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Chairman Carper, Ranking Member Cornyn, and members of the Subcommittee on International Trade, Customs, and Global Competitiveness, thank you for inviting me to testify on the important topics of supply chain resiliency, national security, and emerging technologies.

My name is Gilman Louie and I am the CEO of America's Frontier Fund, a new non-profit public-private investment fund focused on deep technologies and platforms critical to the security and prosperity of the United States and its allies. Before I begin, I should note that I am offering these remarks in my personal capacity. I am not speaking on behalf of the U.S. government, the President's Intelligence Advisory Board, or any other organizations with which I am affiliated.

The United States is in a new full spectrum great-power competition against peer nation-state competitors committed to out-investing and out-innovating the United States. We can no longer take our supply chains for granted, nor can we assume continued U.S. technology leadership. We need a whole-of-nation approach to aligning public and private sector incentives that address the root causes of our eroding global leadership, secure our critical supply chains, and catalyze the next generation of innovation.

Before looking for solutions, we must first ask how we reached this point. The truth is the challenges we face today arose from decades of supply chain optimization, just-in-time manufacturing, and fractional improvements in cost savings and profitability. The result has been a highly efficient but increasingly brittle global supply chain. These well-intentioned decisions by individuals and corporations have created a systemic challenge to our economic security centered on three market failures:

1. Decades of **underinvestment in foundational technolog**y startups have stifled innovation and deterred talent in key sectors.

2. Other countries, especially in East Asia, have created an **artificially attractive offshore investment environment**.

3. The U.S. has **high barriers to entry and challenging economies of scale** for domestic leading-edge manufacturing.

Microelectronics offers a case in point for understanding these three market failures.

Underinvestment in hardware: For the past three decades, U.S. venture capital investment has heavily skewed towards software development rather than hardware advancements, leading to a lack of access to capital for domestic chip startups. In 2021, U.S. venture capital investment in hardware startups was just $9 billion. By comparison nearly 14 times the investment went to software, or $124 billion.[1] Chinese venture investment in microelectronics tripled from 2019 to 2020.[2] And last year, microelectronics startups in China received six times the amount invested in comparable U.S. firms.[3] This makes investing in a U.S. hardware company less attractive, which partially explains the skewed investment in software.

Artificially attractive overseas investment environment: U.S. firms recognized it is cheaper and faster to establish microelectronics manufacturing centers offshore, especially in East Asia. Without the funding proposed in the U.S. Innovation and Competition Act (USICA), the 10-year total cost of ownership of a fabrication facility (fab) in the United States is 30-50 percent higher than in East Asia.[4] And during the same period, U.S. industry invested $14 billion in electronics manufacturing projects in China. For comparison, China invested only $141 million in similar projects in the United States.[5] The Chinese government has also translated its position as a low-cost manufacturing hub into strategic advantage. China often requires that joint ventures with foreign manufacturing firms must establish operations in China. This in turn grants local Chinese firms access to foreign IP.[6] China has also flooded the market with capital for strategic technology sectors and manufacturing. In exchange for access to China's market and low-cost manufacturing, firms from the U.S. and our allies have deferred investing in manufacturing at home in favor of the cheaper and readily accessible market in China. This shifts the cost burden for manufacturing and other high capital expenditure projects from U.S. and allied shareholders onto the Chinese government.

High barriers to entry and challenging economies of scale. In recent years there has been a drastic increase in the cost, complexity, and time to introduce, develop, and scale new

[1]"National Venture Capital Association 2022 Yearbook." *National Venture Capital Association*, Mar. 2022, nvca.org/wp-content/uploads/2022/03/NVCA-2022-Yearbook-Final.pdf, pg. 28

[2] Lu, Shen. "Chinese Chip Companies Raised a Record $11 Billion in 2021." Protocol, 2 Mar. 2022, www.protocol.com/bulletins/china-chip-funding-11-billion.; As a comparison, entrepreneurs in China launched 22,800 new semiconductor companies, in 2020 up 195% from 2019 see Ravi, Sarah. "Taking Stock of China's Semiconductor Industry." Semiconductor Industry Association, 13 July 2021, www.semiconductors.org/taking-stock-of-chinas-semiconductor-industry.

[3]Liu, Coco. "China Venture Funding Hits Record $131 Billion Despite Crackdown." Bloomberg, 9 Jan. 2022. www.bloomberg.com/news/articles/2022-01-09/china-venture-funding-hits-record-131-billion-despite-crackdown.

