intersection of security and emerging technology; and
2. prepare future leaders for public service in relevant arenas.

The DETS program focuses on defense policy issues, public sector strategy execution, and new technologies that have emerged as pivotal to the future of international security. Through its programming, the DETS program seeks to train a new generation of technology-savvy policy and strategy leaders within the Kennedy School.

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Russia Ukraine War: Over 800 FPV drones from the city volunteers are seen in central Lviv, western Ukraine, Friday, May 10, 2024. Lviv volunteers have handed over nearly 7 300 drones to the Ukrainian army over the year in the frame of project “Birds of Victory”. (AP Photo/Mykola Tys)

Introduction

President Donald Trump's return to the White House has brought sweeping changes to American foreign policy that have fundamentally altered the status quo in international relations. By wielding tariffs as a broad negotiating tool against allies and adversaries alike, the Trump Administration has forced longstanding trade partners to reevaluate their economic reliance on the U.S. As the U.S. pressures its allies to contribute more to NATO and, in a significant policy shift, pay for past and future American military aid to Ukraine, partner nations are also pursuing greater defense autonomy. Meanwhile, the U.S. has severely reduced its foreign aid and diplomatic initiatives, including the total shutdown of USAID and widespread layoffs across the State Department.

This whirlwind of changes has led many of America's closest partners to consider turning elsewhere for economic and military stability. The European Union (EU) is moving to decrease its dependence on U.S. military equipment as it seeks to build up its own defense industry.[1] Japan and South Korea are seeking a trilateral free trade agreement with China to hedge against the growing trade war with the United States.[2] Members of the Five Eyes alliance, comprised of the U.S., United Kingdom, Canada, Australia, and New Zealand, are reportedly considering scaling back the intelligence they share with the U.S. because of growing levels of distrust.[3]

These developments are occurring at a time of rapid change in the very nature of national defense, as emerging technologies advance at a dizzying pace. The U.S. is racing against China to develop and deploy Artificial Intelligence (AI) capabilities and wielding an array of policy tools like export controls in an attempt to maintain its vulnerable lead. Autonomous systems like air, sea, and land-based drones are ubiquitous on the battlefield in Ukraine, the largest war in Europe since World War II. And nations all over the world are exploring space as the final economic and military frontier.

1 Lorne Cook, "The EU Wants to Break Its Security Dependency on the US and Buy More European Weapons," AP News, March 19, 2025, https://apnews.com/article/eu-defense-us-ukraine-industry-ammunition-weapons-ea03077814f9113b548d7281f32a11b5.

2 Jessica Sier, "Japan Eyes Pact with China, South Korea as Trade War Hedge," Australian Financial Review, April 23, 2025, https://www.afr.com/world/asia/japan-eyes-pact-with-china-south-korea-as-trade-war-hedge-20250415-p5lru5.

3 Dan De Luce et al., "As Trump Pivots to Russia, Allies Weigh Sharing Less Intel with U.S.," NBC News, March 6, 2025, https://www.nbcnews.com/politics/national-security/trump-pivots-russia-allies-weigh-sharing-less-intel-us-rcna194420.

A common thread across these emerging technologies is that they require a level of industrial capacity and scale that the U.S. has not prioritized for decades. Establishing and maintaining a technological edge is not just about funding breakthrough R&D; it hinges on producing advanced systems at volumes that unlock experience curves and network effects. It also requires striking a delicate balance between protecting domestic industry and partnering with nations whose industrial and technology capabilities complement America's own.

It is still unclear how self-sufficient the Trump administration intends the U.S. to be in onshoring the production of advanced technology. For example, a White House press release boasted of Nvidia's plans to "manufacture its AI supercomputers entirely in the U.S.,"[4] proudly declaring it "the Trump Effect in action." Yet the U.S. excluded Taiwanese semiconductors from its new tariffs, perhaps an acknowledgment that no U.S. facility (including TSMC's in Arizona) can yet match Taiwan's most advanced chips.[5] One thing that is clear is that the Administration aims to sway partners with sticks, not carrots. President Trump has called on Congress to end the CHIPS and Science Act, the bipartisan bill passed in 2022 to subsidize domestic and foreign investment into America's techno-industrial base, and has suggested that tariffs of up to 100% will instead force companies like TSMC to manufacture in the U.S.[6]

Given the decades of global supply chain specialization that have reshaped its economy, it is far from clear whether the United States can now repatriate every stage of advanced technology production—and what complementary strengths from allies it would sacrifice by trying. Accordingly, maintaining and extending America's technological edge is certain to be impacted by the strengths of its partnerships, at a time when many of those partnerships are on precarious grounds.

To better understand the relationship between America's technological edge and its international partnerships, this paper seeks to do the following.

4 https://www.whitehouse.gov/articles/2025/04/trump-effect-nvidia-leads-american-made-chips-boom/

5 https://www.nytimes.com/2025/04/03/business/trump-tariffs-taiwan-chips.html

6 "Trump Wants to Kill $52.7 Billion Semiconductor Chips Subsidy Law | Reuters," accessed May 5, 2025, https://www.reuters.com/technology/trump-wants-kill-527-billion-semiconductor-chips-subsidy-law-2025-03-05/.

1. **Analyze the importance of three critical emerging technologies to U.S. national security**
    a. AI chips
    b. Drones
    c. Space Launch Technology

2. **Discuss the key international players for these technologies, the strengths of the U.S. position in the broader ecosystem, and the need for international coordination**

Finally, we will conclude with the **following recommendations** for how the U.S. can leverage the strengths of its partners to ensure it maintains a technological and industrial edge in its competition with China and other potential adversaries, across each emerging technology.

AI Chips

- Formalize and activate a Silicon Seven alliance of AI powers
- Prioritize talent circulation among partner countries
- Appoint a Dedicated U.S. Special Representative for Artificial Intelligence

Drones

- Establish a partnership with Ukrainian drone industry
- Build an international coalition for free trade of drone tech between allies
- Achieve allied consensus on restricting imports of Chinese made drones
- Use economic policies to incentivize cheap drone production in the U.S.

Space Launch Technology

- Promote U.S. market competition for reusable rockets
- Expand international space partnerships via the Artemis Accords
- Protect key rocket technology via a diffusion framework

Analysis

I. AI Chips

AI has the potential to reshape the global balance of power

Both the United States and China have explicitly identified artificial intelligence (AI) as the emerging technology most critical to national strength and global influence. In 2019, President Donald Trump emphasized that "continued American leadership in Artificial Intelligence is of paramount importance to maintaining the economic and national security of the United States."[7] Similarly, PRC President Xi Jinping has described AI as "the leading goose in the formation" of technologies driving an ongoing scientific and industrial revolution.[8]

Despite this consensus on AI's strategic importance, the immediate geopolitical impact of current AI technologies, particularly generative AI models like large language models (LLMs), remains uncertain. Many researchers in both Western countries9 and China10 have expressed skepticism about the long-term potential of LLMs, viewing them as a possible dead end in the search for artificial general intelligence (AGI). Nevertheless, the advancements in generative AI have demonstrated that scaling computational resources unlocks capabilities.

As a result, AI is set to reshape global power through two levels of impact in both the military and economic domains. On the military side, AI enhances high-level command and control by speeding up decisions and improving battlefield intelligence, while also transforming frontline capabilities like

7 The White House. "Accelerating America's Leadership in Artificial Intelligence." Trump White House Archives, February 11, 2019. https://trumpwhitehouse.archives.gov/articles/accelerating-americas-leadership-in-artificial-intelligence/.

8 "Empowering High-Quality Development with Artificial Intelligence". Red Flag Manuscript, April 13, 2024. http://www.qstheory.cn/dukan/hqwg/2024-04/13/c_1130108914.htm

9 Ben Turner. "Current AI Models a 'Dead End' for Human-Level Intelligence, Scientists Agree." Live Science, March 27, 2025. https://www.livescience.com/technology/artificial-intelligence/current-ai-models-a-dead-end-for-human-level-intelligence-expert-survey-claims.

10 William, Hannas, Huey-Meei Chang, Maximilian Riesenhuber, and Daniel H. Chou. Chinese Critiques of Large Language Models: Finding the Path to General Artificial Intelligence. Issue brief. Washington, DC: Center for Security and Emerging Technology, Georgetown University, January 2025. https://cset.georgetown.edu/wp-content/uploads/CSET-Chinese-Critiques-of-Large-Language-Models-Finding-the-Path-to-General-Artificial-Intelligence.pdf.

autonomous weapons and electronic warfare. Economically, AI is both automating knowledge work and accelerating innovation and research at the high end, while revolutionizing industrial production through smart factories. Collectively, these shifts will confer lasting strategic advantages on the nations that harness them most effectively. For a fuller breakdown of these four areas of AI impact, see Appendix 1.

The current bottleneck on AI development is compute...

All of these economic and military applications will require exponential growth in AI compute to be realized. While continuous improvements in algorithmic efficiency[11] can squeeze more performance out of AI chips,[12] analysts broadly agree that frontier AI models will require orders-of-magnitude increases in compute, both at the edge and in datacenters. Industry leaders predict that the global market for AI chips will grow to 400 billion USD by 2030, constituting the single largest vertical of the semiconductor industry.[13]

While there remain other critical inputs to the development of AI capabilities (notably talent, particularly high-level researchers that can produce breakthroughs in AI model architecture), the current bottleneck is compute. Even tech giants like Microsoft acknowledge they cannot plunge unlimited resources into AI datacenters,[14] and leading Chinese labs like DeepSeek cite compute scarcity as their single biggest obstacle.[15] In short, among AI's three primary inputs (data, compute, algorithms), compute is presently the most significant differentiator in the international race, and coincidentally, the easiest to scale up rapidly.

… but a lead in AI chips doesn't guarantee U.S. dominance of compute

11 Danny Hernandez and Tom B. Brown. "Measuring the Algorithmic Efficiency of Neural Networks." arXiv preprint arXiv:2005.04305, May 8, 2020. https://arxiv.org/abs/2005.04305.

12 Throughout this paper, we will use "AI chips" as shorthand to refer to graphics processing units (GPUs), field-programmable gate arrays (FPGAs), and application-specific integrated circuits (ASICs) specialized for AI training and inference).

13 Toby Sterling. "ASML outlook bullish through 2030 due to AI boom." Reuters, November 14, 2024. https://www.reuters.com/technology/asml-says-its-revenue-grow-44-bln-60-bln-euros-by-2030-2024-11-14/.

14 Victor Tangermann. "Microsoft Backing Out of Expensive New Data Centers After Its CEO Expressed Doubt About AI Value." Futurism, February 24, 2025. https://futurism.com/microsoft-ceo-hesitation-ai-expensive-data-centers.

15 Gregory C. Allen. "DeepSeek, Huawei, Export Controls, and the Future of the U.S.-China AI Race." Center for Strategic and International Studies, March 7, 2025. https://www.csis.org/analysis/deepseek-huawei-export-controls-and-future-us-china-ai-race.

Advanced manufacturing processes provide the most efficient path to AI chip performance, but they aren't the only path. The PRC, although facing U.S. restrictions from purchasing the latest and greatest AI chips, can compensate through scale. Consider Huawei, China's AI champion, which is attempting to vertically integrate the AI stack from chip design and software frameworks to semiconductor manufacturing equipment. Its Ascend 910C chips deliver only one-third the performance of Nvidia's top GPUs, but Huawei offsets this by packing far more of them into a single system, achieving greater overall compute at roughly 2.5 times the energy cost.[16] So long as electricity costs do not become a limiting factor, this sort of quantity over quality approach can work, revealing how nations willing to pour in power and industrial capacity can stay competitive even a generation behind the leading edge.

How much does the current U.S. lead in AI compute matter?

Some analysts argue that the current lead in AI compute could lock in long-term supremacy. Former Google CEO Eric Schmidt predicts that a jump to superintelligence within ten years will hand the first mover "an asymmetric, powerful monopoly for decades to come" because the system will recursively improve itself.[17]

This assumption that a first-mover advantage, enabled by today's lead in AI compute, will prove enduring, is shaky. As leading AI executive Dario Amodei notes, "The problem with this is that there are real physical and practical limits, for example around building hardware or conducting biological experiments. […] Intelligence may be very powerful, but it isn't magic fairy dust."[18] To illustrate this, consider a military example. An AI command-and-control suite that has ten times the compute of a rival's will not generate a ten-fold battlefield edge. Aircraft still fly at finite speeds, munitions still reload at human-governed rates, and logistics still depend on roads, fuel, and weather. The system's intelligence is throttled by the slowest physical link in the kill chain.

16 Dylan Patel. "Huawei AI CloudMatrix 384 – China's Answer to Nvidia GB200 NVL72." SemiAnalysis, April 16, 2025. https://semianalysis.com/2025/04/16/huawei-ai-cloudmatrix-384-chinas-answer-to-nvidia-gb200-nvl72/.

17 Amanpour & Company. "Are We Ready for the AI Revolution? Fmr. Google CEO Eric Schmidt Says No." PBS Video, December 13, 2024. https://www.pbs.org/video/are-we-ready-for-the-ai-revolution-fmr-google-ceo-eric-schmidt-says-no-vlwkyd/.

18 Dario Amodei. "Machines of Loving Grace." Oct 2024. https://www.darioamodei.com/essay/machines-of-loving-grace.

Once the incremental gains from adding more GPUs start to diminish, sustained competitive advantage will depend increasingly on the ability to mass-produce and deploy AI technology across multiple dimensions. This broader capability requires knitting together complementary strengths from global partners, leveraging U.S. leadership in chip design and AI software, East Asian scale in manufacturing and semiconductor production, European equipment and materials, and globally distributed talent pools. In other words, long-term AI leadership isn't simply about who currently leads in raw compute; it's about who can reliably integrate and scale diverse technological capacities, making international partnerships indispensable.

American AI competitiveness depends on global partnerships

To fully understand the United States' competitive position, it's crucial to examine not just our ability to scale AI chip fabrication, but also our capacity to deploy AI at scale across various critical applications.

The United States leads globally in AI chip design and related R&D. Major U.S. firms (Nvidia, AMD, Google's TPU group, etc.) dominate GPU and accelerator design and capture well over 90% of AI chip design market share.[19] U.S. firms also dominate many other key inputs, including software used to design the chips.[20]

U.S. capacity for fabricating AI chips, on the other hand, has lagged far behind Taiwan and South Korea, but is growing. The top domestic chip foundry is Intel, which is ramping up its "18A" (1.8 nm) process to produce chips designed for AI workloads. Intel has broken ground on new projects in Arizona, Ohio, New Mexico, and Oregon that serve as the foundation of its hopes to regain the technological crown it has long since ceded to competitors in both design and manufacturing. As of April 2025, however, the most advanced chips manufactured in the U.S. are Nvidia's latest Blackwell GPUs, made at TSMC's fab in Phoenix.21 That fab, along with plants belonging to Intel, Samsung, and others, is among the beneficiaries of the CHIPS Act, which thus far has committed $32.5 billion in grants and $5.85 billion in loans to 32 companies. As a result, the U.S. may capture

19 TechInsights. "Data-Center AI Chip Market – Q1 2024 Update." May 9, 2025. https://www.techinsights.com/blog/data-center-ai-chip-market-q1-2024-update.

20 Bob Smith. "The State of the EDA Industry in 2024." Semiconductor Engineering, November 21, 2024. https://semiengineering.com/the-state-of-the-eda-industry-in-2024/.

21 NVIDIA Newsroom. "NVIDIA to Manufacture American-Made AI Supercomputers in US for First Time." NVIDIA Blog, April 14, 2025. https://blogs.nvidia.com/blog/nvidia-manufacture-american-made-ai-supercomputers-us/.

as much as 20% of the market for fabricating AI chips by 2030.[22] While this would represent a significant leap in self-sufficiency and end-to-end capability, the U.S. would still be significantly reliant on allied capacity.

Are "secure" supply chains for AI chips possible or necessary?

In areas where supply chain security is paramount, particularly AI chips for military use, the U.S. has expressed willingness to pay substantially more, as it is doing with the $3 billion in CHIPS Act funding for a Secure Enclave program that would create a dedicated Intel facility to fabricate highly sensitive chips exclusively for the U.S. military and intelligence agencies.[23] Supporters of Secure Enclave argue that, if tomorrow's command-and-control systems hinge on AI chips, outsourcing their fabrication would be reckless; critics counter that allocating nearly 10 percent of CHIPS funding to this narrow program diverts resources from projects with broader payoff.[24]

Beyond establishing secure supply chains for a handful of defense-critical chips, attempting to re-shore the entire AI semiconductor ecosystem makes little economic sense. The commercial AI chip market is orders of magnitude larger than military demand. One forecast sees defense-specific spending on AI chips increasing from around $10 billion today to $20 billion in 2030.[25] Military purchases of AI chips will account for only a tiny fraction of total demand, a disparity that is likely illustrative of a bigger phenomenon: any major shift in the balance of global power driven by AI will likely be a result of commercial uses, not military.[26] In practice, even a "Secure Enclave" fab will depend on global inputs: only the Dutch firm ASML makes the lithography tools necessary for Intel's 18A process,[27] only the German firm Zeiss can make the optics for ASML's

22 Pete Singer. "U.S. Aims for 20 Percent of World's Leading-Edge Semiconductor Production by 2030." Semiconductor Digest, March 5, 2024. https://www.semiconductor-digest.com/u-s-aims-for-20-of-worlds-leading-edge-semiconductor-production-by-2030/.

23 Christine Mui. "A $3 Billion Secret Program Undermining Biden's Tech Policy." Politico, May 24, 2024. https://www.politico.com/news/2024/05/23/3-billion-secret-program-undermining-bidens-tech-policy-00158757.

24 Austin Ahlman. "Intel's $3.5 Billion Boondoggle." The American Prospect, March 8, 2024. https://prospect.org/economy/2024-03-08-intels-3-5-billion-boondoggle-chips-act/.

25 Grand View Research. "Artificial Intelligence in Military Market Size, Share & Trends Analysis Report, 2025 – 2030." 2025. https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-military-market-report.

26 Michael Horowitz, Elsa B. Kania, Gregory C. Allen, and Paul Scharre. "Strategic Competition in an Era of Artificial Intelligence." Center for a New American Security, July 25, 2018. https://www.cnas.org/publications/reports/strategic-competition-in-an-era-of-artificial-intelligence.

27 Stephen Nellis, "Intel says new ASML Machines are in Production, With Positive Results." Reuters, February 25, 2025. https://www.reuters.com/technology/intel-says-first-two-new-asml-machines-are-production-with-positive-results-2025-02-24/.

tools,[28] and so on. Rebuilding those capabilities at home would be prohibitively expensive and take years, squandering one of the United States' primary advantages over China, which is being forced to "Sinicize" its inputs to escape U.S. export control pressure.

If China can do it, why not the United States?

The PRC's aggressive strategy of trying to capture the entire AI stack, led by firms like Huawei, may cause some American policymakers to ponder why we cannot do the same. Huawei is reportedly building multiple fabs in Shenzhen that co-locate chip design, equipment production, and packaging under one roof.[29] Such an ambitious play would almost certainly not be attempted by most countries' combined industries, let alone a single company. Part of this can be attributable to the fact that Huawei has certain advantages that no other global firm can replicate, namely that it can recruit the best STEM graduates from the largest talent pool in the world. China graduates 3.5 million STEM graduates a year, roughly four times the United States.[30]

Yet despite these efforts, Huawei and other PRC firms' AI chips still rely heavily on imports. Huawei's flagship AI chips continue to use high-performance memory chips from South Korea's SK Hynix and are manufactured at least in part by Taiwan's TSMC.[31] In essence, even a country like China, which possesses the world's most formidable capacity for domestic resource and talent mobilization, and facing the additional motivation of U.S. export controls and sanctions, finds complete technological self-sufficiency to be an extraordinary challenge.

The U.S., unlike China, is unlikely to find itself cut off from global supply chains. It benefits from a network of allies who complement each other in terms of design expertise, fabrication capacity, and tools and materials. President Biden's administration explicitly called for a "Fab 4" semiconductor partnership of the

28 ZEISS Semiconductor Manufacturing Technology. "High-NA EUV Lithography: ZEISS and ASML Reach Key Milestone Toward Next-Generation Chip Manufacturing." Press release, January 25, 2024. https://www.zeiss.com/semiconductor-manufacturing-technology/news-and-events/smt-press-releases/2024/high-na-euv-lithography.html.

29 Antonia Hmaidi. "Huawei Is Quietly Dominating China's Semiconductor Supply Chain." Mercator Institute for China Studies (MERICS) and UC Institute on Global Conflict and Cooperation, April 2024. https://merics.org/en/report/huawei-quietly-dominating-chinas-semiconductor-supply-chain.

30 Brendan Oliss, Cole McFaul, and Jaret C. Riddick. "The Global Distribution of STEM Graduates: Which Countries Lead the Way?" Center for Security and Emerging Technology, November 27, 2023. https://cset.georgetown.edu/article/the-global-distribution-of-stem-graduates-which-countries-lead-the-way/.

31 Dylan Patel. "Huawei AI CloudMatrix 384 – China's Answer to Nvidia GB200 NVL72." SemiAnalysis, April 16, 2025. https://semianalysis.com/2025/04/16/huawei-ai-cloudmatrix-384-chinas-answer-to-nvidia-gb200-nvl72/.

U.S., Japan, South Korea, and Taiwan, but U.S. allies were already beginning to push back on restrictive U.S. policy during the Biden's tenure[32] and there is little to indicate this initiative will be carried forward by an increasingly unilateralist Trump administration.

The U.S. also faces workforce challenges that cannot be addressed in the short term. U.S. fabs chronically lack trained technicians as many STEM graduates choose higher-paying or more flexible tech careers instead. Over half of U.S. master's grads in engineering are foreign-born, yet strict H-1B caps and backlogs force many to leave or sit idle. One industry analysis predicts roughly 58% of the 115,000 CHIPS Act jobs may remain unfilled by 2030 under current rules.33 TSMC's Arizona plant illustrates this gap: it sent hundreds of Taiwanese experts to get the fab running (nearly half of its 2,200 initial hires came from Taiwan) because U.S. recruits simply weren't available.[34] Importing more engineers to fill these gaps, long advocated by many think tanks, does not seem likely in the near term, since the U.S. does not seem likely to liberalize skilled immigration anytime soon, and a country like Taiwan is not eager to spare them since semiconductors account for roughly 60% of Taiwan's exports.[35]

Weaponized interdependence goes both ways

In his first speech to partners at the AI Action Summit in Paris, Vice President J.D. Vance emphasized that the U.S. is the dominant global leader in AI, and bluntly warned European partners that if they want access to U.S. advances, they'll need to align their regulatory frameworks more closely with the interests of American tech firms.[36] Vance is right that the U.S. holds substantial leverage and could restrict the flow of AI benefits to Europe, but he should also recognize that partners can also disrupt key aspects of America's AI ecosystem in return.