[4]Varas, Antonio, et al. "Government Incentives and US Competitiveness in Semiconductor Manufacturing." Boston Consulting Group and Semiconductor Industry Association, Sept. 2020, web-assets.bcg.com/27/cf/9fa28eeb43649ef8674fe764726d/bcg-government-incentives-and-us-competitiveness-in-semiconductor-manufacturing-sep-2020.pdf, pg. 1

[5]U.S. Department of Commerce and U.S. Department of Homeland Security. "ASSESSMENT OF THE CRITICAL SUPPLY CHAINS SUPPORTING THE U.S. Information and Communications Technology Industry." U.S. Department of Commerce, 24 Feb. 2022, www.commerce.gov/sites/default/files/2022-02/Assessment-Critical-Supply-Chains-Supporting-US-ICT-Industry.pdf., pg. 72

[6] Bradsher, Keith. "How China Obtains American Trade Secrets." The New York Times, 15 Jan. 2020, www.nytimes.com/2020/01/15/business/china-technology-transfer.html.

semiconductor technologies.[7] This is in addition to the rising capital expenditures and R&D intensity required to remain competitive. Only two firms in the world – Taiwan Semiconductor Manufacturing Corporation (TSMC) and South Korea's Samsung– can currently fabricate leading-edge logic chips. Of significant concern is the location of Samsung's semiconductor fabrication facilities in South Korea within North Korean artillery and missile range.[8] Similarly, TSMC produces the vast majority of cutting-edge chips, a mere 110 miles from China, our principal strategic competitor.[9] Proposed federal incentives in USICA would help mitigate the cost of locating a fab in the United States.[10] But additional measures are necessary to make the United States an enduring home for advanced manufacturing. The lack of coordination between federal, state, and local regulations are making it difficult to on-shore advance manufacturing capabilities such as fabs. For example, it takes approximately 5 months longer on average to build a fab in the United States compared to Japan, in large part due to permitting.[11]

Today the U.S. is at risk of losing access to the critical technology components that we rely upon every day. This impacts everything from our personal communications devices to our nation's defense systems. Russia's invasion of Ukraine highlights the peril of depending upon supply chains that can be severed by an adversary.[12] The United States has rightly responded to Russian aggression by imposing sanctions designed to eliminate Russia's access to the technological goods that are critical to a diversified economy as well as Vladimir Putin's ability to project power. By blocking key technology imports – including semiconductors – in coordination with the European Union, South Korea, Japan, Taiwan, and others, the United States is bringing Russia's technological development to a screeching halt. The cautionary tale here is that we must continue to innovate and protect our supply chains, otherwise another nation may one day do the same thing to us. We must do whatever it takes to avoid a future scenario in which the United States can be cut off from key technologies by an authoritarian regime such as Russia or China.

Over the long-term, we face an even greater risk of being surpassed technologically by China. This situation is unacceptable. We face a renewed era of great-power competition in which the primary battleground is "winner-take-all" technologies. We have never failed as a nation to answer such a challenge, whether in war or in peace. I am encouraged this Committee is taking a leadership role to address these urgent issues.

Fortunately, there are still good reasons for optimism. The threats to our national security and economic competitiveness that I have described are also creating opportunities for revitalization in the United States and allied nations. Addressing underlying market failures and securing supply chains over the long-term can be the catalyst to grow our domestic manufacturing

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[7] As an example, complexity – as measured by number of process steps -- is roughly double for a 5 nm chip compared to a 10 nm chip. "CMC Materials Investor Presentation." CMC Materials, Dec. 2020, s23.q4cdn.com/881970339/files/doc_presentations/2020/12/CMC_InvestorPresentation_Dec_2020_FINAL.pdf, slide 11

[8] Mazarr, Michael, et al. "The Korean Peninsula: Three Dangerous Scenarios." The RAND Corporation, 2018, www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE262/RAND_PE262.pdf., pg. 9

[9] National Security Commission on Artificial Intelligence, Final Report, March 2021, https://www.nscai.gov/ wp-content/uploads/2021/03/Full-Report-Digital-1.pdf pg. 3

[10] Varas, Antonio, et al. "Government Incentives and US Competitiveness in Semiconductor Manufacturing." Boston Consulting Group and Semiconductor Industry Association, Sept. 2020, pg. 1

[11] VerWey, John. "No Permits, No Fabs." Center for Security and Emerging Technology, 1 Apr. 2022, cset.georgetown.edu/publication/no-permits-no-fabs, pg. 5

[12] Inboden, William, and Adam Klein. "A Lesson from the Ukraine War: Secure Our Semiconductor Supply Chains." *The Hill*, 22 May 2022, thehill.com/opinion/technology/3494860-a-lesson-from-the-ukraine-war-secure-our-semiconductor-supply-chains

industry, create high-paying jobs, and deepen our security and economic partnerships with allies around the world. I'll now offer a framework with four pillars for tackling these problems.