32 Nisarg Jani. "The 'Fab 4' Allies Are Pushing Back on US Export Controls on China." The Diplomat, October 29, 2024. https://thediplomat.com/2024/10/the-fab-4-allies-are-pushing-back-on-us-export-controls-on-china/.

33 2023 State of the U.S. Semiconductor Industry, Semiconductor Industry Association (2023), https://www.semiconductors.org/wp-content/uploads/2023/08/SIA_State-of-Industry-Report_2023_Final_080323.pdf

34 Jeff Butts. "TSMC Arizona Struggles to Overcome Vast Differences between Taiwanese and US Work Culture." Tom's Hardware, August 8, 2024. https://www.tomshardware.com/tech-industry/semiconductors/tsmc-arizona-struggles-to-overcome-vast-differences-between-taiwanese-and-us-work-culture.

35 "Taiwan's Dominance of the Chip Industry Makes It More Important." The Economist, March 6, 2023. https://www.economist.com/special-report/2023/03/06/taiwans-dominance-of-the-chip-industry-makes-it-more-important.

36 Vance, J.D. "Remarks by the Vice President at the Artificial Intelligence Action Summit in Paris, France." The American Presidency Project, February 11, 2025. https://www.presidency.ucsb.edu/documents/remarks-the-vice-president-the-artificial-intelligence-action-summit-paris-france.

For example, Washington can threaten the Dutch firm ASML with the Foreign Direct Product Rule (FDPR), which allows the U.S. to restrict sales of foreign-made tech that relies on U.S. components, if it were to sell its most advanced lithography machines to China. But since ASML is the sole maker of those tools, the U.S. remains just as reliant on Dutch exports as China. The same logic applies to Japan's photoresist giants (JSR, TOK) and South Korea's DRAM suppliers (Samsung, SK Hynix). Indeed, there is a strategic asymmetry here, as the U.S. stands to lose the most: any breakdown in semiconductor supply chains would disproportionately damage U.S. big tech firms the most, as they are most poised to benefit from AI. America's "Magnificent Seven" (Amazon, Apple, Google, Meta, Microsoft, Nvidia, Tesla), all betting heavily on AI, now make up roughly one-third of the S&P 500, and a chip shortage would wipe hundreds of billions from U.S. market capitalization overnight.

While it is unlikely that the U.S. would push its allies and partners so far that they embrace China as a counterweight, there are already signs of partners seeking to exert more leverage vis-à-vis the U.S. The Dutch parliament has reclaimed licensing authority over some ASML tools, partly to re-assert sovereignty after U.S. pressure.[37] Seoul, meanwhile, has accepted U.S. export rules but insisted on carve-outs so Samsung and SK Hynix can keep their Chinese fabs running. If Washington overplays its hand, Beijing will be ready and waiting, dangling market access and subsidies to woo European equipment firms and Korean memory makers alike. Even a partial tilt (say, looser Korean and Japanese servicing of equipment in China) would erode U.S. power to control critical chokepoints to frontier AI development.

Another way forward

The Biden Administration's last act of AI policy—the Commerce Department's January 2025 AI Diffusion rules that created a tiered system of countries enjoying access to U.S. AI technology, with "Tier 1" allied countries able to freely purchase AI chips—has already been rescinded by the Trump administration. The tiered system, which angered some friendly nations that expected a higher status, provided a valuable lesson for Washington on the importance of using both carrot and stick. Over the past four years, the U.S. wielded export controls against the

37 Toby Sterling. "Dutch Government Retakes Export Control over Two ASML Tools from US." Reuters, September 6, 2024. https://www.reuters.com/technology/dutch-government-retakes-export-control-over-two-asml-tools-us-2024-09-06/.

PRC in a way that negatively affected not only PRC semiconductor firms, but those based in friendly countries as well. However, it also co-financed on-shore fabs with partners in Texas and Arizona, underwrote joint R&D platforms, and demonstrated the logic of ally-shoring: pooling capital, talent, and supply-chain nodes with trusted democracies so that everyone scales faster than China while critical chokepoints stay in friendly hands.

II. Drones

Drones have become one of the most critical technologies on the battlefield

While the history of unpiloted aircraft in war dates as far back as 1849 when Austria launched an attack on Venice with explosive-carrying balloons[38], unmanned aerial vehicles (UAVs), or drones, have transformed warfare in the past two decades. Drones rose to prominence during America's wars in Iraq and Afghanistan, where multi-million-dollar systems like the MQ-9 Reaper patrolled the skies providing coalition forces with Intelligence, Surveillance, and Reconnaissance (ISR) and precision strike capabilities. These conflicts also saw the proliferation of small hand-launched remote UAVs, like the RQ-11 Raven, employed primarily by infantrymen for low-level, short-range reconnaissance and fires observation.

Drone use is proliferating among both state and non-state actors in conflicts all over the world. As of 2021, drone attacks had been waged in 46 conflicts across 26 countries, and that trend has only accelerated since.[39] Terrorist groups Hamas and Hezbollah have recently employed drones to carry out attacks on Israeli observation posts[40], while Israel has used drones in Gaza for constant surveillance and kamikaze attacks, on top of indoor and underground operations.[41] In April 2024, Iran launched one of the largest drone attacks in history, deploying a barrage

38 Ulrike Franke, "Drones in Ukraine and beyond: Everything You Need to Know," ECFR, August 11, 2023, https://ecfr.eu/article/drones-in-ukraine-and-beyond-everything-you-need-to-know/.

39 Joshua Schwartz, John Chin, and Haleigh Bartos, "How Drones Make Civil Wars Worse," Lawfare, March 16, 2025, https://www.lawfaremedia.org/article/how-drones-make-civil-wars-worse.

40 "What Can Be Learned from Hamas and Hezbollah's Use of Drones in This War - The Jerusalem Post," accessed May 7, 2025, https://www.jpost.com/israel-hamas-war/article-806302#google_vignette.

41 "How Israel Is Using Drones in Gaza," *The Economist*, accessed May 7, 2025, https://www.economist.com/the-economist-explains/2023/12/04/how-israel-is-using-drones-in-gaza.

of 170 drones on Israel over the span of five hours.[42] Russia's full-scale invasion of Ukraine, however, has elevated the importance of drone technology on the battlefield to unprecedented heights.

The scale of drone usage in Ukraine far exceeds any previous conflict. One report shows that the U.S. carried out roughly 1,200 drone strikes in the five-year period from 2008 to 2012.[43] In 2018, the U.S. had less than 7,000 military drones in its inventory, across varying sizes, like the aforementioned Reaper and Raven, as well as micro-aerial vehicles like the RQ-16 T-Hawk.[44] In steep contrast, Ukrainian state, private, and volunteer-financed manufacturers—by prioritizing small, cheap, attritable drones in favor of larger ISR platforms that dominate the U.S. arsenal—are producing roughly 200,000 drones per-month, as of January 2025. The nation aims to up that production rate to a staggering 4.5 million unmanned aircraft by year's end.[45] [46] Russia, for its part, has a similar target for 2025: between 3 and 4 million drones.

The exponential growth rate of drone production is commensurate with the disproportionate impact the technology is making on the battlefield. Unmanned vehicles in Ukraine are not limited to the aerial variety. Drones are used for a wide array of tasks across the battlefield, from UAVs conducting reconnaissance, surveillance, and attack via air; to unmanned ground vehicles (UGVs) contributing mine laying, mine clearance, resupply, and casualty evacuation capabilities by ground; as well as unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs) completing a variety of sea-based missions.

As of March 2025, drones cause roughly 70% of all casualties in the Russia-Ukraine War, according to commanders on the ground.[47] A

42 Cate Brown and William Neff, "What to Know about Shahed-136 Drones, Which Iran Used to Attack Israel," The Washington Post, April 16, 2024, https://www.washingtonpost.com/world/2024/04/16/iran-israel-drone-attack-shahed-136/.

43 "Revealed: US and Britain Launched 1,200 Drone Strikes in Recent Wars," TBIJ, accessed April 28, 2025, https://www.thebureauinvestigates.com/stories/2012-12-04/revealed-us-and-britain-launched-1-200-drone-strikes-in-recent-wars.

44 Major Zachary Morris, "U.S. Drones: Smaller, Less Capable Drones for the Near Future," Military Review, June 2018, https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/May-June-2018/US-Drones-Smaller-Less-Capable-Drones-for-the-Near-Future/.

45 Stefan Korshak, "Ukraine Drone Production Tops 2.5 Million a Year," Kyiv Post, February 10, 2025, https://www.kyivpost.com/post/46892.

46 David Axe, "4.5 Million Drones Is A Lot Of Drones. It's Ukraine's Goal For 2025.," Forbes, accessed April 29, 2025, https://www.forbes.com/sites/davidaxe/2025/03/12/45-million-drones-is-a-lot-of-drones-its-ukraines-new-production-target-for-2025/.

47 Marc Santora et al., "A Thousand Snipers in the Sky: The New War in Ukraine," The New York Times, March 3, 2025, sec. World, https://www.nytimes.com/interactive/2025/03/03/world/europe/ukraine-russia-war-drones-deaths.html.

preponderance of these systems are small, first-person-view (FPV) drones, which are UAVs that allow for extreme precision by enabling operators to see from the drone's direct perspective and control its movements as if flying onboard the aircraft.

In June 2025, Ukraine successfully executed an extraordinary drone attack where the Security Service of Ukraine (SBU) covertly smuggled truckloads of FPV drones into Russian territory via shipping containers on the backs of lorries.[48] 117 of these drones successfully launched and destroyed or damaged Russian aircraft that initial reports say accounted for over 30% of Russia's strategic bomber capability. This attack dealt a $7 billion blow to Russia, for a minor fraction of the cost to Ukraine. Such a wildly successful operation underscores the impact of drones on today's battlefield and portends a future where such attacks are increasingly routine.

Scale, above all else, is becoming the deciding factor—and the U.S. can't keep up

FPVs, the most ubiquitous variety of drone on the frontlines of Ukraine, are small and fast to produce, at a cost of roughly $500 to $750 each.[49] The cost effectiveness of these systems has upended the traditional balance of power on the battlefield, where the more sophisticated and expensive firepower historically conferred the advantage. FPV drones, at a minor fraction of the cost, have proven effective at destroying $10 million Abrams tanks, among other advanced, heavily armored equipment.[50]

This trend extends beyond FPVs, with reports in May 2025 of a Ukrainian USV equipped with air-to-air missiles successfully shooting down two Russian SU-30 fighter jets.[51] While the MAGURA V5 USV that shot down the Russian war plane is significantly pricier than FPVs, at an estimated cost of $250,000, its cost pales in comparison to similar air defense capabilities, and is a mere fraction of the $50 million price tag of each SU-30 that it destroyed.

48 Christopher Miller, Fabrice Deprez, and Max Seddon, "Ukraine Stages Audacious Attack on Airfields Deep in Russian Territory," *The Financial Times*, June 1, 2025, https://www.ft.com/content/16f33b02-b337-49da-802b-18659582f723.

49 Andrew E. Kramer and Tyler Hicks, "Ukraine Pinning War Hopes on Expanded Drone Program," *The New York Times*, April 28, 2025, sec. World, https://www.nytimes.com/2025/04/28/world/europe/ukraine-russia-war-drones.html.

50 Lara Jakes, "Do Tanks Have a Place in 21st-Century Warfare?," *The New York Times*, April 20, 2024, sec. World, https://www.nytimes.com/2024/04/20/world/europe/tanks-ukraine-drones-abrams.html.

51 Kateryna Zakharchenko, "Ukraine Naval Drone Shoots Down Two Russian Warplanes in 24 Hours: First-Ever USV Fighter Jet Kills (Updated)," Kyiv Post, May 4, 2025, https://www.kyivpost.com/post/51994.

Drones are lost and destroyed in Ukraine at a rapid rate, which makes industrial capacity a key determinant in the tides of the war. A great deal of these losses are by design, as many drones serve as kamikaze weapons designed to fly directly into their intended targets and explode on impact. Attrition rates, however, are compounded by quickly evolving counter-drone capabilities. Every action has an equal and opposite reaction; in Ukraine, every drone development is met with an electronic warfare (EW) technology to defeat it. Advances in EW, such as jamming the signal between drone and operator, or spoofing drones' positioning systems, are evolving daily. In June 2024, French Army Chief of Staff Gen. Pierre Schill stated that three-quarters of all drones on the battlefield are lost to electronic warfare.[52] Counter-drone technologies and techniques quickly make yesterday's UAVs obsolete, which spurs further innovation cycles, like the advent of FPV drones tethered to coils of fiber optic cables, giving pilots up to 12 kilometers of range and rendering the drone unjammable.[53]

The U.S. military is now forced to reckon with a future of drone warfare that makes its past approach obsolete. In terms of cost, the U.S. drone industry operates in another stratosphere. Recall the below $1,000 cost per FPV drone in Ukraine, and compare that to America's most widely fielded small, tactical drone, the Raven, which costs roughly $260,000[54] per system. Larger drones, like the Reaper, cost upwards of $30 million.[55] When it comes to small, dual-use drones like those ubiquitous in Ukraine, the U.S. is utterly reliant on China, with Chinese drones controlling a staggering 90% of the U.S. commercial drone market.[56] Chinese made drones comprise over 80% of the global market, rendering U.S. allies in Europe and Israel similarly reliant.

As counter-UAV technologies evolve, U.S. based technologies have faced major challenges on the battlefield in Ukraine, due to their high cost, underwhelming

52 Rudy Ruitenberg, "Small Drones Will Soon Lose Combat Advantage, French Army Chief Says," Defense News, June 19, 2024, https://www.defensenews.com/global/europe/2024/06/19/small-drones-will-soon-lose-combat-advantage-french-army-chief-says/.

53 "Jam-Proof Fiber Optic Drone Testing In Ukraine," accessed April 29, 2025, https://www.forbes.com/sites/davidhambling/2024/08/02/german-jam-proof-fiber-optic-drone-testing-in-ukraine/.

54 "RQ-11B Raven," Air Force, accessed April 29, 2025, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104533/rq-11b-raven/https%3A%2F%2Fwww.af.mil%2FAbout-Us%2FFact-Sheets%2FDisplay%2FArticle%2F104533%2Frq-11b-raven%2F.

55 "Houthi Rebels Have Shot down 7 US Reaper Drones Worth $200 Million in Recent Weeks," AP News, April 24, 2025, https://apnews.com/article/houthis-us-warships-red-sea-e6e97a7131c48640ccf74b1916628234.

56 Matthew Kroenig and Imran Bayoumi, "A Global Strategy to Secure UAS Supply Chains," *Atlantic Council* (blog), June 25, 2024, https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/a-global-strategy-to-secure-uas-supply-chains/.

performance, and inability to handle EW challenges.[57] Even relatively successful systems, like AeroVironment's Switchblade 600 loitering munition drone, which has been fielded in Ukraine, has had limited impacts because of its high cost and lack of scalability, at an estimated $80,000 per aircraft.58 Even beyond the frontlines of Ukraine, U.S. adversaries have proven that American drones are highly susceptible in modern warfare. Houthi rebels have shot down at least 15 Reapers since October 2023, including seven between March and April 2025 alone, totaling an unsustainable loss of over $400 million.[59]

Accordingly, Ukraine has largely looked beyond the U.S. for its drone fleet, with only two viable paths to achieve scale: purchase commercial Chinese drones or build up its own manufacturing base. Early in the war, Ukraine largely relied on off the shelf Chinese drones like the Mavik from powerhouse manufacturer DJI, as well as bulk purchases of Chinese made components to assemble FPV drones in-house. As the war evolved, Ukraine shifted its focus to building up its own manufacturing capacity, both to increase its ability to control and customize all aspects of the technology, and to reduce its reliance on Russia-aligned China, which implemented a ban on sales of key drone and radio components to Ukraine in Fall 2024.[60]

An exploding market of specialist companies in Ukraine have begun to produce critical drone technologies previously only made in China, like thermal imagers, flight controllers, cameras, and video transmitters, some for prices even below Chinese competitors.[61] There are components, namely electronic chips, that Ukraine still often imports from China, but alternatives exist in the U.S. and Japan.[62] China also maintains a monopoly on critical minerals, like those needed to produce neodymium magnets, but widespread availability of these components across civil markets has made them readily available for Ukrainian

57 Heather Somerville and Brett Forrest | Photographs by Clara Mokri for The Wall Street Journal, "How American Drones Failed to Turn the Tide in Ukraine," WSJ, April 10, 2024, https://www.wsj.com/world/how-american-drones-failed-to-turn-the-tide-in-ukraine-b0ebbac3.

58 "FPVs, Tethered Drones Could Become Formal Army Programs in 2025," Defense One, May 14, 2024, https://www.defenseone.com/threats/2024/05/fpvs-tethered-drones-could-become-formal-army-programs-2025/396573/.

59 "Houthi Rebels Have Shot down 7 US Reaper Drones Worth $200 Million in Recent Weeks."

60 "Chinese Radio, Drone Export Restrictions Starting Sept. 1," Kyiv Post, August 29, 2024, https://www.kyivpost.com/post/38142.

61 David Hambling, "Ukraine Is Making FPV Drones Without Chinese Parts And At Lower Cost," Forbes, accessed May 1, 2025, https://www.forbes.com/sites/davidhambling/2025/04/08/ukraine-is-making-fpv-drones-without-chinese-parts-and-at-lower-cost/.

62 Hambling.

manufacturers.[63] Large scale manufacturers are supplemented by bootstrapped efforts to rapidly produce drone components with 3D printers churning out parts at all hours of the day. According to a statement by Ukraine Minister of Defense Rustem Umerov, over 96% of all drones used by Ukraine's military in 2024 were produced domestically.[64]

America's efforts to close the gap have failed to address the need for scale

Recognizing the preeminence of drones on present and future battlefields, the U.S. has taken several steps to catch up. In 2023, the Pentagon announced the Replicator initiative, an effort to challenge China's supremacy in mass producing drones. Two years later, the results of the program, which aimed to field "multiple thousands of all-domain, attritable autonomous systems to warfighters by 2025," remain dubious.[65] While Ukraine and Russia churn out millions of drones per year, Replicator plans to deliver between 2,500 to 3,000 systems in 2025, over half of which are the Switchblade 600, the $80,000 aircraft currently limited in Ukraine by its cost and technical challenges against EW. [66]

Other efforts are underway to proliferate drones across the force. The U.S. Army now plans to equip every combat division with 1,000 drones (roughly 20,000 in total) within the next two years as part of the "Army Transformation Initiative" launched in 2025.[67] Regulations guarding against the purchase of commercial UAS, largely due to cybersecurity concerns, have historically been barrier to large scale drone adoption in the U.S. military. In 2020, the Defense Innovation Unit launched the Blue sUAS (small unmanned aerial systems) initiative to create an approved list of cleared, secure commercial technologies for unit purchase.[68]

63 Alexander Yan, "No China: Ukrainian Manufacturers Are Close to Independent Production of FPV Drones," *Militarnyi* (blog), December 9, 2024, https://militarnyi.com/uk/articles/niyakogo-kytayu-ukrayinski-vyrobnyky-blyzki-do-samostijnogo-vyrobnytstva-fpv-droniv/.

64 Kateryna Bondar, "Ukraine's Future Vision and Current Capabilities for Waging AI-Enabled Autonomous Warfare," March 6, 2025, https://www.csis.org/analysis/ukraines-future-vision-and-current-capabilities-waging-ai-enabled-autonomous-warfare.

65 "Deputy Secretary of Defense Kathleen Hicks Announces Additional Replicator All-Domain Attr," U.S. Department of Defense, accessed May 3, 2025, https://www.defense.gov/News/Releases/Release/Article/3963289/deputy-secretary-of-defense-kathleen-hicks-announces-additional-replicator-all/https%3A%2F%2Fwww.defense.gov%2FNews%2FReleases%2FRelease%2FArticle%2F3963289%2Fdeputy-secretary-of-defense-kathleen-hicks-announces-additional-replicator-all%2F.

66 Noah Robertson, "The Pentagon's 'Replicator' Drone Bonanza Faces an Uncertain Future," Defense News, January 14, 2025, https://www.defensenews.com/pentagon/2025/01/14/the-pentagons-replicator-drone-bonanza-faces-an-uncertain-future/.

67 Michael R. Gordon, "U.S. Army Plans Massive Increase in Its Use of Drones," The Wall Street Journal, April 30, 2025.

68 "Answers to Frequently Asked Questions about Blue UAS.," accessed May 8, 2025, https://www.diu.mil/blue-uas-faq.

Today, there is no shortage of companies seeking to build and deploy drones en masse, including AeroVironment, Anduril, Performance Drone Works, Skydio, Kodiak Robotics, and more. There is significant venture capital and federal funding being poured into innovative drone technologies, like Shield AI's fully autonomous AI-powered drone (at $1 million a piece)[69] or Red Cat Holdings and Sentien Robotics joint-venture which aims to deploy "drone swarms" by the end of 2025.[70] As part of another initiative known as "transforming-in-contact," Army units are taking the lessons of Ukraine by 3D printing parts for small, short range drones. But these strategies still remain small scale, with one unit boasting that it printed over 100 small drones, a far cry from what's seen in Ukraine.[71]

In June 2025, the Trump Administration released an executive order titled "Unleashing American Drone Dominance" which acknowledges the need for American produced drones.[72] The order, which calls for "strengthening the American drone industrial base," however, does little to solve the issues of cost and scale. It calls on agencies to "prioritize the integration of UAS manufactured in the United States over those made abroad," but the only incentives it mentions that aim to spur production are the calls for foreign investment to support the export of US-manufactured civil UAS.