First, we must **redesign and re-imagine U.S. manufacturing capabilities**. Bringing advanced and agile manufacturing home means producing goods closer to consumers. This transition would lower transportation costs while accelerating the product design and manufacturing cycle. What we need is public funding to act as a signal to investors, along with credits for trade and investment. These are important tools to unlock the necessary private capital. We also need to expand our talent pool at all levels of educational attainment, from knowledge workers to trade skills. Plumbers, electricians, and construction workers are all critical enablers for our R&D and capacity investments.

Second, we must invest across America to **promote promising tech hubs**. Currently, five coastal cities have generated 90 percent of the innovation sector's growth over the last decade.[13] But the next wave of innovation must be broader than Silicon Valley and include more technology hubs across the country. Samsung's announcement of a $17 billion semiconductor fabrication facility in Taylor, Texas, is an excellent example of what is possible.[14] The FinTech Innovation Hub under construction at the University of Delaware is another example of a promising center of excellence.[15] These are steps in the right direction toward creating new hubs but there is more work to do to unlock the potential of places like Delaware, Texas, and the American heartland.

Third, we must **disclose and internalize the risk of investing in authoritarian nations**. As the sanctions on Russia have shown, U.S firms investing and operating in non-democratic nations face material business risks. Wall Street is increasingly applying Environmental, Social, and Governance (ESG) assessments to guide investment decisions, identify growth opportunities, and identify material risks. Building on the ESG framework, I believe it is important to add "D" for "Democracy," or ESGD. Whether a nation is committed to democracy and a rules-based international trading order should shape firms' investment decisions. Firms should also report on resiliency as a measure of supply chain effectiveness for risk committees. Ultimately, additional transparency would raise the cost of capital for investing in authoritarian nations and make investing in democratic nations more attractive.

Finally, we need to **deepen our engagement with our allies and partners** on emerging technologies and supply chains. We cannot become resilient on our own. Reshoring the entire supply chain for microelectronics – just one of several critical industries -- would cost $1 trillion. We need to prioritize "near-shoring" and "friend-shoring" with our allies. As we work together with our allies on supply chains, we should also create new pathways for investing jointly in emerging technologies. Coalitions will be vital forums for pooling capital and creating new

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[13] Atkinson, Robert Mark D. Muro. "The Case for Growth Centers: How to Spread Tech Innovation across America." Brookings, 9 Mar. 2022, https://www.brookings.edu/wp-content/uploads/2019/12/Full-Report-Growth-Centers_PDF_BrookingsMetro-BassCenter-ITIF.pdf, pg. 23

[14] Sayers, Justin. "Taylor Has Annexed 1,200-plus Acres for Samsung Site." Austin Business Journal, 26 Jan. 2022, www.kxan.com/news/texas/taylor-has-annexed-1200-plus-acres-for-samsung-site; "Samsung Electronics Announces New Advanced Semiconductor Fab Site in Taylor, Texas." Samsung, 24 Jan. 2022, news.samsung.com/global/samsung-electronics-announces-new-advanced-semiconductor-fab-site-in-taylor-texas.

[15] Weir, Polly, et al. "UD Requests $6.5M from State for FinTech Fit-Out." Delaware Business Times, 1 Apr. 2022, delawarebusinesstimes.com/colleges-and-universities/ud-requests-6-5m-from-state-for-fintech-fit-out.

networks of democratic investors. The U.S.-EU Trade and Technology Council, the Quad Security Dialogue, and AUKUS will play a key role. In addition to increasing disclosure and vetting requirements for our competitors, we must also make it easier for trusted partners to invest in the United States. Just as we have developed TSA Pre-Check for pre-screening fliers, we need a similar system to make it easier for allied investors to do business in the United States. Such a program would allow us to fast-track joint ventures, technology partnerships, and transactions with allies and like-minded democracies. These types of programs will make more capital available for reshoring and nearshoring, while also building support for restricting truly sensitive technologies from being transferred to our competitors. In my role as a Commissioner on the National Security Commission on Artificial Intelligence, we submitted several recommendations to Congress and the President aligned with these goals.[16]

In conclusion, we must target solutions against three market failures: Underinvestment in foundational technologies, an artificially attractive offshore investment environment, and high barriers to entry. We must re-imagine U.S. manufacturing, invest in promising tech hubs across America, redirect capital from autocracies to democracies, and deepen allied engagement. As the Subcommittee considers policy tools for improving supply chain resiliency and long-term technology leadership, you have an important role to play in improving our national security while generating economic growth, creating good jobs, and reinforcing the rules based international system. The time to act is now. I look forward to your questions.

Thank you.

[16]National Security Commission on Artificial Intelligence, Final Report, March 2021, https://www.nscai.gov/ wp-content/uploads/2021/03/Full-Report-Digital-1.pdf, pg. 495