Nations are looking for domestic and international solutions to reduce their reliance on China

Nations all over the world are grappling with how not to be left behind in the race for drone capacity. European nations are looking to cooperate directly with Ukraine to take advantage of its unique manufacturing capabilities. Latvia and the United Kingdom launched a €550 million effort in 2024 to further fund Ukrainian drone production, while the Netherlands invested €400 million for joint development with Ukraine.[73] French Defense Minister Sebastien Lecornu announced in June 2025 a "completely unprecedented partnership where a large French car company…will join forces with a French Defense SME (small

69 Heather Somerville, "American Drone Startup Shield AI Notches Rare Victory in Ukraine," *The Wall Street Journal*, March 11, 2025.

70 "Hives For U.S. Drone Swarms Ready To Deploy This Year," archive.ph, May 16, 2024, https://archive.ph/rlcB3.

71 Mark Pomerleau, "No Money, No Problem: Army Unit Making Its Own Drones," *DefenseScoop* (blog), March 4, 2025, https://defensescoop.com/2025/03/04/army-unit-making-own-drones-3d-printing-101st-airborne-division/.

72 Executive Orders, "Unleashing American Drone Dominance," The White House, June 6, 2025, https://www.whitehouse.gov/presidential-actions/2025/06/unleashing-american-drone-dominance/.

73 "Minding the Drone Gap: Drone Warfare and the EU | European Union Institute for Security Studies," October 11, 2024, https://www.iss.europa.eu/publications/briefs/minding-drone-gap-drone-warfare-and-eu.

to medium-sized enterprise) to equip production lines in Ukraine to be able to produce drones."[74] Lecornu specifically acknowledged the value of working with Ukrainians on the production line, who he says are "better than us at designing drones and especially at developing the strategies that accompany them."

Others, like Taiwan, Japan, and Israel are looking to build up their domestic drone manufacturing capabilities. Manufacturing leaders in Taiwan, a nation that aims to produce 15,000 homemade drones per month by 2028, say they need more international orders to be able to compete with China on cost.[75] Japan has set its sights on creating an alternative to Chinese drones for the Indo-Pacific market, but suffers from a similar weakness to other competitors: inability to mass-produce.[76] Israel, a leader in the development and deployment of medium and large drones, historically has relied on China for its small drones, like the U.S. The Israeli Defense Research and Development Directorate is in the early stages of encouraging the production of homegrown drones to reduce its reliance on China, similar to the U.S. Replicator initiative.[77]

America's changing international standing makes its quest for a drone build-up more challenging

The U.S. has established partnerships in recent years that showed promise with respect to drone production, but the longevity of these partnerships may be under question. America's AUKUS agreement with Australia and the UK, which included provisions for the development of sea-based drones, demonstrated that production in Australia could boost development times and cut costs.[78] Because of Trump's tariffs, which Australian Prime Minister Anthony Albanese said was "not the act of a friend", many within the Australian government and public are pushing the nation to rethink its commitments to AUKUS.[79]

74 Daria Shulzhenko, "France to Produce Drones in Ukraine, Minister Says," The Kyiv Independent, June 7, 2025, https://kyivindependent.com/france-to-produce-drones-in-ukraine-lecornu-announces/.

75 "Taiwan Flogs America Drones 'Not Made in China,'" archive.ph, April 28, 2025, https://archive.ph/ynjtb.

76 "Made-in-Japan Drones to Be Supplied to Indo-Pacific Partners," Nikkei Asia, accessed May 5, 2025, https://asia.nikkei.com/Business/Aerospace-Defense-Industries/Made-in-Japan-drones-to-be-supplied-to-Indo-Pacific-partners2.

77 Adam Haskel, "Israel Shifts Gears: 20,000 Homegrown Drones on the Horizon," JNS.org, August 30, 2024, https://www.jns.org/israel-shifts-gears-20000-homegrown-drones-on-the-horizon/.

78 Patrick Tucker, "Australia Got a New Sub Drone Far Faster than the US Navy Could Have, Company Says," *Defense One*, April 22, 2024, https://www.defenseone.com/technology/2024/04/australia-got-new-sub-drone-far-faster-us-navy-could-have-company-says/395949/.

79 Paul Daley, "With Friends like Trump, Who Needs Aukus? ALP Members Are Demanding an Answer," *The Guardian,* April 4, 2025, sec. Opinion, https://www.theguardian.com/commentisfree/2025/apr/04/with-friends-like-trump-who-needs-aukus-alp-members-are-demanding-an-answer.

America also recently signed a deal with South Korea to build advanced "short take-off and landing" drones, but these aircraft do not address the need for small, attritable systems.[80] Similarly, the Trump Administration launched a new alliance for autonomous systems with India, building on the Biden administration's INDUS-X program.[81] [82] As a new agreement with a nation that has yet to prove a robust drone production capability, it's unclear whether this partnership will net results in the near term.

The NATO Defense Innovation Accelerator for the North Atlantic (DIANA) presents another opportunity for the U.S. to coordinate with allies on drone development. The program has funded drone startups from nations including the Czech Republic and the Netherlands. However, these investments are likely longer-term plays, and it remains uncertain whether or how these startups will achieve mass scale. With U.S. leaders deprioritizing support for NATO, and some even threatening to exit the treaty altogether, the long-term future of DIANA could be uncertain.

Meanwhile, longtime partners of the U.S. in Europe are looking for alternatives to the American defense industry. Turkey, which has emerged in recent years as the world's largest exporter of military drones[83], has gradually expanded its capabilities, while its relationship with the U.S. worsens. The country has built facilities in Kyiv, Ukraine and announced plans for a plant in Morocco.[84] European nations, questioning their reliance on the U.S. as a defense and trade partner, are pushing for increased ties to Turkey's defense industry, which the U.S. has sanctioned since Turkey purchased Russian air defense systems in 2019.[85] A consortium representing the United Kingdom, Germany, Italy and Spain have proposed a deal to purchase Turkish fighter jets in favor of American aircraft,[86]

80 Christine Casimiro, "S. Korea, US Team Up to Build Advanced Drones for Global Export," *The Defense Post* (blog), April 10, 2025, https://thedefensepost.com/2025/04/10/hanwha-general-atomics-drones-export/.

81 Lauren C. Williams, "Drones Are the next Chapter in US-India's Defense Partnership," Defense One, February 24, 2025, https://www.defenseone.com/defense-systems/2025/02/drones-are-next-chapter-us-indias-defense-partnership/403203/.

82 "India-U.S. Defense Acceleration Ecosystem (INDUS-X) | DIU," accessed May 3, 2025, https://www.diu.mil/india-u-s-defense-acceleration-ecosystem-indus-x.

83 Straturka, "From Importer to Innovator: How Turkey Revolutionized Global Drone Warfare," *Straturka* (blog), November 21, 2024, https://www.straturka.com/from-importer-to-innovator-how-turkey-revolutionized-global-drone-warfare/.

84 "Baykar to Establish Drone Manufacturing Facility in Morocco," *Military Africa* (blog), January 30, 2025, https://www.military.africa/2025/01/baykar-to-establish-drone-manufacturing-facility-in-morocco/.

85 "U.S. Disengagement Spurs Turkish-European Defense Cooperation," *Middle East Council on Global Affairs* (blog), accessed May 3, 2025, https://mecouncil.org/blog_posts/u-s-disengagement-spurs-turkish-european-defense-cooperation/.

86 "U.S. Disengagement Spurs Turkish-European Defense Cooperation."

and Italian and Turkish defense manufacturers announced a partnership to jointly produce UAVs.[87] While Turkey has focused on larger drones like the Bayraktar TB2, its manufacturers have proven they can beat similar U.S. technologies on cost and scale through fully in-house manufacturing capabilities.

III. Space Launch Technology

Space is a key scientific, commercial, and defense frontier

While traditionally overshadowed by maritime, aerospace, and cyberspace interests, the world's ventures into outer space are rapidly emerging as a critical domain for national security strategy. Sensing satellites offer the scientific community vital meteorological, astrophysical, and experimental data. Commercial investment in space has expanded the world's access to satellite imagery, over-the-horizon telecommunications, and broadband internet that we all rely on. Furthermore, commercial space mining may soon provide access to valuable minerals and metals essential for cutting-edge technology. Space technology has also unlocked enormous defense and security capabilities, including navigation equipment, worldwide data communications, intelligence gathering, and missile warning systems. Operation Desert Storm was the first major conflict where space technology delivered results to combatants; the United States used satellites to navigate formations, communicate and coordinate globally, and deploy precision-guided bombs that overwhelmed the Iraqi military in a matter of days. Modern satellite technologies, like Starlink and others, enable today's military formations to communicate instantaneously, identify technical threats, and collect unprecedented amounts of data across the globe.

These endeavors are not possible without the right technology to deploy satellites, exploration modules, and other payloads that deliver these capabilities. The United States is the world's current leader in space launch technologies, but competitors like China are quickly closing the gap. Possessing that leadership is an opportunity to exercise scientific, commercial, and defense dominance while maintaining the international order for this emerging and promising frontier.

87 Tom Kington, "Turkish-Italian Venture Adds New Force to Europe's Drone Market," Defense News, March 6, 2025, https://www.defensenews.com/global/europe/2025/03/06/turkish-italian-venture-adds-new-force-to-europes-drone-market/.

Commercial innovation is key to U.S. space leadership, but limited market competition creates risk

The United States has enjoyed primacy in space during the 21st Century, thanks largely to public-private sector innovation and strong collaboration with other technologically advanced space partners. Despite this current space leadership, advancements in dual-use and military space hardware threaten America's leading position as strategic competitors, like China and Russia, invest in their ability to project power from space.

America's space launch successes have increasingly relied on private sector manufacturing, development, and administration since the U.S. founded NASA in 1958. As federally funded laboratories designed the first American rockets, contracting firms manufactured expendable launch vehicles (ELVs) like Titan, Scout, and the Apollo missions' Saturn V rocket exclusively for the United States government. NASA would supervise all launches for these rockets procured through federal contracts.[88]

Over time, initiatives like NASA's reusable space shuttle sought to build efficiencies in launch technology through public-private partnerships. The Reagan administration's Commercial Space Launch Act of 1984 went one step further, permitting licensed commercial firms to independently develop rockets, deploy satellites, and operate launch sites independent of NASA and the Department of Defense.

In 2006, NASA implemented its Commercial Orbital Transportation Services (COTS) Program, strengthening private partnerships. Acting as an advisor and investor, NASA expanded the private space market with investments in firms like Boeing, Blue Origin, and SpaceX.[89] The resulting innovation and competition dramatically reduced the cost per kilogram to deliver payloads into orbit, expanded commercial deployments of space technologies like Starlink and other satellite communications systems, and encouraged competition for space exploration efforts like NASA's Artemis Program. Of note, SpaceX's reusable

88 Tom Kington, "Turkish-Italian Venture Adds New Force to Europe's Drone Market," Defense News, March 6, 2025, https://www.defensenews.com/global/europe/2025/03/06/turkish-italian-venture-adds-new-force-to-europes-drone-market/.

89 "Spotlight on Lessons Learned: Lessons Learned from NASA's Commercial Orbital Transportation Services (COTS) Program" (National Aeronautics and Space Administration, November 21, 2022), https://appel.nasa.gov/2022/11/21/spotlight-on-lessons-learned-lessons-learned-from-nasas-commercial-orbital-transportation-services-cots-program/.

rockets have contributed significantly to these savings; the Falcon Heavy and Falcon 9 rockets can deploy a kilogram of payload for approximately 10% of what it costs via the Space Launch System, an expendable rocket used for the Artemis Program.[90] Additionally, the proliferation of U.S.-commercial services helped end American reliance on the Russian space program, Roscosmos, to launch its astronauts to the International Space Station from 2011 to 2020.[91]

With greater demand for commercial space employment and cheaper deployment costs, the U.S. launched significantly more rockets (108) in 2023 than its competitors, China (67) and Russia (19), and its allies, including India (7) and France (3). America has maintained this lead despite scant competition in the U.S. space launch industry. SpaceX provided 98 of 108 U.S. orbital launches in 2023, primarily to deploy Starlink satellites and other customer payloads.[92] Other established commercial players like United Launch Alliance (ULA) provide orbital launch services with expendable rockets, but their high cost and small market share (less than 3% of U.S. launches in 2023) emphasize the lack of scalable, cost-effective redundancy for the U.S. government and commercial sector. Competitor firms like Blue Origin are developing reusable rockets, but delays have allowed SpaceX to pull ahead as the clear market leader.

The U.S. government's investment in commercial space partners catalyzed powerful innovation that pushed the United States' launch capabilities into global dominance, but limited market competition poses strategic risk. SpaceX's reusable Falcon 9 and Falcon Heavy can deliver orbital and lunar payloads at a fraction of the cost of expendable systems. Nevertheless, SpaceX's outsized market share in the United States means that the government is overly reliant on a single point of failure. In a recent spat between President Trump and SpaceX CEO Elon Musk, the President threatened to cancel many of the U.S. government's contracts with SpaceX for launch technologies and Starlink satellite internet services. In return, Musk threatened to decommission SpaceX's Dragon spacecraft, a crew module used to support the International Space Station. Though Musk ultimately withdrew his threats and walked back some of his comments, the feud underscored the

90 Edgar Zapata, "The State of Play US Space Systems Competitiveness: Prices, Productivity, and Other Measures of Launchers & Spacecraft" (National Aeronautics And Space Administration, October 11, 2017), https://ntrs.nasa.gov/citations/20170012517.

91 Michael O'Connor and Kathleen Curlee, "Shaping the U.S. Space Launch Market" (Center for Security and Emerging Technology, February 2025), https://doi.org/10.51593/20240017, 5.

92 "Recap of All Global Launches for 2023" (SpaceWorks, January 10, 2024), https://www.spaceworks.aero/recap-of-all-global-launches-for-2023/.

potential risks associated with this important relationship and SpaceX's position as a single point of failure.[93]

Though a handful of fledgling reusable rocket firms exist, they remain in the development stages of production, like many of their Chinese counterparts, with goals of testing and recovering their rockets this year. The exception is Blue Origin's New Glenn rocket, which launched in January with an unsuccessful recovery.

The U.S. collaborates heavily with space partners, for now

The United States has leveraged its space launch dominance to bolster its national security capabilities in outer space and to collaborate thoroughly with its allies on shared space interests. In 2019, President Trump created the U.S. Space Force (USSF) as a standalone military branch. The USSF maintains global missile warning satellites, GPS satellites, and other space-based capabilities essential for national security. Like the National Reconnaissance Office, the USSF partners heavily with the private sector to deploy new systems and capabilities into orbit. It also collaborates with allies on capabilities development. The United States primarily benefits from this collaboration by developing its allies' capabilities through combined exercises, data sharing, and synchronizing technical effects to achieve mission objectives. For instance, data sharing and synchronizing with Canada via North American Aerospace Defense Command (NORAD) provides wider missile defense coverage of the continent via their combined satellite capabilities. In April 2025, the USSF's Chief of Space Operations, General Chance Saltzman, announced they will be "capitalizing on partner strengths, improving data and system interoperability, and aligning service-level force development across allied nations" via a pending "International Partnership Strategy."[94] This framework will build resilience and redundancy in space capabilities, galvanize the U.S.-led order, and strengthen industrial capabilities away from China.[95]

93 The Associated Press, "Elon Musk Pulls Back on Threat to Withdraw Dragon Spacecraft," *AP News*, June 5, 2025, sec. Science, https://apnews.com/article/musk-trump-spacex-dragon-capsule-e1fa0607a8e69bc2ad1677f5920b5f56.

94 Emmeline James, "Saltzman Details Space Force's International Partnership Strategy at Space Symposium," *Secretary of the Air Force Public Affairs*, April 10, 2025, https://www.spaceforce.mil/News/Article-Display/Article/4151977/saltzman-details-space-forces-international-partnership-strategy-at-space-sympo/.

95 Nicholas Eftimiades, "Integrating US and Allied Capabilities to Ensure Security in Space," Harnessing Allied Space Capabilities: A Series of Papers Assessing Commercial, Exploration, and Security Space Objectives (Atlantic Council, April 2023), https://www.atlanticcouncil.org/wp-content/uploads/2023/06/Harnessing-Allied-Space-Capabilities_paper-series.pdf.

Other space initiatives in which the U.S. collaborates include NASA's Artemis Program, which is ambitiously pursuing manned lunar missions and will launch equipment for the Canadian Space Agency (CSA), the European Space Agency (ESA), and the Japan Aerospace Exploration Agency (JAXA). NASA's Artemis Accords were built upon the UN Outer Space Treaty to establish international norms, procedures, and collaboration in space for 54 signatories, including allies from the EU, the Middle East, and the Indo-Pacific. The U.S. also joined a bilateral space relationship with India's Space Research Organization (ISRO), which will put the first Indian astronaut on the International Space Station via a SpaceX rocket this June.[96] In another Indo-Pacific partnership, the U.S. and New Zealand used their bilateral Technology Safeguards Agreement to deploy American firm Rocket Lab's Electron rockets from New Zealand's soil.[97]

Despite China and Russia's efforts to inject multipolarity into space collaboration via their own multilateral International Lunar Research Station, the United States remains the undisputed leader in bilateral and multilateral space agreements. The Artemis Accords and the U.S. Space Force's pending International Partnership Strategy demonstrate America's global commitment to civil and military space. Furthermore, existing space relationships are leveraging smaller space programs' resources to complement the United States' leading rocket technology.

For instance, the ESA is a small but capable ally to the United States. Some of the agency's leading initiatives include exploration within the solar system, asteroid impact surveying, and commercial mining. It can deploy satellites autonomously with its commercially sourced Ariane 6 expendable rocket. These onshore capabilities provide valuable, independent launch capabilities, particularly given the cooling U.S.-European relationship may jeopardize the ESA's ability to deploy payloads on SpaceX rockets. Nevertheless, the Ariane 6 expendable rockets are expensive, and ESA's budget is only approximately 30% the size of NASA's and decreasing, down 1.4% in 2025 from last year's budget.[98] Like Russia, the ESA does not anticipate possessing reusable launch capabilities until the 2030s. The ESA is also collaborating with NASA to develop the Orion spacecraft as part of the Artemis

96 Express News Service. "Axiom-4 Launch Delayed Again; New Date June 22, Says Isro." *The Indian Express*, June 18, 2025. https://indianexpress.com/article/technology/science/shubhanshu-shukla-axiom-4-mission-delayed-launch-date-june-22-10073218/.

97 Kenneth Chang, "NASA's CAPSTONE Mission Launches to the Moon," *The New York Times*, June 28, 2022, https://www.nytimes.com/2022/06/28/science/capstone-nasa-launch-moon.html.

98 Jeff Foust, "ESA Budget Dips Slightly in 2025," *SpaceNews*, January 10, 2025, https://spacenews.com/esa-budget-dips-slightly-in-2025/#:~:text=At%20a%20Jan.,billion%20euros%20(%247.91%20billion).

Program, though President Trump's proposed NASA budget would cancel U.S. collaboration on Orion.

Japan is another U.S. partner with specialized space capabilities, including JAXA's leading efforts to remove space debris, which can unlock important technology to protect future satellites, space crews, and reusable launch vehicles.[99] JAXA's commercial partner, MHI, provides Japan with the H3, an expendable heavy-lift rocket with several successful launches to date. Beyond traditional space capabilities, many new ventures are leveraging Japan's robotics technology to innovate in sustainability and space exploration.[100] JAXA's overall budget pales in comparison to even the European Space Agency (approximately $1.05 billion in 2024), but growing budgets for JAXA and other space stakeholders indicate Tokyo's increasing interest in space as a component of strategy. Japan's robust bilateral cooperation in space with the United States underscores this notion.

Canada is perhaps the most consistent U.S. partner on space exploration and security. NORAD exemplifies the benefits of this bilateral partnership, whose defense capabilities secure vital interests for both governments. Despite a modest 2024 budget of $413 million, the CSA has contributed to civil space efforts with the Mobile Servicing System, a key piece of maintenance and assembly equipment on the ISS.[101] The CSA is also developing a lunar rover for the Artemis Program, now under threat of cancellation by the Trump administration. Finally, the CSA plans to send its first astronaut to the moon via the Artemis missions.

The U.S. remains a global space leader, but President Trump's move toward U.S. commerce, government efficiency, and isolationist foreign policy may upset collaborative frameworks like the Artemis Accords, which was in fact first signed under the previous Trump administration. This preference for unilateralist policy shaped the President's proposed 25% budget cuts at NASA, which would reduce or end the United States' collaborative work on programs like the International Space Station and the Artemis program's Lunar Gateway.[102] The administration also

99 Jeff Foust, "Astroscale Finalizes Contract for Japanese Debris Removal Mission," *SpaceNews*, August 21, 2024, https://spacenews.com/astroscale-finalizes-contract-for-japanese-debris-removal-mission/.

100 Kari A. Bingen and Makena Young, "From Earth to Uchū: The Evolution of Japan's Space Security Policy and a Blueprint for Strengthening the U.S.-Japan Space Security Partnership" (Center for Strategic & International Studies, August 2024), 27.

101 "Mobile Servicing System" (National Aeronautics And Space Administration), accessed May 7, 2025, https://www.nasa.gov/international-space-station/mobile-servicing-system/.

102 Jeff Foust, "White House Proposal Would Slash NASA Science Budget and Cancel Major Missions," April 11, 2025, https://spacenews.com/white-house-proposal-would-slash-nasa-science-budget-and-cancel-major-missions/.

proposed cancelling the Space Launch System, a costly, expendable rocket used for the Artemis program's lunar missions. These sweeping changes to the United States' space programs seek to reduce government spending and foster market competition between SpaceX, Rocket Lab, United Launch Alliance, and newer rocket firms.[103]

The Trump administration's foreign policy agenda, however, has distanced the U.S. from several space allies in pursuit of domestic policy goals and onshore development. This approach risks losing would-be partners to China and Russia's space programs like the International Lunar Research Station (ILRS). As states look to leverage existing space powers' capabilities to build their own, China is becoming an increasingly attractive partner for cooperative exploration and research. Cancelling collaborative programs like the Lunar Gateway could exacerbate this challenge.

ILRS membership includes no major U.S. space partners, but it soon may be the only option for lunar exploration and research. NATO ally Turkey has applied for membership with the ILRS, and others could soon follow as the U.S. scales back its own collaborative efforts.[104] One can reasonably expect that America's space partners, like India's ISRO, would consider joining the ILRS to advance their lunar capabilities. China's collaborative ILRS efforts, like their diplomatic efforts, have largely targeted the Global South. Artemis Accords signatories from these regions are also likely candidates to pivot towards China amid this isolationism.

America's adversaries hope to upend its space leadership

China is approaching parity with the United States in space launch technology. Despite the United States' global leadership in the space domain and space launch technology, China's position has grown increasingly competitive. While many U.S. space partners are developing their own reusable rockets, China is the only major player that will challenge U.S. primacy soon.[105] In January 2025, the China National Space Administration conducted high-altitude testing on its Longxing-2

103 Jeff Foust, "White House Budget Proposal Would Phase Out SLS and Orion, Scale Back ISS Operations," *SpaceNews*, May 2, 2025, https://spacenews.com/white-house-budget-proposal-would-phase-out-sls-and-orion-scale-back-iss-operations/.

104 Andrew Jones, "China Wants 50 Countries Involved in Its ILRS Moon Base," *SpaceNews* (blog), July 23, 2024, http://spacenews.com/china-wants-50-countries-involved-in-its-ilrs-moon-base/.

105 Michael O'Connor and Kathleen Curlee, "Shaping the U.S. Space Launch Market" (Center for Security and Emerging Technology, February 2025), https://doi.org/10.51593/20240017, 26.

and other reusable rockets.106 While it continues to develop this technology, China is deploying satellites into orbit using expendable rockets with increasing frequency. Furthermore, China restructured its People's Liberation Army to create an Aerospace Force, indicating its greater strategic emphasis on national security in space.[107]

China's consistent investment in reusable rocket technology presents a noteworthy threat to the United States. Beijing's public investment in several commercial competitors—now testing reusable rockets of various payload capacities—will present economic, diplomatic, and security challenges to U.S. industry dominance. Their bilateral space ties to the Russian Federation could offer a competitive alternative to nations seeking to deploy their own space-based communications, navigation, sensing, and scientific satellites and payloads.

Russia is still a capable space player, though its capabilities are trailing the United States and China at an increasing rate. Roscosmos has plans to develop its own reusable rockets, but research and development delays have already pushed test flights from 2026 to 2030.[108] Finally, Putin's regime continues to orient much of its space launch resources toward deploying space defense technology, like its anti-satellite (ASAT) capability that it successfully tested in 2021.[109] Toward that end, the former U.S. Assistant Secretary of Defense for Space Policy, John Plumb, testified in 2024 that "Russia is developing a nuclear ASAT weapon" that threatens deployed U.S. satellites in low Earth orbit.[110]

These ASAT developments could necessitate scalable launch options to reconstitute destroyed U.S. space capabilities in the future. Moscow's offensive space posture threatens to destroy thousands of U.S. commercial and government satellites via space debris, rendering American space capabilities ineffective for extended periods. China also possesses ASAT capabilities, compounding this threat. The U.S. and its allies will need a rapidly scalable rocket arsenal to replace communications, navigation, sensing, and scientific satellites that their governments and commercial firms have deployed over several decades. The

106 Andrew Jones, "China Performs High Altitude Reusable Rocket Test with Uncertain Outcome," *Space News*, January 20, 2025, https://spacenews.com/china-performs-high-altitude-reusable-rocket-test-with-uncertain-outcome/.

107 Clayton Swope et al., "Space Threat Assessment 2025" (Center for Strategic & International Studies, April 2025), https://www.csis.org/analysis/space-threat-assessment-2025, 6.

108 "Russia's Roscosmos Set to Develop Amur-SPG Reusable Rocket by 2030," Interfax, January 28, 2025, https://interfax.com/newsroom/top-stories/109417/.

109 Clayton Swope et al., "Space Threat Assessment 2025," 10.

110 Clayton Swope et al, 13.

December 2022 UN resolution calling for a halt to anti-satellite tests passed overwhelmingly in the general assembly, but it is a non-binding treaty.[111] China and Russia are among the nine states that voted against it.

Beyond developing their own advanced space launch abilities, these strategic adversaries are collaborating to challenge the United States' international space policy leadership. In response to the multi-lateral Artemis Accords, China and the Russian Federation's ILRS seeks to leverage multipolarity against the United States' dominance, and already includes major regional powers like Pakistan, Egypt, and South Africa. Xi and Putin hope to power this lunar station with nuclear fission and include 50 states in this exploration: a direct challenge to the Artemis Accords.[112]

The U.S. has previously addressed space competition, particularly with China, with International Traffic in Arms Regulations (ITAR) export restrictions and the Wolf Amendment, which requires the Federal Bureau of Investigation and Congress to approve collaborative efforts. This decoupling strategy inhibited some technology transfer to Beijing, but its unilateral nature was easy to circumvent in international markets and forced other states to choose between the two space powers. It also may have inhibited U.S. space progress: the Bureau of Industry and Security's 2014 assessment estimated that export controls cost the U.S. space industry between $988 million and $2 billion in revenue. These policy consequences should be a cautionary tale for decision-makers as they look at frameworks to maintain American space dominance.[113]

111 Jeff Foust, "United Nations General Assembly Approves ASAT Test Ban Resolution," *Space News*, December 13, 2022, https://spacenews.com/united-nations-general-assembly-approves-asat-test-ban-resolution/.

112 Eduardo Baptista, "China, Russia May Build Nuclear Plant on Moon to Power Lunar Station, Official Says," *Reuters*, April 23, 2025, sec. Energy, https://www.reuters.com/business/energy/china-led-lunar-base-include-nuclear-power-plant-moons-surface-space-official-2025-04-23/.

113 Tim Hwang and Emily S. Weinstein, "Decoupling in Strategic Technologies: From Satellites to Artificial Intelligence" (Center for Security and Emerging Technology, July 2022), https://doi.org/10.51593/20200085.

Recommendations

I. AI Chips

Formalize and activate a *Silicon Seven* alliance of AI powers

Building on the idea of a "Fab 4" alliance, the U.S. should formally establish a Silicon Seven forum, comprising the U.S., Japan, South Korea, Taiwan, United Kingdom, Germany, and the Netherlands. Recognizing the already interconnected nature of the AI and semiconductor industries, this group should establish regular dialogues and consultations among members before and after implementing AI- and semiconductor-related regulations. This proactive approach will ensure better coordination, reduce unilateral surprises, and foster a more predictable environment for the Western semiconductor industry and the broader development and deployment of AI.

Furthermore, the U.S. should use the Silicon Seven to actively support Japan's efforts to revive its semiconductor industry and encourage South Korea to reduce its heavy dependence on China for both markets and materials, thus finding ways to build allied scale for AI chips. This includes fostering joint ventures, R&D collaborations (such as Japan's Rapidus working with IBM), and strategic investments that strengthen the collective resilience of the alliance against supply chain disruptions and geopolitical pressures from China. China represents a massive, enticing market for global semiconductor firms; to improve the efficacy of U.S. export controls and firms' compliance with restrictions, it is prudent to insulate international AI chip supply chains from disruption by broader trade disputes, which is consistent with the Trump administration's recent exclusion of semiconductors from tariffs on Taiwan.

Beyond hardware, the Silicon Seven platform can provide a forum to coordinate the diffusion and application of AI technology across friendly borders. This collaborative framework can also facilitate the sharing of best practices and standards related to AI safety, ethics, and interoperability, accelerating the responsible integration of AI into societies and economies worldwide.

Prioritize talent circulation among partner countries

While the current Western advantage in AI hardware offers a temporary moat against PRC competitors training and deploying the most compute-hungry AI models, it's crucial to recognize that the long-term race in AI will ultimately be determined by talent. Over-reliance on a temporary hardware advantage alone is a precarious strategy. The administration faces a critical juncture as there are only three real paths for talent development: liberalizing immigration rules to attract global STEM graduates, making significant long-term investments in domestic higher education to cultivate U.S.-based talent, or leveraging the expertise of overseas allies and partners.

The U.S. should aggressively champion global talent circulation by facilitating seamless exchange of STEM expertise through expanded visa pathways, joint research centers, and incentives for partner-country experts to work in and with U.S. tech firms. Recognizing the crucial role that foreign talent plays in the dominance of U.S. tech firms, we should establish targeted AI hardware fellowships at leading U.S. institutions and fund international joint-degree programs.

Appoint a dedicated U.S. Special Representative for Artificial Intelligence

The United States currently relies on broad positions like the "AI and Crypto Czar"[114] and the Special Envoy for Critical and Emerging Technology, portfolios too diffuse to effectively advance coordinated AI policy. Instead, the administration should appoint a dedicated Special Representative for AI, empowered as the definitive U.S. government voice on AI policy internationally. They would serve as the lead official managing key strategic priorities such as export-control coordination, allied partnerships, talent circulation, and private-sector collaboration. This position could be housed at the NSC and streamline currently fragmented initiatives across Commerce, State, Treasury, and Defense, ensuring coherent strategic messaging, consistent regulatory alignment, and clear engagement with industry and partner nations.

114 Fisher Phillips. "David Sacks Named AI Czar: What Employers Need to Know About a New Era of AI Oversight." Fisher Phillips Insights, December 27, 2024. https://www.fisherphillips.com/en/news-insights/david-sacks-named-ai-czar.html.

II. Drones

Establish a partnership with Ukrainian drone industry

At present, there is simply no nation better equipped to compete with China on mass manufacture of drones than Ukraine. While the Trump Administration has made a deal with Ukraine over mineral rights a priority, there is no greater strategic value to leverage from Ukraine than its drone industry. From the specialized production of individual components to the rapidly developing software innovations and end-to-end manufacturing of unmanned aerial, surface, underwater, and ground vehicles, Ukraine is unmatched by any nation other than China. The U.S. should form a partnership where it continues to provide Ukraine with its most critical military aid, with a specific emphasis on air defense systems (eg. Patriot Missile Defense System) and long-range artillery (eg. ATACMs), while Ukraine provides the U.S. access to its most cutting-edge drone technologies and manufacturing houses. This partnership should include significant U.S. investments in joint-ventures with Ukrainian drone manufacturers to build up both Ukraine and American stockpiles.

Build an international coalition for free trade of drone tech between allies

Every significant military power is scrambling to reduce its reliance on Chinese drones and seeking answers elsewhere. The U.S. must take a leading role in organizing these efforts to leverage the strengths of geopolitically aligned nations, similar to how the AI supply chain is organized. Imposing punitive tariffs on nations trying to build up their drone manufacturing capacity like those in the EU, Japan, Taiwan, and India will only make funding for manufacturing growth harder to come by. And nations facing these tariffs become more encouraged to open trade with geopolitically fraught states, as we've seen through free-trade talks between Japan and South Korea with China. America must facilitate free trade agreements and encourage foreign investment between allies disparately attempting to accelerate drone manufacturing capacity. Rather than dismantle NATO, the Trump administration should also use the common interest of maintaining a technological edge against a Russian-Chinese alliance to bridge divides with Turkey, a growing industrial power with respect to drone manufacturing.

Achieve allied consensus on restricting imports of Chinese made drones

China grew to dominate the market for small drones through a combination of manufacturing expertise and gradual innovation assisted by massive government subsidies, which allowed Chinese firms like DJI to flood the market with cheap, high-quality products. The U.S. has imposed its own sanctions on Chinese technologies, but must garner consensus with allies to further choke the Chinese drone industry by blocking imports of Chinese made drones and components. As one lever to achieve this aim, free-trade agreements could be contingent upon shared import restrictions. This will further motivate nations to develop in-house capabilities, but it will require significant collaboration and capital to meet the demand currently filled by Chinese technologies.

Use economic policies to incentivize cheap drone production in the U.S.

While the U.S. alone will not match the production of Ukraine, Russia, and China on attritable drones in the near term, it must build a foundation for a flourishing, long-term drone manufacturing industry. Rather than eschew industrial policies like the CHIPs Act and the Inflation Reduction Act, the U.S. should use the tools written into these policies, like tax benefits, loan guarantees, and grants to explicitly incentivize both U.S. and foreign investment in the production of cheap drones, with a particular focus on constituent components that China currently dominates, like batteries and flight controllers. Likewise, the DoD must explicitly call for drones that can be produced under a price cap to prevent more of the same high cost, sophisticated systems from being prioritized. Instead, the DoD should award milestone-based contracts for systems that incentivize frugality. Finally, the U.S. should generally look toward 'abundance-agenda'[115]-style policies to cut unnecessary regulations that make factory construction slow and expensive, like permitting reform.

115 Derek Thompson, "A Simple Plan to Solve All of America's Problems," *The Atlantic* (blog), January 12, 2022, https://www.theatlantic.com/ideas/archive/2022/01/scarcity-crisis-college-housing-health-care/621221/.

III. Space Launch Technology

Promote U.S. market competition for reusable rockets

Given SpaceX's outsized market share of the U.S. space launch industry, the administration can incentivize a more competitive market to build redundancy into space launch operations via contracts and tax breaks for new firms. This redundancy will reduce reliance on a single vendor and build scalability in the domestic, reusable rocket industry, particularly in the case of an inadvertent or intentional incident that destroys existing U.S. satellites.

Expand international space partnerships via the Artemis Accords

The U.S. can expand the Artemis Accords and its membership to inexpensively solidify its international leadership in space exploration and mitigate international space collaboration with China's ILRS. Expanding upon the Accords' section five, which outlines interoperability commitments, will open pathways to leverage comparative advantage and information sharing in space launch technology. The administration can achieve this with informal procedures by revising the accords to reflect modern space concerns, including a new provision that commits to the 2022 UN resolution banning ASAT testing, which will unite the international community against this dangerous practice. Diplomatic efforts to expand membership to China's targeted sphere of influence—the Global South—will solidify a global coalition committed to these principles. It also may help assuage partners' concerns about our cooperation in space, particularly in light of the proposed Lunar Gateway cancellation, which would affect the CSA, ESA, JAXA, and the UAE's Mohammed Bin Rashid Space Centre.

Protect key rocket technology via a diffusion framework

To protect space launch technology relevant to U.S. security, the President should implement a regulatory diffusion framework to share the right technologies with the right partners, building scalability and global redundancy to deploy payloads into orbit. This framework would complement increased competition in the U.S. rocket industry, open avenues for commercial deployments on allied launches, and create options to quickly recover from debris damage in the wake of counterspace warfare. A tiered system like the ill-fated United States' 2025 AI diffusion framework could accomplish this endeavor, encourage membership in the Artemis

Accords, and deny adversaries access to critical space launch technology to sustain the United States' leadership in this domain. The Bureau of Industry and Security should partner with NASA and the U.S. Space Force to ensure such a framework achieves these goals in a multi-lateral fashion, avoiding the pitfalls of the Wolf Amendment's unilateral approach and previous ITAR restrictions.

Conclusion

In today's scale-intensive strategic environment, the United States simply cannot pretend to out produce China alone by reviving itself as a solo "Arsenal of Democracy," the position it once enjoyed in the 20th century. The old WWII model only worked because the U.S. emerged from 1945 as the sole intact industrial economy. By contrast, the modern Chinese economy rivals the U.S. in size and is backed by vastly lower costs, as Chinese manufacturing wages are roughly 20% of U.S. levels, and its workforce is over four-times the size as America's. No set of tax breaks or modest industrial subsidies can erase those fundamental limits.

Even if Washington champions massive industrial reshoring, it will still hit hard workforce constraints. Surveys show roughly 80% of Americans say we need more factory jobs, yet only about 25% would personally choose to work one.[116] In short, best-case domestic reforms to reindustrialize will still leave the United States short of the people required to match China's output. By contrast, U.S. treaty allies collectively bring far larger industrial workforces and talent pools to bear.

Even combined with treaty allies (namely NATO members, Japan, and South Korea), a U.S.-led bloc would have fewer STEM graduates and a smaller workforce than China.[117] Only by bringing more and more countries into alignment with the U.S. (namely India, which itself graduates nearly as many

116 Alicia Adamczyk. "Americans Want More U.S. Factory Jobs—As Long as They Don't Have to Work Them." Fortune, April 15, 2025. https://fortune.com/2025/04/15/americans-want-factory-jobs-reshored-dont-want-work-them/.

117 World Bank. The Human Capital Index 2020 Update: Human Capital in the Time of COVID-19. Washington, DC: World Bank, 2020. https://documents1.worldbank.org/curated/en/456901600111156873/pdf/The-Human-Capital-Index-2020-Update-Human-Capital-in-the-Time-of-COVID-19.pdf.

STEM graduates as the U.S. and EU combined)[118], can the U.S. compete at scale with China's human capital. Washington cannot win by retreating into isolation; it must harness the aggregate strength of its partnerships.

AI is the most obvious area for integration, since no single country can make a leading-edge AI chip on its own. U.S. firms lead in AI chip design, but America lacks any competitive options in key inputs like photolithography machines and specialty chemicals and materials. If one includes Taiwan, the U.S. and its partners collectively account for about 90% of the semiconductor supply chain value, and China only six percent.[119] Maintaining technological leadership means coordinating these distinct pieces, rather than trying (and failing) to duplicate all of them on U.S. soil.

For drones, American innovators can design cutting-edge UAVs and loitering munitions, but U.S. defense firms cannot mass-produce kamikaze drones at attrition rates. By contrast, allied producers in Ukraine have fielded millions of cheap, expendable drones and others like Turkey have managed to drastically cut costs on medium and larger drones. No U.S. factory setup today approaches the output of the Russia-Ukraine war. Any realistic strategy for drone warfare must involve allied assembly lines and shared procurement.

In space, the U.S. retains world-leading launch capabilities (SpaceX, ULA) and advanced satellite technology, but it remains a very expensive domain without a strong political constituency, making it particularly vulnerable to budgetary pressures. Furthermore, U.S. commercial firms' recent success in space, notably SpaceX's Starlink, have been largely buoyed by support from international customers[120]–but a unilateralist approach to space will likely drive these international customers, including U.S. allies, to find more reliable alternatives.

Recent moves show how partnerships multiply capacity. Under AUKUS, the U.S., UK and Australia have waived most export licenses on each other's defense tech, enabling freer joint development of advanced weapons. Australia is even investing

118 Katharina Buchholz. "Which Countries' Students Are Getting Most Involved in STEM?" World Economic Forum, March 20, 2023. https://www.weforum.org/stories/2023/03/which-countries-students-are-getting-most-involved-in-stem/.

119 Akhil Thadani and Gregory C. Allen. "Mapping the Semiconductor Supply Chain: The Critical Role of the Indo-Pacific Region." Center for Strategic and International Studies, May 30, 2023. https://www.csis.org/analysis/mapping-semiconductor-supply-chain-critical-role-indo-pacific-region.

120 Rich Smith. "It's Official. Starlink is SpaceX's Biggest Money-Maker Now." *The Motley Fool*. February 10, 2025. https://www.fool.com/investing/2025/02/10/its-official-starlink-is-spacexs-biggest-money-mak/

roughly $3 billion in U.S. shipyards to expand submarine production facilities so that supply chains scale for all partners.[121] These "license-free" arrangements and reciprocal investments institutionalize exactly the kind of shared industrial base America needs.

Only hard-nosed realism should dictate America's ultimate emerging tech strategy. The United States simply does not have the human capital or industrial capacity to win the marathon race of technological advancement. If America insists on going it alone, demanding every chip fab, drone factory, and satellite be purely American, it will simply be outproduced by a China that has adeptly built a dominant global manufacturing position over the last twenty years. Conversely, by intentionally leveraging the partnerships it has built over decades, the U.S. can scale its capacity and innovate faster. America cannot return to being the singular arsenal of democracy, but it can build an arsenal of strategic partners that turns allied capacity into an American advantage.

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Appendices

Appendix 1: Overview of AI's effects on national military and economic power

Category	Impact of AI	Potential Power Shifts	Key Considerations
Military Command and Control	• AI-enabled decision support systems • Predictive analytics for strategic planning • Automated logistics and resource allocation	• Nations with integrated AI C2 systems gain decision superiority • Reduced operational planning cycles create timing advantages • Decentralized command structures become more viable • Resilience against disruption increases	• Over-reliance on algorithms may create strategic blindspots • System vulnerabilities to cyber attacks • Need for human oversight in critical decisions • Questions of interoperability with allies
Military Edge Applications	• Autonomous and semi-autonomous weapons platforms • AI-powered electronic warfare • Enhanced intelligence gathering and analysis • Swarm tactics and coordinated operations	• Lower barriers to power projection for tech-advanced states • Asymmetric advantages for smaller nations with AI expertise • Shifts in strategic deterrence calculations • New forms of combat effectiveness delinked from population size	• Proliferation concerns and arms race dynamics • Questions of accountability and international law • Ethical boundaries of autonomous ethal force • Unpredictable interactions between opposing AI systems
Economic Knowledge Work	• Automation of professional and cognitive tasks • AI augmentation of human expertise • Enhanced research & development capabilities • Transformation of service industries	• Knowledge economy leadership shifts to AI-capable nations • New divisions between AI producers and consumers • Reshaping of global financial services architecture • Competitive advantages in innovation ecosystems	• Profound labor market disruptions • Changes in educational requirements and systems • Knowledge sovereignty concerns • Concentration of benefits in tech-savvy populations
Economic Industrial Production	• Smart manufacturing and Industry 4.0 • Supply chain optimization and resilience • Energy efficiency through predictive maintenance • Resource allocation optimization	• Reshoring of manufacturing to AI-advanced economies • Reduced importance of low-cost labor advantages • Shifts in comparative advantage between nations	• Environmental impacts of AI-optimized production • Access to critical materials for AI hardware • Digital divide in manufacturing capabilities • Need for new industrial policies and regulations

Appendix 2: Summary of U.S. strategic technology positioning and international dependencies

	AI Chips	Drones	Space Launch Tech
Strength of U.S. Position	Medium	Low	High
Reliance on Inter-national Partners	High	Medium	Low
Risk of falling be-hind	Medium	High	Medium
Summary	U.S dominates chip design, relies on partners for chip manufacturing, and China is closing the gap in both domains. U.S. measures to slow Chinese growth have had uneven impacts.	The drone technologies America has relied on in the Global War on Terror have proven vulnerable on modern battlefields, and the U.S. lacks manufacturing capability to produce small drones in large quantities. Ukraine, Russia, and China are leading the way on small drones, while additional competitors like Turkey are seizing market share.	America maintains a healthy lead in space launch capabili-ties, but as nations all over the world commit significant resources to catching up, the U.S. is proposing major cuts to NASA's budget. Russia and China are meanwhile partnering to leverage each other's strengths.

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